Configuring Security on Avaya Ethernet Routing Switch 4800 Series

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Contents

Chapter 1: Introduction

Purpose

Security documentation provides procedures and conceptual information that you can use to administer and configure the security features on the switch.

Chapter 2: New in this document

The following section details what is new in *Configuring Security on Avaya Ethernet Routing Switch 4800 Series*, NN47205-505.

Features

See the following sections for information about feature changes.

EAP enhancements

Release 5.10 provides the following EAP enhancements:

- Configuring RADIUS server reachability
- Delayed MAC Authentication
- Dual key authentication
- RADIUS authentication delay
- Track All MACS per port
- RFC4675 RADIUS attributes: Egress-VLANID and Egress-VLAN-NAME

Security enhancements

Password complexity

Password complexity feature enforces complexity password rules. The rules are different when the switch is upgraded from an unsupported to a supported release for the first time. The following rules can be configured and applied when you enable this feature:

- Minimum password length and valid characters
- Number of passwords retained in password history
- Check for sequential and repeated characters in password

For more information, see Password complexity on page 81.

Password aging and lockout policy

Passwords expire after a specified aging period. The values for the lockout period and aging can be configured. The default values are different when the switch is upgraded from an unsupported to a supported release for the first time.

The management passwords can be configured to comply with company security policies. The following rules can be configured and applied when you enable this feature:

- Number of days before password expiration
- Number of warning days before password expiration
- Failed login attempts
- Automatic unlock timer value for disabled accounts
- Ability to change password during first login
- Password login failure notification
- Number of times a password can be changed in a day

For more information, see Password aging and lockout policy on page 83.

Enhanced Secure Mode

When Enhanced Secure Mode is enabled the switch defaults to higher level of security.

The following security enhancements are available in this operating mode:

- The switch supports multiple role-based access levels.
- Every attempt to access the product requires a username and password to be presented for authentication.
- The switch enforces stronger password requirements, and stronger rules on password length, password complexity, password change intervals, password reuse, and password maximum age use.
- The audit logging is enabled by default and cannot be disabled or modified. The audit records all valid activities performed on the system, including the identity of each user through its username, IP and session ID and the date and time stamp of access attempt. If you configure a remote Syslog server, the switch sends each issued command to this remote server. The log file is not affected by a restart or a default boot. Log encryption is supported.
- The command for configuring the switch banner provides an option to display the DoD approved banner.
- TFTP protocol is disabled by default.
- The switch uses NTP as default clock source. NTP authentication keys are hidden in ACLI and ASCII config.

For more information see:

- Enhanced Secure Mode on page 105
- Configuring Enhanced Secure Mode on page 459

- RADIUS and SYSLOG server configuration examples on page 619

Chapter 3: Security fundamentals

This chapter describes the hardware-based and software-based security features supported by the switch.

ACLI command modes

Avaya Command Line Interface (ACLI) provides the following command modes:

- User EXEC
- Privileged EXEC
- Global Configuration
- Interface Configuration
- Router Configuration
- Application Configuration
- DHCP Guard Configuration
- RA Guard Configuration

Mode access is determined by access permission levels and password protection.

If no password is set, you can enter ACLI in User EXEC mode and use the **`enable`** command to move to the next level (Privileged EXEC mode). However, if you have read-only access, you cannot progress beyond User EXEC mode, the default mode. If you have read-write access you can progress from the default mode through all of the available modes.

With sufficient permission, you can use the rules in the following table to move between the command modes.

Table 1: ACLI command modes

Command mode and sample prompt	Entrance commands	Exit commands
User EXEC `Switch>`	No entrance command, default mode	`exit` or

Table continues…

Command mode and sample prompt	Entrance commands	Exit commands
		`logout`

Privileged EXEC
`Switch#`
	`enable`	`exit`
		or
		`logout`

Global Configuration
`Switch(config)#`
	`configure terminal`	To return to Privileged EXEC mode, enter
		`end`
		or
		`exit`
		To exit ACLI completely, enter
		`logout`

Interface Configuration
`Switch(config-if)#`
You can configure the following interfaces:
• Ethernet
• VLAN
• Loopback
	From Global Configuration mode:
	To configure a port, enter `interface ethernet` *<port number>*.
	To configure a VLAN, enter `interface vlan` *<vlan number>*.
	To configure a loopback, enter `interface loopback` *<loopback number>*.
		To return to Global Configuration mode, enter
		`Exit`
		To return to Privileged EXEC mode, enter
		`end`
		To exit ACLI completely, enter
		`logout`

Router Configuration `Switch(configrouter)#` You can configure the following routers: • RIP • OSPF • VRRP • ISIS	From Global or Interface Configuration mode: To configure RIP, enter `router rip`. To configure OSPF, enter `router ospf`. To configure VRRP, enter `router vrrp`. To configure IS-IS, enter `router isis`.	To return to Global Configuration mode, enter `exit`. To return to Privileged EXEC mode, enter `end`. To exit ACLI completely, enter `logout`.
Application Configuration `Switch(config-app)`	From Global, Interface or Router Configuration mode, enter `application`.	To return to Global Configuration mode, enter `exit`. To return to Privileged EXEC mode, enter

Table continues…

Command mode and sample prompt	Entrance commands	Exit commands
		`end`. To exit ACLI completely, enter `logout`.
DHCP Guard Configuration `Switch(config-dhcpguard)`	From Global, Interface, Router, Application Configuration mode, enter `ipv6 dhcp guard policy <`*`policy_name`*`>`.	To return to Global Configuration mode, enter `exit`. To return to Privileged EXEC mode, enter `end`. To exit ACLI completely, enter `logout`.
RA Guard Configuration `Switch(config-raguard)#`	From Global, Interface, Router, Application Configuration mode, enter `ipv6 nd raguard policy <`*`policy_name`*`>`.	To return to Global Configuration mode, enter `exit`. To return to Privileged EXEC mode, enter `end`. To exit ACLI completely, enter `logout`.

Hardware-based security

Network administrators enable or disable the USB or serial console ports on the switch to control access to an operational switch. To prevent unauthorized access and configuration, the network administrators disable the USB or serial console ports.

HTTP/HTTPS port configuration

The Web server can operate in either HTTPS (secure) mode or HTTP (non-secure) mode, with HTTPS as the default mode. You can select the Web server mode with the ACLI and SNMP management interfaces. The SSL Management Library interacts with the Web server in selecting these modes.

In secure mode, you can use the **SecureOnly** option to configure the Web server to respond to HTTPS only, or both HTTPS and HTTP client browser requests. If you configure the Web server to respond to HTTPS client browser requests only, all existing non-secure connections with the browser are terminated.

By default, the Web server listens on TCP port 443 for HTTPS client browser requests, and listens on TCP port 80 for HTTP client browser requests. You can designate alternate TCP ports, ranging in value from 1024 to 65535, for HTTPS and HTTP client browser requests.

Note:

The TCP port for HTTPS client browser requests and the TCP port for HTTP client browser requests cannot be the same value.

In non-secure mode, the Web server responds to HTTP client browser requests only. All existing secure connections with the browser are terminated.

MAC address-based security

The Media Access Control (MAC) address-based security feature is based on Avaya BaySecure local area network (LAN) Access for Ethernet, a real-time security system that safeguards Ethernet networks from unauthorized surveillance and intrusion.

You can use the MAC-address-based security feature to set up network access control based on source MAC addresses of authorized stations.

You can use MAC-address-based security to perform the following activities:

- Create a list of up to 10 MAC addresses to filter
  - as destination addresses (DA)—all packets with one of the specified MAC addresses as the DAs are dropped regardless of the ingress port, source address intrusion, or virtual local area network (VLAN) membership
  - as source addresses (SA)—all packets with one of the specified MAC addresses as the SAs are dropped

  Important:

  Ensure that you do not enter the MAC address of units in the stack using MAC security. This can impact operation of switch management or the stack.
- Create a list of up to 448 MAC SAs and specify SAs that are authorized to connect to the switch or stack configuration.

  You can configure the 448 MAC SAs within a single stand-alone or distribute them in any order among the units in a single stack configuration.

When you configure MAC-based security, you must specify the following:

- Switch ports that can be controlled for each MAC address security association.

  The options for allowed port access include NONE, ALL, and single or multiple ports that are specified in a list (for example, 1/1-4, 1/6, 2/9).
- Optional actions that the switch can perform if the software detects a source MAC address security violation.

The options are to send an SNMP trap, turn on DA filtering for the specified source MAC address, disable the specific port, or a combination of these three options.

Use either the Avaya Command Line Interface (ACLI) or Enterprise Device Manager (EDM) to configure MAC-address based security features.

MAC address-based security autolearning

The MAC address-based security autolearning feature provides the ability to add allowed MAC addresses to the MAC Security Address Table automatically without user intervention.

MAC address-based security autolearning has the following features:

- You can specify the number of addresses that can be learned on the ports, to a maximum of 25 addresses for each port. The switch forwards traffic only for those MAC addresses statically associated with a port or learned with the autolearning process.
- You can configure an aging timer, in minutes, after which autolearned entries are refreshed in the MAC Security Address Table. If you set the aging time value to 0, the entries never age out. To force relearning of entries in the MAC Security Address Table you must reset learning for the port.
- If a port link goes down, the autolearned entries associated with that port in the MAC Security Address Table are removed.
- You cannot modify autolearned MAC addresses in the MAC Security Address Table.
- MAC Security port configuration including the aging timer and static MAC address entries are saved to the switch configuration file. MAC addresses learned with autolearning are not saved to the configuration file. They are dynamically learned by the switch.
- You can reset the MAC address table for a port by disabling the security on the port and then enabling it.
- If a MAC address is already learned on a port (port x) and the address migrates to another port (port y), the entry in the MAC Security Address Table changes to associate that MAC address with the new port (port y). The aging timer for the entry is reset.
- If you disable autolearning on a port, all autolearned MAC entries associated with that port in the MAC Security Address Table are removed.
- If a static MAC address is associated with a port (which is or is not configured with the autolearning feature) and the same MAC address is learned on a different port, an autolearn entry associating that MAC address with the second port is not created in the MAC Security Address Table. In other words, user settings have priority over autolearning.

MAC Security Port Lockout

Use the MAC Security Port Lockout feature to exclude specific ports from MAC-based security. Use this feature to simplify switch operations and prevent accidental loss of network connectivity caused by improper MAC security settings.

For more information, see

- Configuring MAC address-based security on page 145
- Configuring_general_switch_security_using_EDM on page 366

Block subsequent MAC authentication

Prior to Release 5.7, in MHMA mode, if a station successfully authenticates, the switch places the port in the RADIUS-assigned VLAN that corresponds to that station's login credentials. If a second station properly authenticates on that same port, the switch ignores the RADIUS-assigned VLAN and the user is placed in the same VLAN as the first successfully authenticated station, creating a potential security risk. This feature enhancement gives the administrator the option of either using the current implementation or a separate option that will block subsequent MAC authentications if the RADIUS-assigned VLAN is different than the first authorized station's VLAN.

When a new EAP or Non-EAP client is added to a port with a valid RAV it is assigned the same RADIUS as the first EAP or Non-EAP client present on port.

In order to be enabled, the option must be enabled both globally and per port.

EAP and Non-EAP clients are blocked dependent on whether MultiVlan is disabled or enabled and in the following situations:

MultiVlan Disabled:

All clients on a specific port are authenticated on a single VLAN.

EAP clients are blocked in the following situations:

- EAP client comes without any VLAN
- EAP client comes with a VLAN that does not exist on the switch
- EAP client comes with a VLAN different from the one specified by the first EAP client present on port
- “use-radius-assignment-vlan” is disabled on port

Note:

In all the preceding cases, information is logged with details about the fail reasons.

Non-EAP clients are blocked in following situations:

- Non-EAP client comes without any VLAN
- Non-EAP client comes with a VLAN that does not exist on the switch
- Non-EAP client comes with a VLAN different from the one specified by the first EAP client present on port or by first non-EAP client if no EAP clients are present.
- “non-eap-radius-assignment-vlan” is disabled per port

Note:

In all the preceding cases, information is logged with details about fail reasons.

PVID is set according to VLAN available for EAP/non-EAP clients.

MultiVlan Enabled:

In this situation there are 2 VLANs available (1 for EAP clients and 1 for non-EAP clients). The 2 VLANs are determined by the first EAP/non-EAP successful authentication.

EAP clients are blocked in the following situations:

- EAP client comes without any VLAN
- EAP client comes with a VLAN that does not exist on the switch
- EAP client comes with a VLAN different from the one specified by the first EAP client present on port
- “use-radius-assignment-vlan” is disabled on port
- EAP client comes with a VLAN for Non-EAP clients

Non-EAP clients are blocked in the following situations:

- Non-EAP client comes without any VLAN
- Non-EAP client comes with a VLAN that does not exist on the switch
- Non-EAP client comes with a VLAN different from the one specified by the first Non-EAP client present on port
- “non-eap-radius-assignment-vlan” is disabled per port
- Non-EAP client comes with a VLAN for EAP clients

Note:

No PVID changes.

Sticky MAC address

Sticky MAC address provides a high level of control, and simpler configuration and operation for MAC address security, on a standalone switch or a switch that is part of a stack. With Sticky MAC address, you can secure the MAC address to a specified port so if the MAC address moves to another port, the system raises an intrusion event. When you enable Sticky MAC address, the switch performs the initial auto-learning of MAC addresses and can store the automatically learned addresses across switch reboots.

RADIUS-based network security

Remote Access Dial-In User Services (RADIUS) is a distributed client server system that helps secure networks against unauthorized access, allowing a number of communication servers and clients to authenticate user identities through a central database. The database within the RADIUS server stores information about clients, users, passwords, and access privileges; these are protected with a shared secret.

RADIUS authentication is a fully open and standard protocol defined by RFC 2865.

How RADIUS works

A RADIUS application has two components:

- RADIUS server—a computer equipped with RADIUS server software (for example, a UNIX workstation). The RADIUS server stores client or user credentials, password, and access privileges, protected with a shared secret.
- RADIUS client—a router, PC, or a remote access server equipped with the appropriate client software.

A switch can be configured to use RADIUS authentication to authenticate users attempting to log on to the switch using telnet, SSH, EDM, or the console port.

Avaya recommends that you configure two RADIUS servers so that if one server is unreachable, the switch will attempt authentication using the secondary server. If a specific RADIUS server does not respond to a certain request, the switch retries the request a maximum of five times, which is the retry limit. The default retry value is three times. To prevent false retries, you can configure the interval between retries up to 60 seconds, based on network requirements. The default retry interval is 2 seconds.

RADIUS server configuration

You must set up specific user accounts on the RADIUS server before you can use RADIUS authentication in the switch network. User account information about the RADIUS server contains user names, passwords, and service-type attributes.

Provide each user with the appropriate level of access.

- for read-write access, set the Service-Type field value to Administrative
- for read-only access, set the Service-Type field value to NAS-Prompt

For more information about configuring the RADIUS server, see the documentation that came with the server software.

Change the RADIUS Password

The remote users can change their account passwords when RADIUS server is configured and enabled in their network.

Note:

Change RADIUS password is available only in secure software builds.

When RADIUS servers are configured in a network, they provide centralized authentication, authorization, and accounting for network access. The MS-CHAPv2 encapsulation method can be enabled to permit RADIUS password change for the user accounts.

Change RADIUS password is disabled by default.

When the RADIUS encapsulation MS-CHAPv2 is enabled and if an account password expires, the RADIUS server reports the password expiry during the next log on attempt and the system prompts you to create a new password. You can also change the password before the password expire using ACLI.

The following configurations are required to change RADIUS password:

- at least one configured and reachable RADIUS server in your network
- configured RADIUS encapsulation MS-CHAPv2

Change RADIUS password is compatible with RADIUS password fallback.

Settings for the change RADIUS password feature are saved in both the binary and ASCII configuration files.

Effects of software upgrade on RADIUS settings:

The RADIUS password settings are saved in NVRAM and are available after an upgrade.

Effects of software downgrade on RADIUS settings:

The RADIUS password setting is disabled if a release with this feature is downgraded.

RADIUS server reachability

You can use RADIUS server reachability to configure the switch to use ICMP packets or dummy RADIUS requests to determine the reachability of the RADIUS server. The switch regularly performs the reachability test to determine if the switch should fail over to the secondary RADIUS server or to activate the fail open VLAN, if that feature is configured on the switch.

If you implement internal firewalls which limit the flow if ICMP reachability messages from the switch to the RADIUS server, you can configure the switch to use dummy RADIUS requests. If the switch is configured to use dummy RADIUS requests, the switch generates a regular dummy RADIUS request with the username *avaya* and password *avaya*. Because the switch interprets either Request Accept or Request Reject responses as a confirmation for reachability, you do not have to add the credentials on server in order to test for server reachability. You can configure both username and password for the dummy account via ACLI. It is recommended that you set up a dummy account with the user name *avaya* and correct password on the RADIUS server to avoid the generation of error messages indicating invalid user logins, if RADIUS server reachability is enabled.

If the `use-radius` option is configured, the username and password for the dummy RADIUS packet can also be configured via ACLI.

By default, the switch uses ICMP packets to determine the reachability of the RADIUS server.

The switch regularly checks each RADIUS Server (i.e. Global, EAP and NEAP servers, in that order) for reachability. For each of these RADIUS servers, the switch performs the following:

- If the primary server is reachable, the server status is updated to *reachable* and further authentication will use this server. As long as the primary server is reachable, the secondary server will not be tested for reachability.
- If the primary server is not reachable but the secondary server is reachable, the current status of the secondary server is updated to *reachable* and further authentication will use this server
- If both primary and secondary servers are unreachable, the current server status is updated to *unreachable* and no further authentication occurs until the next successful reachability check.

You can configure the intervals between two consecutive reachability checks. The default values are as follows:

- one minute, if the last check result was *unreachable*
- three minutes, if the last check result was *reachable*

A server is marked as unreachable after a number of retries and timeouts. The default number of retries is three and the default timeout value is 20 seconds, but you can also configure these values in ACLI.

The use-radius method is usually better for testing reachability. Testing using ICMP packets may mark the server as reachable after a successful response from a ping, but the RADIUS Service may not be started on the server side.

RADIUS EAP or non-EAP requests from different servers

You can manage EAP and Non-EAP (NEAP) functions on separate RADIUS servers.

EAP RADIUS servers: You can configure a maximum of two EAP RADIUS servers, either IPv4 or IPv6, for the authentication and accounting of EAP client requests. You can configure one EAP RADIUS server as the primary server and the other EAP RADIUS server as the secondary server.

Non-EAP RADIUS servers: You can configure a maximum of two non-EAP RADIUS servers, either IPv4 or IPv6, for the authentication and accounting of Non-EAP client requests. You can configure one non-EAP RADIUS server as the primary server and the other non-EAP RADIUS server as the secondary server.

Global RADIUS servers: Global RADIUS servers process both EAP and Non-EAP client requests if EAP or non-EAP RADIUS servers are not configured. You can configure one Global RADIUS server as the primary server and the other Global RADIUS server as the secondary server.

RADIUS servers with SHSA, MHSA, and MHMA modes

When you use SHSA, MHSA and MHMA modes, if the primary RADIUS server is not reachable, the system attempts to connect to the secondary RADIUS server. If both the primary and secondary RADIUS servers cannot be reached, the EAP or Non-EAP client is not authenticated.

Note:

If the system cannot reach a RADIUS server with a valid IP address, it disconnects clients from the server at the next re-authentication.

RADIUS server priority in SHSA and MHSA modes

For SHSA and MHSA modes, if you configure EAP RADIUS servers, only the EAP RADIUS servers are used in the following priority order:

- EAP RADIUS server – primary
- EAP RADIUS server – secondary

For SHSA and MHSA modes, if you do not configure EAP RADIUS servers, servers are used in the following priority order:

- Global RADIUS server – primary
- Global RADIUS server – secondary

Note:

Because SHSA and MHSA modes do not support the authentication of Non-EAP clients, ports in SHSA or MHSA mode do not use Non-EAP RADIUS servers for authentication.

RADIUS server priority in MHMA mode

Since MHMA mode is used when multiple authentications are required for a single port, and authenticated clients can be either EAP or Non-EAP, the client type determines which RADIUS server processes client requests.

EAP clients

- If only EAP RADIUS servers are configured, all EAP clients are authenticated using an EAP server (primary or secondary). If both primary and secondary EAP RADIUS servers become unavailable, the EAP clients remain authenticated until the next re-authentication.
- If EAP and Global RADIUS servers are configured, all EAP clients are authenticated using only an EAP server (primary or secondary). If both primary and secondary EAP RADIUS servers become unavailable, the EAP clients remain authenticated until the next re-authentication.
- If only Global RADIUS servers are configured, all EAP clients are authenticated using a Global RADIUS server (primary or secondary). If both primary and secondary Global RADIUS servers become unavailable, the EAP clients remain authenticated until the next re-authentication.

Non-EAP clients

- If only non-EAP RADIUS servers are configured, all Non-EAP clients are authenticated using the non-EAP RADIUS servers (primary or secondary). If both primary and secondary non-EAP RADIUS servers become unavailable, the Non-EAP clients remain authenticated until the next re-authentication.

- If Non-EAP and Global RADIUS servers are configured, all Non-EAP clients are authenticated using only the non-EAP RADIUS servers (primary or secondary). If both primary and secondary non-EAP RADIUS servers will become unavailable, the Non-EAP clients remain authenticated until the next re-authentication.
- If only Global RADIUS servers are configured, all Non-EAP clients are authenticated using a Global RADIUS server (primary or secondary). If both primary and secondary Global RADIUS servers become unavailable, the Non-EAP clients remain authenticated until the next re-authentication.

Examples of RADIUS servers with MHMA mode

The following diagram illustrates a network that includes the following:

- a switch with a port configured for MHMA
- the MHMA port connected to multiple EAP and Non-EAP clients
- a group of RADIUS servers configured as primary and secondary EAP RADIUS servers, non-EAP RADIUS servers, and Global RADIUS servers

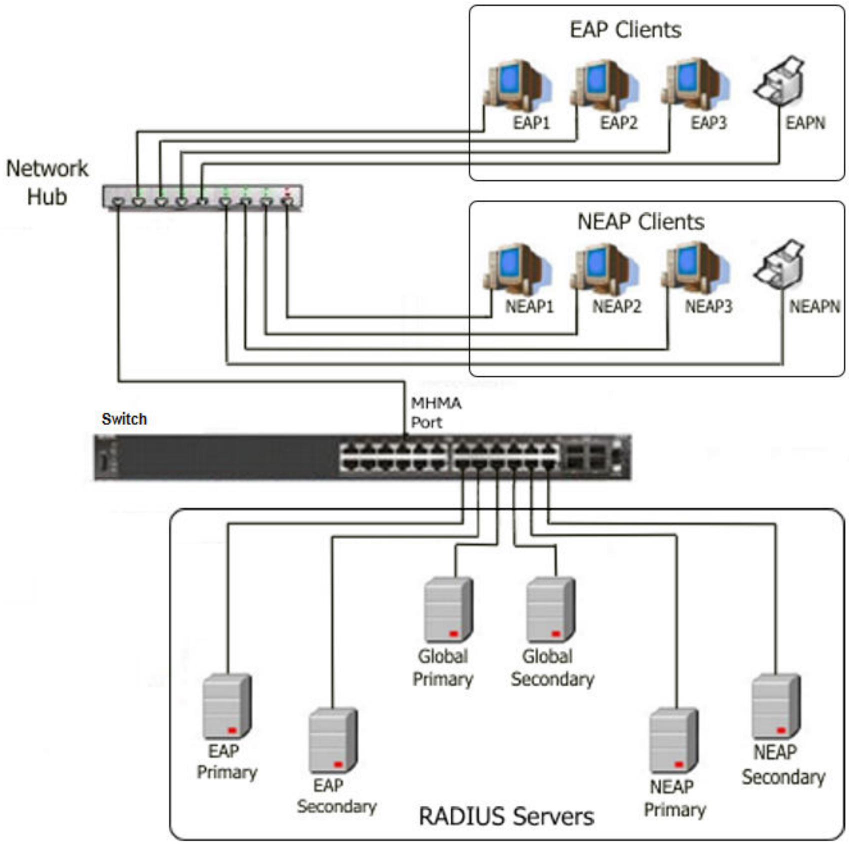


Figure 1: EAP and non-EAP RADIUS servers in MHMA mode

The following scenarios for EAP clients are based on the configuration in the preceding diagram:

1. EAP clients are authenticated on a Global RADIUS server and you configure the EAP RADIUS servers. At the next re-authentication, all EAP clients authenticate on the EAP RADIUS server.

2. Both the EAP RADIUS servers and the Global RADIUS servers are configured, with EAP clients authenticated on an EAP RADIUS server. In this case, the following can occur:
    - If the EAP RADIUS server becomes unavailable, the system disconnects the EAP clients at the next re-authentication, and the system does not re-authenticate the EAP clients on the Global RADIUS server.
    - If you reset the EAP RADIUS servers to default settings, where the IP addresses for both the primary and secondary hosts return to 0.0.0.0, at the next re-authentication the system authenticates EAP clients on the Global RADIUS server.

    Assumptions:

    - If you configure an EAP RADIUS server, the system does not use the Global RADIUS server for EAP clients.
    - The system does not use the non-EAP RADIUS server for EAP clients

The following scenarios for Non-EAP clients are based on the configuration in the preceding diagram:

1. Non-EAP clients are authenticated on a Global RADIUS server and you configure the non-EAP RADIUS servers. At the next re-authentication, all Non-EAP clients are authenticated using the non-EAP RADIUS server.
2. Both the non-EAP RADIUS servers and the Global RADIUS are configured; with Non-EAP clients authenticated on a non-EAP RADIUS server. In this case, the following can occur:
    - If the non-EAP RADIUS server becomes unavailable, the system disconnects the Non-EAP clients at the next re-authentication, and the system does not re-authenticate the Non-EAP clients on the Global RADIUS server.
    - If you reset the non-EAP RADIUS servers to default settings, where the IP addresses for both the primary and secondary hosts return to 0.0.0.0., at the next re-authentication, the system authenticates Non-EAP clients on the Global RADIUS server.

Assumptions:

- If you configure the non-EAP RADIUS server, the system does not use the Global RADIUS server for Non-EAP clients.
- The system does not use the non-EAP RADIUS server for EAP clients.

Interaction with other features

The following sections describe how the RADIUS EAP or non-EAP requests from different servers feature interacts with other features.

Interaction with RADIUS server reachability

When you use the RADIUS EAP or non-EAP requests from different servers feature, the method you use to determine RADIUS server reachability, ICMP or dummy RADIUS requests, applies equally to either Global RADIUS servers, EAP RADIUS servers, or NEAP RADIUS servers.

Interaction with Fail Open VLAN and Multivlan

Earlier, Fail Open VLAN and Multivlan were mutually exclusive when interacting with other features. With the introduction of RADIUS EAP or non-EAP requests from different servers, this behavior is changed as described in this section.

When you configure Global RADIUS servers, EAP RADIUS servers, or non-EAP RADIUS servers, and a switch port cannot connect to the RADIUS servers, the system moves the port to the designated Fail Open VLAN.

When the RADIUS servers are unreachable, the different RADIUS servers feature interacts with Fail Open VLAN to provide some restricted access, independent of the Guest VLAN, when Fail Open VLAN is enabled.

EAP clients authenticate on the EAP RADIUS servers. If EAP RADIUS servers are not configured, EAP clients authenticate on the Global RADIUS server.

NEAP clients authenticate on the NEAP RADIUS servers. If NEAP RADIUS servers are not configured, NEAP clients authenticate on the Global RADIUS server.

EAP or NEAP Multivlan is disabled or not implemented

This section describes RADIUS server interaction with Fail Open VLAN when you disable or do not implement EAP or NEAP Multivlan.

- If you configure either EAP or NEAP RADIUS servers, when the RADIUS server becomes unreachable, the system moves the port to the Fail Open VLAN .
- If you configure both EAP and NEAP RADIUS servers, only when both RADIUS servers become unreachable does the port move to the Fail Open VLAN . Otherwise, port membership does not change.
- If you configure EAP and Global RADIUS servers, only when both RADIUS servers become unreachable does the port move to Fail Open VLAN .
- If you configure NEAP and Global RADIUS servers, only when both RADIUS servers become unreachable does the port move to Fail Open VLAN .
- If you configure only a Global RADIUS server, only when the RADIUS server becomes unreachable does the port move to Fail Open VLAN .
- If you configure EAP, NEAP, and Global RADIUS servers, only when both EAP and NEAP RADIUS servers become unreachable does the port move to Fail Open VLAN . If only the Global RADIUS server becomes unreachable, the port membership does not change.

EAP or NEAP Multivlan is enabled

When you enable and implement EAP or NEAP Multivlan, and the RADIUS servers are unreachable, the port can be copied to Fail Open VLAN, depending on which RADIUS servers you configured.

EAP RADIUS servers only:

If you configure only EAP RADIUS servers, when the RADIUS servers become unreachable, all EAP-enabled ports are moved to Fail Open VLAN, and no PVID or priority changes occur on those ports. Traffic from authenticated EAP clients goes to the corresponding VLAN (RADIUS assigned VLAN or the initial VLAN), and not the Fail Open Vlan.

If all new MACs learned on the EAP-enabled ports are not authenticated as NEAP clients using other authentication methods, like static MACs or DHCP signature, the new MACs are considered potential EAP clients, and traffic is forwarded to Fail Open VLAN.

If EAP re-authentication is enabled, EAP clients do not re-authenticate while ports are in Fail Open VLAN.

NEAP RADIUS servers only:

If you configure only NEAP RADIUS servers, when the RADIUS servers become unreachable, all EAP-enabled ports are moved to Fail Open VLAN, and no PVID or priority changes occur on those ports. Traffic from authenticated NEAP clients goes to the corresponding VLAN (RADIUS assigned VLAN or the initial VLAN), and not the Fail Open Vlan.

All new MACs learned on the ports are considered potential NEAP clients and traffic is fowarded to Fail Open VLAN, unless the clients are authenticated using NEAP methods that do not require connectivity to RADIUS server, like local MACs or DHCP signature.

If non-EAP re-authentication is enabled, NEAP clients do not re-authenticate while ports are in Fail Open VLAN.

EAP and NEAP RADIUS servers:

If you configure both EAP and NEAP RADIUS servers and the EAP RADIUS servers become unreachable, traffic from authenticated EAP clients goes to the corresponding VLAN. EAP-enabled ports are moved to Fail Open VLAN.

If you configure both EAP and NEAP RADIUS servers and the NEAP RADIUS servers become unreachable, traffic from authenticated NEAP clients goes to the corresponding VLAN. EAP-enabled ports are moved to Fail Open VLAN.

If EAP or non-EAP re-authentication is enabled and the corresponding RADIUS server is not reachable, EAP or NEAP clients do not re-authenticate while ports are in Fail Open VLAN.

All new MACs learned on the port are considered potential EAP or NEAP clients, depending on which RADIUS server becomes unreachable, and traffic is forwarded to Fail Open VLAN, unless the MACs are authenticated using methods like static MACs or DHCP signature. If both EAP and NEAP RADIUS servers recover, EAP-enabled ports are removed from Fail Open VLAN and all authenticated MACs, except NEAP clients authenticated based on DHCP signature, are reauthenticated. All MACs that were not authenticated are flushed from the system to be authenticated.

EAP and Global RADIUS servers:

If you configure EAP and Global RADIUS servers, Global RADIUS servers are not used to authenticate EAP clients if EAP RADIUS servers become unreachable. In this case, Global RADIUS servers are used to authenticate NEAP clients. If either EAP or Global radius servers become unreachable, the behavior is similar to when you configure both EAP and NEAP radius servers.

NEAP and Global RADIUS servers:

If you configure NEAP and Global RADIUS servers, Global RADIUS servers are not used to authenticate NEAP clients if NEAP RADIUS servers become unreachable. In this case, Global RADIUS servers are used to authenticate EAP clients. If either NEAP or Global radius servers become unreachable, the behavior is similar to when you configure both EAP and NEAP radius servers.

EAP, NEAP, and Global RADIUS servers:

If you configure EAP, NEAP, and Global RADIUS servers, the Global RADIUS server does not authenticate EAP clients when EAP RADIUS servers become unreachable, or NEAP clients when NEAP RADIUS servers become unreachable. If either EAP or NEAP radius servers become unreachable, the behavior is similar to when you only configure both EAP and NEAP radius servers.

Global RADIUS server only:

If you configure only a Global RADIUS server, both EAP and NEAP clients are authenticated using the Global RADIUS server.

If the Global RADIUS server becomes unreachable all EAP-enabled and EAP-enabled ports are moved to Fail Open VLAN.

Traffic from all authenticated EAP and NEAP clients goes to the corresponding VLAN.

All new MACs learned on the port are considered potential EAP or NEAP clients and traffic is forwarded to Fail Open VLAN, unless the MACs are authenticated using methods like static MACs or DHCP signature.

When the Global RADIUS server recovers, all EAP-enabled and EAP-enabled ports are removed from Fail Open VLAN. All authenticated clients, except those authenticated by DHCP signature, are reauthenticated. All MACs that were not authenticated are flushed from the system to be authenticated.

Note:

If some MACs are forwarding traffic to a Guest VLAN when a RADIUS server becomes unreachable and the EAP-enabled ports are moved to Fail Open VLAN, those MACs continue to forward traffic to the Guest VLAN.

RADIUS password fallback

With the RADIUS password fallback feature the user can log on to the switch or stack by using the local password, if the RADIUS server is unavailable or unreachable for authentication.

RADIUS password fallback is enabled by default.

Configuring RADIUS authentication

You can configure and manage RADIUS authentication using ACLI or Enterprise Device Manager (EDM).

RADIUS Request use Management IP

When the switch is operating in Layer 2 mode, by default, all RADIUS requests generated by the switch use the stack or switch management IP address as the source address in RADIUS requests or status reports. The RADIUS Request use Management IP configuration has no impact when the switch operates in Layer 2 mode.

When the switch is operating in Layer 3 mode, by default, a RADIUS request uses one of the routing IP addresses on the switch. When the switch is operating in Layer 3 mode, the RADIUS Request use Management IP configuration ensures that the switch or stack generates RADIUS requests using the source IP address of the management VLAN. In some customer networks, the source IP in the RADIUS request is used to track management access to the switch, or it can be used when non-EAP is enabled. Because Non-EAP can use an IP in the password mask it is important to have a consistent IP address.

Note:

If the management VLAN is not operational, then the switch cannot send any RADIUS requests when:

- the switch is operating in Layer 2 mode
- the switch is operating in Layer 3 (routing) and RADIUS Request Use Management IP is enabled

This is normal behavior in Layer 2 mode; if the Management VLAN is unavailable, then there is no active Management IP instance. In Layer 3 mode, if RADIUS Request Use Management IP is enabled, then the switch does not use any of the other routing instances to send RADIUS requests when the Management VLAN is inactive or disabled.

RADIUS Management Accounting

You can use the RADIUS Management Accounting feature to send radius accounting packets when management events such as user logon or logoff, or session timeout for a logged on user occur. The feature can record management logon activity to the switch. The switch generates an authentication message, to the RADIUS server, which includes basic information such as: NAS-IP-Address, Service-Type, User-Name, Client-IP-Address, and Timestamp.

The RADIUS Management accounting records are generated when the switch is accessed using the console, telnet, SSH, or when a session is disconnected either by logging out or through time-out.

The following table describes the additional information fields in the RADIUS accounting message. This information enhances the interoperability of the switch in environments where other vendors use their switches.

Table 2: RADIUS Management Accounting Records

RADIUS attribute	Definition
NAS-IP-Address	The IP address of the device generating the RADIUS accounting message (the switch or stack IP address).
NAS-IPv6-Address	The IPv6 address of the device generating the RADIUS Accounting message (the switch or stack address).
NAS-Port-Type	The type of port through which the connection is made to the switch, as defined in RFC2865. In case of logon through the console port, the port takes a value of 1, which corresponds to Async or 5 representing Virtual for the network connections.

Table continues…

RADIUS attribute	Definition
NAS-Port	This is equal to the unit number in a stack if the customer uses the console port. If the connection is virtual, Avaya recommends that this value be set to the protocol used to access the switch, for example, IPv4.
Service-Type	Set to Administrative-User for access to the switch or stack with read-write rights. Set to NAS-Prompt-User for access to the switch/ stack with read-only rights
User-Name	The user name used to connect the current administrative session to the switch.
Acct-Status-Type	Indicates if this is an accounting Start or Stop record, used to respectively identify connection or disconnection to or from the switch.
Acct-Terminate- Cause	This is used in the accounting stop records that the switch generates after a session is disconnected from the switch. Possible values includes the following options. • User-Request - used when user signs off • Idle-Timeout - used when timeout occurs • Lost-Carrier - used when a serial login was performed and the serial cable is unplugged (works with serial security enabled)
Client-IP-Address	Indicates the end client IP address, if the customer connects through IP. If the customer connects through the console, this is the same as the switch or stack address.
Timestamp	The timestamp of the RADIUS accounting record.

RADIUS Management accounting mode can be configured using ACLI and EDM.

RADIUS interim accounting updates

With RADIUS interim accounting updates, the RADIUS server can make policy decisions based on real-time network attributes sent by the switch. The Framed-IP-Address attribute can help compare Layer 2 and Layer 3 IP addresses in the RADIUS server session database and with support for Dynamic Authorization Extensions to RADIUS (RFC 5176), enable integration with applications that operate with Layer 3 IP addresses only. The Framed-IP-Address attribute will only be populated by the switch if DHCP snooping is enabled.

RADIUS interim accounting updates are disabled by default.

Campus security example

The following figure shows a typical campus configuration using the RADIUS-based and MAC-address-based security features for the switch.

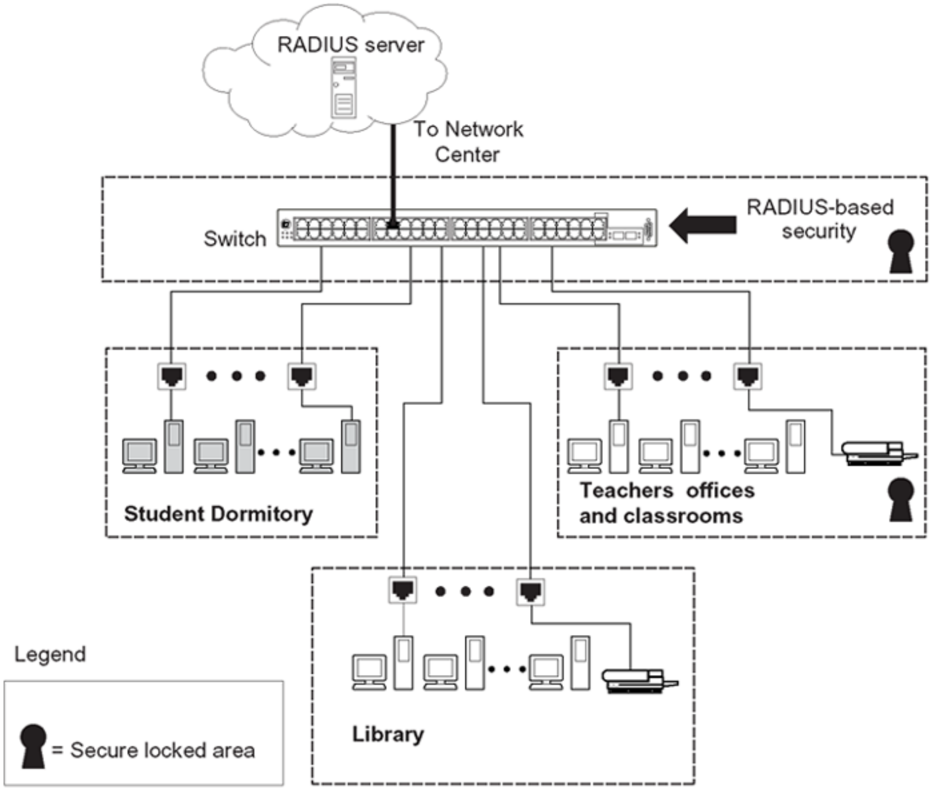


Figure 2: Security features of the switch

This example is based on the assumption that the teachers' offices, classrooms, and the library are physically secure. The student dormitory can also be physically secure.

In the configuration example, the security measures are implemented in the following locations, as follows:

- The switch

  RADIUS-based security limits administrative access to the switch through user authentication. For more information, see RADIUS-based network security on page 30.

  MAC address-based security permits up to 448 authorized stations access to one or more switch ports. For more information, see MAC address-based security on page 27.

  The switch is in a locked closet, accessible only by authorized Technical Services personnel.
- Student dormitory

  Dormitory rooms are typically occupied by two students and are prewired with two RJ-45 jacks.

  As specified by the MAC address-based security feature, only authorized students can access the switch on the secured ports.

- Teachers' offices and classrooms

  The PCs that are in the teachers' offices and in the classrooms are assigned MAC address-based security, which is specific for each classroom and office location.

  The security feature logically locks each wall jack to the specified station, thereby preventing unauthorized access to the switch.

  The printer is assigned to a single station and has full bandwidth on that switch port.

  This scenario is based on the assumption that all PCs are password protected and that the classrooms and offices are physically secured.
- Library

  The PCs can connect to any wall jack in the room. However, the printer is assigned to a single station with full bandwidth to that port.

  This scenario is based on the assumption that all PCs are password protected and that access to the library is physically secured.

EAPOL-based security

The switch uses an encapsulation mechanism, Extensible Authentication Protocol over LAN (EAPOL), to provide security. This concept uses the Extensible Authentication Protocol (EAP) as described in the IEEE 802.1X so you can set up network access control on internal LANs. EAPOL filters traffic based on source MAC address. An unauthorized client, whether EAPOL or NonEAPOL, can receive traffic from authorized clients.

With EAP, the exchange of authentication information can occur between end stations or servers connected to the switch and an authentication server, such as a RADIUS server. The EAPOL-based security feature operates in conjunction with a RADIUS-based server to extend the benefits of remote authentication to internal LAN clients.

The following example illustrates how the switch, configured with the EAPOL-based security feature, reacts to a new network connection:

- The switch detects a new connection on a port.
  - The switch requests a user ID from the new client.
  - EAPOL encapsulates the user ID and forwards it to the RADIUS server.
  - The RADIUS server responds with a request for the user's password.
- The new client forwards a password to the switch within the EAPOL packet.
  - The switch relays the EAPOL packet to the RADIUS server.
  - If the RADIUS server validates the password, the new client can access the switch and the network.

Some components and terms used with EAPOL-based security include the following:

- Supplicant: The device that applies for access to the network.
- Authenticator: The software that authorizes a supplicant attached to the other end of a LAN segment. For SHSA mode, the authenticator sends the EAP Request Identity to the supplicant

using the MAC destination address—the EAP MAC address (01:80:C2:00:00:03). For MHMA mode, the authenticator sends the EAP Request Identity to the supplicant using the MAC destination address—the supplicant MAC address.

- Authentication Server: The RADIUS server that provides authorization services to the Authenticator.
- Port Access Entity (PAE): The software entity that is associated with each port that supports the Authenticator or Supplicant functionality.
- Controlled Port: A switch port with EAPOL-based security enabled.

The Authenticator communicates with the Supplicant using an encapsulation mechanism known as EAP over LANs (EAPOL).

The Authenticator PAE encapsulates the EAP message into a RADIUS packet before sending the packet to the Authentication Server. The Authenticator facilitates the authentication exchanges that occur between the Supplicant and the Authentication Server by encapsulating the EAP message to make it suitable for the packet destination.

The Authenticator PAE functionality is implemented for each controlled port on the switch. At system initialization, or when a supplicant is initially connected to the switch controlled port, the controlled port state is set to Unauthorized. During this time, the authenticator processes EAP packets.

When the Authentication server returns a success or failure message, the controlled port state changes accordingly. If the authorization succeeds, the controlled port operational state is Authorized. The blocked traffic direction on the controlled port depends on the Operational Traffic Control field value in the EAPOL Security Configuration screen.

The Operational Traffic Control field can have one of the following two values:

- Incoming and Outgoing: If the controlled port is unauthorized, frames are not transmitted through the port. All frames received on the controlled port are discarded.
- Incoming: If the controlled port is unauthorized, frames received on the port are discarded, but the transmit frames are forwarded through the port.

EAPOL dynamic VLAN assignment

If you allow EAPOL-based security on an authorized port, the EAPOL feature dynamically changes the port VLAN configuration and assigns a new VLAN. The new VLAN configuration values apply according to previously stored parameters in the Authentication server.

The following VLAN configuration values are affected:

- port membership
- PVID
- port priority

When you disable EAPOL-based security on a port that was previously authorized, the port VLAN configuration values are restored directly from the switch nonvolatile random access memory (NVRAM).

The following exceptions apply to dynamic VLAN assignments:

- The dynamic VLAN configuration values assigned by EAPOL are not stored in the switch NVRAM.
- If an EAPOL connection is active on a port, then changes to the port membership, PVID, or port priority are not saved to NVRAM.
- When you enable EAPOL on a port, and you configure values other than VLAN configuration values, these values are applied and stored in NVRAM.

You can set up your Authentication server (RADIUS server) for EAPOL dynamic VLAN assignments. With the Authentication server, you can configure user-specific settings for VLAN memberships and port priority.

When you log on to a system that is configured for EAPOL authentication, the Authentication server recognizes your user ID and notifies the switch to assign preconfigured (user-specific) VLAN membership and port priorities to the switch. The configuration settings are based on configuration parameters customized for your user ID and previously stored on the Authentication server.

To set up the Authentication server, set the following return list attributes for all user configurations. For more information, see your Authentication server documentation.

- VLAN membership attributes (automatically configures PVID)
  - Tunnel-Type: value 13, Tunnel-Type-VLAN
  - Tunnel-Medium-Type: value 6, Tunnel-Medium-Type-802
  - Tunnel-Private-Group-ID: ASCII value 1 to 4094 or an ASCII string starting with a non-numeric character (this value identifies the specified VLAN)
- Port priority (vendor-specific) attributes
  - Vendor Id: value 562, Avaya vendor ID
  - Attribute Number: value 1, Port Priority
  - Attribute Value: value 0 (zero) to 7 (this value indicates the port priority value assigned to the specified user)

System requirements

The following are the minimum system requirements for the EAPOL-based security feature:

- at least one switch
- RADIUS server (Microsoft Windows 2003 Server or other RADIUS server with EAPOL support)
- client software that supports EAPOL (Microsoft Windows XP Client)

You must configure the Avaya devices with the RADIUS server IP address for the Primary RADIUS server.

EAPOL-based security configuration rules

The following configuration rules apply when you use EAPOL-based security:

- Before configuring your you must configure the Primary RADIUS Server and Shared Secret fields.
- You cannot configure EAPOL-based security on ports that are currently configured for
  - shared segments
  - MultiLink Trunking
  - MAC-address-based security
  - IGMP (Static Router Ports)
  - port mirroring
- With EAPOL SHSA (the simplest EAPOL port operating mode), you can connect only one client on each port that is configured for EAPOL-based security. If you attempt to add additional clients to a port, that port state changes to Unauthorized.

RADIUS-based security uses the RADIUS protocol to authenticate local console, Telnet, and EAPOL-authorized logons.

Advanced EAPOL features

EAPOL supports the following advanced features:

- Single Host with Single Authentication (SHSA) and Guest VLAN.
- Multihost (MH) support:
  - Multiple Host with Multiple Authentication (MHMA).
  - Non EAP hosts on EAP-enabled ports.
  - Multiple Host with Single Authentication (MHSA).
- 802.1X or non-EAP and Guest VLAN on the same port.
- 802.1X or non-EAP with Fail Open VLAN.
- 802.1X or non-EAP Last Assigned RADIUS VLAN.
- 802.1X or non-EAP with VLAN names.

Important:

Support exists only for untagged traffic when you use the multihost features.

Note:

With the 802.1x-2004 standard, the switch can authenticate EAPOL version 1 and EAPOL version 2 supplicants. In multihost mode, the switch can communicate with EAPOL version 1 and EAPOL version 2 supplicants in the same time.

Client reauthentication

If your system is configured for SHSA and MHSA, when clients are reauthenticated the system moves them into the new RADIUS-assigned VLAN, if the new RADIUS-assigned VLAN differs from the current VLAN.

If you use RADIUS-assigned VLAN in multi-host mode and, if the RADIUS-assigned VLAN of the first authenticated clients is invalid, the switch ignores those RADIUS VLAN assignments and assigns the port to the first valid RADIUS VLAN assignment if Last RADIUS Assigned VLAN is disabled. If Last RADIUS Assigned VLAN is enabled, the port remains assigned to the last valid RADIUS Assigned VLAN. If your system is configured for MHMA, when clients are reauthenticated the system does not move them into the new RADIUS-assigned VLAN.

Single Host with Single Authentication and Guest VLAN

Single Host with Single Authentication (SHSA) support is the default configuration for an EAP-enabled port. At any time, only one MAC user can be authenticated on a port, and the port assigned to only one port-based VLAN.

If you configure no guest VLAN, only the particular device or user that completes EAP negotiations on the port can access that port for traffic. Tagged ingress packets are sent to the PVID of that port. The only exceptions are reserved addresses.

You can configure a guest VLAN for non authenticated users to access the port. Any active VLAN can be a guest VLAN.

The following rules apply for SHSA:

- When the port is EAP enabled
  - If Guest VLAN is enabled, the port is placed on a Guest VLAN.

    PVID of the port = Guest VLAN ID
  - If Guest VLAN is not enabled, the port handles EAPOL packets only until successful authentication.
- During EAP authentication
  - If Guest VLAN is enabled, the port is placed on a Guest VLAN.
  - If Guest VLAN is not enabled, the port handles EAPOL packets only.
- If authentication succeeds
  - The port is placed on a preconfigured VLAN or a RADIUS-assigned VLAN. Only packets with the authenticated MAC (authMAC) can be on that port. Other packets are dropped.

- If authentication fails
  - If Guest VLAN is enabled, the port is placed on a Guest VLAN.
  - If Guest VLAN is not enabled, the port handles EAPOL packets only.
- Reauthentication can be enabled for the authenticated MAC address. If reauthentication fails, the port is placed back in the Guest VLAN.

The EAP-enabled port belongs to the Guest VLAN, RADIUS-assigned VLAN, or configured VLANs.

Guest VLAN

You can configure a global default Guest VLAN ID for the stack or the switch. Set the VLAN ID as Valid when you configure the switch or the stack.

Guest VLAN support contains the following features:

- Guest VLAN support is available for each port. Guest VLANs can have a valid Guest VLAN ID on each port. If a Guest VLAN ID is not specified for a port, the global default value is used. You cannot enable this feature on a particular port if the global default value or the local Guest VLAN ID is invalid.
- The Guest VLAN chosen must be an active VLAN configured on the switch. EAP registers with the VLAN module, so that it can be recovered if you delete a VLAN.

  When a VLAN that is in use by EAP is deleted, the following actions are performed:

  - A message is sent to the syslog.
  - The port is blocked.
- When an authentication failure occurs, a port is placed back in the Guest VLAN.
- This feature affects ports that have EAP-Auto enabled. Therefore, the port must always be in a forwarding mode. It does not affect ports with administrative state, force-authorized, or force-unauthorized.
- This feature uses Enterprise Specific Management Information Bases (MIB).
- The Guest VLAN configuration settings are saved across resets.

❗ **Important:**

The EAP enabled port is not moved to the Guest VLAN, if the Guest VLAN and original VLAN are associated with different Spanning Tree Groups. The EAP port does not forward traffic in the guest VLAN or the original VLAN. If EAP authentication succeeds, packets are transmitted properly in the original VLAN.

802.1X or non-EAP and Guest VLAN on the same port

802.1X or non-EAP and Guest VLAN on the same port removes the previous restrictions on configuring the 802.1X and non-EAP function on the same port simultaneously. In the current release, 802.1X functionality supports multiple modes simultaneously on the port allowing Guest VLAN to function along with non-EAP and various 802.1X operational modes.

For example, the switch supports authenticating an IP Phone using non-EAP according to the DHCP signature of the phone. The data VLAN remains in the Guest VLAN until a device on that port is appropriately authenticated using 802.1X and optionally placed in the appropriate RADIUS assigned VLAN.

802.1X or non-EAP with Fail Open VLAN

802.1X or non-EAP with Fail Open VLAN provides network connectivity when the switch cannot connect to the RADIUS server. Every three minutes, the switch verifies whether the RADIUS servers are reachable. If the switch cannot connect to the primary and secondary RADIUS servers, then after a specified number of attempts to restore connectivity, the switch declares the RADIUS servers unreachable.

All authenticated devices move into the configured Fail Open VLAN, when the switch declares the RADIUS servers unreachable. This prevents the clients from being disconnected when the reauthentication timer expires and provides the devices some form of network connectivity. To provide the level of connectivity as required by corporate security policies, configure the Fail Open VLAN within the customer network. For example, the Fail Open VLAN configured to provide access to corporate IT services can be restricted from access to financial and other critical systems. In these situations clients receive a limited level of network connectivity when the RADIUS servers are unreachable rather than receiving no access.

When a switch is operating in the Fail Open mode, which means that the RADIUS servers are unreachable, the switch regularly verifies the connectivity. When the RADIUS servers become reachable, the clients are reauthenticated and, as appropriate, moved to the assigned VLANs, allowing normal network connectivity to resume.

When a client operates in the Fail Open VLAN, because RADIUS servers are unreachable, any 802.1X logoff messages received from the EAP supplicant are not processed by the switch.

For an EAP or non-EAP enabled port, by default, the Fail Open VLAN feature is disabled. When the RADIUS servers are unreachable, if the Fail Open VLAN is defined, then

- the port becomes a member of both the EAP Fail Open VLAN and EAP Fail Open VoIP VLAN
- the switch sets the PVID of the switch port to EAP Fail Open VLAN
- all the EAP-enabled ports move to the Fail Open VLANs across the units in a stack

Important:

When the switch is operating in Fail Open mode, it does not send EAP authentication requests to the RADIUS Server.

Important:

When the port transitions from normal EAP operation to Fail Open, the end client is not aware that the port has transitioned to a different VLAN. Depending upon the association of the IP addressing scheme to VLANs, it is necessary for the client to obtain a new IP address when transitioning to or from the Fail Open VLAN. An enhancement calls for the port to be administratively turned off, and then back on again when the port transitions between Fail Open VLAN. If the PC is directly connected to the switch, this results in the client automatically refreshing the IP address. If the PC is located behind an IP handset, another switch, or a hub, the client must perform a manual renewal of the IP address.

After the switch accesses the RADIUS server and authentication succeeds, the ports move to the Guest VLAN, or to configured VLANs, and age to allow the authentication of all incoming MAC addresses on the port. If there is at least one authenticated MAC address on the port, it blocks all other unauthenticated MAC addresses on the port. You must turn on the debug counters to track server reachability changes.

Fail Open VLAN Continuity Mode

The Fail Open VLAN Continuity Mode feature introduces a new mode of operation for EAP/NEAP clients when the RADIUS server(s) become unreachable.

RADIUS Server reachability is checked periodically. When the RADIUS server is unreachable, the interval is one minute. When the RADIUS server is reachable, the interval is 3 minutes. This can lead to a delay of up to 3 minutes, from the moment when the RADIUS Server becomes unreachable until the movement to Fail Open VLAN is performed.

In previous releases, if EAP/NEAP reauthentication is enabled and an EAP/NEAP client tries to reauthenticate in this interval, the client is removed from port.

When Fail Open VLAN Continuity Mode is enabled and if the RADIUS client does not receive any response from RADIUS Server, the EAP or Non-EAP MACs are not flushed. The RADIUS reachability is triggered, and the port is moved or copied to Fail Open VLAN.

With Fail Open VLAN Continuity Mode enabled, the switch operates as follows:

- The authenticated state of a client is not altered if RADIUS reachability changes.
- If a client performs reauthentication (either EAP or NEAP), and the RADIUS Server is unreachable, then the current state of the client is preserved.

Fail Open VLAN Continuity Mode is a global configuration that applies to all switches in a stack.

Note:

It is recommended that the RADIUS Reachability to be set on Use RADIUS. If Use ICMP is used and the RADIUS server is reachable, but the RADIUS Server Service is stopped, an ICMP packet is sent for every authentication. If there are many EAP/Non-EAP clients in the setup, this flood with ICMP packets can be disturbing.

This is a corner case and can be avoided using RADIUS packets for reachability, as recommended, or starting RADIUS Server Service if Use ICMP is used for reachability.

This situation appears because with Fail Open Continuity Mode enabled, the RADIUS Reachability mechanism is triggered when no response is received from the RADIUS Server.

Note:

With MHMV option enabled, when an EAP or NEAP client tries to re-authenticate and the RADIUS server is not reachable, the switch keeps the client in the VLAN currently assigned by RADIUS and maintains any applicable policies. If necessary, the switch provides appropriate communication back to the EAP supplicant to indicate that re-authentication was successful.

In MHMA mode with the multihost multiVLAN option disabled, when a new EAP or NEAP client cannot be re-authenticated because the RADIUS server is not reachable, the client is placed into the configured Fail Open VLAN.

Multiple Host with Multiple Authentication

For an EAP-enabled port configured for Multiple Host with Multiple Authentication (MHMA), a finite number of EAP users or devices with unique MAC addresses are allowed on the port.

Each user must complete EAP authentication before the port allows traffic from the corresponding MAC address. Only traffic from the authorized hosts is allowed on that port.

RADIUS-assigned VLAN values are allowed in the MHMA mode. For more information about RADIUS-assigned VLANs in the MHMA mode, see RADIUS-assigned VLAN use in MHMA mode on page 52

MHMA support is available for an EAP-enabled port.

The following are some of the concepts associated with MHMA:

- Logical and physical ports

  Each unique port and MAC address combination is treated as a logical port. MAX_MAC_PER_PORT defines the maximum number of MAC addresses that can perform EAP authentication on a port. Each logical port is treated as if it is in the SHSA mode.

- Indexing for MIBs

  Logical ports are indexed by a port and source MAC address (src-mac) combination. Enterprise-specific MIBs are defined for state machine-related MIB information for individual MACs.

- Transmitting EAPOL packets

  Only unicast packets are sent to a specific port so that the packets reach the correct destination.

- Receiving EAPOL packets

  The EAPOL packets are directed to the correct logical port for state machine action.

- Traffic on an authorized port

  Only a set of authorized MAC addresses is allowed access to a port.

MHMA support for EAP clients contains the following features:

- A port remains on the Guest VLAN when no authenticated hosts exist on it. Until the first authenticated host, both EAP and non-EAP clients are allowed on the port.

- After the first successful authentication, only EAPOL packets and data from the authenticated MAC addresses are allowed on a particular port.
- Only a predefined number of authenticated MAC users are allowed on a port.
- RADIUS VLAN assignment is enabled for ports in MHMA mode. Upon successful RADIUS authentication, the port gets a VLAN value in a RADIUS attribute with EAP success. The port is added and the PVID is set to the first such VLAN value from the RADIUS server.
- Configuration of timer parameters is for each physical port, not for each user session. However, the timers are used by the individual sessions on the port.
- Reauthenticate Now, when enabled, causes all sessions on the port to reauthenticate.
- Reauthentication timers are used to determine when a MAC is disconnected so as to enable another MAC to log on to the port.
- Configuration settings are saved across resets.

EAP and non-EAP MultiVLAN capability

With the EAP and non-EAP MultiVLAN capability, you can assign multiple EAP and non-EAP hosts to different VLANs on the same port. Before you can enable or disable the MultiVLAN capability, you must disable EAP globally on the switch.

The support of multiple VLAN functionality is an important option for when you want to configure Guest VLAN in MHMA mode and have multiple devices connected to the port. Using multiple VLANs simultaneously with EAP or non-EAP, you can assign the port to VLANs based on client returned attributes, and unauthenticated clients can remain in the Guest VLAN when other clients on the port (for example an IP Phone) are authenticated.

When you enable the MultiVLAN feature, the use of 802.1X or non-EAP Last Assigned RADIUS VLAN functionality is redundant and the switch does not permit Last Assigned VLAN to be enabled.

The advantages of the MultiVLAN capability are seen only when you use the **`use-radius-assigned-vlan`** option for EAP clients. If you perform Non-EAP MAC RADIUS authentication, then you should use **`non-eap-use-radius-assigned-vlan`**. When you use the MultiVLAN capability on a switch, each authenticated client can access the VLAN corresponding to the VLAN RADIUS attribute. If no attribute is received from the RADIUS server, the untagged frames from the authenticated clients will be forwarded in the initial VLAN.

Important:

Avaya recommends that you do not change the MultiVLAN status while Fail Open VLAN is enabled.

RADIUS-assigned VLAN use in MHMA mode

RADIUS-assigned VLAN use in the MHMA mode gives you greater flexibility and a more centralized assignment. This feature is useful in an IP Phone set up also, where the phone traffic is directed to the Voice over IP (VoIP) VLAN and the PC Data traffic is directed to the assigned VLAN. When RADIUS-assigned VLAN values are allowed for the port, the first authenticated EAP MAC address cannot have a RADIUS-assigned VLAN value; at this point, the port is moved to a configured VLAN. A later authenticated EAP MAC address (for instance, the third one on the port) receives a RADIUS-assigned VLAN value. This port is then added, and the port VLAN ID (PVID) is set to the first such

VLAN value from the RADIUS server. The VLAN remains the same irrespective of which MAC leaves, and a change in the VLAN takes place only when there are no authenticated hosts on the port.

You can use the 802.1X or non-EAP Last Assigned RADIUS VLAN functionality to configure the switch such that the last received radius-vlan assignment is always honoured on a port. For more information, see 802.1X or non-EAP Last Assigned RADIUS VLAN on page 58.

Important:

All VLAN movement in an EAP-enabled state is dynamic and is not saved across resets.

Consider the following setup in Figure 3: RADIUS-assigned VLAN in MHMA mode on page 53:

- Stand-alone switch with default settings
- IP Phone connected to the switch in port 1
- PC connected to the PC port of the IP Phone
- RADIUS server connected to switch port 24 (directly or through a network)

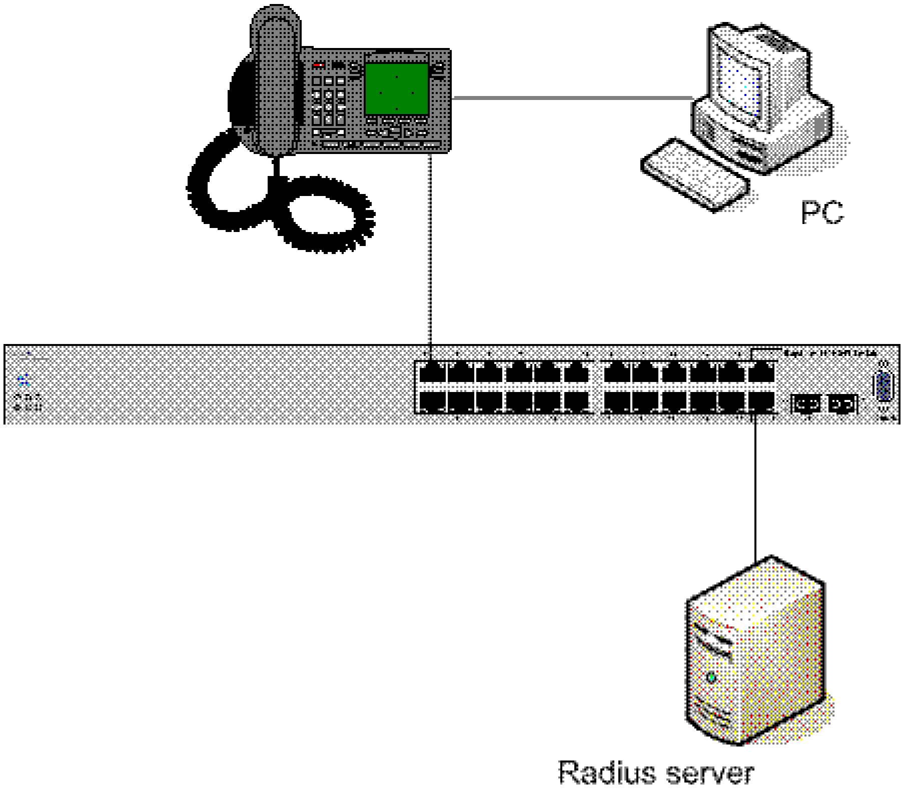


Figure 3: RADIUS-assigned VLAN in MHMA mode

EAP multihost mode needs to be configured on the switch (global settings and local settings for switch port 1/1):

1. Put a valid IP address on the switch.

2. Configure at least the Primary RADIUS server IP address (you can also fill the IP address of the Secondary one).
3. Enable EAP globally.
4. Enable EAP (status Auto) for switch port 1.
5. Enable EAP multihost mode for switch port 1.

   The EAP clients will authenticate using MD5 credentials, but you can use other available types of authentication (such as TLS, PEAP-MSCHAPv2, PEAP-TLS, TTLS). The RADIUS server can be properly configured to authenticate the EAP users with at least MD5 authentication.

Non-EAP IP Phone authentication:

This enhancement is useful mainly for the IP Phones that cannot authenticate themselves with EAP. On an EAP capable IP Phone, EAP must be disabled if the user specifically wants to use the non-EAP IP Phone authentication. DHCP must be enabled on the phone, because the switch examines the phone signature in the DHCP Discover packet sent by the phone.

Following are the steps to enable the enhancement:

1. Enable non-EAP IP Phone authentication in the Global Configuration mode

   ```
   Switch(config)#eapol multihost non-eap-phone-enable
   ```
2. Enable non-EAP IP Phone authentication in the interface mode for switch port 1

   ```
   Switch(config-if)#eapol multihost port 1 non-eap-phone-enable
   ```

   The switch waits for DHCP Discover packets on port 1. After a DHCP Discover packet is received on port 1, the switch looks for the phone signature (for example, Avaya-i2004-A), which can be enclosed in the DHCP Discover packet. If the proper signature is found, the switch registers the MAC address of the IP Phone as an authenticated MAC address and lets the phone traffic pass through the port.

   By default, the non-EAP IP Phone authentication enhancement is disabled in both Global Configuration and Interface Configuration modes, for all switch ports.

Unicast EAP Requests in MHMA

When you enable this enhancement, the switch no longer periodically queries the connected MAC addresses to a port with EAP Request Identity packets. The clients can initiate for themselves the EAP authentication sessions (send EAP Start packets to the switch). Not all EAP supplicants can support this operating mode.

Following are the steps to enable the enhancement:

1. enable unicast EAP requests in the Global Configuration mode:

   ```
   Switch(config)#eapol multihost eap-packet-mode unicast
   ```
2. enable Unicast EAP Requests in the interface mode for switch port 1:

   ```
   Switch(config-if)#eapol multihost port 1 eap-packet-mode unicast
   ```

   By default, multicast mode is selected in both Global Configuration and Interface Configuration modes, for all switch ports. You must set the EAP packet mode to Unicast in both global and Interface Configuration modes for a switch port, to enable this feature. Other combinations (for example, multicast in global, unicast in the interface mode) will select the multicast operating mode.

RADIUS Assigned VLANs in MHMA

This enhancement is basically an extension of the RADIUS assigned VLANs feature in SHSA mode; you can move a port to a specific VLAN even if that switch port operates in EAP MHMA mode.

This enhancement has one restriction. If you have multiple EAP clients authenticating on a switch port (as you normally can in MHMA mode), each one configured with a different VLAN ID on the RADIUS server, the switch moves the port to the VLAN of the first authenticated client. In this way, you can avoid a permanent bounce between different VLANs of the switch port.

Enable the enhancement by following these steps:

1. Enable RADIUS assigned VLANs in the Global Configuration mode:

   ```
   Switch(config)#eapol multihost use-radius-assigned-vlan
   ```

2. Enable RADIUS assigned VLANs in the interface mode for switch port 1:

   ```
   Switch(config-if)#eapol multihost port 1 use-radius-assigned-vlan
   ```

By default, the RADIUS assigned VLANs in the MHMA enhancement is disabled in the Global Configuration and Interface Configuration modes, for all switch ports.

RFC 4675 RADIUS attributes: Egress-VLANID and Egress-VLAN-NAME

This feature introduces support for two standard RADIUS attributes defined in RFC 4675: *Egress-VLANID* and *Egress-VLAN-NAME*. Using these attribute you can control the 802.1Q tagging for traffic egressing a port where RADIUS authentication was performed for a connected EAP or non-EAP client.

You must configure the preferred tagging option and the VLAN name or ID on the RADIUS server. Egress-VLANs are standard attributes, therefore the RADIUS Server should support them by default and offer the ability to configure them. Each attribute contains two parts, the first indicating whether frames on the VLAN egress must be tagged or untagged, and the second specifying the VLAN name or VLAN ID.

The switch applies the VLAN received in the Egress-VLAN attributes to the port where the client was authenticated via RADIUS and then sets the tagging rules (tagged or untagged) accordingly.

The switch does not operate a PVID change due to either one of these attributes. If you need any PVID modification, you must also send attributes that modify the PVID, such as Tunnel-Private-Group-ID or Fabric Attach ISID.

The switch does not automatically create the VLANs specified in these attributes. If you need the VLANs to be auto-created, include attributes that support VLAN auto-creation, such as Tunnel-Private-Group-ID or Fabric Attach ISID. The switch processes last the Egress-VLAN attributes when decoding the RADIUS packet, therefore the switch will first create the VLANs then set the propper tagging for them. You can also create in advance the VLANs on the switch.

Untagged devices such as PCs, or laptops should use the Tunnel-Private-Group-ID attribute, which controls the ingress VLAN. Tagged devices such as phones should use Egress VLAN attribute. For configuring an untagged VLAN for both ingress and egress, Tunnel-Private-Group-ID attribute must be used, while Egress VLAN attributes may be necessary.

The Egress VLAN attributes introduce a new *Hybrid* tagging mode that supports multiple tagged and multiple untagged VLANs on a port. Use the `show vlan interface info` command to display the tagging on a VLAN interface. The output of the `show vlan interface verbose` command is also updated to indicate whether a VLAN is tagged or untagged.

Feature configuration

In order to use the Egress VLAN attributes, you must enable the *Radius assigned VLAN* and *NEAP use RADIUS assigned VLAN* features. Enter the following ACLI commands to enable these features:

- eapol multihost use-radius-assigned-vlan
- eapol multihost non-eap-use-radius-assigned-vlan

Limitations

Because ADAC also sets a custom tagging on the ports where it is enabled, the switch does not process Egress-VLAN attributes on ADAC-enabled EAP ports.

In this release, RFC 3576 Change of Authorization (CoA) is not available for the Egress-VLAN attributes.

RADIUS authentication delay

RADIUS requests sent by the switch are limited to 50 packets per second and the reauthentication period for EAP and Non-EAP clients is reduced to a minimum of 60 seconds.

Delayed MAC authentication

A global delay timer can be configured to delay MAC authentication. When a new MAC is learned on the port, the switch waits the configured delay time between 0 to 20 seconds before Non-EAP traffic is authenticated through the RADIUS server.

Track all MACs per port

This feature tracks the following information for all MACs per port:

- EAP or non EAP authenticated or non-authenticated clients

- status of the RADIUS server authentication response if the MAC is rejected or is not authenticated

Displaying all MACs

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Enter the following command:

   ```
   show eapol sessions {[port <portmask>] | [dhcp-phones] | [[eap] |
   [non-eap [radius] [local] [adac-lldp] [adac-mac-range] [held]
   [mhsa]] | [[unauthenticated [intruder] [guest-vlan] [fail-open-vlan]
   [mhsa-no-limit]]}
   ```

Example

Variable definitions

Use the data in the following table to use the **show eapol sessions** command.

Variable	Value
port <portmask>	Specifies the numeric slot/port format. Range: 1/1 to 8/50 or ALL If no port is specified, the default is ALL. If no parameter is specified, the default is show everything. If “non-eap” is without other parameters, all types of non-eap authenticated macs are shown, except when MHSA under no-limit flag is enabled. When “unauthenticated” is not followed by parameters, all unauthenticated macs are shown.
dhcp-phones	Displays MACs of DHCP Phones.
eap	Displays authenticated EAPOL sessions.
non-eap	Displays authenticated non-EAPOL clients.
radius	Displays non-EAPOL clients authenticated by RADIUS.
local	Displays locally authenticated non-EAPOL clients.
adac-lldp	Displays non-EAPOL clients authenticated through ADAC.
adac-mac-range	Displays neap sessions with macs in the adac mac range list.
held	Displays unauthenticated clients held by RADIUS.
mhsa	Displays non-EAP sessions for MHSA.

Table continues…

Variable	Value
unauthenticated	Displays unauthenticated EAPOL and non-EAPOL clients.
intruder	Displays intruder MACs.
guest-vlan	Displays unauthenticated clients in Guest VLAN.
fail-open-vlan	Displays MACs of clients in Fail Open VLAN.
mhsa-no-limit	Displays non-EAP sessions for MHSA when no-limit is enabled.

Multiple Hosts with Multiple VLANs

With the Multiple Hosts with Multiple VLANs (MHMV) feature, you can assign multiple authenticated devices to different VLANs on the same EAP-enabled or non-EAP-enabled port, using device MAC addresses.

Benefits of using MHMV are:

- Using RADIUS VLAN attributes, different clients can access different VLANS.
- Unauthenticated clients can retain Guest VLAN access.

✱ **Note:**

MHMV is supported only on EAP-enabled or non-EAP-enabled ports configured for Multiple Host with Multiple Authentication (MHMA).

✱ **Note:**

With software releases prior to Release 5.5, the functions of MHMV and Fail Open VLAN were mutually exclusive of each other.

802.1X or non-EAP Last Assigned RADIUS VLAN

You can use 802.1X or non-EAP Last Assigned RADIUS VLAN functionality to configure the switch such that the last received RADIUS VLAN assignment is always honoured on a port. In the previous release, if you enable the use-radius-assigned-vlan option only the first valid RADIUS-assigned VLAN (by EAP or non-EAP authentication) on that port is honoured. The subsequent RADIUS VLAN assignments are ignored for any user on that port. The last RADIUS-assigned VLAN (either EAP or non-EAP) determines the VLAN membership and PVID replacing any previous RADIU-assigned VLAN values for that port.

The functional examples are as follows:

- Multiple EAP and non-EAP clients authenticate on a port.
- The EAP clients can reauthenticate; the non-EAP clients age out and reauthenticate. The Last Assigned VLAN setting for either EAP or non-EAP clients is always applied to the port when

you enable the Last Assigned VLAN. This can result in the port moving unexpectedly between VLANs.

The feature supports ACLI, SNMP, and ACG interfaces. Weber is not available for this function.

ACLI commands

For more information on the commands and procedures for configuring the most recent RADIUS-VLAN assignments on a port, see 802.1X or non-EAP Last Assigned RADIUS VLAN configuration using ACLI on page 170.

802.1X or non-EAP with VLAN names

The 802.1X or non-EAP with VLAN names functionality enhances the switch to match RADIUS assigned VLANs based on either the VLAN number or a VLAN name. Prior to this release, a match occurred based on the VLAN number of the Tunnel-Private-Group-Id attribute returned by the RADIUS server. Now you can use the VLAN number or names for configuring VLAN membership of EAP or non-EAP clients.

The Tunnel-Private-Group-Id attribute is converted to either a VLAN ID or VLAN name, based on the first character of the returned attribute. If the first character in the attribute is a number, the switch processes it as a VLAN number. In other cases, the attribute is taken as a VLAN and matched on the full string. The maximum length of a VLAN name can be 16 characters. You do not have to configure this feature as this mode is always enabled.

Accounting Session ID format enhancement

EAP 802.1x session identifiers are used to track all clients across the network when the RADIUS accounting is enabled. These sessions are not always unique. The Accounting Session ID format enhancement extends the session ID with the IP address of the switch in order to prevent duplicate sessions.

For related ACLI procedures, see:

- Displaying the status of the session ID format on page 166
- Displaying the session ID of an EAP client on page 166
- Configuring accounting session ID format on page 166

Non EAP hosts on EAP-enabled ports

For an EAPOL-enabled port configured for non-EAPOL host support, a finite number of non-EAPOL users or devices with unique MAC addresses are allowed access to the port.

Allow the following types of non-EAPOL users:

- Hosts that match entries in a local list of allowed MAC addresses. You can specify the allowed MAC addresses when you configure the port to allow non-EAPOL access. These hosts are allowed on the port without authentication.
- Non-EAPOL hosts whose MAC addresses are authenticated by RADIUS.
- IP Phones configured for Auto-Detection and Auto-Configuration (ADAC).
- IP Phones detected using LLDP Protocol.
- Avaya IP Phones.

Support for non-EAPOL hosts on EAPOL-enabled ports is primarily intended to accommodate printers and other passive devices sharing a hub with EAPOL clients.

Support for non-EAPOL hosts on EAPOL-enabled ports includes the following features:

- EAPOL and authenticated non-EAPOL clients are allowed on the port at the same time. Authenticated non-EAPOL clients are hosts that satisfy one of the following criteria:
  - Host MAC address matches an entry in an allowed list preconfigured for the port.
  - Host MAC address is authenticated by RADIUS.
- Non-EAPOL hosts are allowed even if no authenticated EAPOL hosts exist on the port.
- When a new host is seen on the port, non-EAPOL authentication is performed as follows:
  - If the MAC address matches an entry in the preconfigured allowed MAC list, the host is allowed.
  - If the MAC address does not match an entry in the preconfigured allowed MAC list, the switch generates a <username, password> pair, which it forwards to the network RADIUS server for authentication. For more information about the generated credentials, see Non-EAPOL MAC RADIUS authentication on page 61.
  - If RADIUS authenticates the MAC address, the host is allowed.
  - If the MAC address does not match an entry in the preconfigured allowed MAC list and fails RADIUS authentication, the host is counted as an intruder. Data packets from that MAC address are dropped.

  EAPOL authentication is not affected.
- For RADIUS-authenticated non-EAPOL hosts, VLAN information from RADIUS is ignored. Upon successful authentication, untagged traffic follows the PVID of the port.
- Non-EAPOL hosts continue to be allowed on the port until the maximum number of non-EAPOL hosts is reached. You can configure the maximum number of non-EAPOL hosts allowed.
- After the maximum number of allowed non-EAPOL hosts has been reached, data packets received from additional non-EAPOL hosts are dropped. The additional non-EAPOL hosts are counted as intruders. New EAPOL hosts can continue to negotiate EAPOL authentication.
- On a single port are allowed a number of EAP-MAC-MAX + 32 intruders. After this limits is reached, the system generates a SNMP trap. The port shuts down, and you must reset the port administrative status (from force-unauthorized to auto) to allow new EAPOL and non-EAPOL negotiations on the port. The intruder counter is reset to zero.
- The feature uses enterprise-specific MIBs.

- Configuration settings are saved across resets.

For more information about configuring non-EAPOL host support, see Configuring support for non-EAPOL hosts on EAPOL-enabled ports on page 193.

Non-EAPOL MAC RADIUS authentication

For RADIUS authentication of a non-EAPOL host MAC address, the switch generates a <username, password> pair as follows:

- The username is the non-EAPOL MAC address in string format.
- The password is a string that combines the MAC address, switch IP address, unit, port, and a user-configurable key string.

  To increase security, the RADIUS NEAP password is set with MD5 based encryption.

  Important:

  Follow these Global Configuration examples to select a password format that combines one or more of these three elements:

  password = 010010011253..0305 (when the switch IP address, unit and port are used).

  password = 010010011253.. (when only the switch IP address is used).

  password= 000011220001 (when only the user's MAC address is used).

The following example illustrates the <username, password> pair format:

```
switch IP address = 10.10.11.253
non-EAP host MAC address = 00 C0 C1 C2 C3 C4
unit = 3 port = 25
```

- username = 00C0C1C2C3C4
- password = 010010011253.00C0C1C2C3C4.0325

Multiple Host with Single Authentication

Multiple Host with Single Authentication (MHSA) is a more restrictive implementation of support for non-EAPOL hosts on EAPOL-enabled ports.

For an EAPOL-enabled port configured for MHSA, one EAPOL user must successfully authenticate before a finite number of non-EAPOL users or devices with unique MAC addresses can access the port without authentication.

The MHSA feature is intended primarily to accommodate printers and other passive devices sharing a hub with EAPOL clients.

MHSA support is on a port by port basis for an EAPOL-enabled port.

MHSA support for non-EAPOL hosts includes the following features:

- The port remains unauthorized when no authenticated hosts exist on it. Before the first successful authentication occurs, both EAPOL and non-EAPOL clients are allowed on the port to negotiate access, but only one host can negotiate EAPOL authentication.
- After the first EAPOL client successfully authenticates, EAPOL packets and data from that client are allowed on the port. No other clients are allowed to negotiate EAPOL authentication. The port is set to preconfigured VLAN assignments and priority values or to values obtained from RADIUS for the authenticated user.
- After the first successful authentication, new hosts, up to a configured maximum number, are automatically allowed on the port, without authentication.
- After the maximum number of allowed non-EAPOL hosts has been reached, data packets received from additional non-EAPOL hosts are dropped. The additional non-EAPOL hosts are counted as intruders.
- As a general rule, the switch allows a number of EAP-MAC-MAX + 32 intruders on a port. With MHSA, only one EAP client can authenticate, meaning that the switch limits the number of intruders to 33. After this limit is reached, a SNMP trap and system message are generated. The port is set to force-unauthorized and you must reset the port to auto to allow new EAPOL negotiations on the port. The intruder counter is reset to zero.
- If the EAPOL-authenticated user logs off, the port returns to an unauthorized state and non-EAPOL hosts are not allowed.
- This feature uses enterprise-specific MIBs.

The maximum value for the maximum number of non-EAPOL hosts allowed on an MHSA-enabled port is 32. However, Avaya expects that the usual maximum value configured for a port is 2. This translates to around 200 for a box and 800 for a stack.

MHSA No-Limit

The MHSA No-Limit feature accommodates the scenario when an access point is connected to the switch. Only the access point performs authentication. The hosts connected behind the access point access the network without any authentication.

The **mhsa-no-limit** option allows an unlimited number of hosts behind the access point. This is a per-port option. If the **mhsa-no-limit** option is enabled on a port, all traffic will be allowed on that port after the first successful client authentication.

Non-EAP client re-authentication

The Non-EAP (NEAP) client re-authentication feature supports the re-authentication of non-EAP clients at defined intervals.

You can enable or disable NEAP client re-authentication globally for the switch, but the time interval for NEAP client re-authentication is determined by the value you set for EAP client re-authentication, at the port level. For information about setting the EAP client re-authentication timer, see either of the following sections:

- Configuring port-based EAPOL using EDM
- eapol command for modifying parameters

Except the re-authentication interval timer, NEAP client re-authentication and EAP client re-authentication function independent of each other.

When you enable NEAP client re-authentication, an authenticated NEAP client is only removed from the authenticated client list if you remove the client account from the RADIUS server, or if you clear the NEAP authenticated client from the switch.

If an authenticated NEAP client does not generate traffic on the network, the system removes the MAC address for that client from the MAC address table when MAC ages out. Although the client MAC address is not displayed in MAC Address table, the client can appear as an authenticated client. If NEAP client re-authentication is enabled, the idle NEAP authenticated client is not removed from the authenticated client list when MAC ages out.

When you disable NEAP client re-authentication, the switch cancels authentication for all authenticated NEAP clients, and automatically clears the MAC addresses of the NEAP clients from the forwarding database.

If you disconnect an authenticated NEAP client from a switch port, or if the port shuts down, the switch clears all NEAP clients authenticated on that port.

You cannot authenticate one NEAP client on more than one switch port simultaneously. If you connect NEAP clients to a switch port through a hub, those clients are authenticated on that switch port. If you disconnect a NEAP client from the hub and connect it directly to another switch port, the client is authenticated on the new port and its authentication is removed from the port to which the hub is connected.

If NEAP client re-authentication is enabled and the RADIUS server that the switch is connected to becomes unavailable, the system clears all authenticated NEAP and removes those clients from the switch NEAP client list.

For NEAP client re-authentication to function properly, you must enable the following features:

- MHMA at the port level
- RADIUS for non-EAP clients globally
- RADIUS for non-EAP clients at the port level

Note:

You do not have to enable the preceding features before you can enable or disable NEAP client re-authentication globally for the switch.

NEAP Not Member of VLAN

The NEAP Not Member of VLAN feature ensures that ports configured with RADIUS Non-EAP authentication are assigned to at least one VLAN to make authentication possible for Non-EAP clients.

When the RADIUS Non-EAP configuration is ready, the port is automatically assigned to default VLAN.

Note:

For the NEAP Not Member of VLAN feature to function properly, you must enable the following features:

- EAPOL globally and at the port level
- multihost at the port level
- non-EAP RADIUS authentication globally and at the port level

Summary of multiple host access on EAPOL-enabled ports

The following table summarizes the order of the checks performed by the switch when a new host is seen on an EAPOL multihost port. If all the checks fail, the new host is counted as an intruder.

Table 3: EAPOL Multihost access

Scenario	Action
• No authenticated hosts on the port. • Guest VLAN is enabled.	Allow
• New host MAC address is authenticated.	Allow
• Port is configured for MHSA. • One EAPOL-authenticated host exists on the port. • The number of existing non-EAPOL hosts on the port is less than the configured maximum number allowed.	Allow
• Host is an IP Phone. • Port is configured for ADAC (allowed PhoneMac, not callSvr, not Uplink).	Allow
• Port is configured for non-EAPOL host support. • Host MAC address is in a preconfigured list of allowed MAC addresses. • The number of existing non-EAPOL hosts on the port is less than the configured maximum number allowed.	Allow

Table continues…

Scenario	Action
• Port is configured for non-EAPOL host support. • Host MAC address is authenticated by RADIUS. • The number of existing non-EAPOL hosts on the port is less than the configured maximum number allowed.	Disallow pending RADIUS authentication; allow when authentication succeeds.

802.1X authentication and Wake on LAN

WoL networking standard enables remotely powering-up a shutdown computer from a sleeping state. In this process, the computer is shutdown with power reserved for the network card. A packet known as Magic Packet is broadcast on the local LAN or subnet. The network card on receiving the Magic Packet verifies the information. If the information is valid, the network card powers-up the shutdown computer.

The WoL Magic Packet is a broadcast frame sent over a variety of connectionless protocols like UDP and IPX. The most commonly used connectionless protocol is UDP. The Magic Packet contains data that is a defined constant represented in hexadecimal as FF:FF:FF:FF:FF:FF, followed by 16 repetitions of the target computer MAC address and possibly by a four or six byte password.

If you implement enhanced network security using 802.1X, the transmission of Magic Packets to sleeping or unauthorized network devices is blocked. An interface specific 802.1X feature known as traffic-control can be used to address this requirement of supporting both WoL and 802.1X Authentication simultaneously. The default mode of traffic-control operation blocks both ingress and egress unauthenticated traffic on an 802.1X port. Setting the traffic control mode to in enables the transmission of Magic Packets to sleeping or unauthenticated devices. This mode allows any network control traffic, such as a WoL Magic Packet to be sent to a workstation irrespective of the authentication or sleep status.

Important:

If a PC client is assigned to a VLAN based on a previous RADIUS Assigned VLAN, when the client goes into sleep or hibernation mode it reverts to either the default port-based VLAN or Guest VLAN configured for that port. So, the WoL Magic Packet must be sent to the default VLAN or Guest VLAN.

EAP (802.1X) accounting

EAP accounting provides RADIUS accounting for EAP-authenticated clients in the network.

The RADIUS accounting protocol is defined in RFC 2866.

RADIUS accounting in the switch utilizes the same RADIUS server used for RADIUS authentication.

By default, the RADIUS accounting UDP port is the RADIUS authentication port + 1. You can configure RADIUS accounting separately.

Non-EAP accounting

EAP (802.1X) accounting is extended to non-EAP (NEAP) clients.

If you configure EAP clients and non-EAP clients on different servers, the system directs accounting messages to the appropriate EAP and non-EAP servers.

The maximum number of clients for NEAP accounting permitted on a switch port is limited to the maximum number of configurable NEAP clients on the port (32).

The maximum number of clients for NEAP accounting permitted on a standalone switch or a stack is 384.

Because the switch can only report statistics for individual ports, NEAP accounting information for MultiHost modes reflects the total network activity on a port.

NEAP accounting supports the following authentication methods:

- IP phone DHCP signature authentication
- ADAC authentication
- MHSA NEAP authentication
- RADIUS authentication

Fail Open UBP

If Fail open UBP is configured and the QoS support for UBP is enabled, the configured UBP classifier gets installed with the source MAC for every new MAC address learned on the port while the port is in FailOpenVLAN (FOV) Mode. The UBP is deleted when the MAC ages, migrates, or authenticates, or when the port exits the FailOpenVLAN.

The filter on-mac option from regular UBP is disabled by default. If the UBP cannot be installed in the hardware, a log message is generated from EAP, containing the MAC address and the unit and port where the operation failed. QoS sends detailed logs with more information on the error.

Note:

When the filter-on-mac option is active, traffic ingress on port 1/7 is re-marked with priority value 4, regardless of client configuration.

If the UBP is not created in QoS, the installation operation creates only a software user-policy association, by issuing “show qos user-policy”. On proceeding to create the filter in the QoS settings, an auto-installation takes place in the hardware. This is inherited from UBP behavior with EAP or NEAP clients.

When a port is removed from FailOpenVLAN state, Fail Open UBP is uninstalled on that port and all clients are re-authenticated.

Limitations:

The following are the limitations for UBP installation related to EAP and QoS:

- When the port transitions to FOV, all authenticated clients retain the UBPs, if they are received from the RADIUS server. Depending on the EAP settings, the filters can be applied with or without filter-on-mac, therefore the traffic flow may vary.
- The FOV UBP is applied only for new MACs that send traffic while in FOV. MACs that had been intruders prior to the port entering FOV are still treated as intruders, and no FOV UBP are installed for them.
- UBP cannot be changed while EAP is enabled globally, and per port is not permitted.
- UBP support must be enabled from QoS.
- The filter can fail the Fail Open VLAN installation for reasons such as QoS resource exhaustion.
- Some combinations of QoS rules do not work, since the source MAC is added into the classifier when installing it.

For related ACLI procedures, see:

- Configuring Fail Open UBPs on ports on page 184

Feature operation

RADIUS accounting logs all of the activity, of each remote user in a session on the centralized RADIUS accounting server.

Session IDs for each RADIUS account are generated as 12-character strings. The first four characters in the string form a random number in hexadecimal format. The last eight characters in the string indicate, in hexadecimal format, the number of user sessions started since reboot.

The Network Access Server (NAS) IP address for a session is the IP address of the switch management VLAN.

The following table summarizes the events and associated accounting information logged at the RADIUS accounting server.

Table 4: Accounting events and logged information

Event	Accounting information logged at server
Accounting is turned on at the router	`Accounting on` request: NAS IP address
Accounting is turned off at the router	`Accounting off` request: NAS IP address
User logs on	`Account start` request: • NAS IP address

Table continues…

Event	Accounting information logged at server
	• NAS port • Account session ID • Account status type • User name
User logs off or port is forced to unauthorized state	`Account stop` request: • NAS IP address • NAS port • Account session ID • Account status type • User name • Account session time • Account terminate cause • Input octet count for the session* • Output octet count for the session* • Input packet count for the session* • Output packet count for the session* **Note:** Octet and packet counts are by port and therefore provide useful information only when ports operate in the SHSA mode.

The following table summarizes the accounting termination causes supported.

Table 5: Supported Account Terminate causes

Cause	Cause ID	When logged at server
ACCT_TERM_USER_REQUEST	1	on User LogOff
ACCT_TERM_LOST_CARRIER	2	on Port Link Down/Failure
ACCT_TERM_ADMIN_RESET	6	on Authorised to ForceUnAuthorised
ACCT_TERM_SUPP_RESTART	19	on EapStart on Authenticated Port
ACCT_TERM_REAUTH_FAIL	20	on ReAuth Failure
ACCT_TERM_PORT_INIT	21	on Port ReInitialization
ACCT_TERM_PORT_ADMIN_DISABLE	22	on Port Administratively Shutdown

Spanning Tree Learning mode behavior on EAP enabled ports

When a port that belongs to an EAP VLAN is bounced, the configuration of the port changes to no VLAN for a short period of time and the port will no longer belong to any STP group. When the port is re-configured with a VLAN, it is added to the group of that VLAN according to the port-mode settings.

EAP and NEAP separation

Use the EAP/ NEAP separation command to disable EAP clients without disabling NEAP clients.

The separation command is:

```
no eap multihost eap-protocol-enable
```

To re-enable EAP authentication, use the following command:

```
eap multihost eap-protocol-enable
```

You can issue the command to disable authentication for EAPOL clients both globally or per port. For EAPOL authentication to be possible, you must enable the EAPOL protcol both globally and per port.

When you enable EAPOL globally and per port, and enable or disable the EAP and NEAP clients, the following behaviors occur:

- At the switch, the default is enabled per port to keep the existing EAP clients enabled per port behavior.
- You can choose to enable NEAP clients. Detected NEAP clients are authenticated on the port.
- You can choose to disable the EAP clients and have only NEAP clients on a port or no client type enabled on port. In the case that EAP is disabled, the EAP packets that are not processed on port traffic from non-authenticated MACs are discarded. Authenticated MACs as NEAP clients can forward traffic on the port.
- If both EAP and NEAP clients are disabled on the port, no clients are authenticated and traffic is not forwarded or received on the port.

If you do not enable EAPOL per port, then enabling or disabling these options have no effect on the authorized/forced unauthorized state of the port and on the processing of the traffic.

The following table describes the separation command behavior when applied to EAP per port features.

Table 6: EAP per port features

Feature	Behavior
Single-Host	When Single Host is enabled (multihost is disabled) this setting has no effect on the EAP packets. This setting is a multihost specific setting.
Multihost	This setting is applied to the port only when multihost is enabled per port.
Non-EAP	When multihost and non-EAP are enabled per port, then the functionality is presented in the single-host and multi-host.
VLAN assignment for EAP clients	If you disable or enable EAP protocol on a port, then the VLAN assignment works for the remaining client types (non-EAP); the existing applied settings on a port for authenticated clients are kept.
VLAN assignment for NEAP clients	If you assign the VLAN for an authenticated EAP or NEAP client, then the VLAN is kept if authenticated clients are present on port.
VLAN assignment for EAP or NEAP clients	If you assign the VLAN for an authenticated EAP or NEAP client, then the VLAN is kept if authenticated clients are present on the port, no matter the client types.
Guest-VLAN	There is no restriction to disable the EAP protocol if you enable the Guest VLAN globally and per port (both EAP and non-EAP).

For more information on the EAP and NEAP separation command, see Using the EAP and NEAP separation command on page 204

802.1X dynamic authorization extension (RFC 3576)

With 802.1X dynamic authorization extension (RFC 3576), you can enable a third party device to dynamically change VLANs on switches or close user sessions.

The 802.1X dynamic authorization extension devices include the following:

- Network Access Server (NAS) — the switch that authenticates each 802.1X client at a RADIUS server.
- RADIUS server sends disconnect and Change of Authorization (CoA) requests to the NAS. A CoA command modifies user session authorization attributes, and a disconnect command ends a user session.

> ❗ **Important:**
>
> The term *RADIUS server*, which designates the device that sends the requests, is replaced in RFC 5176 with the term *Dynamic Authorization Client (DAC)*. The NAS is the Dynamic Authorization Server (DAS).

- 802.1X client — the device that requires authentication and uses the switch services.

> ❗ **Important:**
>
> Requests from the RADIUS server to the NAS must include at least one NAS identification attribute and one session identification attribute.

The switch can receive disconnect or CoA commands in the following conditions:

- a user authenticated session exists on a port (one user session for single-host configuration or multiple user sessions for Multihost configuration)
- the port maintains the original VLAN membership (Guest VLAN and RADIUS VLAN configurations)
- the port is added to a RADIUS-assigned VLAN (port VLAN ID (PVID) is the RADIUS-assigned VLAN ID)

802.1X dynamic authorization extension (RFC 3576) applies only to Extensible Authentication Protocol (EAP) clients and does not impact non-EAP clients.

802.1X dynamic authorization extension supports the following configured features:

- Guest VLAN
- RADIUS VLAN for EAP clients
- RADIUS VLAN for non-EAP clients

802.1X dynamic authorization extension functions when either of the RADIUS VLAN assignment features are active on a port.

802.1X dynamic authorization extension functions with SHSA, MHMA, and MHSA port operating modes.

The following authorization considerations apply:

- Enable only used servers to prevent receiving and processing requests from servers not trusted.
- The requirements for the shared secret between the NAS and the RADIUS server are the same as those for a well chosen password.
- If user identity is essential, do not use specific user identification attributes as the user identity. Use attributes that can identify the session without disclosing user identification attributes, such as port or calling-station-id session identification attributes.

To enable the 802.1X dynamic authorization extension feature, you must do the following:

- Enable EAP globally.
- Enable EAP on each applicable port.
- Enable the dynamic authorization extensions commands globally.
- Enable the dynamic authorization extensions commands on each applicable port.

Important:

The switch ignores disconnect or CoA commands if the commands address a port on which 802.1X dynamic authorization extension is not enabled.

Note:

All RFC 3576 requests should select a RADIUS authenticated client. Requests using only the port number as the client selection attribute have no impact on port or client configuration.

While listening for request traffic from the DAC, the NAS can copy and send a UDP packet, which can disconnect a user. Avaya recommends that you implement reply protection by including the Event Timestamp attribute in both the request and response. To correctly process the Event Timestamp attribute, you must synchronize the DAC and the NAS (an SNTP server must be used by both the DAC and the NAS).

The DAC must use the source IP address of the RADIUS UDP packet to determine which shared secret to accept for RADIUS requests to be forwarded by a proxy. When a proxy forwards RADIUS requests, the NAS-IP-Address or NAS-IPv6-Address attributes do not match the source IP address observed by the DAC. The DAC cannot resolve the NAS-Identifier attribute, whether a proxy is present or not. The authenticity check performed by the DAC does not verify the NAS identification attributes, and an unauthorized NAS can forge identification attributes and impersonate an authorized NAS in your network.

To prevent these vulnerabilities, Avaya recommends that you configure proxies to confirm that NAS identification attributes match the source IP address of the RADIUS UDP packet.

802.1X dynamic authorization extension complies with the following standards and RFCs:

- IEEE 802.1X standard (EAP)
- RFC 2865–RADIUS
- RFC 3576–Dynamic Authorization Extensions to RADIUS

Reauthentication Requests

The Reauthentication Vendor Specific Attribute (VSA) can be used to immediately reauthenticate EAP/NEAP clients. The reauthentication attribute can be present in both the Disconnect and CoA requests, using the associated Disconnect or CoA packet ID.

The Reauthentication-Request is an integer type with a value of either 1 (enabled) or 0 (disabled). When the Reauthentication-Request is disabled (value of 0), the switch ignores the sent VSA and the request is processed as the initial packet ID type, either CoA or Disconnect.

After reauthentication, the client removes all original settings and authenticates with the newly received attributes received from the RADIUS server.

Supported standard attributes for RFC 3576

ID value	Attribute
1	User-Name
4	NAS-IP_Address
5	NAS-Port
6	Service-Type

Table continues…

ID value	Attribute
18	Reply-Message
24	State
26	Vendor-Specific
30	Called-Station-Id
31	Calling-Station-Id
32	NAS-Identifier
33	Proxy-State
44	Accounting-Session-Id
55	Event-Timestamp
61	NAS-Port-Type
64	Tunnel-Type
65	Tunnel-Medium-Type
79	Eap-Message
81	Tunnel-Private-Group-Id

Supported Vendor Specific Attributes (VSAs) for RFC 3576

ID value	VSA
1	Port-Priority
2	Port-Pvid
190	Reauthentication-Request

RFC 3576 Disconnect and CoA support for NEAP clients

This feature adds support for processing of RFC 3576 Disconnect and Change of Authorization (CoA) RADIUS requests for Non-EAP clients.

To enable the feature on a specific port or list of ports, you must perform the following actions:

- globally enable EAP
- enable EAP per-port
- enable dynamic authorization extension per-port
- configure the RADIUS dynamic client

Disconnect request processing

When the feature is operational, after receiving a RADIUS Disconnect-Request packet, the switch disconnects authenticated NEAP users on a port and removes the requested client session.

If the requested user session is found and all attributes specified in the RADIUS server request exist on the required port, the switch performs the following operations for that session:

- removes the requested client session from the specified port
- performs port VLAN restore operations if the port does not have other sessions
- removes the port from any existing RADIUS assigned VLAN

If all the above operations perform successfully, the switch sends the *Disconnect-ACK* disconnect response to the RADIUS dynamic client. If the user session is not found or the switch is unable to disconnect the client session, the switch sends the *Disconnect-NAK* response to the RADIUS dynamic client, including details on the cause of the problem.

CoA command processing

When the feature is operational, after receiving a RADIUS CoA-Request packet, the switch dynamically changes port assignment for a specific port to a specific VLAN.

If the requested user session is found and a valid VLAN ID is specified for the port, the switch performs the following operations:

- if the specified port is assigned to a VLAN different than the one specified in the RADIUS request, the port is removed from that VLAN and assigned to the VLAN specified in the RADIUS request
- depending on the configured EAP mode, the switch can change the port PVID to the new VLAN value

If the above operations perform successfully, the switch sends a CoA-ACK response to the RADIUS dynamic client.

If the requested user session is not found, the VLAN specified in the request is not port-based or if errors are encountered while processing the CoA request, the switch sends a CoA-NAK response to the RADIUS dynamic client, including details on the cause of the problem.

Note:

CoA requests for NEAP clients with Guest VLAN enabled will reauthenticate the clients.

TACACS+

The switch supports the Terminal Access Controller Access Control System plus (TACACS+) client. TACACS+ is a security application implemented as a client/server based protocol that provides centralized validation of users attempting to gain access to a router or network access server.

TACACS+ differs from RADIUS in two important ways:

- TACACS+ is a TCP-based protocol.
- TACACS+ uses full packet encryption, rather than just encrypting the password (RADIUS authentication request).

Important:

TACACS+ encrypts the entire body of the packet but uses a standard TACACS+ header.

TACACS+ separates authentication, authorization, and accounting services. This means that you can selectively implement one or more TACACS+ service.

TACACS+ provides management of users who access the switch through Telnet, serial, and SSH v2 connections. TACACS+ supports users only on ACLI.

Access to SNMP and EDM interface are disabled when TACACS+ is enabled.

For more information about TACACS+, see the Microsoft Web site: http://www.microsoft.com

Important:

TACACS+ is not compatible with previous versions of TACACS.

TACACS+ architecture

You can configure TACACS+ on the switch using the following methods:

- Connect the TACACS+ server through a local interface. Management PCs can reside on an out-of-band management port or serial port, or on the corporate network. The TACACS+ server is placed on the corporate network so that it can be routed to the switch.
- Connect the TACACS+ server through the management interface using an out-of-band management network.

You can configure a secondary TACACS+ server for backup authentication. You specify the primary authentication server when you configure the switch for TACACS+.

Feature operation

During the log on process, the TACACS+ client initiates the TACACS+ authentication session with the server. After successful authentication, if TACACS+ authorization enables, the TACACS+ client initiates the TACACS+ authorization session with the server. After successful authentication, if TACACS+ accounting enables, the TACACS+ client sends accounting information to the TACACS+ server.

Note:

TACACS+ packets are not generated if Management VLAN is not operational.

TACACS+ authentication

TACACS + authentication offers complete control of authentication through log on and password dialog, and response. The authentication session provides user name and password functionality.

You cannot enable both RADIUS and TACACS+ authentication on the same interface. However, you can enable RADIUS and TACACS+ on different interfaces; for example, RADIUS on the serial connection and TACACS+ on the Telnet connection.

Important:

Prompts for log on and password occur prior to the authentication process. If TACACS+ fails because there are no valid servers, the user name and password are used for the local database. If TACACS+ or the local database return an access denied packet, the authentication process stops. No other authentication methods are attempted.

TACACS+ authorization

The transition from TACACS+ authentication to the authorization phase is transparent to the user. Upon successful completion of the authentication session, an authorization session starts with the authenticated user name. The authorization session provides access level functionality.

With TACACS+ authorization, you can limit the switch commands available to a user. When TACACS+ authorization enables, the NAS uses information retrieved from the user profile, which is located either in the local user database or on the security server, to configure the user session. The user is granted access to a requested command only if the information in the user profile allows it.

TACACS+ authorization is not mandatory for all privilege levels.

After the NAS requests authorization, the entire command is sent to the TACACS+ daemon for authorization. You preconfigure command authorization on the TACACS+ server by specifying a list of regular expressions that match command arguments, and associating each command with an action to deny or permit. For more information about the configuration required on the TACACS+ server, see TACACS+ server configuration example on page 77.

Authorization is recursive over groups. If you place a user in a group, the daemon looks in the group for authorization parameters if it cannot find them in the user declaration.

If authorization is enabled for a privilege level to which a user is assigned, the TACACS+ server denies commands for which access is not explicitly granted for the specific user or for the user group. On the daemon, ensure you authorize each group to access basic commands such as **`enable`** or **`logout`**.

If the TACACS+ server is not available or an error occurs during the authorization process, the only command available is **`logout`**.

In the TACACS+ server configuration, if a privilege level is not defined for a user but the user can execute at least one command, the user defaults to privilege level 0. If all commands are explicitly denied for a user, the user cannot access the switch at all.

Changing privilege levels at runtime

Users can change their privilege levels at runtime by using the following command on the switch:

```
tacacs switch level [<level>]
```

[<level>] is the privilege level you want to access.

You are prompted to provide the required password. If you do not specify a level in the command, the administration level (15) is selected by default.

To return to the original privilege level, enter the following command on the switch:

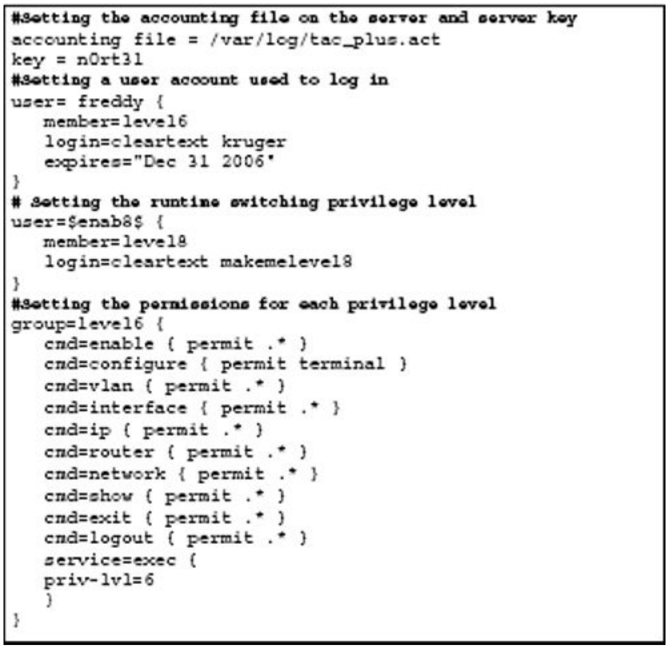
```
tacacs switch back
```

To support runtime switching of users to a particular privilege level, you must preconfigure a dummy user for that level on the daemon. The format of the user name for the dummy user is `$enab<n>$`. The privilege level to which you want to allow access is <*n*>.

For more information about the configuration required on the TACACS+ server, see TACACS+ server configuration example on page 77.

TACACS+ server configuration example

The following figure shows a sample configuration for a Linux TACACS+ server. In this example, the privilege level is defined for the group, not the individual user. The dummy user is created to support runtime switching of privilege levels.



```
#Setting the accounting file on the server and server key
accounting file = /var/log/tac_plus.act
key = n0rt31
#Setting a user account used to log in
user= freddy {
   member=level6
   login=cleartext kruger
   expires="Dec 31 2006"
}
# Setting the runtime switching privilege level
user=$enab8$ {
   member=level8
   login=cleartext makemelevel8
}
#Setting the permissions for each privilege level
group=level6 {
   cmd=enable { permit .* }
   cmd=configure { permit terminal }
   cmd=vlan { permit .* }
   cmd=interface { permit .* }
   cmd=ip { permit .* }
   cmd=router { permit .* }
   cmd=network { permit .* }
   cmd=show { permit .* }
   cmd=exit { permit .* }
   cmd=logout { permit .* }
   service=exec {
   priv-lvl=6
   }
}
```

Figure 4: Example: TACACS+ server configuration

TACACS+ accounting

TACACS+ accounting allows you to track

- the services accessed by users

- the amount of network resources consumed by users

When you enable TACACS+ accounting, the NAS reports user activity to the TACACS+ server in the form of accounting records. Each accounting record contains accounting attribute=value (AV) pairs. The accounting records are stored on the security server. The accounting data can be analyzed for network management and auditing.

TACACS+ accounting provides information about user ACLI terminal sessions within serial, Telnet, or SSH shells (from ACLI management interface).

The accounting record includes the following information:

- user name
- date
- start, stop, and elapsed time
- access server IP address
- reason

You cannot customize the set of events that are monitored and logged by TACACS+ accounting. TACACS+ accounting logs the following events:

- user logon and logoff
- logoff generated because of activity timeout
- unauthorized command
- Telnet session closed (not logged off)

TACACS+ configuration

You can use ACLI to configure TACACS+ on the switch. You cannot configure TACACS+ using Enterprise Device Manager.

For more information about configuring TACACS+ server information and TACACS+ authentication, authorization, and accounting using ACLI, see TACACS+ configuration using ACLI on page 240.

You can also use the console interface to enable or disable TACACS+ authentication on serial and Telnet connections. On the Console/Comm Port Configuration menu, select Telnet/WEB Switch Password Type or Telnet/WEB Stack Password Type, and select TACACS+ Authentication.

IP Manager

You can limit access to the management features of the the switch by defining the IP addresses that are allowed access to the switch.

You can use the IP Manager to do the following:

- Define up to 50 Ipv4 and 50 Ipv6 addresses and masks that can access the switch. No other source IP addresses have management access to the switches.
- Enable or disable access to Telnet, SNMP, SSH, and Web-based management.

You cannot change the Telnet access field if you are connected to the switch through Telnet. Use a non-Telnet connection to modify the Telnet access field.

Important:

To avoid locking a user out of the switch, Avaya recommends that you configure ranges of IP addresses that are allowed to access the switch.

Changes you make to the IP Manager list are applied immediately.

Password protection

For each switch model, there is a secure image and standard software image available. SSH is available only on the secure image.

On a switch, there is no access security enabled by default. This allows a user to access the switch either through the local serial port, HTTP (WEB), or through Telnet without any user name or password protection.

Password protection for Telnet, WEB, or SSH (user name and password) can be added using local user names and passwords or authentication against an external RADIUS or TACACS+ server. In regards to SSH, password authentication can be enabled or disabled in addition to using SSH with public key authentication.

There are two default users on a switch: the RW user, with read-write permissions and the RO user, with read-only permissions. The RO user can access only User EXEC and Privileged EXEC modes. The RW user can access all ACLI command modes. Eight more users with read-only or read-write rights can be added.

For more information about multiple user accounts, see Multiple local RW and RO user accounts on page 85

For the standard image, the default password for RO is `user` and `secure` for RW. For the secure software image, the default password for RO is `userpasswd` and `securepasswd` for RW.

Note:

User names and passwords are only applicable after you enable local authentication.

Enabling telnet password protection, either local user/password or against a RADIUS server, also applies to WEB access.

Unified password authentication

With unified password authentication you can manage the local authentication type, username and password for a switch, whether it is part of a stack or a standalone unit.

For a stack environment, the local username and password authentication is applied universally across all switches in a stack.

If you insert a standalone switch with authentication credentials and mode already configured into an existing stack, both authentication credentials and mode of stack base unit are applied to the newly inserted switch. This maintains unified authentication management throughout the stack.

If you remove a switch from a stack to have it function as a standalone unit, that switch retains the unified stack authentication credentials until you manually change the credentials.

Switch authentication is identical to stack authentication except when RADIUS or TACACS+ authentication is used for the stack and there is no IP address configured for one or more of the stack units. In this case, the stack authentication type is set to RADIUS or TACACS+, the authentication type is automatically changed to “Local” for the units without IP addresses configured, and log messages are generated.

Password security

The password security feature, if enabled, enhances password security for the switch or stack read-only password and read-write passwords. By default, password security is disabled for the standard software image and enabled for the secure software image. If password security is disabled, there is no minimum restriction on number of characters required or are there any other restrictions. You can enable password security from ACLI only.

When you enable password security, the following happens:

- Current passwords remain unchanged if they meet the required specifications. If they do not meet the required specifications, you are prompted to change them to passwords that do meet the requirements.
- An empty password history bank is established. The password bank stores one used password.
- Password verification is required.

When you disable password security, the following happens:

- Current passwords remain valid.
- Password history bank is removed.
- Password verification is not required.

For more information about enabling password security, see Configuring password security on page 251.

With password security enabled, the following features and requirements are active:

Password length and valid characters

Valid passwords are from 8 to 255 characters long.

Where, x-y-z-t specifies the number of characters from each character type that need to be in included in the password. Their minimum values can be configured.

- minimum w lower-case characters
- minimum y numeric characters
- minimum z special characters
- minimum t upper-case characters

The password is case-sensitive.

Note:

The RO and RW passwords cannot be the same.

Password retry

If the user fails to provide the correct password after a number of consecutive retries, the switch resets the log-on process. You can configure the number of retries, using ACLI. The default is three.

Password history

You can configure the switch to keep a maximum history of the last twelve passwords. If you set the password for the fourth time and the history size is set to 3, you can reuse the password that you used the first time. You cannot reuse a password stored in history.

Password aging time

Passwords expire after a specified aging period. The aging period is configurable, with a range of 0 day to approximately 365 days. The default is 0 days. When a password has aged out, you are prompted to create a new password. Only users with a valid Read-Write (RW) password can create a new RW password or Read-Only (RO) password.

Password check sequential and repeated characters

You cannot use passwords that contains sequential characters, such as ab, ba, qw, wq, 12, 21, !@, @! or repeated characters, such as 11, aa, @@.

Password verification

When you provide a new password, you must confirm it by retyping the password. If the two passwords do not match, the password update process fails. In this case, you must try to update the password again. No limit exists on the number of times you are allowed to update the password.

Password display masking

The password is not displayed as clear text. Each character of the password is substituted with an asterisk (*).

Password complexity

Password complexity feature enforces complexity password rules. The rules are different when the switch is upgraded from an unsupported to a supported release for the first time.

The following password complexity rules are applicable when the feature is enabled.

Table 7: Password complexity rules

Type	Description	Value range	Minimum length	Default value when the feature is enabled	Default value when switch is upgraded from an unsupported to a supported release for first time
Length	Specifies number of characters in password.	8 to 255	8 characters	8	10
Character	Specifies the number of character from each character type that need to be included in password.			0–0–0–0	2-2-2-2
				Where, x-y-z-t specify the number of characters from each character type. Following are the details: • x — lowercase • y — uppercase • z — numeric • t — special characters	
	Character type				
	lowercase	a to z	0 to 9	0	2
	uppercase	A to Z	0 to 9	0	2
	numeric	0 to 9	0 to 9	0	2
	special characters	(!, @, #, $, %, ^, &, *, (,), -, +, =, _	0 to 9	0	2
History	Number of passwords retained in history	0 to 12		1	3
Sequential	Checks for sequential characters within passwords when enabled. For example, abcdefgh.	Enable or Disable		Enable	Enable
Check-repeated	Checks for repeated characters within passwords when enabled. For example, aa.	Enable or Disable		Enable	Enable

Password aging and lockout policy

Passwords expire after a specified aging period. The values for the lockout period and aging must be configured. The default values are different when the switch is upgraded from an unsupported to a supported release for the first time.

The following table lists the password aging and lockout policy rules and their default values:

Table 8: Password aging and lockout policy rules

Rule	Description	Value range	Default value when the feature is enabled	Default value when switch is upgraded from an unsupported to a supported release for first time
Password expiration	Number of days before password expiration	0 to 365 days	0 for no expiration	90 days
Warning	Number of warning days before password expiration	30 days	10 days	30 days
Failed login attempts	Number of consecutive failed login attempts before lockout Failures are counted only for consecutive login failures. The lockout count is reset after a successful login. This is configurable using username lockout-retries.		0 for no lockout	3 times
Unlock timer value	Automatic unlock timer value for disabled accounts	1 to 365 days	7 days. This timer re-enables the username after the specified number of days if the username is disabled due to inactivity timeout.	inactive period is 90 days or 360 days
Password delay time	Amount of delay time to add after three consecutive failed login attempts within one minute	0 to 3600 seconds	60 seconds	
Password change on first login	Ability to force a password change on first login	Enable or Disable	Disable	

Table continues…

Rule	Description	Value range	Default value when the feature is enabled	Default value when switch is upgraded from an unsupporte d to a supported release for first time
Password change rate-limiter	Number of times a password can be changed in a day	1 to 10 times	1	
Password login failure notification	Notification message displays when a login fail occurs	less than 100 characters	No message	

It is recommended to use an active clock configured correctly through NTP or SNTP before configuring password aging-time, password delay-time, password notifications, password password-change-rate-limiter, and password unlock-timer.

After downgrading from a supported to unsupported release, the default passwords are applied for RW and RO users. The default passwords for RO and RW are:

- RW — securepasswd
- RO — userpasswd

Upgrade considerations

When the software is upgraded from a release that does not support password aging and lockout to a supported release, the password must be changed and the default values must be configured. The following are the default values until they are configured through ACLI:

- password aging 90 days
- inactive period is 90 days or 360 days
- warning days before password expiration is 30 days

To default the values for inactive period and password aging, use the following settings:

- set the inactive period for a specific user — **`username <username> inactive-period 0`**
- set the password aging time — **`password aging-time 0`**
- set the password aging time for a specific user — **`password aging-time username <username> 0`**

Multiple local RW and RO user accounts

With multiple users support, you can create eight more users on a switch in addition to the default two users, therefore avoiding the use of shared accounts. User actions are visible through the analysis of audit records.

New users can have read-write or read-only permissions. Each user can access the switch through the local serial port, telnet, SSH, or HTTP (web). Users require a username and password to connect to the switch and authenticating against an external RADIUS or TACACS+ server is supported. RADIUS fallback extends the search for local users, if the RADIUS server is unavailable.

Log files display read-only (RO) and read-write (RW) users names, and when and how the users log in, including the source IP address from where the login occurred.

RW user has administrator rights to create, remove, or modify other users. Exceptions are the default RO and RW users, which cannot be deleted.

The audit log displays information containing the user name for the authenticated user. The user name displays in SYSLOG when the user logs in, logs out, or fails to log in or log out, when the connection authenticates using serial, Telnet, SSH, or EDM.

Each user name must be unique.

For security reasons, if a login attempt fails, the error feedback does not indicate if the failed login is due to an invalid user name or an invalid password. As well, response times for invalid user name and invalid user name/password pair are identical, to prevent identification of which of the two failed. The passwords are encrypted and do not appear in any log.

Note:

Maximum length of user name is 16 characters. Maximum length of password is 255 characters. For remote users, such as RADIUS and TACACS+, the maximum length of the user name and password is 32 characters.

Limitations

The following limitations apply:

- EDM allows the authentication of any of the 10 supported users but not more than the number of maximum HTTP/HTTPS sessions. Also, you cannot configure more than the number of maximum HTTP/HTTPS sessions.
- Users can log into a switch using SSH, Telnet, serial, or EDM connections.

  A new user can be logged into a maximum of 20 sessions at a time. The maximum number of sessions is 20 at a time.
- When a unit is joining a stack, all users created on the base unit are also created on non-base units.
- When disabling telnet all users connected through telnet are disconnected. When disabling SSH, all users connected through SSH are disconnected.
- Boot default can be initialized only by RW users.

Feature operation during upgrade

The following conditions are observed when the software is upgraded from a release that does not support Password complexity and Password aging and lockout feature:

- passwords are retained
- default users become RW and RO users even if their names were changed on the previous image as their names cannot be changed with Multiple Users feature.

When the software is downgraded to a previous release that does not have the Password complexity and Password aging and lockout feature, the passwords are defaulted as the maximum length of the passwords. Without the feature the maximum character length is 16 and with the feature, it is 255.

For more information about configuring multiple local user accounts, see:

- Configuring multiple local RW and RO users accounts on page 263
- Displaying local user information on page 264

Lockout for failed logon attempts

The lockout for failed logon attempts feature prevents brute force hacking. Following a consecutive number of log on failures, the user account used for connecting is locked out for a configurable amount of time. This feature applies to all user accounts, with the exception of the last unlocked account with RW rights.

The default number of retries before lockout is 0 and the lockout interval is set to one minute.

ACLI audit

ACLI audit provides a means for tracking ACLI commands.

A special area of flash memory reserved for ACLI audit stores the command history. Access to this area is read-only. When you enable remote logging, the audit message is also forwarded to a remote syslog server, no matter the logging level.

Every time you issue a ACLI command, the switch generates an audit message. Each log entry consists of the following information:

- timestamp
- fixed priority setting of 30 (= informational message)
- command source
  - serial console and the unit connected
  - Telnet or SSH connection and the IP address
- command status (success or failure)

- ACLI command itself

By default ACLI audit is enabled. You can disable the audit log that stops log messages from being written to the FLASH memory and the syslog server, if configured.

Erasable ACLI audit log

You can erase the contents of the CLI audit log on a switch running the standard software image, should circumstances arise that require the log contents to be cleared. For example, you can clear the CLI audit log contents on switches that are being decommissioned or moved to another company location.

Because the CLI audit log is an important security feature, the audit log cannot be erased on switches running the secure software image or on switches that have the no-erase audit log flag enabled. Enabling the no-erase audit log function when using the standard software image is a one-time configuration option. After the audit log flag has been set to non-erasable, you cannot reverse this configuration action and you will not be able to clear the audit log, even if the switch is re-configured to factory defaults.

Simple Network Management Protocol

SNMP is traditionally used to monitor devices running software that allows the retrieval of SNMP information (for example, UNIX systems, Windows systems, printers, modem racks, switches, routers, power supplies, Web servers, and databases).

You can also use SNMP to change the state of SNMP-based devices. For example, you can use SNMP to turn off an interface on your device.

SNMP Version 1 (SNMPv1)

SNMP Version 1 (SNMPv1) is a historic version of the SNMP protocol, defined in RFC 1157 and is an Internet Engineering Task Force (IETF) standard.

SNMPv1 security is based on communities, which are passwords (plain text strings allowing SNMP-based applications, which know the strings, to gain access to device management information). SNMPv1 typically has three communities: read-only, read-write, and trap.

SNMP Version 2 (SNMPv2)

SNMP Version 2 (SNMPv2) is another historic version of SNMP, and is often referred to as community string-based SNMPv2. This version of SNMP is technically called SNMPv2c, defined in RFC 1905, RFC 1906, and RFC 1907.

SNMP Version 3 (SNMPv3)

SNMP Version 3 (SNMPv3) is the current formal SNMP standard, defined in RFCs 3410 through 3419, and in RFC 3584. It provides support for strong authentication and private communication between managed entities.

Switch support for SNMP

The SNMP agent in the supports SNMPv1, SNMPv2c, and SNMPv3. Support for SNMPv2c introduces a standards-based GetBulk retrieval capability using SNMPv1 communities.

SNMPv3 support provides industrial-grade user authentication and message security. This includes MD5- and SHA-based user authentication and message integrity verification, as well as AES- and DES-based privacy encryption.

You to configure SNMPv3 using EDM, or ACLI.

SNMP MIB support

The switch supports an SNMP agent with industry-standard Management Information Bases (MIB) as well as private MIB extensions, which ensures compatibility with existing network management tools.

The IETF standard MIBs supported on the switch include MIB-II (originally published as RFC 1213; then split into separate MIBs as described in RFCs 4293, 4022, and 4113), Bridge MIB (RFC 4188), and the RMON MIB (RFC2819), which provides access to detailed management statistics.

For more information about the MIBs supported by the switch, see Supported SNMP MIBs and traps on page 491.

SNMP trap support

With SNMP management, you can configure SNMP traps to automatically generate notifications globally, or on individual ports. These notifications can report conditions such as an unauthorized access attempt or changes in port operating status.

SNMP trap notification-control defines traps, such as **bsnConfigurationSavedToNvram**, on a global basis (per bridge). You can also use SNMP trap notification-control to configure supported notifications, such as **linkDown** or **linkup**, to be enabled or disabled on individual interfaces as well as globally.

All notifications are enabled on individual interfaces by default.

The switch supports both industry-standard SNMP traps, as well as private Avaya enterprise traps. SNMP trap notification-control provides a generic mechanism for the trap generation control that works with any trap type.

For more information about the MIBs and traps supported by the switch, see *Supported SNMP MIBs and traps*.

You can use ACLI or EDM to enable or disable SNMP traps for the following features:

- DHCP Snooping
- Dynamic ARP Inspection (DAI)
- IP Source Guard (IPSG)
- Auto-Detection and Auto-Configuration (ADAC)

You can use ACLI or EDM to generate the following SNMP traps for operational conditions and errors:

- lldpRemTablesChange
- risingAlarm
- fallingAlarm
- newroot
- vrrpTrapNewMaster
- pethPsePortOnOffNotification
- pethMainPowerUsageOnNotification
- pethMainPowerUsageOffNotification
- ospfVirtIfStateChange
- ospfNbrStateChange
- ospfVirtNbrStateChange
- ospfIfConfigError
- ospfVirtIfConfigError
- ospfIfAuthFailure
- ospfVirtIfAuthFailure
- ospfIfStateChange
- entConfigChange
- coldStart
- warmStart
- linkDown
- linkUp
- authenticationFailure

- lldpXMedTopologyChangeDetected
- ntnQosPolicyEvolLocalUbpSessionFailure
- slaMonitorAgentExceptionDetected
- bspeIpPhonePowerLimitNotification
- bspeIpPhonePowerPriorityNotification
- bsAdacPortConfigNotification
- bsAdacPortOperDisabledNotification
- bsveVrrpTrapStateTransition
- bsDhcpSnoopingBindingTableFull
- bsDhcpSnoopingTrap
- bsDhcpOption82MaxLengthExceeded
- bsDhcpSnoopingExtSaveEntryMACConflict
- bsDhcpSnoopingExtSaveEntryInvalidInterface
- bsDhcpSnoopingExtSaveEntryLeaseExpired
- bsDhcpSnoopingExtSaveEntryParsingFailure
- bsDhcpSnoopingExtSaveNTP
- bsDhcpSnoopingExtSaveUSBSyncSuccess
- bsDhcpSnoopingExtSaveTFTPSyncSuccess
- bsDhcpSnoopingExtSaveUSBSyncFailure
- bsDhcpSnoopingExtSaveTFTPSyncFailure
- bsDhcpSnoopingExtSaveUSBRestoreSuccess
- bsDhcpSnoopingExtSaveTFTPRestoreSuccess
- bsDhcpSnoopingExtSaveUSBRestoreFailure
- bsDhcpSnoopingExtSaveTFTPRestoreFailure
- bsDhcpSnoopingExtSaveEntryInvalidVlan
- bsaiArpPacketDroppedOnUntrustedPort
- bsSourceGuardReachedMaxIpEntries
- bsSourceGuardCannotEnablePort
- bsRadiusReachabilityServerDown
- bsRadiusReachabilityServerUp
- bsprimeNeighborStateChanged
- bsnesGloballyEnabled
- bsnesGloballyDisabled

- bsnesManuallyActivated
- bsnesManuallyDeactivated
- bsnesScheduleNotApplied
- bsnesScheduleApplied
- bsnesActivated
- bsnesDeactivated
- bsStormControlBelowLowWatermark
- bsStormControlAboveHighWatermark
- bsLstInterfaceStatusChanged
- bsLstGroupOperStateChanged
- bsIpv6NDNotificationsUntrustedPort
- rcnBpduReceived
- rcnIsisPlsbMetricMismatchTrap
- rcnIsisPlsbDuplicateSysidTrap
- rcnIsisPlsbLsdbUpdateTrap
- rcnIsisPlsbBvidMismatchTrap
- rcnIsisPlsbAdjStateTrap
- rcnIsisPlsbDuplicateNnameTrap
- rcnIsisPlsbMultiLinkAdjTrap
- bsnConfigurationSavedToNvram
- bsnEapAccessViolation
- bsnStackManagerReconfiguration
- bsnLacTrunkUnavailable
- bsnLoginFailure
- bsnTrunkPortDisabledToPreventBroadcastStorm
- bsnTrunkPortEnabledToPreventBroadcastStorm
- bsnLacPortDisabledDueToLossOfVLACPDU
- bsnLacPortEnabledDueToReceiptOfVLACPDU
- bsnStackConfigurationError
- bsnTrialLicenseExpiration
- bsnEnteredForcedStackMode
- bsnEapRAVError
- bsnSystemUp365Days

- bsnUSBInsertion
- bsnUSBRemoval
- bsnSFPInsertion
- bsnSFPRemoval
- bsnROPasswordExpired
- bsnRWPasswordExpired
- bsnRunScripts
- bsnAaaUserAccountNotUsed
- bsnAaaAlreadyConnected
-
- rcnSlppGuardHoldDownExpired
- rcnSlppGuardPacketReceived
- s5EtrSbsMacTableFull
- s5EtrSbsMacTableClearedForPort
- s5EtrSbsMacTableCleared
- s5EtrSbsMacRemoved
- s5EtrNewSbsMacAccessViolation
- s5EtrMacAddressTablesThresholdReached
- s5CtrNewHotSwap
- s5CtrNewProblem
- s5CtrNewUnitUp
- s5CtrNewUnitDown
- s5CtrFanDirectionError
- s5CtrHighTemperatureError
- ubpEAPSessionStart
- ubpEAPSessionEnd

Important:

When you use SNMPv1, trap receivers can mistakenly interpret the **s5EtrSbsMacRemoved** SNMP trap as **s5EtrRedBadRemCfgDetected**.

Important:

When you use SNMPv1, trap receivers can mistakenly interpret the **s5EtrSbsMacTableClearedForPort** SNMP trap as **5EtrPortDteJabbering**.

Important:

When you use SNMPv1, trap receivers can mistakenly interpret the **s5EtrNewSbsMacAccessViolation** SNMP trap as **s5EtrSbsMacAccessViolation**.

Important:

Trap receivers may not display the correct TFTP server IP address in SNMP trap text related to DCHP Snooping External Save.

Note:

You can only use SFTP server when you are running the secure software image on the switch.

Secure Socket Layer protocol

Secure Socket Layer (SSL) deployment provides a secure Web management interface.

The SSL server has the following features:

- SSLv3-compliant
- PKI key exchange
- key size of 1024-bit encryption
- RC4 and 3DES cryptography
- MAC algorithms MD5 and SHA-1

Generally, an SSL certificate is generated when

- The system is powered up for the first time and the NVRAM does not contain a certificate that can be used to initialize the SSL server.
- The management interface (ACLI and SNMP) requests that a new certificate to be generated. A certificate cannot be used until the next system reset or SSL server reset.

Secure versus Non-secure mode

The management interfaces (ACLI and SNMP) can configure the Web server to operate in a secure or nonsecure mode. The SSL Management Library interacts with the Web server to this effect.

In secure mode, the Web server listens on TCP port 443 for client browser requests. You can use the **`https-only`** command to configure the Web server to respond to both HTTPS and HTTP requests, or HTTPS requests only, from client browsers when the Web server is in secure mode. By default, the Web server is configured to respond to HTTPS client browser requests only.

In the nonsecure mode, the Web server listens on TCP port 80, by default, and responds only to HTTP client browser requests. All existing secure connections with the browser are closed down. You can designate this TCP port as a value between 1024 and 65535.

Important:

If the TCP port is set to a number other than 80, you must configure the HttpPort attribute for the device properties to match the switch configuration to access the device home page using EDM.

SSL Certificate Authority

SSL certificates are issued and signed by a Certificate Authority (CA) such as VeriSign. Because the management and cost of purchasing a certificate from a CA is a client concern, Avaya issues and signs the SSL certificate with the understanding that it is not a recognized CA.

The SSL certificate contains the following information. The first three items (Issuer, Start Date, End Date) are constant. The remaining items are derived from the RSA host key associated with the certificate.

```
Issuer     : Avaya
Start Date : May 26 2003, 00:01:26
End  Date : May 24 2033, 23:01:26
SHA1 Finger Print:
d6:b3:31:0b:ed:e2:6e:75:80:02:f2:fd:77:cf:a5:fe:9d:6d:6b:e0
MD5 Finger Print:
fe:a8:41:11:f7:26:69:e2:5b:16:8b:d9:fc:56:ff:cc
RSA Host Key (length= 1024 bits):
40e04e564bcfe8b7febf1f7139b0fde9f5289f01020d5a59b66ce7207895545f
b3abd694f836a9243651fd8cee502f665f47de8da44786e0ef292a3309862273
d36644561472bb8eac4d1db9047c35ad40c930961b343dd03f77cd88e8ddd3dd
a02ae29189b4690a1f47a5fa71b75ffcac305fae37c56ca87696dd9986aa7d19
```

SSL configuration and management

For more information about configuring and managing SSL services, see Secure Socket Layer services on page 269

Secure Shell protocol

Secure Shell (SSH) protocol replaces Telnet to provide secure access to ACLI interface.

The SSH protocol includes two versions: SSH1 and SSH2. The switch supports SSH2.

Components of SSH2

You can use SSH2 for secure remote log on and other secure network services over an insecure network. SSH2 consists of three major components:

- The Transport Layer Protocol (SSH-TRANS): SSH-TRANS is one of the fundamental building blocks, providing initial connection, packet protocol, server authentication, and basic encryption, and integrity services. The protocol can also provide compression. The transport layer is used over a TCP/IP connection and can be used on top of other reliable data streams.
- The User Authentication Protocol (SSH-USERAUTH) authenticates the client-side user to the server. It runs over the transport layer protocol. SSH-AUTH supports two methods: public key and password authentication. To authenticate, an SSH2 client tries a sequence of authentication methods chosen from the set allowed by the server (for example, public key, password) until one succeeds or all fail.
- The Connection Protocol (SSH-CONNECT) multiplexes the encrypted tunnel into several logical channels. This protocol runs over the user authentication protocol.

SSH service configuration

The SSH service engine allows you to configure the SSH service. You can configure SSH through ACLI interface and the SNMP interface.

Important:

If you enable SSH on the switch and you load an ASCII configuration file containing SSH related commands, those commands will fail. You must disable SSH on the switch before you load an ASCII configuration file containing SSH related commands.

The management objects are:

- SSH enable or disable

  When SSH is enabled, you can configure the SSH server to disable other non-secured interfaces. This is referred to as the SSH secured mode. Otherwise, when you enable SSH, it operates in unsecured mode.
- DSA authentication enable or disable

  You can configure the SSH server to allow or disallow DSA authentication.
- RSA authentication enable or disable

  You can configure the SSH server to allow or disallow RSA authentication.
- **Note:**

  If SSH is enabled on the switch and you load an ASCII configuration file containing SSH related commands, those commands will fail. You must disable SSH on the switch before you load an ASCII configuration file containing SSH related commands.

- Password authentication enable or disable

  If password authentication is not enabled, you can only connect by the public key authentication method, and only if you have the correct authentication key (DSA or RSA). You cannot disable both public key and password authentication. If you disable password authentication, you must ensure that at least one of RSA and DSA authentication is enabled.
- DSA public key upload and download
- RSA public key upload and download
- SSH information dump: shows all the SSH-related information

SSH clients

The following SSH clients are supported by the switch:

- Putty SSH (Windows 2000)
- F-secure SSH, v5.3 (Windows 2000)
- SSH Secure Shell 3.2.9 (Windows 2000)
- SecureCRT 4.1
- Cygwin OpenSSH (Windows 2000)
- AxeSSH (Windows 2000)
- SSHPro (Windows 2000)
- Solaris SSH (Solaris)
- Mac OS X OpenSSH (Mac OS X)

SSH and SSH Client

Secure Shell (SSH), a network protocol, uses a secure channel to exchange data between two network devices. Remote login to execute commands is a typical use of SSH. SSH also supports file transfer (using SFTP or SCP protocols), tunneling, forwarding TCP ports and X11 connections. SSH uses the client-server model to provide confidentiality and integrity of data over an unsecured / public network, such as the Internet. The SSH Client is a secure shell protocol for connecting to an SSH Server device in the network that is accepting remote connections. SSH Client is present only on switches with SSH images and is available only through the ACLI.

The Avaya-implemented SSH Client uses SSH version 2 protocol (SSH-2) to provide an SSH Client session.

The SSH Client authenticates to a SSH server using (in order):

1. DSA public key authentication
   - —the system performs this authentication only if DSA Auth Key exists, using the DSA key for authentication.

2. RSA public key authentication
    - —the system performs this authentication only if the previous authentication method fails, and if RSA Auth Key exists, using the RSA key for authentication.
3. password authentication
    - —the system performs this authentication only if previous authentication methods fail. You can enter a username and password.

        Note:

        If public key authentication fails and SSH server does not support password authentication, password authentication will be tried only one time.

If any authentication method succeeds, the methods following in order are not performed.

SSH Client connection can be performed from serial console, or from a SSH connection to the switch or stack. You cannot initiate the SSH connection from a telnet connection. When the Console session terminates, the inner SSH Client also terminates.

To end the SSH session and return to ACLI, enter a '~' followed by a period (~.). You can also use the ACLI command 'ssh close-session' from a different ACLI console.

Note:

From release 5.7, you can open only one SSH Client session. Multiple SSH Client sessions are not supported.

SSH Client known hosts

To support public key authentication, the switch saves a list of SSH Client know hosts—Host IP, public key entries— in NVRAM. The switch identifies a host as known when the host's public key matches the NVRAM saved public key. Only administrators, users with read-write access, have access to known hosts.

During SSH connection to a host, on receipt of the host public key the switch accepts the host if the Host IP/received public key pair matches the Host IP/public key entry of known hosts. If keys do not match, the SSH Client ends the connection.

If the Host IP does not have an entry in the known-hosts list for read-write access, you can accept or decline the Host IP/received public key association. If you accept the host, then the switch updates the known-hosts list and the switch accepts the connection.

You can delete known hosts from the ACLI, by host IP address—you require read-write access. You do not affect an existing connection if you delete the Host IP entry of an active SSH session. You do not affect the running sessions if you modify known hosts. The switch only consults known hosts during SSH connection time. After you reset the switch to default, the switch empties the SSH known-hosts list.

SSH Client known hosts in stacks

In switch stacks, the system saves and updates known hosts in the NVRAM of all units. Therefore, if the base unit leaves the stack, or the stack breaks, the rest of the units retain the learned hosts from the stack configuration.

During stack formation, the switch synchronizes the known-hosts list on all stack units and removes deleted known hosts from all units in the stack. When the stack forms, the starting known-hosts list contains the base unit known hosts. SSH Client initialization overrides known hosts on the rest of the units in the stack with known hosts from the base unit. During stack configuration, the known-hosts list updates on all units in the stack.

Switch capacity to learn keys

At 32 Bytes NVRAM per saved key, a switch should be able to save the public keys of at least twenty different hosts, and more if there is available NVRAM.

Standards and Compliance

The SSH Client complies with SSH version 2 protocol, described in these RFCs:

- • RFC 4251 (Protocol Architecture) describes the overall design of SSH-2.
- • RFC 4253 (Transport Layer Protocol) provides a single, full-duplex, byte-oriented connection between client and server, with privacy, integrity, server authentication, and man-in-the-middle protection.
- • RFC 4252 (Authentication Protocol) identifies the client to the server.
- • RFC 4254 (Connection Protocol) provides richer, application-support services over the transport pipe, such as channel multiplexing, flow control, remote program execution, signal propagation, connection forwarding, and so on.
- • RFC 4250 (Assigned Numbers) gathers together and lists various constant assignments made in the other drafts.

Feature Interactions

The SSH Client interacts with the SFTP Client application. They share the same DSA and RSA keys and key sizes.

DHCP snooping

Dynamic Host Configuration Protocol (DHCP) snooping provides security to the network by preventing DHCP spoofing. DHCP spoofing refers to an attacker's ability to respond to DHCP requests with false IP information. DHCP snooping acts like a firewall between untrusted hosts and the DHCP servers, so that DHCP spoofing cannot occur.

DHCP snooping classifies ports into two types:

- Untrusted—ports that are configured to receive messages from outside the network or firewall. Only DHCP requests are allowed.
- Trusted—ports that are configured to receive messages only from within the network, such as switch-to-switch and DHCP server ports. In the switch-to-switch scenario, in the path from switch B to switch A to the DHCP server: the outgoing port of B to A is trusted, the incoming port from A to B is untrusted, and the outgoing port from A to the server is trusted. All types of DHCP messages are allowed.

DHCP snooping operates as follows to eliminate the capability to set up rogue DHCP servers on untrusted ports:

- DHCP snooping allows only DHCP requests from untrusted ports. DHCP replies and all other types of DHCP messages from untrusted ports are dropped.
- DHCP snooping verifies the source of DHCP packets.
    - When the switch receives a DHCP request on an untrusted port, DHCP snooping compares the source MAC address and the DHCP client hardware address. If the addresses match, the switch forwards the packet. If the addresses do not match, the switch drops the packet.
    - When the switch receives a DHCP release or DHCP decline broadcast message from a client, DHCP snooping verifies that the port on which the message was received matches the port information for the client MAC address in the DHCP binding table. If the port information matches, the switch forwards the DHCP packet.

DHCP binding table

DHCP snooping dynamically creates and maintains a binding table. The DHCP binding table includes the following information about DHCP leases on untrusted interfaces:

- source MAC address
- IP address
- lease duration
- time to expiry
- VLAN ID
- port

The maximum size of the DHCP binding table is 1024 entries.

The DHCP binding table is stored in RAM, and therefore is not saved across restarts. You can take a back up of the DHCP binding table using *DHCP snooping external save* feature and automatically restore after it restarts. See Externally saving the DHCP Snooping binding table file on page 100for more information.

Static DHCP binding table entries

You can manually add static entries in the DHCP binding table to protect IP devices using applications such as DAI and IPSG, that on DHCP snooping table entries. When the protection of these statically configured IP devices is no longer required, you can manually delete entries from the DHCP binding table.

Static DHCP binding table entries are stored in NVRAM and will be saved across restarts.

Externally saving the DHCP Snooping binding table file

You can use DHCP Snooping external save to store the DHCP Snooping database at predefined, 5 minute intervals, to an external TFTP or SFTP server, or to a USB drive.

When the DHCP Snooping external save feature is enabled, the switch monitors changes to the DHCP Snooping database. If a change is detected, the sync flag is set to true, and when the five minute interval is reached, the binding database is saved to the selected TFTP server or USB drive. If a reboot occurs, the switch attempts to restore the DHCP Snooping database with the externally saved file. If the switch learns duplicate DHCP addresses or processes duplicate DHCP requests between the completion of the reboot process and when the DHCP Snooping database is restored from the externally saved file, the new information takes precedence over the information from the restored file.

Any DHCP Snooping database entries that you manually configure, or that the switch learns between the time of the last initiated external save and the beginning of the reboot process are lost and not available when the switch is again operational.

Enabling SNTP and synchronization is mandatory. The DHCP snooping external save uses the clock time as it is supported by SNTP and NTP. The lease expiry time the switch writes to the externally saved DHCP Snooping database is the absolute lease expiry time, which can be accurately restored from the externally saved file when you reboot the switch .

DHCP snooping configuration and management

DHCP snooping is configured on a VLAN to VLAN basis.

Configure and manage DHCP snooping using the Avaya Command Line Interface (ACLI), Enterprise Device Manager (EDM), and SNMP. For more information about configuring DHCP snooping through ACLI see DHCP snooping configuration using ACLI on page 286. For more information about configuring DHCP snooping through EDM, see DHCP snooping configuration using EDM on page 397.

DHCP snooping Global Configuration

This configuration enables or disables DHCP snooping for the entire unit or stack. If you enable DHCP snooping globally, the agent determines whether the DHCP reply packets will be forwarded, based on the DHCP snooping mode (enable or disable) of the VLAN and the untrusted or trusted state of the port. You must enable DHCP snooping globally before using DHCP snooping on a VLAN. If you disable DHCP snooping globally, the switch or stack will forward DHCP reply packets to all required ports, irregardless of whether the port is configured as trusted or untrusted.

DHCP Option 82

With DHCP Option 82, the switch can transmit information about the DHCP client and the DHCP agent relay to the DHCP server. The server can use the information from the switch to locate the DHCP client in the network and allocate a specific IP address to the DHCP client.

DHCP Option 82 function is controlled by the one switch at the edge of a network and not by any switches located between the network edge switch and the DHCP server.

DHCP Option 82 functions with DHCP snooping (Layer 2 mode) or DHCP relay (Layer 3 mode) and cannot function independent of either of these features. To use DHCP snooping with DHCP Option 82 enable both features globally and for each client VLAN.

To use DHCP Option 82 with DHCP relay, you must enable DHCP relay globally on the switch and client VLANs. For more information about DHCP Option 82 with DHCP relay, see *Configuring IP Routing and Multicast on Avaya Ethernet Routing Switch 4800 Series*, NN47205-506.

Dynamic ARP inspection

Dynamic Address Resolution Protocol (Dynamic ARP) inspection is a security feature that validates ARP packets in the network.

Without Dynamic ARP inspection, a malicious user can attack hosts, switches, and routers connected to the Layer 2 network by poisoning the ARP caches of systems connected to the subnet and by intercepting traffic intended for other hosts on the subnet. Dynamic ARP inspection prevents this type of attack. It intercepts, logs, and discards ARP packets with invalid IP-to-MAC address bindings.

The address binding table is dynamically built from information gathered in the DHCP request and reply when DHCP snooping is enabled. The MAC address from the DHCP request is paired with the IP address from the DHCP reply to create an entry in the DHCP binding table. For more information about the DHCP binding table, see DHCP binding table on page 99.

When you enable Dynamic ARP inspection, ARP packets on untrusted ports are filtered based on the source MAC and IP addresses seen on the switch port. The switch forwards an ARP packet when the source MAC and IP address matches an entry in the address binding table. Otherwise, the ARP packet is dropped.

For Dynamic ARP inspection to function, DHCP snooping must be globally enabled.

Dynamic ARP inspection is configured on a VLAN to VLAN basis.

Configure and manage Dynamic ARP inspection using ACLI or Enterprise Device Manager (EDM). For more information about configuring this feature with ACLI, see Configuring dynamic ARP inspection on page 297. For more information about configuring this feature with EDM, see Configuring dynamic ARP inspection on VLANs using EDM on page 406 and Configuring dynamic ARP inspection on ports using EDM on page 406.

IP Source Guard

IP Source Guard provides security to the network by filtering clients with invalid IP addresses. IP Source Guard is a Layer 2 (L2), port-to-port basis feature that works closely with information in the Dynamic Host Control Protocol (DHCP) snooping binding table. For more information about DHCP snooping, see DHCP snooping on page 99. When you enable IP Source Guard on an untrusted port with DHCP snooping enabled, an IP filter entry is created or deleted for that port automatically, based on IP information stored in the corresponding DHCP binding table entry. When a connecting client receives a valid IP address from the DHCP server, a filter is installed on the port to allow traffic only from the assigned IP address. A maximum of 10 IP addresses are allowed on each IP Source Guard-enabled port. When this number is reached, no more filters are set up and traffic is dropped.

IP Source Guard is available to the switch utilizing Broadcom 569x ASICs, and is implemented with the facility provided by the port ContentAware Processor (CAE) in the ASIC.

Important:

Enable IP Source Guard only on an untrusted DHCP snooping port.

Avaya recommends that you do not enable IPSG on MLT, DMLT and LAG ports.

The following table shows you how IP Source Guard works with DHCP snooping.

Table 9: IP Source Guard and DHCP snooping

IP Source Guard configuration state	DHCP snooping configuration state	DHCP snooping Binding Entry action (untrusted ports)	IP Source Guard action
disabled or enabled	enabled	creates a binding entry	creates a filter for the IP address using the IP address from the binding table entry
enabled	enabled	creates a binding entry	creates a filter for the IP address using the IP address from the binding table entry

Table continues…

IP Source Guard configuration state	DHCP snooping configuration state	DHCP snooping Binding Entry action (untrusted ports)	IP Source Guard action
enabled	enabled	deletes a binding entry	deletes the IP filter and installs a default filter to block all IP traffic on the port
enabled	enabled	deletes binding entries when one of the following conditions occurs • DHCP is released • the port link is down, or the administrator is disabled • the lease time has expired	deletes the corresponding IP Filter and installs a default filter to block all IP traffic
enabled or disabled	enabled	not applicable	deletes the installed IP filter for the port
disabled	enabled	creates a binding entry	not applicable
disabled	enabled	deletes a binding entry	not applicable

You can configure IP Source Guard using the Avaya command line interface (ACLI), Enterprise Device Manager, and SNMP.

Avaya Identity Engines Ignition Server

Avaya Identity Engines Ignition Server (Ignition Server) is an 802.1X-capable RADIUS authentication server and TACACS+ server that grants or denies users access to your network based on your policies. When you use Ignition Server you can create a single set of policies that control access for all user connection methods: over a wired Ethernet jack, wireless, or VPN.

Ignition Server also authenticates devices and you can configure an 802.1X authentication bypass for older devices on your network that cannot perform an 802.1X authentication.

While you store access policies on the Ignition Server, user accounts remain in your traditional user store(s) such as LDAP and Active Directory servers

To reduce security risks and task duplication, and maintain clear lines of responsibility, Ignition Server acts as a single policy decision point that makes and logs access decisions but leaves the management of user account data in your enterprise directories. Your user account data can remain in your enterprise directories because you can specify a search order that directs Ignition Server identity routing to direct the Ignition Server to search one or more user directories to find the correct user account.

Consolidating access decisions provides:

- consistent policy enforcement of your network access policies across wired, wireless, VPN, and remote access
- streamlined security and compliance audits because users can access the network through any allowed switch or access point, but wherever they connect, the log entry resolves to the user account in the appropriate enterprise user directory
- faster network extension and new network services deployment, since you can add a new access point or network with just a few steps in Ignition Server.

Ignition Server includes a policy engine that lets you make network access decisions based on, but not limited to, the following criteria:

- user identity
- acccount details and group memberships
- the location of the login attempt
- the time of day

For example, you can create an Ignition Server policy that grants network access to a user based on identity, point of access - which network switch or wireless access point the user connects through, and the user's laptop security state - ensuring that the laptop is a company-owned laptop as recorded in the corporate Active Directory store and ensuring that it has up-to-date anti-virus profiles installed.

Ignition Server network access tool can check whether the workstation has passed MAC authentication, Windows machine authentication, and/or a security posture check and you can combine many policy elements to enforce a single rule. For example, you can create a rule to authenticate the user with PEAP/MSCHAPv2, check that the user device has been authenticated, and, if those checks are successful, assign the user to the appropriate VLAN based on role.

For more information about Ignition server, see http://support.avaya.com.

Trace feature

The trace feature is a troubleshooting feature that provides detailed information about errors and events on the device. Use this feature to understand the cause of an error and take action to resolve it. The trace feature provides more detailed, real time information than a **show** command.

Syslog events for 802.1x/NEAP

The syslog event feature logs any warning or error related to EAP that affects usability of the device. Use this feature to view a message that describes the EAP feature issue and the origins of the issue.

Storm Control

This feature provides granular control of Broadcast, Multicast and Unicast traffic rates on a per-port basis. Broadcast, Multicast and Unicast traffic rates can be individually or collectively controlled on a switch or switch stack by setting the following:

- low-watermark and high watermark values in packets per second (pps)
- polling interval value
- action type
- SNMP traps

When a high watermark is exceeded, an action of None, Drop or Shutdown can be applied to the traffic type.

A defined action is reversed, or ceases, when the traffic rate in pps falls below the low-watermark setting. When an action of ‘drop’ is used, traffic is dropped when traffic exceeds the high-watermark and does not resume forwarding until the traffic rate falls below the low-watermark. When the action of ‘shutdown’ is used, the switch port is administratively shutdown when traffic exceeds the high-watermark and requires administrator intervention to re-enable the switch port to resume traffic forwarding.

The Storm Control feature includes logging of watermark crossings and sending of traps for the high watermark crossings. Traps for high watermark exceeded can be sent repeatedly at a user-specified interval.

Storm Control feature uses the rising and falling threshold levels to block and restore the forwarding of Broadcast, Multicast or Unicast packets. Storm Control feature is disabled by default.

Enhanced Secure Mode

The switch defaults to higher level of security when Enhanced Secure Mode is enabled.

The following security enhancements are available in this operating mode:

- The switch supports multiple role-based access levels.
- Every attempt to access the product requires a username and password to be presented for authentication.
- The switch enforces stronger password requirements, and stronger rules on password length, password complexity, password change intervals, password reuse, and password maximum age use.
- The audit logging is enabled by default and cannot be disabled or modified. The audit records all valid activities performed on the system, including the identity of each user through its username, IP and session ID and the date and time stamp of access attempt. If you configure a remote Syslog server, the switch sends each issued command and security log to this remote

server. The log file is not affected by a restart, default boot or upgrade. Log encryption is supported.

- The command for configuring the switch banner provides an option to display the DoD approved banner.
- TFTP protocol is disabled by default.
- The switch uses NTP as default clock source. NTP authentication keys are hidden in ACLI and ASCII config.

By default, enhanced secure mode is disabled. You must restart the switch after enabling or disabling the feature in order to apply the new setting.

Note:

Configurations are not transferable between operating modes with enhanced secure mode enabled and enhanced secure mode disabled. When switching modes of operation, the switch or stack resets to default configuration.

Feature operation when Enhanced Secure Mode is enabled

The following table contains information about feature functionality when Enhanced Secure Mode is enabled.

	Enhanced Secure Mode enabled	Enhanced Secure Mode disabled
Syslog:		
Secure Syslog	Supported through the Mocana SSH Port forwarding tunnel support	No SSH Port forwarding tunnel support
Remote Syslog connection type	UDP, TCP or SSH secured TCP connection	UDP connection
Clock, Network Time Protocol Clients:		
Default clock source	The switch uses NTP as default clock source	The switch uses SNTP as default clock source
NTP authentication key support	SHA1	MD5 (Enhanced Secure Mode enabled)
NTP authentication keys visibility	The switch hides NTP authentication keys in CLI and ASCII config	NTP authentication keys are not hidden
Authentication/Access-level and Banner Requirements:		
Password protection	The switch requires password to gain administrative access to the switch	The switch allows login without authentication
Maximum wait time for TCP connections to be established with the switch	10 seconds or less	75 seconds or less

Table continues…

	Enhanced Secure Mode enabled	**Enhanced Secure Mode disabled**
TFTP Protocol	TFTP protocol is turned off by default	TFTP protocol is turned on by default
Authentication	Every attempt to access requires a username and password	Only when authentication is set, username and password is required
Telnet-Access	Telnet access is enabled by default, permitting any existing user ID in the system (including any default user ID)	Telnet access is enabled by default.
Local user accounts database	Role based. The switch supports multiple configurable roles.	Access rights based. The switch only supports read-write (RW) and read-only (RO) users.
Initial userID/Password	The default username and password are *admin/password*	When authentication is enabled, default users are *RW* and *RO* with *secure* and *user* passwords.
Banner	The default banner is the static banner: The Standard Avaya Commercial Banner	The default banner is the static banner: The Standard Avaya Commercial Banner

Upgrade considerations

Upgrading from a previous version not supporting Enhanced Secure Mode maintains the existing non Enhanced Secure configuration. If you switch to Enhanced Secure Mode after upgrade, the configuration is defaulted.

Upgrading to a newer release supporting Enhanced Secure Mode maintains the existing configuration parameters including the following:

- Users and passwords
- Network configuration
- Settings for TFTP, TELNET, SSH protocols.

Multiple user roles

When Enhanced Secure Mode is enabled, the switch supports multiple management accounts and role-based authentication.

Each username is associated with a certain role. Each role provides authorization rights for viewing or executing groups of commands. The Security Administrator can create groups of ACLI commands (or use the default groups of commands) and associate some groups to a role, specifying which rights the role has for each group of commands

There are four default roles on the switch. Each of these roles grants user access to configuring or viewing specific command groups. The Security Administrator can also define other roles.

The switch provides the following default roles:

- System security administrator
- System administrator
- Application administrator
- Emergency user

Note:

When Enhanced Secure Mode is enabled, the EDM interface is disabled by default. After enabling the web server, only a user associated with the Security Administrator role can access the EDM interface.

The administrator initially logs on to the switch using the default login of *admin* and the default password of *password*. After the first login, the switch prompts the administrator to create a new username and password. The new user has Security Administrator privileges and the initial administrator user is deleted.

Note:

By default, the switch does not allow repeated characters or sequential characters in the new passwords. Sequential strings include the following ones, in forward and reverse order, uppercase letters included:

- `abcdefghijklmnopqrstuvwxyz`
- `01234567890`
- `qwertyuiop`
- `asdfghjkl`
- `zxcvbnm`
- `!@#$%^&*()`

The Security Administrator then creates other users and configures default passwords for them. After the first authentication, the switch prompts each user to create a new password, in order to ensure that the user is the only person knowing the password associated with his account. After the new username and password are entered, the default username and password are deleted and no subsequent attempts to login to the switch using the default username and password are permitted.

User access can be restricted based on time of day interval. The number of concurrent sessions for a user is configurable, with a default of 12 sessions.

When a login attempt fails, it can be due to an invalid username or an invalid password. In either case, there is no error feedback indicating which of two failed. There are no differences between the response time for entering an invalid username or an invalid password for that username, as a time difference can be used to determine that a username failed and not the password.

Note:

Reset the switch to factory default if the switch manager loses or forgets access credentials and the switch gets locked,

Remote access

The switch supports RADIUS or TACACS-based remote user authentication and authorization. When a remote server is not available, local authentication is available.

The RADIUS server allows three types of users: Security, System and Application administrators. The users can login through SSH, Telnet and serial every time the server is accessible and the proper key is configured. The Security Administrator can also login through Web. All successful connections are audited.

The TACACS+ server allows Security administrator user and accepts SSH, Telnet and serial connection if the TACACS+ server is accessible and has configured the proper key. All successful logins are audited.

Default roles

The following table details the access level for the default roles.

Access level	Description
Security administrator	The Security administrator access level permits read-write access to create, delete other logins, create, delete, modify or assign roles, install ASG keys, install licenses, install PKI certificates and keys and read-write access to system parameters such as IP addresses or upgrade software, and the ability to start and stop services.
Emergency Administrator	This privilege access level has the same rights as security administrators but can log on by serial even if another authentication method is set on switch. An account timeout can be set for the account assigned with this role. The user with emergency administrator role can log on device only by serial or telnet port, not by SSH or Web. This user is also the only account allowed for RADIUS or TACACS+ authentication fallback, in case the connectivity to remote access servers is temporarily lost.
Application Administrator	The Application Administrator has read-only access to most switch configurations and status information.
System Administrator	The System Administrator has read-write access to system parameters such as IP addresses or upgrade software, and has the ability to start and stop services.

Default command groups

The following table contains details about the default command groups.

CLI command group	CLI commands general description
cli-basic-group	Contains all the commands available for all the users: `configure terminal, default, enable, end, exit, interface *, logout, no, show, username password *`
security-cmds-group	Contains the commands related to logins, access to the debug menu, create, delete, modify user accounts, assign or define roles and command groups: `banner *, cli *, cli-command-group *, cmd-interface *, dbg *, menu *, password *, role *, tech *, ssh *, ssl *, system last-exception *, username *, web-server *`
system-cmds-group	System command group which contains all system commands: `accept *, adac *, application *, area *, arp *, arp-table *, as-boundary-router *, asset-id *, auto-negotiation-advertisements *, auto-negotiation-capabilities *, auto-pvid *, auto-vlink *, autosave *, autotopology *, blink-leds * , boot * , brouter *, cfm *, clear *, clear-stats *, clock *, config-network *, config-usb-loadonboot *, configure *, copy *, count *, cpu-utilization *, csnp-interval *, ddi-logging *, default-cost *, default-metric *, device-role*, disable *, download *, duplex *, eap-all *, eapol *, ecmp *, edm *, enable *, end *, energy-saver *, enhanced-secure-mode *, environmental *, except *, exit *, fa *, find *, flash *, flowcontrol *, head *, help *, hop-limit *, host-route *, http-port *, https-only *, https-port *, i-sid *, install *, interfaces *, ip *, ip-blocking *, ip-source-address *, ipmgr *, ipv6 *, is-type *, isis *, ist * , jumbo-frames *, l2 *, lacp *, license *, link-state *, lldp *, logging *, logout *, mac-address-table *, mac-security *, managed-config-flag *, manual-area *, manualtrigger *, match *, max-lsp-gen-interval *, maximum-path *, memory-utilization *,`

Table continues…

CLI command group	CLI commands general description
	mem-show *, metric *, mgmt.-port *, min-lsp-gen-interval *, mlt *, mvr *, name *, network *, no-more *, nsna *, ntp *, nvram *, ospf *, overload *, overload-on-startup *, ping *, ping-virtual-address *, poe *, poe-main-status *, poe-port-status *, poe-power-measurement *, poe-shutdown *, port-mirroring *, port-statistics *, preference *, psnp-interval *, qos *, quickconfig * , radius *, radius-server *, range *, rate-limit *, redistribute *, reload *, renew *, renumber *, restore *, retransmit-lsp-interval *, rfc1583-compatibility *, rip *, rmon *, route-map *, router *, router-id *, router-preference *, run *, running-config *, save *, script *, serial-console *, serial-security *, shared-port *, sftp-server *, shutdown *, slamon *, slpp *, slpp-guard *, smlt *, snmp *, snmp-server *, sntp *, spanning-tree *, spbm *, speed *, spf-delay *, sshc *, stack *, stack-info *, stack-monitor *, storm-control *, sys-info *, sys-name *, system, system verbose *, system-id *, tacacs *, tail *, tdr *, telnet *, telnet-access *, terminal *, tftp-access *, tftp-server *, timers *, toggle-next-boot-image *, trace *, traceroute *, trap *, ui-button *, usb-files *, usb-host-port *, vlacp * , vlan *, wan-mode *, write *, who *
audit-cmds-group	audit *

Limitations

The following feature limitations apply:

- The switch supports up to 32 CLI command groups.
- The switch supports up to 32 roles.
- The switch supports up to 10 user accounts.
- The switch supports one account for emergency user.
- The Emergency user can login only via serial or Telnet.
- The lockout is disabled after reset.
- Time settings function only when the clock source is synchronized.

- The switch supports user login via SSH, using username and password, DSA key or RSA key. If the Security administrator loads a public key on switch, the user that has the corresponding private key can log on switch as any user, including the security_admin.

  Note:

  Only a public key can be stored on switch.

Audit logging in enhanced secure mode

Audit logging allows the recording of CLI commands issued on the switch or stack in an unalterable audit file. The feature is enabled by default in Enhanced Secure Mode and cannot be disabled or altered by any individual.

Only the Security, Emergency or System administrators have access to the audit log . The Security or Emergency administrators can also configure the encryption of the log file.

The audit log survives a restart and initialization of the switch. Every command issued on the switch is stored in the local log. If a remote syslog server is configured, each command is also sent to it. The audit log cannot be deleted, except through disabling the Enhanced Secure Mode, which resets the switch to default settings. For this reason, the commands *audit log save* and *no audit log* do not exist in enhanced secure mode.

Note:

The maximum number of records in the local audit log is 159, with newer entries replacing the oldest. On the remote syslog server there is no such limit, meaning that the remote server can record a complete history of the commands issued on the switch.

The following table details the audit logging behavior when Enhanced Secure Mode is enabled or disabled.

	Enhanced Secure ON mode	Enhanced Secure OFF mode
Log File encryption	The log is encrypted with Mocana AES encryption.	No encryption
Access	• The audit log is unalterable by any individual. • The contents are available only to Security, Emergency and System administrators. • The default encryption key can be modified only by the Security and Emergency Administrators. • The log cannot be deleted except through switching the security mode.	• All users can view the audit log. • The log cannot be deleted except through switching the security mode.

Table continues…

	Enhanced Secure ON mode	Enhanced Secure OFF mode
Tracking	The identity of each user is tracked by the audit record through its username, IP and session id.	The identity of users is tracked by the audit record through its username and role only if user authentication is enabled.
Recording	Records the date and time stamp of access attempt.	Records the date and time stamp of access attempt.
	Records all valid activities performed on the system.	Records only the commands.
	The audit file captures the following events: • All successful log-in attempts • Invalid user authentication attempt • Unauthorized attempts to access system resources • Each logout or session termination • All software downloads	The audit log does not record the security relevant actions.
Login, logout and session initiation	The audit system is configured to audit login, logout and session initiation.	No support.
Audit trail	Protected against modification or deletion.	No support.
Log storage on a non-volatile medium	The device supports log storage on a non-volatile medium. The log is not affected by a restart or a default boot.	The device supports log storage on a non-volatile medium. The log is not affected by a restart or a default boot.

Summary of security features

For more information about some of the security features available on the switch, see Table 10: MAC security on page 113 through Table 14: SNMPv3 security on page 115.

Table 10: MAC security

MAC security	Description
Description	Use the MAC address-based security feature to set up network access control based on source MAC addresses of authorized stations.
What is being secured	Access to the network or specific subnets or hosts.
For each port or each switch	Each port.
Layer	Layer 2.

Table continues…

MAC security	Description
Level of security	Forwarding.
Violations	SA filtering, DA filtering, Port Partitioning, SNMP Trap.
Requirements for setup	Not applicable.
Configuring using interfaces	ACLI, ASCII configuration file, SNMP, and EDM.
Restrictions and limitations	—
Reference	s5sbs MIB (S5-SWITCH-BAYSECURE-MIB)
Comments	—

Table 11: Password Authentication security

Password authentication	Description
Description	Security feature.
What is being secured	User access to a switch or stack.
Port to port or switch to switch	For RADIUS authentication. • The RADIUS server needs to be accessible from switch. • The RADIUS client from the switch must be provided with the RADIUS server IP and UDP Port and a shared secret.
Layer	Not applicable.
Level of security	Provides Read Only and Read Write access. The access rights are checked against Local Password and RADIUS Server.
Violations	Not applicable.
Requirements for setup	For RADIUS authentication. • The RADIUS server needs to be accessible from the switch. • The RADIUS client from the switch must be provisioned with the RADIUS server IP, the UDP Port, and a shared secret.
Configuring using interfaces	EDM, ACLI, ASCII configuration file.
Restrictions and limitations	Not applicable.

Table 12: EAPOL security

EAPOL	Description
Description	Extensible Authentication Protocol Over LAN (Ethernet)—you can use this to set up network access control on internal LANs.
What is being secured	User access to the network.
Port to port or switch to switch	User authentication by port.
Layer	Layer 2.
Level of security	Network access encryption.

Table continues…

EAPOL	Description
Violations	The switch blocks a port if intruder is seen on that port. Administration has to reenable port.
Requirements for setup	RADIUS Server configuration on the switch. EAP-RADIUS server needs to be accessible from the switch.
Configuring using interfaces	Enterprise Device Manger (EDM) and Avaya Command Line (ACLI).
Restrictions and limitations	Not allowed: shared segments and ports configured for MultiLink Trunking, MAC address-based security, IGMP (static router ports), or port mirroring.
Reference	IEEE802.1X, RFC 2284.

Table 13: IP Manager security

IP Manager	Description
Description	IP Manager is an extension of Telnet. It provides an option to enable or disable access for TELNET (Telnet On or Off), SNMP (SNMP On or Off) and Web Page Access (Web On or Off) with or without a list of 50 IP Addresses and masks.
What is being secured	User access to the switch through Telnet, SNMP, or Web.
Port to port or switch to switch	By switch.
Layer	IP.
Level of security	Access.
Violations	User is not allowed to access the switch.
Requirements for setup	Optional IP Addresses or Masks, Individual Access (enable or disable) for Telnet, SNMP or Web page.
Configuring using interfaces	Web and ACLI.
Restrictions and limitations	Not applicable.

Table 14: SNMPv3 security

SNMPv3	Description
Description	The latest version of SNMP provides strong authentication and privacy for Simple Network Management Protocol (SNMP)—using hash message authentication codes message digest 5 (HMAC-MD5), HMAC-secure hash algorithm (SHA), cipher block chaining Data Encryption Standard (CSCDES), Advanced Encryption Standard (AES), and Triple DES (3DES)—plus access control of Management Information Base (MIB) objects based on user names.
What is being secured	Access to MIBs using SNMPv3 is secured. Access to MIBs using SNMPv1 or v2c can be restricted.
Port to port or switch to switch	By switch.
Layer	SNMP Port 161, 162.
Level of security	Access and Encryption.

Table continues…

SNMPv3	Description
Violations	Received SNMPv3 packets that cannot be authenticated are discarded. For authenticated packets that try to access MIB objects in an unauthorized manner, an error is returned to the sender. Various MIB counters are incremented when a violation occurs. (These can be monitored to detect intrusions, for example, by using RMON alarms.)
Requirements for setup	For maximum security, initial configuration of views, users, and keys must be done through the console port or over a physical network connection. Subsequent secure configuration changes can be accomplished using SNMPv3 using a secure SHA or DES connection.
Configuring using interfaces	Enterprise Device Manger (EDM), Avaya Command Line Interface (ACLI), ASCII configuration file, and SNMP Set requests.

Table 15: DHCP Snooping security

DHCP Snooping	Description
Description	Use the Dynamic Host Control Protocol (DHCP) snooping security feature to provide security to the network by filtering untrusted DHCP messages to prevent DHCP spoofing.
What is being secured	Access to the network.
Port to port or switch to switch	Per port.
Layer	Layer 2 and 3.
Level of security	Forwarding.
Violations	Allows only DHCP requests from untrusted ports. DHCP replies and all other types of DHCP messages are dropped. If the source MAC address and the DHCP client hardware address do not match, the switch drops the packet.
Requirements for setup	Not applicable.
Configuring using interfaces	Avaya Command Line Interface (ACLI) and Enterprise Device Manager (EDM).

Table 16: Dynamic ARP Inspection security

Dynamic ARP Inspection	Description
Description	Use the dynamic Address Resolution Protocol (ARP) Inspection to validate ARP packets in a network.
What is being secured	Access to the network.
Per port or per switch	Per port.
Layer	Layer 2 and 3.
Level of security	Forwarding.

Table continues…

Violations	Dynamic ARP Inspection intercepts, logs, and discards ARP packets with invalid IP-to-MAC address bindings.
Requirements for setup	DHCP snooping must be globally enabled.
Configuring using interfaces	Avaya Command Line Interface (ACLI) and Enterprise Device Manager (EDM).

Chapter 4: IPv6 First Hop Security

This chapter describes the IPv6 security concerns and attempts to mitigate them using First Hop Security (FHS).

Related links

What is IPv6? on page 118

IPv6 security concerns on page 118

First Hop Security on page 123

What is IPv6?

Internet Protocol version 6 (IPv6) is the latest version of the Internet Protocol (IP).

IPv6 is expected to coexist with and eventually replace IPv4. IPv6 provides a larger address space to support future Internet growth. IPv6 is increasingly deployed in enterprise, university, and government networks. The success of the IPv6 deployment depends on the network security and quality of service (QoS) that it offers when compared to Internet Protocol version 4 (IPv4).

For more information about IPv6 basics, see *Configuring Systems on Avaya Ethernet Routing Switch 4800 Series*, NN47205-500 .

Related links

IPv6 First Hop Security on page 118

IPv6 security concerns

The enhancements in IPv6 provide better security in certain areas, but some of these areas are still open to exploitation by attackers. This section identifies the IPv6 FHS concerns associated with Router Discovery, Neighbor Discovery, and Dynamic Host Configuration Protocol version 6 (DHCPv6).

Related links

IPv6 First Hop Security on page 118

Router Discovery on page 119

Stateless Address Autoconfiguration on page 120

Neighbor Discovery on page 122
Duplicate Address Detection on page 123

Router Discovery

IPv6 nodes use the Neighbor Discovery Protocol (NDP) to discover other nodes on the link. NDP is also used to determine the node link-layer addresses to find routers, and to maintain reachability information about the paths to active neighbors (RFC 4861), but it has some First Hop Security concerns.

RFC 4861 resolves link-local specific problems including Router Discovery, Prefix Discovery, stateless address autoconfiguration (SLAAC), IPv6 address resolution (replaces IPv4 ARP), Neighbor Unreachability Detection (NUD), Duplicate Address Detection (DAD), and redirection, but it does not resolve Denial of Service (DoS) attack.

For example, consider the following figure where the host attempts to discover the router on its local segment. The host uses Internet Control Message Protocol version 6 (ICMPv6) messages, which rely heavily on multicast. In this scenario, Host A attempts to discover routers on its link through router discovery. Host A sends a router solicitation message requesting information about routers on its local segment. The router in turn replies with a router advertisement for a lifetime x. Host A then installs a default route in its routing table with a time x before another router discovery cycle is initiated.

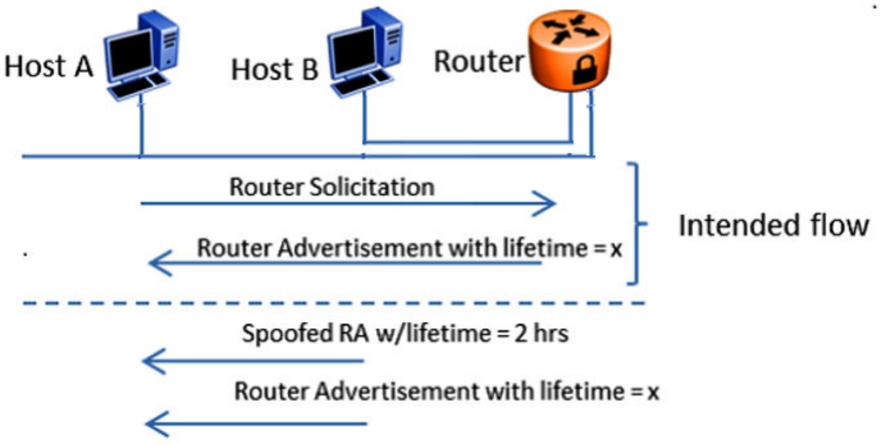

Host A
Host B
Router
Router Solicitation
Router Advertisement with lifetime = x
Intended flow
Spoofed RA w/lifetime = 2 hrs
Router Advertisement with lifetime = x

Figure 5: Message Flow IPv6 Router Discovery

If there is an intruder, Host B, on the segment, the intruder can attempt to insert itself as the router by spoofing the legitimate router advertisement and set the lifetime to two hours. According to RFC 4862, “If Remaining Lifetime is less than or equal to two hours, ignore the Prefix Information option with regard to the valid lifetime, unless the Router Advertisement from which this option was obtained has been authenticated.” Host A removes the installed default route that points to the legitimate router after two hours. Host B is then free to send another router advertisement inserting itself as the default route for Host A. Host B now receives all packets intended for the default gateway from Host A. This constitutes a DoS attack, as Host A potentially loses access to the network beyond the legitimate router. Host B can then utilize this to initiate further attacks.

Even though IPv6 can use SEcure Neighbor Discovery (SEND) as an option, the implementation of the SEND is not common. Implementation of SEND can open the door for the first hop attack with respect to the previously-defined threats which is solved by RFC 4861. The FHS predominantly addresses these kinds of threats. FHS takes care of the threats caused by the immediate node to another immediate node attached to the same FHS device.

Related links

IPv6 security concerns on page 118

Stateless Address Autoconfiguration

As defined in RFC 4862, SLAAC enables an IPv6 endpoint to obtain an IPv6 address from the link it is coming up on without requiring DHCPv6 address allocation.

IPv6 address autoconfiguration is stateless, therefore it does not require a mechanism to track the address allocations before it assigns a new address. The address allocation is based on the IPv6 prefix information provided by ICMPv6 router advertisements.

The following figure illustrates the steps involved in deploying the IPv6 address autoconfiguration attack.

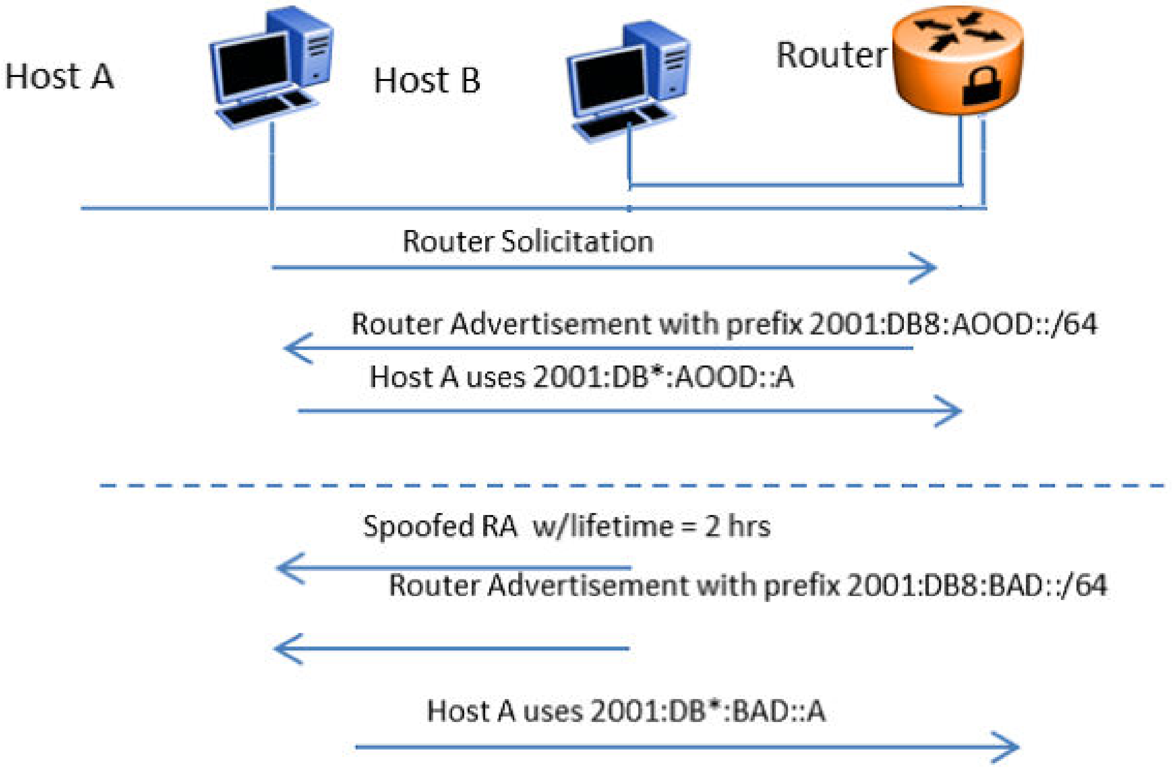

Host A
Host B
Router
Router Solicitation
Router Advertisement with prefix 2001:DB8:AOOD::/64
Host A uses 2001:DB*:AOOD::A
Spoofed RA w/lifetime = 2 hrs
Router Advertisement with prefix 2001:DB8:BAD::/64
Host A uses 2001:DB*:BAD::A

Figure 6: Stateless Address Autoconfiguration

When Host A wants to receive an IPv6 address, it sends an ICMPv6 router solicitation requesting the link information. The router responds with an ICMPv6 router advertisement providing the IPv6 address prefix (shown as 2001:DB8:A00D::/64) on the link with a lifetime x. Then, Host A can pick an address (shown as 2001:DB8:A00D::A) on the link and start using it after checking the duplicate address availability (DAD). If malicious Host B manages to insert itself in the link, it can spoof an ICMPv6 router advertisement from a router that sets the lifetime for the link to two hours. According to RFC 4862, “If Remaining Lifetime is less than or equal to two hours, ignore the Prefix Information option with regards to the valid lifetime, unless the Router Advertisement from which this option was obtained has been authenticated”. This can cause the Host A address to expire in two hours, and Host B can then send a new router advertisement with a new prefix (shown as 2001:DB8:FAFE::/64). On seeing the new prefix, Host A picks a new address (shown as 2001:DB8:FAFE::A). Depending on the network configuration, the router Access Control Lists (ACL) can deny the new address from traversing the network, and therefore Host A can be blocked from accessing beyond the next hop router, or even its link-local peers. If IPv6 address autoconfiguration is used and FHS protection is not employed, Host B can potentially black-hole hosts in its local link by spoofing two IPv6 router advertisements.

Related links

IPv6 security concerns on page 118

Neighbor Discovery

Neighbor Discovery (ND) is similar to Router Discovery but ND is used for hosts.

ND performs operations such as address resolution, DAD, Neighbor Unreachability Detection (NUD), and redirection. Along with Router Discovery, in IPv6 there are also ND ICMPv6 messages that are responsible for network discovery - ICMPv6 Neighbor Solicitation (NS) and Neighbor Advertisement (NA). This section describes concerns related to Neighbor Discovery.

The following figure illustrates the steps involved in deploying an address resolution attack.

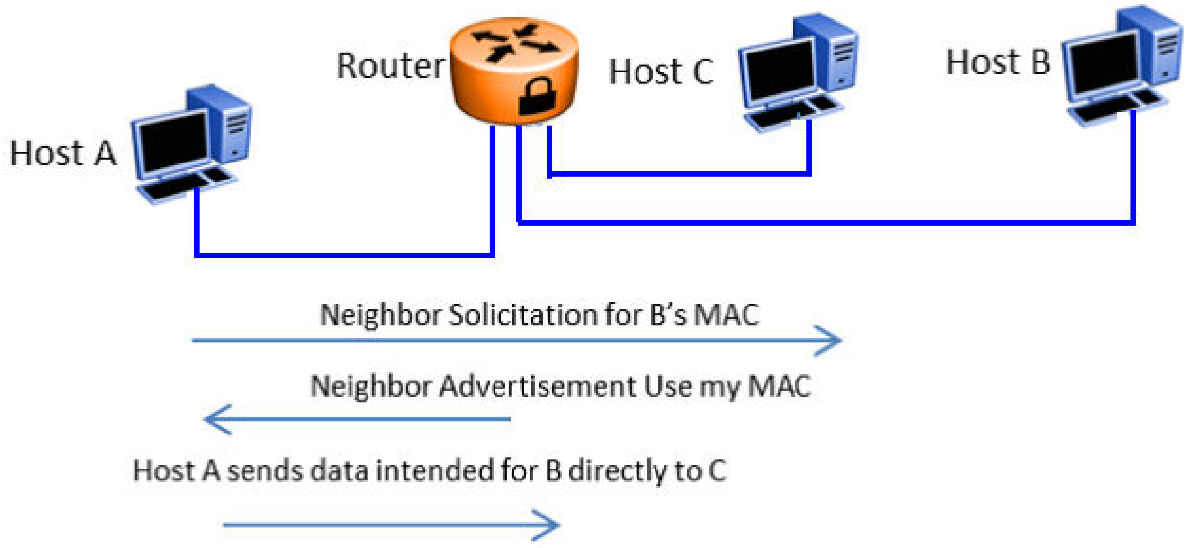

Router
Host C
Host B
Host A
Neighbor Solicitation for B's MAC
Neighbor Advertisement Use my MAC
Host A sends data intended for B directly to C

Figure 7: IPv6 Neighbor Discovery

Address resolution is the process that an endpoint (shown as Host A) follows when it wants to forward a packet to another endpoint (shown as Host B) in the local link when it does not know its Layer 2 address. Host A resolves the IP address of Host B into a MAC address and then forwards the packet by setting the Host B MAC address as the Layer 2 frame's destination MAC address.

In IPv4, ARP is responsible for address resolution and in IPv6, ICMPv6 is responsible for that service. Host A sends an ICMPv6 NS requesting the link-layer address for Host B. When Host B sends an ICMPv6 NA response, Host A knows the MAC address for sending the frame. At the same time, Host A creates a neighbor cache entry for Host B that binds the MAC for Host B to its IPv6 address (similar to the ARP table in IPv4).

If malicious Host C manages to insert itself in the link, it can impersonate Host B and intercept all packets that were originally destined for Host B. Therefore, if proper FHS protections are not employed, Host B can perform a man-in-the-middle attack or intercept traffic.

Related links

IPv6 security concerns on page 118

Duplicate Address Detection

Duplicate Address Detection (DAD) is an IPv6 protocol that enables an endpoint to verify the IP address uniqueness. In essence, a host sends a probe message to verify if the address is claimed by other hosts. The following figure illustrates the steps involved in deploying a duplicate address attack.

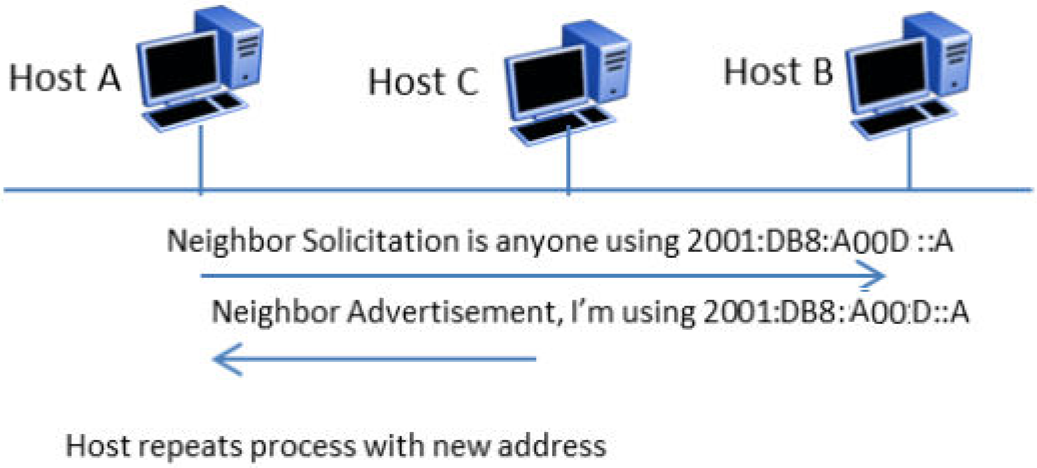

Host A
Host C
Host B
Neighbor Solicitation is anyone using 2001:DB8:A00D ::A
Neighbor Advertisement, I'm using 2001:DB8:A00D::A
Host repeats process with new address

Figure 8: IPv6 Duplicate Address Detection

In IPv6, when Host A wants to perform DAD, it sends an ICMPv6 Neighbor Solicitation (NS) for the address it wants to claim (for example, 2001:DB8:A00D::A). Host A can use the address if other hosts do not respond with an ICMP Neighbor Advertisement (NA) stating the address is taken.

In this scenario, DAD can be susceptible to attacks by malicious Host C, which wants to prevent host A from receiving an IPv6 address. When Host A sends an NS for 2001:DB8:A00D::A, Host C can send an NA stating the address is taken. If Host A tries to claim another address (for example, 2001:DB8:A00D::AA), Host C can send an NS and claim it. Essentially, Host C can claim every address with which Host A performs DAD, and prevent Host A from obtaining an IPv6 address to communicate with the network.

Related links

IPv6 security concerns on page 118

First Hop Security

First Hop Security improves local network security by employing a number of mitigation techniques. This section describes the base set functionality which provides protection from a wide host of rogue or mis-configured users, and this can be extended with additional features for different deployment scenarios. For example, see the following topology.

Sample topology

In the following topology, Layer 2 switch SW-1 is connected to another Layer 2 switch SW-2. SW-2 is connected to three hosts and SW-1 is connected to two hosts.

In this network, if FHS is enabled only on SW-1, then it can only save the nodes which are directly connected to it. To protect the good node connected to SW-2, the FHS must be enabled on SW-2.

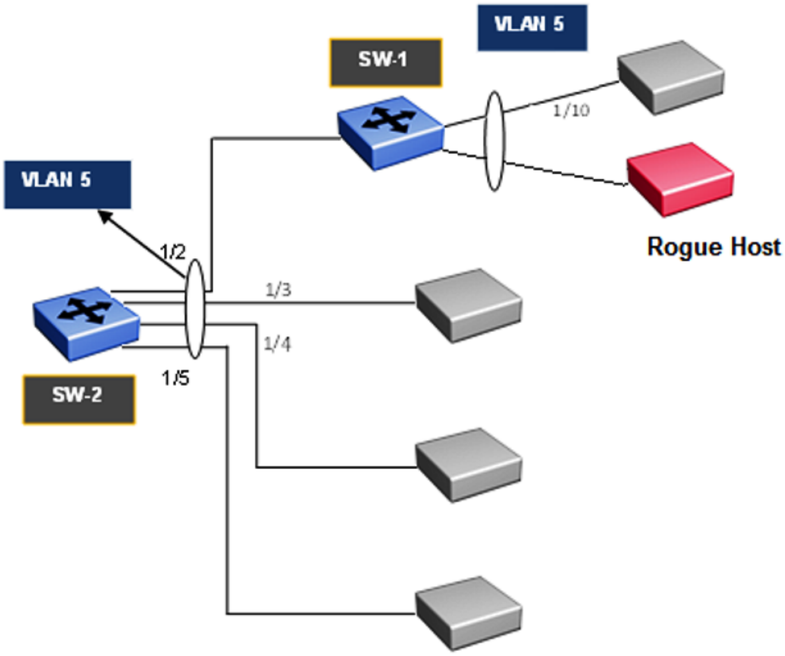


Figure 9: First Hop Security topology

First Hop Security contains the majority of the RIPE 554 mandatory requirements for Layer 2 switches. This includes the following:

- DHCPv6–guard or DHCPv6 filtering
- RA-guard or Router Advertisement filtering
- Dynamic IPv6 Neighbor solicitation or advertisement inspection
- Neighbor reachability detection inspection
- Duplicate Address Detection inspection

Related links

IPv6 First Hop Security on page 118
DHCPv6–guard on page 124

DHCPv6–guard

DHCPv6–guard provides Layer 2 security to DHCPv6 clients by protecting them against rogue DHCPv6 servers. DHCPv6–guard ensures that Layer 2 device filters DHCPv6 messages meant for

DHCPv6 clients. The basic filtering criterion is that the Layer 2 device discards the DHCPv6 messages if they are not received on a specified Layer 2 device port.

The following are DHCPv6 topology samples:

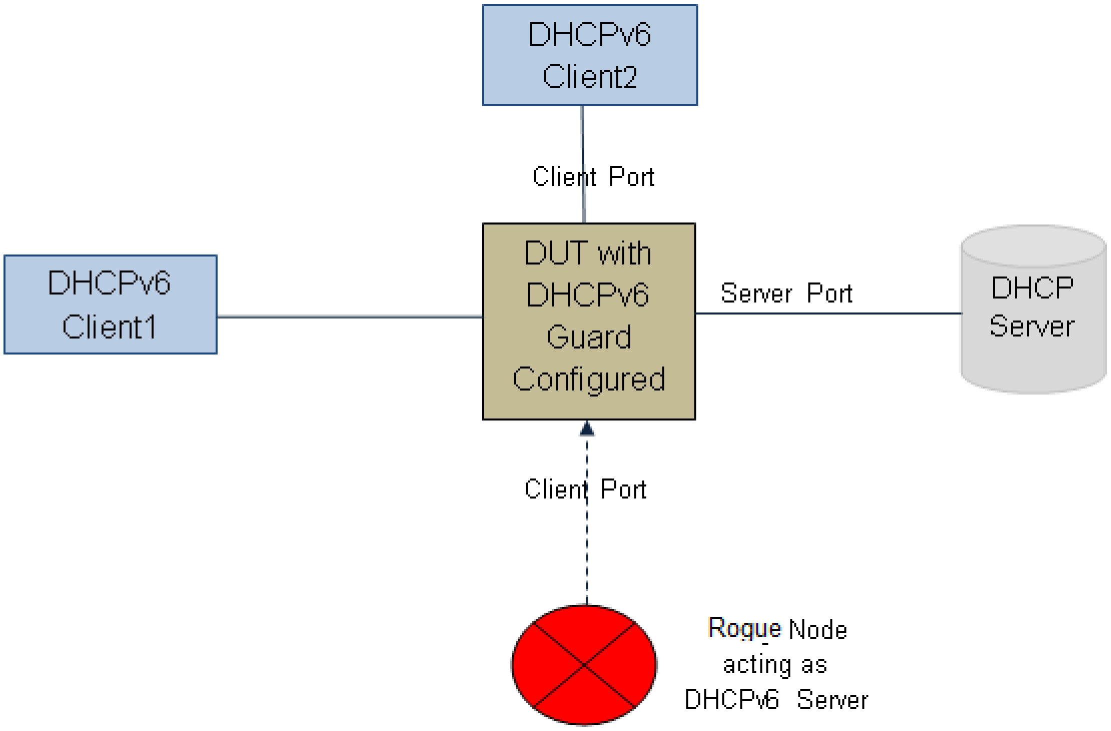


Figure 10: DHCPv6 Topology 1

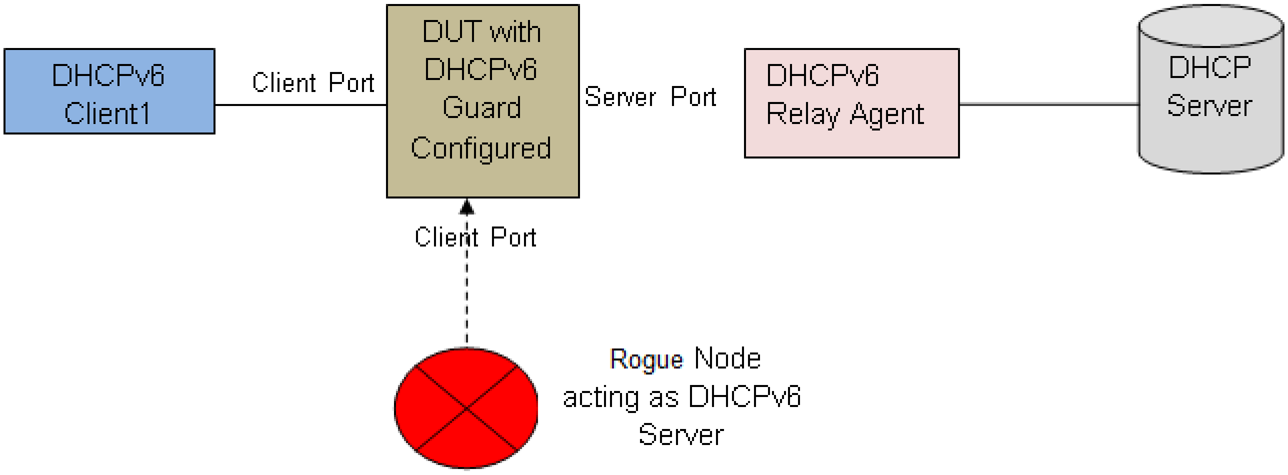


Figure 11: DHCPv6 Topology 2

Related links

First Hop Security on page 123

DHCPv6–guard policies configuration on page 126
RA-guard on page 127
ND-inspection on page 132
Capturing and verifying FHS specific packets against the configured policies on page 136
Limitations on page 136

DHCPv6–guard policies configuration

DHCPv6-guard policies can be configured using ACLI, SNMP and EDM. The following policies are supported for DHCPv6–guard.

Related links

DHCPv6–guard on page 124
Port-based filtering using device-role on page 126
Server or relay agent IP address based filtering on page 126
Advertising IP prefix-based filtering on page 127
Server preference-based filtering on page 127

Port-based filtering using device-role

Port-based filtering using device-role is an interface-based configuration. Only a DHCPv6 server or relay agent can send a DHCPv6 advertisement or reply. By configuring the device-role attached to the port (whether it is a client or server), the rogue server generating DHCPv6 advertisement or reply packets can be blocked if these packets are received on a port configured as a client. The role of a device can be configured on a single port or Multi-link Trunking (MLT).

In DHCPv6 Guard Topology 1, only DHCPv6 server packets (that is, advertisement, reply) received on a port configured as a Server Port accept the packets and process them for security validation and forwarding. The Client port drops the packets if it receives packets generated from a DHCPv6 rogue server.

Related links

DHCPv6–guard policies configuration on page 126

Server or relay agent IP address based filtering

Server or relay agent IP address-based filtering enables the verification of the advertised DHCP server and relay address in messages with the configured authorized server access list. In DHCPv6-guard Topology 1 and Topology 2, you can configure the access list to accept DHCPv6 server packets from a specific Source IPv6 address such as a DHCPv6 server or DHCPv6 relay IPv6 address. If so, in case DHCPv6 relay is used, you must configure the access-list to accept server packets from the relay agent link-local address.

Related links

DHCPv6–guard policies configuration on page 126

Advertising IP prefix-based filtering

Advertising IP prefix-based filtering enables verification of the advertised prefixes in DHCP reply messages with the configured authorized prefix list.

Related links

DHCPv6–guard policies configuration on page 126

Server preference-based filtering

Server preference-based filtering enables verification by checking if the advertised preference (in preference option) is greater than or less than the specified limit.

Related links

DHCPv6–guard policies configuration on page 126

RA-guard

IPv6 hosts can configure themselves automatically when connected to a routed IPv6 network using the ND Protocol through ICMPv6 router discovery messages. When the host is connected to the network for the first time, it sends a link-local router solicitation multicast request for its configuration parameters. It the host is configured correctly, routers respond to the request with a Router Advertisement (RA) packet. The RA packet contains network-layer configuration parameters.

There is a risk of rogue RAs in a shared Layer 2 network segment when SEND support is not complete or if the infrastructure to support SEND is not available. The RA is generated maliciously by the unauthorized or improperly-configured routers connecting to the segment. RA-guard provides complementary solutions in those environments where SEND is not suitable or fully supported by all devices involved. RA-guard implementation validates RAs on behalf of hosts and potentially simplifies some of these challenges.

RA-guard can be seen as a superset of SEND with regard to router authorization. RA-guard filters RAs based on few criteria. The criteria can range from a simplistic “RA disallowed on a given interface” to “RA allowed from pre-defined sources” and up to a full-fledged SEND “RA allowed from authorized sources only”.

In addition to filtering RAs, RA-guard introduces the concept of router authorization proxy. Instead of each node on the link analyzing RAs and making an individual decision, a legitimate “node-in-the-middle” performs the analysis on behalf of all other nodes on the link.

Stateless and statefull RA-guards are available. This document discusses only the stateless RA-guard function.

Stateless RA-guard examines incoming RAs and decides whether to forward or block them based on the information found in the message or in the Layer 2 device configuration. The following is the typical information available in the received frames that are used for RA validation:

- Port on which the frame is received
- Source IP Address
- Prefix list which RA carries
- Link-Layer Address of the sender

After the Layer 2 device validates the RA frame content against the configuration, the RA is forwarded to its destination, whether unicast or multicast. If not validated, the RA is dropped at the Layer 2 device.

Related links

DHCPv6–guard on page 124
Port-based filtering using device-role on page 128
Source IP-based filtering on page 129
Advertised IP prefix-based filtering on page 130
Source MAC address-based filtering on page 130
RA packet for managed address configuration flag validation on page 130
RA packet for hop count limit validation on page 131
RA packet for router preference validation on page 131

Port-based filtering using device-role

This is an interface based configuration. According to ND RFC 4861, only the IPv6 router can generate the RA packets. By configuring the role of the device attached to the port whether it is a host or router, the rogue host which is generating RA packets can be blocked. This can be configured on a single port or Multi-Link Trunking (MLT) or Split Multi-Link Trunking (SMLT) ports.

Note:

The preceding configuration is supported only on single port interfaces.

In the following topology, the Device Under Test (DUT) switch is connected to a Layer 3 router and three hosts. Because the “Router” is directly connected to the port 1/2, the device-role of the port 1/2 is configured in “Router” mode. Similarly, other three hosts are connected to port number 1/3, 1/4 and 1/5 corresponding to the device-role of ports 1/3, 1/4, and 1/5, and they are configured in “Host” Mode.

The host connected to the port 1/4 is a Rogue Host and if it is trying to send RA packets, then the DUT switch drops those RA packets received on the interface 1/4 as the device-role of this port is “Host” Mode.

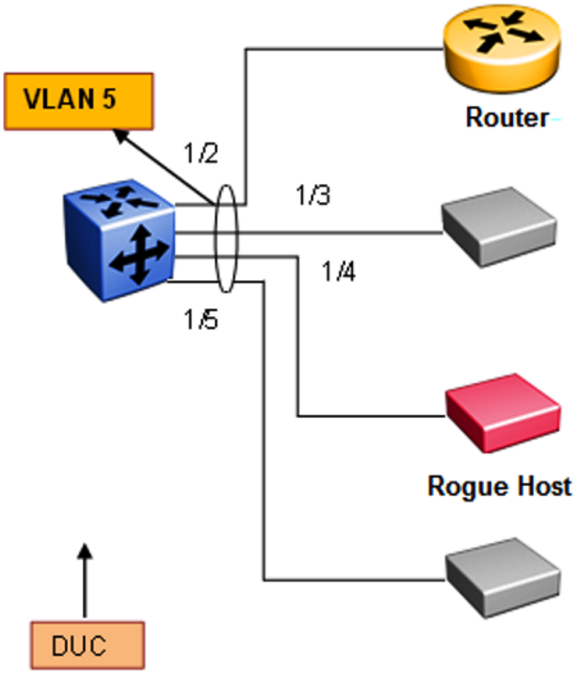


Figure 12: RA-guard Topology1

Related links

[RA-guard](#) on page 127

Source IP-based filtering

A Source IP-based filtering policy enables the source IP address verification of the RA packets against the configured authorized source IP or subnet list.

The following figure illustrates the IPv6 ICMP RA data packet outline. This RA-guard policy verifies the IPv6 source IP (SrcIP) in the IPv6 Header against the configured authorized Source IP or subnet list.

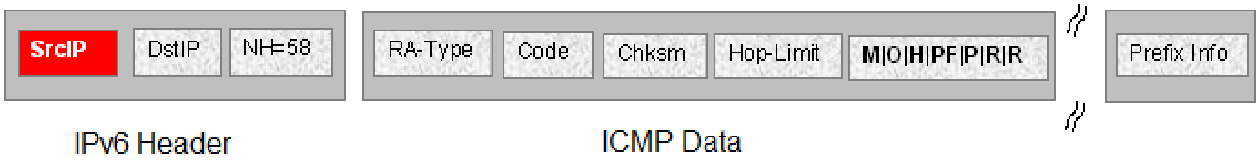


Figure 13: IPv6 ICMP RA data packet online

Related links

[RA-guard](#) on page 127

Advertised IP prefix-based filtering

Advertised IP prefix-based filtering enables the verification of the advertised prefixes in inspected messages against the configured authorized prefix list. This filtering policy can be applied on an interface or globally.

The following figure illustrates the IPv6 ICMP RA data packet outline. This RA-guard policy verifies the RA (Prefix Information) in ICMPv6 data against the configured authorized source IP or subnet list.

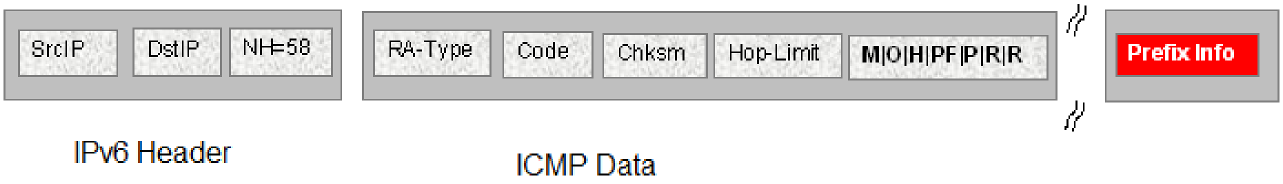


Figure 14: IPv6 ICMP RA data packet outline

Related links

[RA-guard](#) on page 127

Source MAC address-based filtering

Source MAC address-based filtering enables the source MAC address of the RA packets verification against the configured authorized MAC list.

The following figure illustrates the IPv6 Ethernet packet. This RA-guard policy verifies the received RA packets source MAC address against the configured authorized MAC access list.

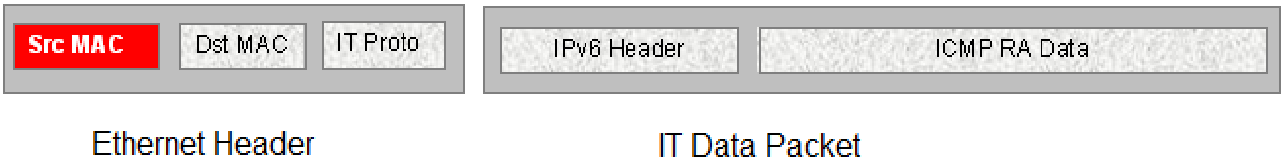


Figure 15: IPv6 Ethernet packet

Related links

[RA-guard](#) on page 127

RA packet for managed address configuration flag validation

In the RA packets, there is an “M” flag (managed address configuration flag) that can be configured to indicate that the address assignments are available through DHCPv6. This means that DHCPv6 takes care of the interface address assignment in that LAN segment. If a filtering policy is enabled, then all the RA packets without an “M” flag are dropped. By default, this validation is not performed.

The following figure illustrates IPv6 ICMP RA data packet outline for managed address configuration.

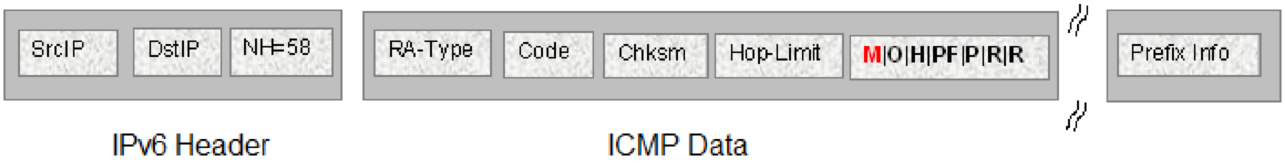


Figure 16: IPv6 ICMP RA data packet outline

Related links

RA-guard on page 127

RA packet for hop count limit validation

RA packet for hop count limit validation policy verifies the advertised RA message if the hop count limit is within the configured hop count limit. If the received hop count limit is not within the configured limit, then those RA packets are dropped.

The following figure illustrates IPv6 ICMP RA data packet outline for hop count limit validation.

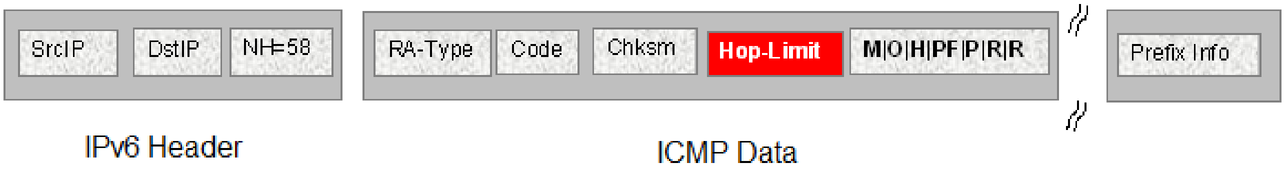


Figure 17: IPv6 ICMP RA data packet outline

Related links

RA-guard on page 127

RA packet for router preference validation

The RA packet contains the Router Preference as part of the flags field. This can be high, medium, or low. This filtering policy option verifies if the advertised default router preference parameter value is lower than or equal to a specified limit.

The following figure illustrates IPv6 ICMP RA data packet outline for router preference validation.

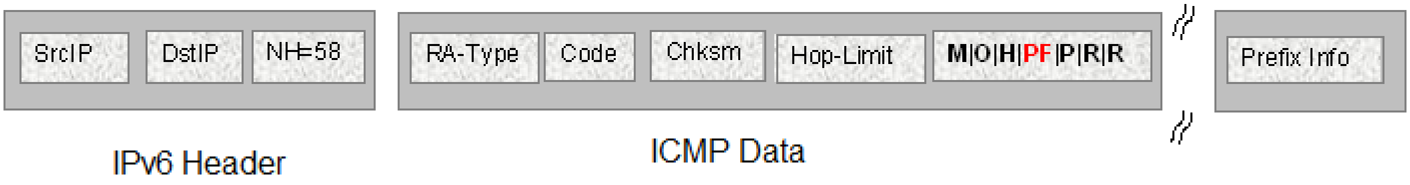


Figure 18: IPv6 ICMP RA data packet outline for router preference validation

Related links

RA-guard on page 127

ND-inspection

IPv6 ND inspection learns and secures bindings for stateless auto configuration addresses and DHCPv6 (stateful configuration) binding in Layer 2 neighbor tables.

FHS analyzes NDP and DHCPv6 packets to build a trusted Source Binding Table (SBT). SBT allows the FHS to know the source IPv6 address binding information like location (source IP belongs to which interface) and MAC address attached to the source IP.

This feature mitigates some of the inherent vulnerabilities for the neighbor discovery mechanism, such as attacks on Duplicate Address Detection (DAD), Neighbor Unreachability Detection (NUD) and address resolution using Neighbor Solicitation (NS) or Neighbor Advertisement (NA).

Source Binding Table

Neighbor source IP address are learned on the ports where ND-inspection is enabled.

In the case of conflicting ND packets from different ports or VLANs, the SBT entry is chosen based on the priority given to the ND packets. The priorities are derived from the ND packet and how their source address is learned. The high priority values are the most preferred ND entries. The following is the priority list based on their hex values:

1. NA from trusted port (non ND-inspection enabled port) – (hex – 00000020)
2. SBT entry learns this entry as a DHCP leant interface IP – (hex – 00000010)
3. SBT entry learns this entry by tracking from DAD – (hex – 00000008)
4. ICMPv6 optional Source-link-layer is same as source Ethernet MAC address – (hex – 00000002)
5. Packet from access port – (hex – 00000001)

Note:

Static SBT entries are preferred over any dynamically-learned SBT.

SBT Entry Values:

The following are the different SBT entry states:

INCOMPLETE–This is the state where the neighbor IP address is in the process of validation. In this state, except for the RA packet, other ND packets are dropped. The validation is done by sending DAD message to all the ports in the VLAN and the best ND packet is selected depending on the priority (hex value). If ND is found in the DHCP tracking table, entry is transitioned immediately to REACHABLE without further validation.

REACHABLE–This is the state where the neighbor IP address is already validated. In this state, all ND packets matching the SBT entry are forwarded and rest of the packets undergo validation. A reachable timer runs for each entry. This timer is refreshed when the FHS-enabled switch receives any ND packets matching SBT entry. If the reachable timer expires, it moves to a STALE state. But static SBT entry is always in a REACHABLE state.

STALE–This is the state transition from REACHABLE after the reachable timer expires. In this state, any ND packet matching the SBT entry change its state to REACHABLE and the rest of the packets are validated. A stale timer runs for each entry. After the timer expires, the corresponding SBT entry is deleted from the SBT.

DOWN–This is the state of the SBT entry when the corresponding interface goes down. In this state, any ND packet matching the IP address in the SBT entry updates the SBT entry and moves the state to REACHABLE, and forwards the packet.

Note:

If the system receives a packet without LL option, the packet is dropped and moves to an INCOMPLETE state, then sends a DAD message towards the source port to get the LL option information. If the response is not received within seven seconds, this entry is deleted.

There is a down timer for each down entry. After this timer expires, the corresponding SBT entry is deleted from the SBT.

In all the previous states, if the switch receives an ND packet without source-link-layer option and if the existing SBT entry priority is 0, then the switch sends a DAD packet towards the source to learn the source-link-layer address. If the node does not respond to the DAD message, then those ND messages are ignored.

Related links

DHCPv6–guard on page 124

Duplicate Address Detection on page 133

Neighbor Unreachability Detection on page 133

Neighbor Address Discovery on page 134

Duplicate Address Detection

Duplicate Address Detection (DAD) is a mechanism used to detect duplicate IP address in the same VLAN domain. This is achieved by sending a simple NS message with source IP address of "0::0" (Unspecified IP address) and the NS target IP address as its own new IP address. If any other network device is assigned the same source IP address, then that device sends a NA message in response to the DAD-NS message. If the node does not receive any response from other devices before the DAD timeout, the IP address is assigned.

What is the security threat

There can be a rogue network device attached to the same VLAN domain which can fabricate the fake NA response for the DAD-NS request and prevent other nodes from assigning its IP address.

How to guard the DAD mechanism

If the Layer 2 device connected to the Host or Router in a star topology builds a Source Binding Table (SBT) by learning the source IP address attached to the particular port or VLAN, then it can validate the received NA packets. If NA packet is valid, then DAD mechanism can be protected.

Related links

ND-inspection on page 132

Neighbor Unreachability Detection

NUD is a mechanism used to detect neighbor reachability in the same VLAN domain. This mechanism is used to detect the reachability of the default gateway and is triggered by the upper layer to determine the node reachability. The NUD node sends a targeted NS message to the specific node (using unicast destination IP address). If the node does not receive an NA message in response to NUD-NS message within the NUD timeout, the node declares the other node is not reachable.

What is the security threat

There can be a rogue network device attached to the same VLAN domain that can fabricate a fake NA response for the NUD-NS request and pretend that the node is reachable even though the actual node is not reachable.

In this case, if the default gateway is not reachable, then the rogue network device can fake that default gateway is still reachable; therefore, the host does not choose the other default gateway and all the traffic goes to a black hole.

How to guard the NUD mechanism

If the Layer 2 device connected to the Host or Router in a star topology builds a source binding table by learning the source IP address attached to the particular port or VLAN, then it can validate the received NA packets. If NA packet is valid, then NUD mechanism can be protected.

Related links

ND-inspection on page 132

Neighbor Address Discovery

Neighbor Address Discovery is a mechanism to learn the neighbor's link layer address for the given IPv6 address. This is equivalent to the Address Resolution Protocol (ARP) mechanism in IPv4. NS is equivalent to ARP-Request in IPv4, and similarly NA is equivalent to ARP-Reply in IPv4.

What is an NS/NA security threat

There can be a rogue network device attached to the same VLAN domain which can fabricate the fake NA response for the NS request and provide the wrong link layer address. If the fake NA is the latest NA for the received NS message, the most recent NA is used in the Neighbor cache (IPv6 address against MAC entries). This can block the traffic from flowing through the right path causing traffic disruption.

How to guard NS/NA mechanism

If the Layer 2 device connected to the host or router in a star topology builds a source binding table by learning the source IP address attached to the particular port or VLAN, then it can validate the received NA packets. If the NA packet is valid, the NS/NA mechanism of learning the IPv6 address against the link layer address can be protected.

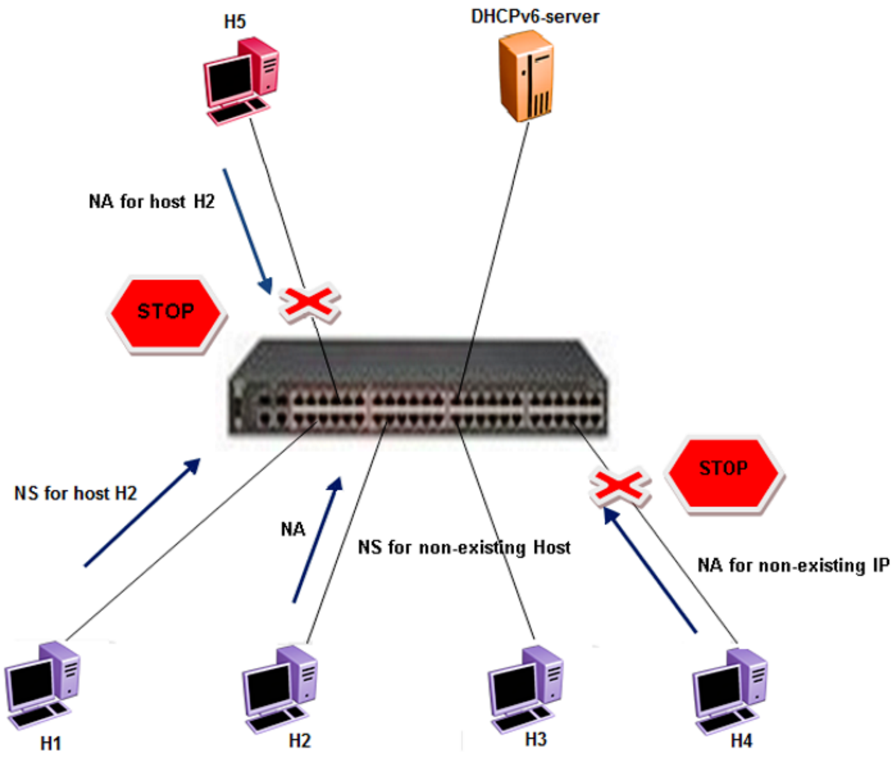


Figure 19: DAD/NUD/NS/NA attack prevention using ND-inspection

Table 17: Security Binding Table

IP-H1	MAC-H1	INTF-H1
IP-H2	MAC-H2	INTF-H2
IP-H3	MAC-H3	INTF-H3
IP-H4	MAC-H4	INTF-H4
IP-H5	MAC-H5	INTF-H5

On enabling ND-inspection on the ports, the First Hop Security module begins learning the neighbor source IP address on the configured port using the DAD mechanism and builds a Security Binding Table (SBT).

If the First Hop Security switch receives any ND message and if source IP address entry is not present in the SBT, then the FHS module begins the process of learning the source or target IP address using the DAD mechanism and drops the ND messages until the verification is successful.

Counters for monitoring the violation and send SNMP TRAP for the violation are maintained.

In the preceding example, in the H5 case, the H2 IP address is already learned in the SBT and the source IP address port points to the port which is connected to the host H2. The NA incoming port is an incorrect port and therefore, NA packet with the forged address is dropped (NS/NA or NUD attack)

In the H4 case, the NA target IP address is not present in the SBT. Therefore, the NA packet is dropped and the FHS module begins the process of learning the IP address. After the learning process, the IP address is not detected and this entry is not added to the SBT table (DAD or NUD attack)

First Hop Security feature consists the following functional blocks:

- Configuring First Hop Security specific policies
- Capturing and verifying First Hop Security specific packets against the configured policies

Related links

ND-inspection on page 132

Capturing and verifying FHS specific packets against the configured policies

First Hop Security filters can be installed only if the global FHS is enabled. The DHCPv6-guard or RA-guard filters are created as a part of First Hop Security filter with port bit mask “0”.

The following is a high-level procedure to capture DHCPv6 or ND packets received on a physical port:

1. Enable FHS globally.
2. Enable DHCPv6-guard or RA-guard or ND-inspection globally.
3. Create DHCPv6-guard or RA-guard policy.
4. Attach DHCPv6-guard and/or RA-guard policy and/or ND-inspection to a physical port.

By attaching the DHCPv6-guard or RA-guard policy on a port, the DHCPv6-guard or RA-guard port bit mask filter for that particular physical port is set. Similarly, detaching the DHCPv6-guard or RA-guard policy from a physical port resets the DHCPv6-guard or RA-guard port bit mask filter for that particular physical port.

After DHCPv6-guard or RA-guard policies are configured on the physical port, the DHCPv6 or ND packets are captured on the local CPU. The DHCPv6-guard or RA-guard policy denied packets are dropped and rest of the DHCPv6 or RA packets are forwarded to the corresponding outgoing ports. In the case of ND-inspection, denied packets are dropped and SNMP trap is sent.

Related links

DHCPv6–guard on page 124

Limitations

The following limitations exist in the First Hop Security:

- If this feature is enabled, the IP packet destined for the IPv6 link-local (fe80::0/10) or all-node multicast (ff02::0/16) address with the following extension header options are dropped:
  - Routing
  - Destination
  - Hop-by-Hop (except for MLD packets)
  - Mobility
  - Fragmentation extension option with other preceding extension options

- A Fragmented DHCPv6 or RA packet is dropped.
- All ND packets are software forwarded on the FHS enabled interfaces.
- DHCPv6-guard, RA-guard, or ND-inspection does not work on devices connected on the shared media or on the tunneled interfaces.
- DHCPv6-guard or RA-guard policies are not VLAN based.
- In the case of trunk ports, the statistics are incremental on the lowest active port in the trunk.
- Rate limiting cannot be applied.
- Dynamic learning is not supported for ND packets with IPv6 any-cast address. A static SBT configuration is required
- In the case of ND-inspection, DAD or DHCP track learning is based on the interface readiness and the time interval in which the host sends the DAD message to the new interface.
- FHS statistics is not updated during Temporary Base Unit (TBU) takeover,

Related links

DHCPv6–guard on page 124

Chapter 5: Security configuration and management using ACLI

This chapter describes the methods and procedures necessary to configure security on the swtich using the Avaya Command Line Interface (ACLI).

Depending on the scope and usage of the commands listed in this chapter, different command modes are needed to execute them.

Setting user access limitations

For more information about the configuration and management of user access limitations using ACLI, see the *Configuring Systems on Avaya Ethernet Routing Switch 4800 Series*, NN47205-500.

USB port and serial console port control using ACLI

This section describes how you can control access to the switch by enabling or disabling the USB port or serial console port. All serial console ports on the switch are enabled by default.

Disabling serial console ports

About this task

Disable serial console ports to deny users console access to the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable serial console ports on all switches in a stack:

   ```
   no serial-console <enable>
   ```

3. Disable the serial console port on a specific switch unit in a stack

   ```
   no serial-console [unit <1–8>] <enable>
   ```

Variable definitions

Use the data in the following table to use the **`no serial-console [unit <1-8>] <enable>`** command.

Variable	Value
[unit <1-8>]	Identifies the unit number of the switch in a stack. Values range from 1 to 8.

Enabling serial console ports

About this task

Enable serial console ports to grant users console access to the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable serial console ports on all switches in a stack:

   ```
   serial-console <enable>
   ```

   OR

   ```
   default serial-console <enable>
   ```

3. Enable the serial console port on a specific switch unit in a stack:

   ```
   serial-console [unit <1-8>] <enable>
   ```

   OR

   ```
   default serial-console [unit <1-8>] <enable>
   ```

Variable definitions

Use the data in the following table to use the **`serial-console`** command.

Variable	Value
[unit <1-8>]	Identifies the unit number of the switch in a stack. Values range from 1 to 8.

Viewing serial console port status

About this task

View serial console port status to display the operational status of serial console ports on all switches in a stack or on a stand-alone switch.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. View the status of all serial console ports on the switch:

   ```
   show serial-console
   ```

3. View the status of a specific serial console port on the switch

   ```
   show serial-console [unit <1-8>]
   ```

Example

```
Switch>enable
Switch#show serial-console
Serial Console: Enabled
```

Variable definitions

Use the data in the following table to use the **`show serial-console [unit <1-8>]`** command.

Variable	Value
[unit <1-8>]	Identifies the serial console port unit number. Values range from 1 to 8.

Disabling USB ports

About this task

Disable USB ports to deny users console access to USB ports on the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable USB ports on all switches in a stack:

   ```
   no usb-host-port [unit <1-8>] <enable>
   ```

3. Disable the USB port on a stand-alone switch:

```
no usb-host-port <enable>
```

Variable definitions

Use the data in the following table to use the **`usb-host-port`** command.

Variable	Value
[unit <1-8>]	Identifies the unit number of the switch in a stack. Values range from 1 to 8.

Enabling USB ports

About this task

Enable USB ports to grant users console access to the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable USB ports on all switches in a stack:

   ```
   usb-host-port [unit <1-8>] <enable>
   ```

   OR

   ```
   default usb-host-port [unit <1-8>] <enable>
   ```

3. Enable the USB port on a stand-alone switch:

   ```
   usb-host-port <enable>
   ```

   OR

   ```
   default usb-host-port <enable>
   ```

Variable definitions

Use the data in the following table to use the **`usb-host-port`** command.

Variable	Value
[unit <1-8>]	Identifies the unit number of the switch in a stack. Values range from 1 to 8.

Viewing USB port status

About this task

View USB port status to display the operational status of USB ports on all switches in a stack or on a stand-alone switch.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. View the status of USB ports on all switches in a stack:

   ```
   show usb-host-port [unit <1-8>]
   ```

3. View the status of the USB port on a stand-alone switch:

   ```
   show usb-host-port
   ```

Variable definitions

Use the data in the following table to use the **`show serial-console`** command.

Variable	Value
`[unit <1-8>]`	Identifies the unit number of the switch in a stack. Values range from 1 to 8.

HTTP/HTTPS port configuration using ACLI

This section describes HTTP/HTTPS port configuration.

Setting the switch HTTP port

Use this procedure to set the value for the HTTP port that the switch uses for client Web browser requests.

Before you begin

If the switch is running a secure image, disable SSL.

About this task

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

```
configure terminal
```

2. At the command prompt, enter the following command:

```
http-port {1024-65535}
```

Variable definitions

The following table describes the parameters for the **`http-port`** command.

Variable	Value
{1024–65535}	Specifies a value for the switch HTTP port, ranging from 1024 to 65535. DEFAULT: 80

Restoring the switch HTTP port to default

Use this procedure to restore the value for the HTTP port that the switch uses for client Web browser requests to the default value of 80.

Procedure

1. Enter Global Configuration mode:

```
enable
configure terminal
```

2. At the command prompt, enter the following command:

```
default http-port
```

Displaying the switch HTTP port value

Use this procedure to display the value for the HTTP port that the switch uses for client Web browser requests.

About this task

Procedure

1. Enter Privileged EXEC mode:

```
enable
```

2. At the command prompt, enter the following command:

```
show http-port
```

Example

```
Switch>enable
Switch#show http-port
HTTP Port: 80
```

Restoring the switch HTTPS port to default

Use this procedure to set the value for the HTTPS port that the switch uses for secure client Web browser requests.

Before you begin

If the switch is running a secure image, disable SSL.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. At the command prompt, enter the following command:

```
https-port {1024-65535}
```

Variable definitions

Use the data in the following table to use the **`https-port`** command.

Variable	Value
{1024–65535}	Specifies a value for the switch HTTPS port, ranging from 1024 to 65535. DEFAULT: 443

Restoring the switch HTTPS port to default using ACLI

Use this procedure to restore the value for the HTTPS port that the switch uses for secure client Web browser requests to the default value of 443.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. At the command prompt, enter the following command:

```
default https-port
```

Displaying the switch HTTP port value using ACLI

Use this procedure to display the value for the HTTPS port that the switch uses for secure client Web browser requests.

Procedure

1. Enter Privileged EXEC mode:

   `enable`

2. At the command prompt, enter the following command:

   `show https-port`

Example

```
Switch>enable
Switch#show https-port
HTTPS Port: 443
```

Configuring MAC address-based security

The following ACLI commands allow for the configuration of the BaySecure application using Media Access Control (MAC) addresses.

Important:

The MAC Security feature shares resources with QoS. Precedence values for non QoS features are allocated dynamically in descending order of availability. Therefore, the precedence value used depends on the order in which features are configured. With DHCP Relay enabled by default and assigned the highest precedence value (15), a QoS policy with a precedence value of 15 cannot be installed. If the MAC Security feature is also enabled, it is assigned a precedence value of 14. Therefore, a QoS policy with a precedence value of 14 cannot be installed.

For more information about QoS policies, see *Configuring Quality of Service on Avaya Ethernet Routing Switch 4800 Series*, NN47205-504.

Displaying MAC address security settings

About this task

Use the following procedure to display configuration information for the BaySecure application.

Procedure

1. Enter Privileged EXEC mode:

   `enable`

2. Display MAC address security settings:

   `show mac-security {config|mac-address-table [address <macaddr>]|mac-da-filter|port <portlist> |security-lists}`

Example

```
Switch>enable
Switch#show mac-security config
MAC Address Security: Disabled
MAC Address Security SNMP-Locked: Disabled
Partition Port on Intrusion Detected: Disabled
DA Filtering on Intrusion Detected: Disabled
MAC Auto-Learning Age-Time:  60 minutes
MAC Auto-Learning Sticky Mode: Disabled
Current Learning Mode: Disabled
Learn by Ports: NONE

Switch#show mac-security mac-address-table
Number of addresses: 0

Port Allowed MAC Address   Type
---- ------------------- ---------

Security List Allowed MAC Address   Type
------------- ------------------- ---------

Trunk Allowed      MAC Address       Type
 --------------- ------------------- ---------
4
```

Variable definitions

Use the data in the following table to use the **`show mac-security`** command.

Parameter	Description
config	Displays general BaySecure configuration.
mac-address-table [address <macaddr>]	Displays contents of BaySecure table of allowed MAC addresses: • address — specifies a single MAC address to display; enter the MAC address
mac-da-filter	Displays MAC DA filtering addresses. Packets can be filtered from up to 10 MAC DAs or MAC SAs.
port <portlist>	Displays the BaySecure status of all ports.
security-lists	Displays port membership of all security lists.

Configuring MAC address security options

About this task

Configure the switch settings.

Procedure

1. Enter Global Configuration mode:

```
enable

configure terminal
```

2. Configure MAC address security options:

```
mac-security {[auto-learning]{[aging-time <0-65535>][sticky]}
[disable][enable][filtering]{[disable][enable] }[intrusion-detect]
{[disable][enable][forever]}[intrusion-timer <0-65535>][learning]
{[disable][enable]}[learning-ports]{[add][LINE][remove]}[mac-
address-table]{[address H.H.H]{[mlt-id]{[<1-32>]}[port LINE]
[security-list]{[<1-32>]}}[sticky-address H.H.H]{[mlt-id]{[<1-32>]}
[port LINE]}}[mac-da-filter]{[add][delete][H.H.H]}[security-list]
{[<1-32>]{[add][LINE][remove]}}[snmp-lock]{[disable][enable]}}
```

Variable definitions

Use the data in the following table to use the **`mac-security`** command.

Parameter	Description
disable|enable	Disables or enables MAC address-based security.
filtering {enable|disable}	Enables or disables destination address (DA) filtering on intrusion detected.
intrusion-detect {enable|disable|forever}	Specifies partitioning of a port when an intrusion is detected: • enable — port is partitioned for a period of time • disabled — port is not partitioned on detection • forever —- port is partitioned until manually changed
intrusion-timer <0-65535>	Specifies, in seconds, length of time a port is partitioned when an intrusion is detected; enter the number of seconds desired.
auto-learning {aging-time|sticky}	Configures MAC Autolearning.
learning-ports {add|LINE|remove}	Specifies MAC address learning. Learned addresses are added to the table of allowed MAC addresses. Enter the ports to learn; a single port, a range of ports, several ranges, all ports, or no ports can be entered.
learning {enable|disable}	Specifies MAC address learning: • enable — enables learning by ports • disable — disables learning by ports
mac-address-table {address|sticky-address}	Specifies MAC address to be added.
mac-da-filter {add|delete|H.H.H}	Add or delete MAC DA filtering addresses.
security-list <1-32> {add|LINE|remove}	Specifies the security list number from 1 to 32.

Table continues…

Parameter	Description
snmp-lock {enable|disable}	Enables or disables SNMP lock on MAC address security parameters.

Adding addresses to MAC security address table

About this task

Use the following procedure to assign either a specific port or a security list to the MAC address. This removes any previous assignment to the specified MAC address and creates an entry in the BaySecure table of allowed MAC addresses.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Add addresses to MAC security address table:

   ```
   mac-security mac-address-table address <H.H.H> {port <portlist> |
   security-list <1-32>}
   ```

Variable definitions

Use the data in the following table to use the **mac-security mac-address-table** command.

Variable	Value
<H.H.H>	Enter the MAC address in the form of H.H.H.
port <portlist>	Enter the port number or the security list number. ❗ **Important:** In this command, portlist must specify only a single port.

Assigning a list of ports to a security list

About this task

Use the following procedure to assign a list of ports to a security list.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Assign a list of ports to a security list:

   ```
   mac-security security-list <1-32> [add|remove] <portlist>
   ```

Variable definitions

Use the data in the following table to use the **`mac-security security-list`** command.

Variable	Value
<1–32>	Enter the number of the security list that you want to use.
<portlist>	Enter a list or range of port numbers.

Disabling MAC source address-based security

About this task

Use the following procedure to disable MAC source address-based security.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable MAC security:

   ```
   no mac-security
   ```

Clearing the MAC address security table

About this task

Use the following procedure to clear entries from the MAC address security table.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Clear the MAC address security table:

   ```
   no mac-security mac-address-table {address <H.H.H> | port <portlist>
   | security-list <1-32>]
   ```

Variable definitions

Use the data in the following table to use the **`no mac-security mac-address-table`** command.

Variable	Value
address <H.H.H>	Enter the MAC address in the form of H.H.H
port <portlist>	Enter a list or range of port numbers.
security-list <1–32>	Enter the security list number.

Clearing the port membership of a security list

About this task

Use the following procedure to clear the port membership of a security list.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Clear the port membership of a security list:

   ```
   no mac-security security-list <1-32>
   ```

Variable definitions

Use the data in the following table to use the **`mac-security security-list`** command.

Variable	Value
<1–32>	Enter the number of the security list that you want to clear.

Configuring MAC security for specific ports

About this task

Use the following procedure to configure the switch status of specific ports.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Configure MAC security for specific ports:

   ```
   mac-security [port <portlist>]{auto-learning|disable| enable|
   learning}
   ```

   Note:

   Auto-learning option is available when you do not specify the port value in the command.

Variable definitions

Use the data in the following table to use the **`mac-security`** command.

Variable	Value
port <portlist>	Specifies the port numbers.
auto-learning|disable|enable|learning	Directs the specific port: • • auto-learning — configures MAC Auto- Learning • disable — disables BaySecure on the specified port and removes the port from the list of ports for which MAC address learning is performed • enable —enables BaySecure on the specified port and removes the port from the list of ports for which MAC address learning is performed • learning — disables BaySecure on the specified port and adds these port to the list of ports for which MAC address learning is performed

Filtering packets from specified MAC DAs

About this task

Use the following procedure to filter packets from up to 10 specified MAC DAs. You can also delete such a filter and then receive packets from the specified MAC DA.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Filter packets from specified MAC DAs:

   ```
   mac-security mac-da-filter {add|delete|<H.H.H.>]
   ```

Variable definitions

Use the data in the following table to use the **`mac-security mac-da-filter`** command.

Variable	Value
add|delete|<H.H.H.>	Add or delete the specified MAC address, enter the MAC address in the form of H.H.H

Configuring MAC address autolearning

Use the following procedures to configure MAC address auto-learning to automatically add allowed MAC addresses to the MAC security address table.

Configuring MAC address auto-learning aging time

About this task

Use the following procedure to configure MAC address auto-learning aging time for the MAC addresses automatically learned in the MAC security table.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure MAC address auto-learning settings:

   ```
   mac-security auto-learning aging-time <0-65535>
   ```

Variable definitions

Use the data in the following table to use the **`mac-security auto-learning aging-time`** command.

Variable	Value
<0–65535>	Specifies the aging time period in minutes. A value of 0 indicates an infinite aging time period. DEFAULT: 60 minutes RANGE: 0 to 65535

Disabling MAC address auto-learning aging time

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable MAC address auto-learning aging-time:

   no mac-security auto-learning aging-time

Configuring MAC address auto-learning aging time to default

About this task

Use the following procedure to configure MAC address auto-learning aging time to default to configure the aging time for the MAC addresses automatically learned in the MAC security table. The default value is 60 minutes.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure MAC address auto-learning aging time to default:

   ```
   default mac-security auto-learning aging-time
   ```

Viewing the current Sticky MAC address mode

About this task

Use the following procedure to view the current Sticky MAC address mode.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. View the current Sticky MAC address mode:

   ```
   show mac-security config
   ```

Example

```
Switch>enable
Switch#show mac-security config
MAC Address Security: Disabled
MAC Address Security SNMP-Locked: Disabled
Partition Port on Intrusion Detected: Disabled
DA Filtering on Intrusion Detected: Disabled
MAC Auto-Learning Age-Time:  60 minutes
MAC Auto-Learning Sticky Mode: Disabled
Current Learning Mode: Disabled
Learn by Ports: NONE
```

Enabling Sticky MAC address mode

Before you begin

Avaya recommends that you disable autosave using the **`no autosave enable`** command when you enable Sticky MAC address.

About this task

Use the following procedure to enable Sticky MAC address mode so that the system can secure the MAC address to a specified port and store automatically-learned MAC addresses across switch reboots.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable Sticky MAC address mode:

   ```
   mac-security auto-learning sticky
   ```

Disabling Sticky MAC address mode

About this task

Use the following procedure to disable Sticky MAC address mode. The default state is disabled.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable Sticky MAC address mode:

   ```
   no mac-security auto-learning sticky
   ```

   OR

   ```
   default mac-security auto-learning sticky
   ```

Enabling MAC security lock-out mode

About this task

The **`mac-security lock-out`** command enables the lockout of specific ports from MAC-based security.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Enable MAC security lock-out mode:

   ```
   mac-security lock-out
   ```

Disabling MAC security lock-out mode

About this task

Disable the lockout of specific ports from MAC-based security.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   configure terminal
   interface ethernet <port number>
   ```

2. Disable MAC security lock-out mode:

   ```
   no mac-security lock-out
   ```

   OR

   ```
   default mac-security lock-out
   ```

Enabling or disabling block subsequent MAC authentication

About this task

Use this procedure to enable block subsequent MAC authentication.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   configure terminal
   ```

2. Block subsequent MAC authentication:

   ```
   eapol multihost block-different-radius-assigned-vlan
   ```

   Note:

   By default this feature is disabled.

3. Disable block subsequent MAC authentication:

   To reset (disable) the feature, enter the following command:

   ```
   default eapol multihost block-different-radius-assigned-vlan
   ```

or

```
no eapol multihost block-different-radius-assigned-vlan
```

Note:

Commands issued on a unit are propagated through the entire stack and any new unit added receives the global setting.

RADIUS authentication configuration using ACLI

You can use the procedures in this section to help secure networks against unauthorized access, by configuring communication servers and clients to authenticate user identities through a central database.

Configuring switch RADIUS server settings

Before you begin

- Configure at least one RADIUS server.
- Physically connect the RADIUS server to your network.

About this task

Use this procedure to configure RADIUS server account information on the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure RADIUS server account information on the switch :

   ```
   [no] [default] radius server host {ipaddr | ipv6addr} [acct-enable]
   [acct-port <port>] [key{key}] [port <port>] [retry <1-5>]
   [secondary] [timeout <1-60>] [used-by <eapol| non-eapol>]
   ```

Variable definitions

Use the data in the following table to use the **radius server host** command.

Variable	Value
<ipaddr>	Specifies the IPv4 address of the primary server you want to add or configure.

Table continues…

Variable	Value
	❗ **Important:** A value of 0.0.0.0 indicates that a primary RADIUS server is not configured.
<ipv6addr>	Specifies the IPv6 address of the primary server you want to add or configure. ❗ **Important:** A value of 0.0.0.0 indicates that a primary RADIUS server is not configured.
acct-enable	Enables RADIUS accounting for a RADIUS server instance.
acct-port <port>	Specifies the UDP accounting port number for clients to use when trying to contact the RADIUS server at the corresponding Global RADIUS Server IP address. Values range from 0 to 65535.
default	Restores the switch RADIUS server settings to default values.
key <key>	Specifies the secret authentication and encryption key used for all communications between the NAS and the RADIUS server. The key, also referred to as the shared secret, must be the same as the one defined on the server. You are prompted to enter and confirm the key.
no	Deletes switch RADIUS server settings.
port <port>	Specifies the UDP port number for clients to use when trying to contact the RADIUS server at the corresponding RADIUS server IP address. Values range from 1 to 65535. The default port number is 1812.
retry <1–5>	Specifies the number of RADIUS retry attempts for a RADIUS Server instance. Values range from 1 to 5.
secondary	Specifies the RADIUS server you are configuring as the secondary server. The system uses the secondary server only if the primary server is not configured or is not reachable.
timeout <timeout>	Specifies the timeout interval between each retry for service requests to the RADIUS server. Values range from 1 to 60 seconds. The default value is 2 seconds.
used-by <eapol| non-eapol>	Specifies the RADIUS server as an EAP RADIUS Server or a Non-EAP (NEAP) RADIUS Server. • eapol—configures the RADIUS server to process EAP client requests only . • non-eapol—configures the RADIUS server to process Non-EAP client requests only. If you do not specify the RADIUS server as either EAP or Non-EAP, the system configures the server as a Global RADIUS Server, and processes client requests without designating them as separate EAP or Non-EAP.

Table continues…

Variable	Value
encapsulation <MS-CHAP-V2>	Specifies to enable or disable Microsoft Challenge-Handshake Authentication Protocol version 2 (MS-CHAP-V2). MSCHAP-V2 provides an authenticator controlled password change mechanism also known as the change RADIUS password function. The default value is disabled. **Note:** When you disable MS-CHAP-V2, RADIUS encapsulation is set to password authentication protocol (PAP) by default. PAP is not considered a secure encapsulation. Change RADIUS password is available only in secure software builds.

Enabling or disabling RADIUS password fallback

About this task

Use this procedure to enable or disable RADIUS password fallback feature for logging on to a switch or stack by using the local password, if the RADIUS server is unavailable or unreachable.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable RADIUS password fallback:

   ```
   [no] [default] radius-server password fallback
   ```

Viewing RADIUS information

About this task

Use this procedure to display RADIUS server configuration information.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display RADIUS configuration status:

   ```
   show radius-server
   ```

Example

```
Switch>enable
Switch#show radius-server
RADIUS Global Server
-------------------------------------------------------------
Primary Host           : 0.0.0.0
Secondary Host         : 0.0.0.0
Port                   : 1812
Time-out               : 2
Key                    : ***************
Radius Accounting      : Disabled
Radius Accounting Port : 1813
Radius Retry Limit     : 3
Current Status         : NonReachable
TimeUntilNextCheck     : 40

RADIUS EAP Server
-------------------------------------------------------------
Primary Host           : 0.0.0.0
Secondary Host         : 0.0.0.0
Port                   : 1812
Time-out               : 2
Key                    : ***************
Radius Accounting      : Disabled
Radius Accounting Port : 1813
Radius Retry Limit     : 3
Current Status         : NonReachable
TimeUntilNextCheck     : 40

RADIUS Non-EAP Server
-------------------------------------------------------------
Primary Host           : 0.0.0.0
Secondary Host         : 0.0.0.0
Port                   : 1812
Time-out               : 2
Key                    : ***************
Radius Accounting      : Disabled
Radius Accounting Port : 1813
Radius Retry Limit     : 3
Current Status         : NonReachable
TimeUntilNextCheck     : 40

Other Settings
-------------------------------------------------------------
Password Fallback      : Enabled
RADIUS Encapsulation   : PAP
```

Configuring RADIUS server reachability

About this task

Use this procedure to select and configure the method by which to determine the reachability of the RADIUS server.

Procedure

1. Enter Global Configuration mode:

```
enable

configure terminal
```

2. Configure the reachability of the RADIUS server:

```
[default] radius reachability [bad-timer <30-600>] [check {eap |
non-eap | global} [good-timer <30-600>] [mode {use-icmp | use-radius
[username <username> password <password>]}}] [retry <1-5>] [timeout
<1-60>]
```

Variable definitions

Use the data in the following table to use the **radius reachability** command.

Variable	Value
default	Restores RADIUS server reachability to default values.
password <password>	Specifies a password for the RADIUS request.
use-icmp	Uses ICMP packets to determine reachability of the RADIUS server (default).
use-radius	Uses dummy RADIUS requests to determine reachability of the RADIUS server.
username <username>	Specifies a user name for the RADIUS request.
timeout <1–60>	Sets the time-out period. Range is 1 to 60 seconds.
retry <1–5>	Specifies the number of retry attempts. Range is from 1 to 5.
bad-timer <30–600>	Sets the interval between checks when the RADIUS server is unreachable. Range is 30 to 600 seconds.
check	Initiates an immediate check to determine the reachability of the RADIUS server.
eap	Checks the EAP RADIUS server reachability.
global	Checks the Global RADIUS server reachability.
non-eap	Checks the Non-EAP RADIUS server reachability.
good-timer <30–600>	Sets the interval between checks when the RADIUS server is reachable. Range is 30 to 600 seconds.

Viewing the RADIUS server reachability method

About this task

Use this procedure to display the configured RADIUS server reachability method.

Procedure

1. Log on to ACLI to enter User EXEC mode.
2. Display the configured RADIUS server reachability method:

   `show radius reachability`

Example

```
Switch>show radius reachability
RADIUS reachability: USE ICMP
RADIUS reachability timeout: 2
RADIUS reachability retry: 3
RADIUS reachability bad timer: 60
RADIUS reachability good timer: 180
```

Configuring EAPOL security

Use the following procedures to configure security based on the Extensible Authentication Protocol over LAN (EAPOL).

Important:

You must enable EAPOL before you enable UDP Forwarding, IP Source Guard, and other features that use QoS policies.

Enabling or disabling EAPOL-based security

About this task

Use the following procedure to enable or disable EAPOL-based security.

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`
2. Enable EAPOL-based security:

   `eapol enable`
3. Disable EAPOL-based security:

   `eapol disable`

Modifying EAPOL-based security parameters for a specific port

About this task

Use the following procedure to modify EAPOL-based security parameters for a specific port.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2.

   ```
   eapol [port <portlist>] [init] [status {authorized|unauthorized|
   auto}] [traffic-control {in-out|in}] [reauthentication {enable|
   disable}] [reauthentication-period <1-604800>] [re-authenticate]
   [quiet-interval <num>] [supplicant-timeout <num>] [server-timeout
   <num>] [max-request <num>]
   ```

Variable definitions

Use the data in the following table to use the **eapol** command.

Parameter	Description
port <portllist>	Specifies the ports to configure for EAPOL; enter the desired port numbers **Important:** If this parameter is omitted, the system uses the port number specified when the interface command was issued.
init	Reinitiates EAP authentication.
status {authorized | unauthorized | auto}	Specifies the EAP status of the port: • authorized — port is always authorized • unauthorized — port is always unauthorized • auto — port authorization status depends on the result of the EAP authentication
traffic-control {in-out I in}	Sets the level of traffic control: • in-out — if EAP authentication fails, both ingressing and egressing traffic are blocked • in —- if EAP authentication fails, only ingressing traffic is blocked

Table continues…

Parameter	Description
	EAPOL filters traffic based on the source MAC address. An unauthorized client, whether EAPOL or NonEAPOL, can receive traffic from authorized clients.
reauthentication enable|disable	Enables or disables reauthentication for EAPOL clients.
reauthentication-period <1-604800>	Enter the desired number of seconds between reauthentication attempts.
re-authenticate	Specifies an immediate reauthentication. NonEAP clients are not reauthenticated even if reauthentication is enabled on the port.
quiet-interval <num>	Enter the desired number of seconds between an authentication failure and the start of a new authentication attempt; range is 0 to 65535.
supplicant-timeout <num>	Specifies a waiting period for response from supplicant for all EAP packets except EAP Request/Identity packets. Enter the number of seconds to wait; range is 1 to 65535.
server-timeout <num>	Specifies a waiting period for response from the server. Enter the number of seconds to wait; range is 1 to 65535.
max-request <num>	Enter the number of times to retry sending packets to supplicant; range is 1 to10.

Displaying the current EAPOL-based security status

About this task

Use the following procedure to display the status of the EAPOL-based security.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display the current EAPOL-based security status:

   ```
   show eapol[auth-diags {interface <LINE>}][auth-stats {interface <LINE>}][guest-vlan {interface <LINE>}][multihost {[dummy-adac-radius-requests][fail-open-vlan][interface <LINE>][multivlan][non-eap-mac]{[interface <LINE>][status <LINE>]}}[non-eap-pwd-fmt <key>][status {[<LINE>[verbose][verbose]}[voip-vlan][port LINE][summary][interface <LINE>]
   ```

Example

```
Switch>enable
Switch#show eapol
EAPOL Administrative State:  Disabled
Port-mirroring on EAP ports:  Disabled
EAPOL User Based Policies:  Disabled
EAPOL User Based Policies Filter On MAC Addresses:  Disabled
```

```
Port:  1
    Admin Status:  F Auth
    Auth:  Yes
    Admin Dir:  Both
    Oper Dir:  Both
    ReAuth Enable:  No
    ReAuth Period:  3600
    Quiet Period:  60
    Supplic Timeout:  30
    Server Timeout:  30
    Max Req:  2
    RDS DSE:  No
Port:  2
    Admin Status:  F Auth
    Auth:  Yes
    Admin Dir:  Both
    Oper Dir:  Both
    ReAuth Enable:  No
    ReAuth Period:  3600
    Quiet Period:  60
    Supplic Timeout:  30
    Server Timeout:  30
    Max Req:  2
    RDS DSE:  No
Port:  3
    Admin Status:  F Auth
----More (q=Quit, space/return=Continue)----
```

Variable definitions

Use the data in the following table to use the **`show eapol`** command.

Parameter	Description
port <LINE>	Specifies the ports to display. If no port is entered, all ports are displayed.
multihost {dummy-adac-radius-requests | fail-open-vlan | interface <LINE> | multivlan | non-eap-mac | {interface <LINE> | status <LINE>} | non-eap-pwd-fmt <key> | {status [<LINE> verbose]| [verbose]} | [voip-vlan]}	Displays EAPOL multihost configuration. Select interface to display multihost port configuration and status to display multihost port status. **Important:** If you apply the **`show eapol multihost status`** command on a large stack with complex configuration, you can experience slow output if this command is executed within 4-5 minutes of the stack being booted or power-cycled. If you wait 5 minutes after the stack is booted or power-cycled before executing this show command, the normal response times will be observed.
guest-vlan [interface <LINE>]	Displays EAPOL port Guest VLAN settings.
auth-diags [interface <LINE>]	Displays the EAPOL authentication diagnostics interface.
auth-stats [interface <LINE>]	Displays the authentication statistics interface.
summary [interface <LINE>]	Displays summary of authenticated clients.

Resetting EAP settings globally

To simplify the configuration process on the switch, you can reset all EAP-related settings using a single command.

This command resets the following EAP settings:

- EAP state
- Fail Open VLAN
- VoIP VLANs
- allow port mirroring
- all multihost settings
- multiVLAN
- user-based policies
- NEAP user-based policies

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. At the command prompt, enter the following command:

   ```
   default eap-all
   ```

Resetting EAP settings at the port level

About this task

Reset all EAP settings at the port level. This command resets:

- all EAP related settings
- all EAP multihost settings
- EAP guest VLAN settings

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Reset all EAP settings at the port level:

```
default eap-all <port-list>
```

Variable definitions

Use the data in the following table to use the **`default eap-all`** command.

Variable	Value
<port-list>	The list of ports to which you want the setting to apply. You can enter a single port, a range of ports, or all ports..\

Displaying the status of the session ID format

About this task

Use the following procedure to display the status of the session ID format.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. At the command prompt, enter the following command:

   ```
   show eapol acct-session-id
   ```

Displaying the session ID of an EAP client

About this task

Use the following procedure to display the session ID of an EAP client.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. To display the session ID of an EAP client, enter the following command:

   ```
   show eapol multihost status verbose
   ```

Configuring accounting session ID format

About this task

Use the following procedure to configure the accounting session ID format.

The accounting session ID format is enabled by default.

Note:

Session ID contains only the inband configured IP address.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. To enable the accounting session ID format, enter the following command:

   ```
   [default] eapol acct-session-id  extend-with-addr
   ```

3. To disable the accounting session ID format, enter the following command:

   ```
   no eapol acct-session-id extend-with-addr
   ```

4. Press Enter.

Enabling and disabling Non-EAP client re-authentication

About this task

Use this procedure to enable or disable Non-EAP (NEAP) re-authentication for the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable Non-EAP re-authentication:

   ```
   eapol multihost non-eap-reauthentication-enable
   ```

3. Disable Non-EAP re-authentication:

   ```
   no eapol multihost non-eap-reauthentication-enable
   ```

   OR

   ```
   default eapol multihost non-eap-reauthentication-enable
   ```

Viewing the non-EAP client re-authentication

About this task

Use this procedure to display the configuration status of NEAP re-authentication for the switch.

Procedure

1. Enter Privileged EXEC mode:

   `enable`

2. Display the configuration status of NEAP re-authentication:

   `show eapol multihost`

Example

```
Switch>enable
Switch#show eapol multihost
Allow Local Non-EAP Clients                         :  Disabled
Non-EAP RADIUS Authentication                       :  Disabled
Non-EAP AutoLearned After Single Authent (MHSA)     :  Disabled
Non-EAP DHCP Phone Authentication                   :  Disabled
EAPoL Request Packet Generation Mode                :  Unicast
EAP RADIUS Assigned VLANs                           :  Disabled
Non-EAP RADIUS Assigned VLANs                       :  Disabled
Non-EAP RADIUS Password Attribute Format            :  IpAddr.MACAddr.PortNumber
Non-EAP User Based Policies                         :  Disabled
Non-EAP User Based Policies Filter On MAC Addresses :  Disabled
EAP Protocol                                        :  Enabled
Use Most Recent RADIUS Assigned VLAN                :  Enabled
Non-EAP ReAuthentication                            :  Disabled
Block Different RADIUS Assigned VLAN Authentication :  Disabled
Dummy ADAC Radius Requests                          :  Disabled
ADAC Non-EAP Phone Authentication                   :  Disabled
Fail Open VLAN                                      :  Disabled
Fail Open VLAN ID                                   :  1
Fail Open VLAN Continuity Mode                      :  Disabled
Switch#
```

Clearing non-EAP authenticated clients from ports

About this task

Use this procedure to clear authenticated NEAP clients from a specified port.

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`

2. Clear authenticated NEAP clients from a specified port:

   `clear eapol non-eap [<portList>] [address <H.H.H>]`

Variable definitions

Use the data in the following table to use the **`clear eapol non-eap`** command.

Variable	Value
address <H.H.H>	Specifies the MAC address of an authenticated NEAP client to clear from the port. If you enter a MAC address value of 00:00:00:00:00:00, all authenticated NEAP clients are cleared from the specified port.
<portlist>	Specifies an individual port or list of ports from which to clear authenticated NEAP clients.

Removing all local non EAPOL clients from the MAC address list

About this task

Use the following procedure to remove all authenticated, locally managed NEAP clients from the MAC address list.

Procedure

1. Enter Ethernet Interface Configuration mode:

   ```
   enable
   configure terminal
   interface Ethernet <port>
   ```

2. Enter the following command:

   ```
   no eapol multihost non-eap-mac [port <portlist>] <delete-all>
   ```

   OR

   ```
   default eapol multihost non-eap-mac [port <portlist>] <default-all>
   ```

Variable definitions

Use the data in the following table to use the **`no eapol multihost non-eap-mac`** and **`default eapol multihost non-eap-mac`** commands.

Variable	Value
<delete-all>	Delete all local NEAP clients.
<default-all>	Default all local NEAP clients.

Table continues…

Variable	Value
<portlist>	Specify the port on which you want to allow the specified non EAPOL hosts.
<H.H.H>	Specify the MAC address of the allowed non EAPOL host.

802.1X or non-EAP Last Assigned RADIUS VLAN configuration using ACLI

This section describes the procedures for the configuration of 802.1X non-EAP Last Assigned RADIUS VLAN using ACLI.

Enabling use-most-recent-RADIUS assigned VLAN

About this task

Perform this procedure to allow the system to use the most recently assigned RADIUS VLAN.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable the most recent RADIUS VLAN:

   ```
   eap multihost use-most-recent-radius-vlan
   ```

Variable Definitions

Use the data in the following table to use the **eap multihost** command.

Variable	Value
use-most-recent-radius-vlan	Allows the use of most recent RADIUS VLAN.

Disabling use-most-recent-RADIUS assigned VLAN

About this task

Perform this procedure to prevent the system from using the most recently assigned RADIUS VLAN.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Disable the use of most recent RADIUS VLAN:

```
no eap multihost use-most-recent-radius-vlan
```

Variable Definitions

Use the data in the following table to use the**no eap multihost use-most-recent-radius-vlan** command.

Variable	Value
use-most-recent-radius-vlan	Disables the use of most recent RADIUS VLAN.

Restoring use-most-recent-RADIUS assigned VLAN

About this task

Perform this procedure to restore the default EAPol multihost settings.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Restore the default EAPol multihost settings:

```
default eap multihost use-most-recent-radius-vlan
```

Variable Definitions

Use the data in the following table to use the **default eap multihost use-most-recent-radius-vlan** command.

Variable	Value
use-most-recent-radius-vlan	Disables the use of most recent RADIUS VLAN.

Selecting the packet mode for EAP requests

This feature prevents repeated EAP responses from an EAP-capable device that has already been authenticated.

Use the following command to globally select the packet mode for EAP requests:

```
eapol multihost [eap-packet-mode {multicast | unicast}]
```

The following table outlines the parameters for this command.

Table 18: eapol multihost [eap-packet-mode {multicast | unicast}] parameters

Parameter	Description
[eap-packet-mode {multicast | unicast}]	globally enables the desired packet mode (multicast or unicast) for EAP requests.

Use the following command to select the packet mode on the desired interface or on specific ports:

```
eapol multihost [port <portlist>] [eap-packet-mode {multicast | unicast}]
```

The following table outlines the parameters for this command.

Table 19: eapol multihost [eap-packet-mode {multicast | unicast}] parameters: Interface mode

Parameter	Description
<portlist>	the port or ports for which you want to select the packet mode. You can enter a single port, several ports or a range of ports.
[eap-packet-mode {multicast | unicast}]	enables the desired packet mode (multicast or unicast) on the desired port or ports.

Use one of the following commands to globally disable the selection of packet mode:

```
no eapol multihost [eap-packet-mode {multicast | unicast}]
```

or

```
default eapol multihost [eap-packet-mode {multicast | unicast}]
```

The following tables outline the parameters for the `no` and `default` versions of this command, respectively:

Table 20: no eapol multihost [eap-packet-mode {multicast | unicast}] parameters

Parameter	Description
[eap-packet-mode {multicast | unicast}]	globally disables selection of the packet mode.

Table 21: default eapol multihost [eap-packet-mode {multicast | unicast}] parameters

Parameter	Description
[eap-packet-mode {multicast | unicast}]	globally sets the default (disable) for the selection of packet mode.

Use one of the following commands to disable the selection of packet mode on the desired interface:

```
no eapol multihost [port <portlist>][[eap-packet-mode {multicast |
unicast}]
```

or

```
default eapol multihost [<portlist>][eap-packet-mode {multicast |
unicast}]
```

The following tables outline the parameters for the `no` and `default` versions of this command, respectively:

Table 22: no eapol multihost [eap-packet-mode {multicast | unicast}] command parameters

Parameter	Description
[eap-packet-mode {multicast | unicast}]	disables selection of packet mode on the desired interface.

Table 23: default eapol multihost [eap-packet-mode {multicast | unicast}] command parameters

Parameter	Description
[eap-packet-mode {multicast | unicast}]	sets the default (disable) for the selection of packet mode on the desired interface.

EAPOL User Based Policy Configuration using ACLI

To process the User Based Policy (UBP) attributes, UBP support must be enabled on the EAPOL Security Configuration. Also, the RADIUS server must be configured for retrieving the user information during EAP Authentication.

Use the following procedure to configure EAPOL User Based Policy.

Enabling EAPOL User Based Policy

Before you begin

A RADIUS server must be configured before enabling EAPOL User Based Policies.

Note:

If the RADIUS server is not configured, an error appears while loading the ASCII file.

About this task

Perform the following procedure to enable 802.1x (RADIUS server accounting) User Based Policy settings.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable 802.1x (RADIUS server accounting) User Based Policy settings:

```
eapol user-based-policies { [enable] [filter-on-mac enable] }
```

Variable definitions

Use the data in the following table to use the **eapol user-based-policies** command.

Parameter	Description
enable	Configures 802.1x User Based Policies settings.
filter-on-mac enable	Enables filtering on MAC addresses.

Disabling EAPOL User Based Policies

About this task

Disable 802.1x (RADIUS server accounting) User Based Policy settings.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable 802.1x (RADIUS server accounting) User Based Policy settings:

   ```
   no eapol user-based-policies { [enable] [filter-on-mac enable] }
   ```

Variable definitions

Use the data in the following table to use the **eapol user-based-policies** command.

Parameter	Description
enable	Disables 802.1x (RADIUS server accounting) User Based Policy settings.
filter-on-mac enable	Disables filtering on MAC addresses.

Setting EAPOL User Based Policy as Default

About this task

Perform the following procedure to set EAPOL User Based Policy as the default.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Set the EAPOL User Based Policy as the default:

```
default eapol user-based-policies { [enable] [filter-on-mac
enable] }
```

Variable definitions

Use the data in the following table to use the **default eapol user-based-policies** command.

Parameter	Description
enable	Disables 802.1x (RADIUS server accounting) User Based Policy settings.
filter-on-mac enable	Disables filtering on MAC addresses.

Configuring guest VLANs

To configure guest VLAN support, do the following:

1. Enable guest VLAN globally, and set the guest VLAN ID.
2. Enable guest VLAN on specific ports on an interface.

Setting the guest VLAN for EAPOL

About this task

Use the following procedure to set the guest VLAN globally.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Set the guest VLAN:

```
eapol guest-vlan enable vid <1-4094>
```

Variable definitions

Use the data in the following table to use the **eapol guest-vlanS** command.

Parameter	Description
enable	Enable Guest VLAN.
<vid>	Guest VLAN ID.

Disabling guest VLAN for EAPOL

About this task

Use the following procedure to disable the guest VLAN.

Note:

EAP enabled port is not moved to guest VLAN, if guest VLAN and original VLAN are associated with different STGs. EAP port does not forward traffic in guest VLAN or original VLAN; if EAP authentication succeeds packets are transmitted properly in the original VLAN.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable guest VLAN:

   ```
   no eapol guest-vlan [enable]
   ```

   OR

   ```
   default eapol guest-vlan
   ```

802.1X or non-EAP and Guest VLAN on the same port configuration using ACLI

Use the commands in this section to allow a non-EAP phone to function with the Guest VLAN enabled.

Enabling EAPOL VoIP VLAN

About this task

Perform this procedure to enable the EAPOL multihost VoIP VLAN.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable the EAPOL multihost VoIP VLAN:

```
eapol multihost voip-vlan <1-5> {[enable] [vid <1-4094>]}
```

Variable definitions

Use the data in the following table to use the **`eapol multihost`** command.

Variable	Value
enable	Enables VoIP VLAN.
voip-vlan <1-5>	Sets number of VoIP VLAN from 1 to 5.
vid <1-4094>	Sets VLAN ID, which ranges from 1 to 4094.

Disabling EAPOL VoIP VLAN

About this task

Perform this procedure to disable the EAPOL multihost VoIP VLAN.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable the EAPOL multihost VoIP VLAN:

   ```
   no eapol multihost voip-vlan <1-5> [enable]
   ```

Variable Definitions

Use the data in the following table to use the **`no eapol multihost`** command.

Variable	Value
enable	Disables VoIP VLAN.
voip-vlan <1-5>	Sets number of VoIP VLAN from 1 to 5.

Configuring EAPOL VoIP VLAN as the default VLAN

About this task

Perform this procedure to configure the EAPOL multihost VoIP VLAN as the default setting.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the EAPOL multihost VoIP VLAN:

   ```
   default eapol multihost voip-vlan <1-5> [enable] [vid]
   ```

Variable Definitions

Use the data in the following table to use the **`default eapol multihost`** command.

Variable	Value
enable	Disables VoIP VLAN.
vid	Default VoIP VLAN ID.
voip-vlan <1-5>	Sets number of VoIP VLAN from 1 to 5.

Displaying EAPOL VoIP VLAN

About this task

Perform this procedure to display information related to the EAPOL multihost VoIP VLAN.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Display information related to the EAPOL multihost VoIP VLAN:

   ```
   show eapol multihost voip-vlan
   ```

3.

Example

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#show eapol multihost voip-vlan
Voip Vlan State    Vid
--------- -------- ----
1         Disabled N/A
2         Disabled N/A
3         Disabled N/A
4         Disabled N/A
5         Disabled N/A
```

Multihost Non-EAP User Based Policy Configuration using ACLI

Clients that do not support EAP can be authenticated based on their MAC address. RADIUS authenticates the Non-EAP users and sends their information similar to the EAP users. Also, the User Based Policy support for Non-EAP users is similar to EAP users.

Use the following procedures to configure 802.1x (RADIUS server accounting) Multihost Non-EAP User Based Policy.

Enabling Multihost Non-EAP User Based Policy

Before you begin

RADIUS server must be configured.

> **Note:**
>
> If the RADIUS server is not configured, an error appears while loading the ASCII file.

About this task

Perform the following procedure to enable 802.1x (RADIUS server accounting) Multihost Non- EAP User Based Policy settings.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable 802.1x (RADIUS server accounting) Multihost Non-EAP User Based Policy settings:

   ```
   eapol multihost non-eap-user-based-policies { [enable][filter-on-mac
   enable] }
   ```

Variable definitions

Use the data in the following table to use the **`apol multihost non-eap-user-based-policies`** command.

Parameter	Description
enable	Configures the Multihost Non-EAP User Based Policies settings.
filter-on-mac enable	Configures settings for the Multihost Non-EAP filtering on MAC addresses.

Disabling Multihost Non-EAP User Based Policy

About this task

Perform the following procedure to disable 802.1x (RADIUS server accounting) Multihost Non- EAP User Based Policy settings.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable 802.1x (RADIUS server accounting) Multihost Non-EAP User Based Policy settings:

```
no eapol multihost non-eap-user-based-policies { [enable][filter-
onmac enable] }
```

Variable definitions

Use the data in the following table to use the **`no eapol multihost non-eap-user-based-policies`** command.

Parameter	Description
enable	Disables the Multihost Non-EAP User Based Policies settings.
filter-on-mac enable	Disables settings for the Multihost Non-EAP filtering on MAC addresses.

Setting Multihost Non-EAP User Based Policy as Default Configuration

About this task

Perform the following procedure to set 802.1x (RADIUS server accounting) Multihost Non-EAP User Based Policy as the default configuration.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Set 802.1x (RADIUS server accounting) Multihost Non-EAP User Based Policy settings as default configuration:

   ```
   default eapol multihost non-eap-user-based-policies { [enable]
   [filter-on-mac enable] }
   ```

Variable definitions

Use the data in the following table to use the **`default eapol multihost non-eap-user-based-policies`** command.

Parameter	Description
enable	Sets the default Multihost Non-EAP User Based Policies settings.
filter-on-mac enable	Sets the default Multihost Non-EAP settings for filtering on MAC addresses.

802.1X or non-EAP with Fail Open VLAN configuration using ACLI

Use the procedures in this section to configure the 802.1X non-EAP with Fail Open VLAN using ACLI.

Note:

The switch does not validate that RADIUS Assigned VLAN attribute is not the same as the Fail_Open VLAN. This means that if you configure the Fail_Open VLAN name or ID the same as one of the VLAN names or IDs which can be returned from the RADIUS server, then EAP or NEAP clients is assigned to the Fail_Open VLAN even though no failure to conenct to the RADIUS server has occurred.

Enabling EAPOL Fail Open VLAN Continuity mode

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable the EAPOL Fail Open VLAN Continuity mode:

   ```
   eapol multihost fail-open-vlan continuity-mode enable
   ```

Variable definitions

Use the data in the following table to use the **eapol multihost fail-open-vlan** command.

Variable	Value
enable	Enables fail-open-vlan.
vid <1-4094>	Specifies a guest VLAN ID in a range from <1-4094>.

Disabling EAPOL Fail Open VLAN

About this task

Perform this procedure to disable the EAPOL Fail Open VLAN.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable the EAPOL Fail Open VLAN:

   `no eapol multihost fail-open-vlan`

Setting EAPOL Fail Open VLAN as the default

About this task

Perform this procedure to set the EAPOL Fail Open VLAN as the default.

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`

2. Set the EAPOL Fail Open VLAN as the default:

   `default eapol multihost fail-open-vlan [enable] [vid]`

Variable Definitions

Use the data in the following table to use the **`default eapol multihost fail-open-vlan [enable] [vid]`** command.

Variable	Value
enable	Disables the Fail Open VLAN.
vid	Sets the default Fail Open VLAN ID.

Displaying EAPOL Fail Open VLAN

About this task

Perform this procedure to display information related to the EAPOL Fail Open VLAN.

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`

2. Display the status of the fail-open VLAN

   `show eapol multihost fail-open-vlan`

Example

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
```

```
Switch(config)#show eapol multihost fail-open-vlan
Fail Open VLAN Enabled         : No
Fail Open VLAN ID              : 1
Fail Open VLAN Continuity Mode: Disabled
```

Fail Open VLAN Continuity mode configuration using ACLI

Use the procedures in this section to configure Fail Open VLAN Continuity mode using ACLI.

Enabling EAPOL Fail Open VLAN Continuity mode

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable the EAPOL Fail Open VLAN Continuity mode:

   ```
   eapol multihost fail-open-vlan continuity-mode enable
   ```

Disabling EAPOL Fail Open VLAN Continuity mode

About this task

Perform this procedure to disable EAPOL Fail Open VLAN continuity mode.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Use the following command to disable EAPOL Fail Open VLAN continuity mode:

   ```
   no eapol multihost fail-open-vlan continuity-mode enable
   ```

Displaying EAPOL Fail Open VLAN Continuity mode

About this task

Perform this procedure to display information related to EAPOL Fail Open VLAN Continuity mode.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Use one of the following commands to display the status of EAPOL Fail Open VLAN mode:

   ```
   show eapol multihost fail-open-vlan
   ```

   OR

   ```
   show eapol multihost
   ```

Configuring Fail Open UBPs on ports

About this task

Use this procedure to configure Fail Open UBPs on ports.

Procedure

1. Enter Ethernet Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface Ethernet <port>
   ```

2. At the command prompt, enter the following command:

   ```
   eapol multihost fail-open-vlan ubp <ubp_name>
   ```

Variable definitions

Use the data in the following table to use the `eapol multihost fail-open-vlan` command.

Variable	Definition
ubp	User Base Policy when FOV is active.
<ubp_name>	UBP name

Configuring features

The switch supports advanced EAPOL features that allow multiple hosts on a port. For more information about the advanced EAPOL features, see Advanced EAPOL features on page 46.

This section provides information about configuring the following features:

- Single Host with Single Authentication (SHSA) and Guest VLAN. For more information, see Configuring guest VLANs on page 175.
- Multiple Host with Multiple Authentication (MHMA). For more information, see Multiple Host with Multiple Authentication on page 51.
- Multiple Host with Single Authentication (MHSA). For more information, see Multiple Host with Single Authentication on page 61.
- Non EAP hosts on EAP-enabled ports. For more information, see Non EAP hosts on EAP-enabled ports on page 59.

SHSA is the default configuration.

Configuring multihost support

Configure multihost support by completing the following steps:

1. Enable multihost support for the interface. The relevant command is executed in the Interface Configuration mode. You can issue the command for the interface selected when you enter the Interface Configuration mode (so that all ports have the same setting), or you can issue the command for specific ports on the interface.
2. Specify the maximum number of EAP clients allowed on each multihost port. You can issue the command for the interface selected when you enter the Interface Configuration mode (so that all ports have the same setting), or you can issue the command for specific ports on the interface.

Enabling EAPOL multihost support

About this task

Enable multihost support for EAPOL.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Enable multihost support for EAPOL:

   ```
   eapol multihost [port <portlist>] enable
   ```

Variable definitions

Use the data in the following table to use the **`eapol multihost`** command.

Variable	Value
<portlist>	Specifies an individual port or list of ports for which to enable EAPOL support.

Disabling EAPOL multihost support

About this task

Disable the EAPOL multihost.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Disable the EAPOL multihost.

   ```
   no eapol multihost [<portlist>] [enable] [allow-non-eap-enable]
   [radius-non-eap-enable] [auto-non-eap-mhsa-enable] [non-eap-phone-
   enable] [use-radius-assigned-vlan]
   ```

Variable definitions

Use the data in the following table to use the **`no eapol multihost`** command.

Variable	Description
<portlist>	is the list of ports on which you want to disable EAPOL support. You can enter a single port, a range of ports, several ranges, or all. If you do not specify a port parameter, the command applies to all ports on the interface
enable	Disables eapol on the desired ports.
radius-non-eap-enable	Disables RADIUS authentication of non-EAP clients.
allow-non-eap-enable	Disables control of non-EAP clients (MAC addresses).
auto-non-eap-mhsa-enable	Disables auto-authentication of non-EAP clients.
non-eap-phone-enable	Disables Avaya IP Phone clients.
use-radius-assigned-vlan	Disables use of RADIUS-assigned VLAN.

Configuring interface EAPOL multihost settings

About this task

Use the following procedure to control the interface multihost settings.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Configure interface EAPOL multihost settings:

   ```
   eapol multihost { [adac-non-eap-enable] [allow-non-eap-enable]
   [auto-non-eap-mhsa-enable] [block-different-radius-assigned-vlan]
   [eap-mac-max <1-32>] [eap-packet-mode {multicast | unicast}] [eap-
   protocol-enable] [enable] [mac-max <1-64>] [mhsa-no-limit] [non-eap-
   mac-max <1-32>] [non-eap-phone-enable] [non-eap-use-radius-assigned-
   vlan] [port] [radius-non-eap-enable] [use-most-recent-radius-vlan]
   [use-radius-assigned-vlan] [radius-non-eap-delay <0-20>]}
   ```

Variable definitions

Use the data in the following table to use the **`eapol multihost`** command.

Parameter	Description
adac-non-eap-enable	Allow authentication of Non-EAP phones using ADAC.
allow-non-eap-enable	Enables MAC addresses of non-EAP clients.
auto-non-eap-mhsa-enable	Enables autoauthentication of non-EAP clients in the Multiple Host with Single Authentication (MHSA) mode.
block-different-radius-assigned-vlan	Blocks subsequent MAC authentications if the RADIUS-assigned VLAN is different than the first authorized station VLAN.
eap-mac-max	Specifies the maximum number of EAP MAC addresses allowed per port.
eap-packet-mode {multicast | unicast}	Enables the packet mode (multicast or unicast) for EAP requests.
eap-protocol-enable	Enables EAP protocol on port
enable	Globally enables EAPOL.
mac-max	Specifies the maximum number of MAC addresses allowed per port.
mhsa-no-limit	Allows an unlimited number of auto-authenticated non-EAPOL clients on the port.
non-eap-mac-max	Specifies the maximum number of non-EAP MAC addresses allowed per port.
non-eap-phone-enable	Enables Avaya IP Phone clients as another non-EAP type.
non-eap-use-radius-assigned-vlan	Allows the use of VLAN IDs assigned by RADIUS for non-EAP clients.

Table continues…

Parameter	Description
port	Specifies the port number on which to apply EAPOL settings.
radius-non-eap-enable	Enables RADIUS authentication of non-EAP clients.
use-most-recent-radius-vlan	Allows the use of most recent RADIUS VLAN.
use-radius-assigned-vlan	Enables use of RADIUS-assigned VLAN values in the multihost mode.
non-eap-mac [port <portlist>] <H.H.H>	Allows the specified non-EAP MAC address.
radius-non-eap-delay <0-20>	Configures 4 sec delay between learning a new MAC and trying to authenticate it via RADIUS

Disabling interface EAPOL multihost settings

About this task

Use the following procedure to disable interface EAPOL multihost settings.

Procedure

1. Enter Ethernet Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface Ethernet <port>
   ```

2. Disable interface EAPOL multihost settings:

   ```
   no eapol multihost [enable] [port] [adac-non-eap-enable] [allow-non-eap-enable] [auto-non-eap-mhsa-enable] [block-different-radius-assigned-vlan] [eap-protocol-enable] [mhsa-no-limit] [non-eap-phone-enable] [non-eap-use-radius-assigned-vlan] [radius-non-eap-enable] [use-most-recent-radius-vlan] [use-radius-assigned-vlan]
   ```

Variable definitions

Use the data in the following table to use the **eapol multihost** command.

Parameter	Description
adac-non-eap-enable	Disables authentication of non-EAP phones using ADAC.
allow-non-eap-enable	Disables MAC addresses of non-EAP clients.
auto-non-eap-mhsa-enable	Disables auto-authentication of non-EAP clients.
block-different-radius-assigned-vlan	Disables the blocking of subsequent MAC authentications if the RADIUS-assigned VLAN is different than the first authorized station VLAN.
eap-protocol-enable	Disables EAP protocol on the port.

Table continues…

Parameter	Description
enable	Disables EAP multihost mode.
mhsa-no-limit	Limits the number of auto-authenticated non-EAPOL clients.
non-eap-phone-enable	Disables authentication of Avaya IP Phone clients as another non-EAP type.
non-eap-use-radius-assigned-vlan	Disables the use of VLAN IDs assigned by RADIUS for non-EAP clients.
port	Specifies the port number on which to disable EAPOL.
radius-non-eap-enable	Disables RADIUS authentication of non-EAP clients.
use-most-recent-radius-vlan	Disables the use of VLAN IDs assigned by RADIUS.
use-radius-assigned-vlan	Disables the use of RADIUS-assigned VLAN values in the MHMA mode.
non-eap-mac [port <portlist>] <delete-all | H.H.H>	Disables a non-EAP MAC address.

Configuring EAPOL multihost settings to default

About this task

Set the EAPOL multihost feature to the defaults.

Procedure

1. Enter Ethernet Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface Ethernet <port>
   ```

2. Configure EAPOL multihost settings to default:

   ```
   default eapol multihost [adac-non-eap-enable] [allow-non-eap-enable]
   [auto-non-eap-mhsa-enable] [block-different-radius-assigned-vlan]
   [eap-mac-max] [eap-packet-mode] [eap-protocol-enable] [enable] [mac-
   max] [mhsa-no-limit] [non-eap-mac-max] [non-eap-phone-enable] [non-
   eap-use-radius-assigned-vlan] [port] [radius-non-eap-enable] [use-
   most-recent-radius-vlan] [use-radius-assigned-vlan] [non-eap-mac]
   ```

Variable definitions

Use the data in the following table to use the **`default eapol multihost`** command.

Parameter	Description
adac-non-eap-enable	Disables authentication of non-EAP phones using ADAC.

Table continues…

Parameter	Description
allow-non-eap-enable	Resets control of non-EAP clients (MAC addresses) to the default (disabled).
auto-non-eap-mhsa-enable	Disables auto-authentication of non-EAP clients.
block-different-radius-assigned-vlan	Disables the blocking of subsequent MAC authentications if the RADIUS-assigned VLAN is different than the first authorized station VLAN.
eap-mac-max	Resets the maximum number of EAP clients allowed on the port to the default value (1).
eap-packet-mode	Resets the EAP packet mode to the default (multicast).
eap-protocol-enable	Enables EAP protocol on the port.
enable	Restores EAPOL multihost support status to the default value (disabled).
mac-max	Resets the maximum number of clients allowed on the port to the default value (1).
mhsa-no-limit	Limits the number of auto-authenticated non-EAPOL clients.
non-eap-mac-max	Resets the maximum number of non-EAP authenticated MAC addresses allowed to the default value (1).
non-eap-phone-enable	Disables authentication of Avaya IP Phone clients as non-EAP type.
non-eap-use-radius-assigned-vlan	Disables the use of VLAN IDs assigned by RADIUS for non-EAP clients.
port	Specifies the port number on which to disable EAPOL.
radius-non-eap-enable	Disables RADIUS authentication of non-EAP clients.
use-most-recent-radius-vlan	Disables the use of most recent RADIUS VLAN.
use-radius-assigned-vlan	Disables the use of RADIUS-assigned VLAN values in the MHMA mode.
non-eap-mac [port <portlist>] <delete-all | H.H.H>	Disables a non-EAP MAC address.

Configuring the maximum number of EAP clients

About this task

Configure the maximum number of EAP clients.

Procedure

1. Enter Interface Configuration mode:

```
enable

configure terminal

interface ethernet <port number>
```

2. Configure the maximum number of EAP clients:

   ```
   eapol multihost [port <portlist>] eap-mac-max <num>
   ```

Variable definitions

Use the data in the following table to use the **`eapol multihost`** command.

Variable	Value
<portlist>	Specify the ports for which you are setting the maximum number of EAP clients.
<num>	Specify the maximum number of EAP clients allowed. RANGE: 1–32

Setting the maximum number of clients allowed per port

About this task

Restrict the maximum number of clients allowed per port.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Restrict the maximum number of clients allowed per port:

   ```
   eapol multihost [port <portlist>] mac-max <num>
   ```

Example

```
Switch(config-if)# eapol multihost port 1 eap-mac-max 32
Switch(config-if)# eapol multihost port 1 non-eap-mac-max 32
Switch(config-if)# eapol multihost port 1 mac-max 10
```

In this example, a maximum of ten EAP and Non-EAP clients are authenticated, in the order of authentication.

```
Switch(config-if)# eapol multihost port 1 eap-mac-max 1
Switch(config-if)# eapol multihost port 1 non-eap-mac-max 1
Switch(config-if)# eapol multihost port 1 mac-max 1
```

In this example, only one EAP or Non-EAP client is authenticated, in the order of authentication.

```
Switch(config-if)# eapol multihost port 1 eap-mac-max 5
Switch(config-if)# eapol multihost port 1 non-eap-mac-max 10
Switch(config-if)# eapol multihost port 1 mac-max 32
```

In this example, the switch allows up to five EAP clients and ten Non-EAP clients.

```
Switch(config-if)# eapol multihost port 1 eap-mac-max 5
Switch(config-if)# eapol multihost port 1 non-eap-mac-max 8
Switch(config-if)# eapol multihost port 1 mac-max 7
```

In this example, the switch allows up to five EAP clients and up to two Non-EAP clients, or up to seven Non-EAP clients.

Variable definitions

Use the data in the following table to use the **`eapol multihost`** command.

Variable	Value
<portlist>	Specify the ports for which you are setting the maximum number of clients.
<num>	Specify the maximum number of EAP and NEAP clients allowed per port. RANGE: 1–64 DEFAULT: 1

Disabling RADIUS-assigned VLAN use in MHMA mode

About this task

Globally disable RADIUS-assigned VLAN use in MHMA mode.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable RADIUS-assigned VLAN use in MHMA mode:

   ```
   no eapol multihost [use-radius-assigned-vlan]
   ```

   OR

   ```
   default eapol multihost [use-radius-assigned-vlan]
   ```

Variable definitions

Use the data in the following table to use the **`no eapol multihost`** and **`default eapol multihost`** commands.

Variable	Value
use-radius-assigned-vlan	globally disables RADIUS-assigned VLAN use in the MHMA mode.
<portlist>	specifies the port on which you want RADIUS-assigned VLAN use disabled in the MHMA mode. You can enter a port, several ports or a range of ports.

Configuring support for non-EAPOL hosts on EAPOL-enabled ports

To configure support for non-EAPOL hosts on EAPOL-enabled ports, do the following:

1. Ensure that:
    a. EAPOL is enabled globally and locally (for the desired interface ports). For more information, see Configuring EAPOL security on page 161.
    b. the desired ports are enabled for multihost mode. For more information, see Configuring multihost support on page 185.
    c. guest VLAN is disabled locally (for the desired interface ports). For more information, see Configuring guest VLANs on page 175.
2. Enable non EAPOL support globally on the switch and locally (for the desired interface ports), using one or both of the following authentication methods:
    a. local authentication. For more information, see Enabling local authentication of non EAPOL hosts on EAPOL-enabled ports on page 193.
    b. RADIUS authentication. For more information, see Enabling RADIUS authentication of non-EAPOL hosts on EAPOL-enabled ports on page 194.
3. Specify the maximum number of non EAPOL MAC addresses allowed on a port. For more information, see Specifying the maximum number of non EAPOL hosts allowed on page 198.
4. For local authentication only, identify the MAC addresses of non EAPOL hosts allowed on the ports. For more information, see Creating the allowed non EAPOL MAC address list on page 199.

By default, support for non EAPOL hosts on EAPOL-enabled ports is disabled.

Enabling local authentication of non EAPOL hosts on EAPOL-enabled ports

About this task

For local authentication of non-EAPOL hosts on EAPOL-enabled ports, you must enable the feature globally on the switch and locally for ports on the interface.

Procedure

1. Enable local authentication of non-EAPOL hosts globally on the switch:
    a. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

   b. Enable local authentication of non-EAPOL hosts globally :

      ```
      eapol multihost allow-non-eap-enable
      ```

2. Enable local authentication of non-EAPOL hosts or a specific port or for all ports on an interface:

   a. Enter Interface Configuration mode:

      ```
      enable
      ```

      ```
      configure terminal
      ```

      ```
      interface ethernet <port number>
      ```

   b. Enable local authentication of non-EAPOL hosts for a specific port or for all ports:

      ```
      eapol multihost [port <portlist>] allow-non-eap-enable
      ```

Variable definitions

Use the data in the following table to use the **`eapol multihost`** command.

Variable	Value
<portlist>	Specifies the port or list of ports on which you want to enable non-EAPOL hosts using local authentication. If you do not specify a port parameter, the command applies to all ports on the interface.

Enabling RADIUS authentication of non-EAPOL hosts on EAPOL-enabled ports

About this task

For RADIUS authentication of non-EAPOL hosts on EAPOL-enabled ports, you must enable the feature globally on the switch and locally for ports on the interface.

Procedure

1. Enable RADIUS authentication of non-EAPOL hosts globally:

   a. Enter Global Configuration mode:

      ```
      enable
      ```

      ```
      configure terminal
      ```

   b. Enable RADIUS authentication of non-EAPOL hosts globally :

      ```
      eapol multihost radius-non-eap-enable
      ```

2. Enable RADIUS authentication of non-EAPOL hosts for a specific port or for all ports on an interface:

   a. Enter Interface Configuration mode:

```
enable
configure terminal
interface ethernet <port number>
```

b. Enable RADIUS authentication of non-EAPOL hosts for a specific port or for all ports on an interface:

```
eapol multihost [port <portlist>] radius-non-eap-enable
```

Variable definitions

Use the data in the following table to use the **eapol multihost** command.

Variable	Value
<portlist>	Specifies the port or list of ports on which you want to enable non-EAPOL hosts using local authentication. If you do not specify a port parameter, the command applies to all ports on the interface.

Configuring the format of the RADIUS password attribute when authenticating non-EAP MAC addresses using RADIUS

About this task

Use the following procedure to configure the format of the RADIUS password when authenticating non-EAP MAC addresses using RADIUS.

Procedure

1. Enter Global Configuration mode:

```
enable
configure terminal
```

2. Configure the format of the RADIUS password:

```
eapol multihost non-eap-pwd-fmt {[ip-addr] [mac-addr] [port-number]
[key] [key-string <key-string>] [padding] [no-padding]}
```

Variable definitions

Use the data in the following table to use the **eapol multihost non-eap-pwd-fmt** command.

Parameter	Description
ip-addr	Includes switch IP address string.
mac-addr	Includes MAC address string.
port-number	Includes port string.

Table continues…

Parameter	Description
key	Includes configurable key string.
key-string <*key-string*>	Defines the Non-EAP configurable key.
padding	The RADIUS password uses dots for every missing parameter.
no-padding	The RADIUS password uses dots only to separate fields. This is the default setting.

Setting the configurable key for RADIUS NEAP password

The RADIUS NEAP password includes a configurable key string in addition to IP address, MAC address, and port number. By default the configurable key feature is disabled and the key is set to null.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Use the following command to include the configurable key in the RADIUS NEAP password:

   ```
   eapol multihost non-eap-pwd-fmt key
   ```

3. Use the following command to define the key string:

   ```
   eapol multihost non-eap-pwd-fmt key-string <key-string>
   ```

   Note:

   If you are using an SSH image or a non-SSH image with password security enabled you cannot enter the key immediately in clear text. Press Enter after "key-string", enter the password, and then re-enter the password to confirm.

Variable definitions

Use the data in the following table to use the **`eapol multihost non-eap-pwd-fmt`** command.

Parameter	Description
key-string <*key-string*>	Define a string up to 32 ASCII characters.

Displaying RADIUS NEAP password settings

About this task

Display the password fields and padding.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display the password fields and padding:

   ```
   show eapol multihost non-eap-pwd-fmt
   ```

3. Display the key used:

   ```
   show eapol multihost non-eap-pwd-fmt key
   ```

   Note:

   The password is displayed in cleartext only when password security is not enabled. Otherwise, the password is displayed as a string of asterisks.

Example

```
Switch>enable
Switch#show eapol multihost non-eap-pwd-fmt
Non-EAPOL RADIUS Password Attribute Format:  IpAddr.MACAddr.PortNumber
Padding: Disabled
```

```
Switch>enable
Switch#show eapol multihost non-eap-pwd-fmt key
EAPoL NEAP Password Format Key:**********
```

Enabling RADIUS-assigned VLAN for non-EAP MACs

About this task

Enable RADIUS-assigned VLAN use for non-EAP MACs in the MHMA mode.

Procedure

1. Enable RADIUS-assigned VLAN use for non-EAP MACs in the MHMA mode:

   a. Enter Global Configuration mode:

      ```
      enable
      configure terminal
      ```

   b. Enable RADIUS-assigned VLAN use for non-EAP MACs in the MHMA mode:

      ```
      eapol multihost [non-eap-use-radius-assigned-vlan]
      ```

2. Enable RADIUS-assigned VLAN use for non-EAP MACs in the MHMA mode for a specific interface:

   a. Enter Interface Configuration mode:

      ```
      enable
      configure terminal
      interface ethernet <port number>
      ```

b. RADIUS-assigned VLAN use for non-EAP MACs in the MHMA mode for a specific interface:

```
eapol multihost [port <portlist>] [non-eap-use-radius-assigned-vlan]
```

Variable definitions

Use the data in the following table to use the **`eapol multihost non-eap-use-radius-assigned-vlan`** command.

Variable	Value
<portlist>	Defines the port on which to enable RADIUS-assigned VLAN use for non-EAP configured in the MHMA mode. You can enter a single port, several ports or a range of ports.

Disabling RADIUS-assigned VLAN for non-EAP MACs

About this task

Disable RADIUS-assigned VLAN use for non-EAP macs in the MHMA mode.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable RADIUS-assigned VLAN use for non-EAP macs in the MHMA mode:

   ```
   no eapol multihost [non-eap-use-radius-assigned-vlan]
   ```

   OR

   ```
   default eapol multihost [non-eap-use-radius-assigned-vlan]
   ```

Specifying the maximum number of non EAPOL hosts allowed

About this task

Configure the maximum number of non EAPOL hosts allowed for a specific port or for all ports on an interface.

Note:

The configurable maximum number of non- EAPOL clients for each port is 32, but Avaya recommends that the maximum allowed for each port be lower. Avaya recommends that the combined maximum be approximately 200 for each box and 800 for a stack.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Configure the maximum number of non EAPOL hosts allowed for a specific port or for all ports on an interface:

   ```
   eapol multihost [port <portlist>] non-eap-mac-max <value>
   ```

Variable definitions

Use the data in the following table to use the **`eapol multihost`** command.

Variable	Value
<portlist>	Specify the list of ports to which you want the setting to apply. Enter a single port, a range of ports, several ranges, or all. If you do not specify a port parameter, the command sets the value for all ports on the interface.
<value>	Specify the maximum number of non EAPOL clients allowed on the port at one time. RANGE: 1–32 DEFAULT: 1

Creating the allowed non EAPOL MAC address list

About this task

Specify the MAC addresses of non EAPOL hosts allowed on a specific port or on all ports on an interface, for local authentication.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Specify the MAC addresses of non EAPOL hosts allowed:

   ```
   eapol multihost non-eap-mac [port <portlist>] <H.H.H>
   ```

Variable definitions

Use the data in the following table to use the **`eapol multihost non-eap-map`** command.

Variable	Value
<portlist>	Specify the port on which you want to allow the specified non EAPOL hosts.
<H.H.H>	Specify the MAC address of the allowed non EAPOL host.

Viewing non EAPOL host settings and activity

Various show commands allow you to view:

- global settings. For more information, see Displaying global settings for non EAPOL hosts on page 200.
- port settings. For more information, see Displaying port settings for non EAPOL hosts on page 201.
- allowed MAC addresses, for local authentication. For more information, see Displaying allowed MAC addresses on page 202.
- current non EAPOL hosts active on the switch. For more information, see Displaying current non EAPOL host activity on page 202.
- status in the Privilege Exec mode. For more information, see Displaying the current EAPOL-based security status on page 163.

Displaying global settings for non EAPOL hosts

About this task

Display global settings for non EAPOL hosts on EAPOL-enabled ports.

Note:

If you apply the **`show eapol multihost`** command on a large stack with complex configuration, you can experience slow output if this command is executed within 4-5 minutes of the stack being booted or power-cycled. If you wait 5 minutes after the stack is booted or power-cycled before executing this show command, the normal response times will be observed.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display global settings for non EAPOL hosts on EAPOL-enabled ports.

   ```
   show eapol multihost
   ```

Example

```
Switch>enable
Switch#show eapol multihost
Allow Local Non-EAP Clients                         :  Disabled
```

```
Non-EAP RADIUS Authentication                         :  Disabled
Non-EAP AutoLearned After Single Authent (MHSA)       :  Disabled
Non-EAP DHCP Phone Authentication                     :  Disabled
EAPoL Request Packet Generation Mode                  :  Unicast
EAP RADIUS Assigned VLANs                             :  Disabled
Non-EAP RADIUS Assigned VLANs                         :  Disabled
Non-EAP RADIUS Password Attribute Format              :  IpAddr.MACAddr.PortNumbe
r
Non-EAP User Based Policies                           :  Disabled
Non-EAP User Based Policies Filter On MAC Addresses :  Disabled
EAP Protocol                                          :  Enabled
Use Most Recent RADIUS Assigned VLAN                  :  Enabled
Non-EAP ReAuthentication                              :  Disabled
Block Different RADIUS Assigned VLAN Authentication :  Disabled
Dummy ADAC Radius Requests                            :  Disabled
ADAC Non-EAP Phone Authentication                     :  Disabled
Fail Open VLAN                                        :  Disabled
Fail Open VLAN ID                                     :  1
Fail Open VLAN Continuity Mode                        :  Disabled
```

Displaying port settings for non EAPOL hosts

About this task

Display non EAPOL support settings for each port.

Procedure

1. Enter Privileged EXEC mode:

   `enable`

2. Display non EAPOL support settings for each port:

   `show eapol multihost interface [<portlist>]`

Example

```
Switch>enable
Switch#show eapol multihost interface
Port:  1
    MultiHost Status                                      :  Disabled
    Total Maximum Number of Clients                       :  1
    Maximum Number of  EAP Clients                        :  1
    Maximum Number of Non-EAP Clients                     :  32
    Allow Local Non-EAP Clients                           :  Disabled
    Non-EAP RADIUS Authentication                         :  Disabled
    Non-EAP AutoLearned After Single Auth (MHSA)          :  Disabled
    Non-EAP DHCP Phone Authentication                     :  Disabled
    EAPoL Request Packet Generation Mode                  :  Unicast
    EAP RADIUS Assigned VLANs                             :  Disabled
    Non-EAP RADIUS Assigned VLANs                         :  Disabled
    EAP Protocol                                          :  Enabled
    Use Most Recent RADIUS Assigned VLAN                  :  Disabled
    Block Different RADIUS Assigned VLAN Authentication :  Disabled
    ADAC Non-EAP Phone Authentication                     :  Disabled
    MHSA No limit Non-EAP Authentication                  :  Disabled
Port:  2
    MultiHost Status                                      :  Disabled
    Total Maximum Number of Clients                       :  1
    Maximum Number of  EAP Clients                        :  1
    Maximum Number of Non-EAP Clients                     :  1
----More (q=Quit, space/return=Continue)----
```

Variable definitions

Use the data in the following table to use the **show eapol multihost interface** command.

Variable	Value
<portlist>	Specify the list of ports you want to view. Enter a single port, a range of ports, several ranges, or all. If you do not specify a port parameter, the command sets the value for all ports on the interface.

Displaying allowed MAC addresses

About this task

Display the MAC addresses of non EAPOL hosts allowed to access ports on an interface.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display the MAC addresses of non EAPOL hosts allowed to access ports on an interface:

   ```
   show eapol multihost non-eap-mac interface [<portlist>]
   ```

Example

```
Switch>enable
Switch#show eapol multihost non-eap-mac interface
Port Allowed MAC Address    Port Allowed MAC Address
---- -------------------    ---- -------------------
Total number of locally configured MAC addresses:  0
```

Displaying current non EAPOL host activity

About this task

Display current non EAPOL host activity.

Note:

If you apply the **show eapol multihost non-eap-mac** status command on a large stack with complex configuration, you can experience slow output if this command is executed within 4-5 minutes of the stack being booted or power-cycled. If you wait 5 minutes after the stack is booted or power-cycled before executing this show command, the normal response times will be observed.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display current non EAPOL host activity:

   ```
   show eapol multihost non-eap-mac status [<portlist>]
   ```

Example

```
Switch>enable
Switch#show eapol multihost non-eap-mac status
Port Client MAC Address State                          Vid  Pri
---- ------------------ ------------------------------ ---- ---
Total number of authenticated clients: 0
```

Enabling and disabling EAP and non-EAP multiple VLAN capability

About this task

Enable and disable EAP and non-EAP multiple VLAN capability.

Important:

Configuring EAP and non-EAP multiple VLAN capability

Important:

Avaya recommends that you do not change the multiple VLAN status while Fail Open VLAN is enabled.

Important:

You cannot enable EAP and non-EAP multiple VLAN capability, and use-most-recent- RADIUS assigned VLAN at the same time.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable the multiple VLAN capability for EAP and non-EAP hosts:

   ```
   eapol multihost multivlan enable
   ```

3. Disable the multiple VLAN capability for EAP and non-EAP hosts:

   ```
   no eapol multihost multivlan
   ```

   OR

   ```
   default eapol multihost multivlan
   ```

Displaying the status the multiple VLAN capability for EAP and non-EAP hosts

About this task

Display the status the multiple VLAN capability for EAP and non-EAP hosts.

Procedure

1. Enter User EXEC mode.
2. Display the status the multiple VLAN capability for EAP and non-EAP hosts:

   `show eapol multihost multivlan`

Example

```
Switch>enable
Switch#show eapol multihost multivlan
Multi-VLAN with MHMA mode: Disabled
```

Using the EAP and NEAP separation command

Use the **`no eap multihost eap-protocol-enable`** command to disable EAP clients without disabling NEAP clients.

Ensure eapol is enabled globally and per port.

Variables

Use the data in the following table to use the **`no eapol multihost eap-protocol-enable`** command.

Variable	Value
eap multihost eap-protocol-enable	Global and per port: allow and process eap packets.
no eap multihost eap-protocol-enable	Global and per port: drop all eap packets.
default eap multihost eap-protocol-enable	Per port: allow and process eap packets.
show eapol multihost interface <port #>	Per port: displays the parameter.

802.1X dynamic authorization extension (RFC 3576) configuration using ACLI

You can configure 802.1X dynamic authorization extension (RFC 3576) for a third party device to dynamically change VLANs on switches or close user sessions.

Configuring 802.1X dynamic authorization extension (RFC 3576)

Before you begin

- Enable EAP globally and on each applicable port.
- Enable the dynamic authorization extensions commands globally and on each applicable port.

Important:

Disconnect or CoA commands are ignored if the commands address a port on which the feature is not enabled.

About this task

Configure RADIUS dynamic authorization extension (802.1X RFC 3576) to enable the RADIUS server to send a change of authorization (CoA) or disconnect command to the Network Access Server (NAS).

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Configure RADIUS dynamic authorization extension:

```
radius dynamic-server client A.B.C.D [ secret] [ port <1024-65535> ]
[ enable ] [process-disconnect-requests] [process-change-of-auth-
requests] [process-reauthentication-requests]
```

Variable definitions

Use the data in the following table to use the **radius dynamic-server client** command.

Variable	Value
<A.B.C.D.>	Adds a new RADIUS dynamic authorization client or changes the configuration of an existing RADIUS dynamic authorization client. <A.B.C.D.> is an IP address.
enable	Enables packet receiving from the RADIUS Dynamic Authorization Client.
port	Configures the server and NAS UDP port to listen for requests from the RADIUS Dynamic Authorization Client. Values range from 1024 to 65535.
process-change-of-auth-requests	Enables change of authorization (CoA) request processing.
process-disconnect-requests	Enables disconnect request processing.
process-reauthentication-requests	Enables reauthentication request processing.

Table continues…

Variable	Value
secret	Configures the RADIUS Dynamic Authorization Client secret word.

Disabling 802.1X dynamic authorization extension (RFC 3576)

About this task

Disable RADIUS dynamic authorization extension (802.1X RFC 3576) to prevent the RADIUS server to send a change of authorization (CoA) or disconnect command to the Network Access Server (NAS).

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable RADIUS dynamic authorization extension:

   ```
   no radius dynamic-server client <A.B.C.D.> [enable] [process-change-of-auth-requests] [process-disconnect-requests] [process-reauthentication-requests] [secret]
   ```

Variable definitions

Use the data in the following table to use the **`no radius dynamic-server client`** command.

Variable	Value
<A.B.C.D.>	Adds a new RADIUS dynamic authorization client or changes the configuration of an existing RADIUS dynamic authorization client. <A.B.C.D.> is an IP address.
enable	Disables packet receiving from the RADIUS dynamic authorization client.
process-change-of-auth-requests	Disables change of authorization (CoA) request processing.
process-disconnect-requests	Disables disconnect request processing.
process-reauthentication-requests	Disables reauthentication request processing.
secret	Sets the RADIUS dynamic authorization client secret to default.

Viewing 802.1X dynamic authorization extension (RFC 3576) configuration

About this task

View RADIUS dynamic authorization client configuration to display and confirm the configuration of RADIUS dynamic authorization client parameters.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. View RADIUS dynamic authorization client configuration:

   ```
   show radius dynamic-server client <A.B.C.D.>
   ```

Example

```
Switch+>enable
Switch#>show radius dynamic-server client 172.32.20.10

                             Process     Process  Process
Client        UDP    Client  Disconnect  Coa      Reauth
Address       Port   Enabled Requests    Requests Requests  Secret
---------     ----   ------- ----------  -------- --------  --------------
172.32.20.10  3799   No      Enabled     Enabled  Enabled   **************
```

Variable definitions

Use the data in the following table to use the **`show radius dynamic-server client <A.B.C.D.>`** command.

Variable	Value
<A.B.C.D.>	Specify the IP address of the RADIUS dynamic authorization client.

Viewing 802.1X dynamic authorization extension (RFC 3576) statistics

About this task

View RADIUS dynamic authorization client statistics to display RADIUS dynamic authorization client statistical information.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. View RADIUS dynamic authorization client configuration:

   ```
   show radius dynamic-server statistics client <A.B.C.D.>
   ```

Example

The following example shows sample output for the command.

```
Switch#show radius dynamic-server statistics client 172.32.20.10
-----------------------------------------------------
Client Address: 172.32.20.10
                                     Change
                          Disconnect Of-Authorization Reauthentication
                          ---------- ---------------- ----------------
Requests                  0          0                0
AuthOnlyRequests          0          0                0
Dup Requests              0          0                0
ACKs                      0          0                0
NAKs                      0          0                0
NAKAuthOnlyRequests       0          0                0
NAKSessNoContext          0          0                0
UserSessRemoved/Changed   0          0                0
MalformedRequests         0          0                0
BadAuthenticationRequests 0          0                0
PacketsDropped            0          0                0

Unknown Requests          0
```

Variable definitions

Use the data in the following table to use the **`show radius dynamic-server statistics client <A.B.C.D.>`** command.

Variable	Value
<A.B.C.D.>	Specify the IP address of the RADIUS dynamic authorization client.

Enabling 802.1X dynamic authorization extension (RFC 3576) on EAP ports

About this task

Enable 802.1X dynamic authorization extension (RFC 3576) on EAP ports for the ports to process CoA and disconnect requests from the RADIUS server.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Enable 802.1X dynamic authorization extension (RFC 3576) on an EAP port

```
eapol radius-dynamic-server enable
```

3. Enable 802.1X dynamic authorization extension (RFC 3576) on a specific EAP port or a list of EAP ports:

```
eapol port <LINE> radius-dynamic-server enable
```

Variable definitions

Use the data in the following table to use the **`eapol port <LINE> radius-dynamic-server enable`** command.

Variable	Value
<LINE>	Specify an individual port or list of ports.

Disabling 802.1X dynamic authorization extension (RFC 3576) on EAP port

About this task

Disable 802.1X dynamic authorization extension (RFC 3576) on EAP ports to discontinue the ports from processing CoA and disconnect requests from the RADIUS server.

Procedure

1. Enter Interface Configuration mode:

```
enable

configure terminal

interface ethernet <port number>
```

2. Disable 802.1X dynamic authorization extension (RFC 3576) on an EAP port:

```
no eapol radius-dynamic-server enable
```

3. Disable 802.1X dynamic authorization extension (RFC 3576) on a specific EAP port or a list of EAP ports:

```
no eapol port <LINE> radius-dynamic-server enable
```

Variable definitions

Use the data in the following table to use the **`no eapol port <LINE> radius-dynamic-server enable`** command.

Variable	Value
<LINE>	Specify an individual port or list of ports.

Enabling 802.1X dynamic authorization extension (RFC 3576) default on EAP ports

About this task

Enable 802.1X dynamic authorization extension (RFC 3576) default on EAP ports to return the ports to the default configuration for processing CoA and disconnect requests from the RADIUS server.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Enable 802.1X dynamic authorization extension (RFC 3576) default on an EAP port:

   ```
   default eapol radius-dynamic-server enable
   ```

3. Enable 802.1X dynamic authorization extension (RFC 3576) default on a specific EAP port or a list of EAP ports:

   ```
   default eapol port <LINE> radius-dynamic-server enable
   ```

Variable definitions

Use the data in the following table to use the **`default eapol port <LINE> radius-dynamic-server enable`** command.

Variable	Value
<LINE>	Specify an individual port or list of ports.

Configuring Wake on LAN with simultaneous 802.1X Authentication

Before you begin

- Configure the primary RADIUS server
- Configure the shared secret
- Enable EAPOL

About this task

Authenticate 802.1X and Wake on LAN simultaneously by changing the 802.1X port configuration control.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   configure terminal
   interface ethernet <port number>
   ```

2. Enable the EAPOL administrative state:

   ```
   eapol port <port_list> traffic-control in
   ```

Variable Definitions

Use the data in the following table to use the **eapol port <port_list> traffic-control in** command.

Variable	Value
<port_list>	Specify a port or list of ports.

Job aid

To verify the EAPOL administrative state, use the following command:

```
show eapol port <port_list>
```

Following is a sample show eapol port <port_list> command output:

EAPOL administrative state enabled – Wake on LAN available	EAPOL administrative state disabled – no Wake on LAN
Switch(config-if)# show eapol port 1/1 EAPOL Administrative State: Enabled Unit/Port: 1/1 Admin Status: Auto Auth: No Admin Dir: In Oper Dir: In ReAuth Enable: No ReAuth Period: 3600 Quiet Period: 60 Xmit Period: 30 Supplic Timeout: 30 Server Timeout: 30 Max Req: 2 RDS DSE: No	Switch(config-if)# show eapol port 1/1 EAPOL Administrative State: Disabled Unit/Port: 1/1 Admin Status: Auto Auth: Yes Admin Dir: In Oper Dir: In ReAuth Enable: No ReAuth Period: 3600 Quiet Period: 60 Xmit Period: 30 Supplic Timeout: 30 Server Timeout: 30 Max Req: 2 RDS DSE: No

Enabling Avaya IP Phone clients on an EAP-enabled port

Enable this feature to allow an Avaya IP Phone client and an EAP PC to exist together on a port. To enable Avaya IP Phone clients on an EAP-enabled port, do the following:

1. Ensure that:
    - EAP is enabled globally and locally (on the desired interface ports). (See Configuring EAPOL security on page 161).
    - Multihost is enabled on the desired ports. (See Configuring multihost support on page 185).
    - NonEAP is enabled globally and locally (on the desired interface ports). (See Configuring support for non-EAPOL hosts on EAPOL-enabled ports on page 193).
    - Filtering is enabled (to capture DHCP packets and to look for the Avaya Phone Signature).

    Important:

    Avaya recommends that the following two features not be enabled at the same time:

    - Guest VLAN.

        This is to ensure that the Call server and VoIP information packets the phone receives from the DHCP server are sent on the configured VLAN, so correct information (such as the IP address) is obtained.
    - EAP at the phone.
2. Enable Avaya IP Phone clients globally on the switch. See Enabling and disabling Avaya IP Phone clients as a non-EAP type globally on page 212.
3. Enable Avaya IP Phone clients locally or for specific ports on the interface. See Enabling Avaya IP Phone clients in the interface mode on page 213.
4. Specify the maximum number of non EAPOL MAC addresses allowed: the maximum number allowed is 32.

Enabling and disabling Avaya IP Phone clients as a non-EAP type globally

About this task

Globally enable Avaya IP Phone clients as a non-EAP type.

Procedure

1. Enter Global Configuration mode:

    ```
    enable
    ```

    ```
    configure terminal
    ```
2. Globally enable Avaya IP Phone clients as a non-EAP type:

    ```
    eapol multihost {[non-eap-phone-enable]}
    ```

3. Disable Avaya IP Phone clients as a non-EAP type:

   ```
   no eapol multihost {[non-eap-phone-enable]}
   ```

   OR

   ```
   default eapol multihost {[non-eap-phone-enable]}
   ```

Variable definitions

Use the data in the following table to use the **`eapol multihost {[non-eap-phone-enable]}`** command.

Parameter	Description
non-eap-phone-enable	globally enables Avaya IP Phone clients as a non-EAP type.

Enabling Avaya IP Phone clients in the interface mode

About this task

Enable Avaya IP Phone clients in the interface mode.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Enable Avaya IP Phone clients in the interface mode:

   ```
   eapol multihost [port <portlist>][non-eap-phone-enable]
   ```

3. Disable Avaya IP Phone clients in the interface mode:

   ```
   no eapol multihost [port <portlist>] [non-eap-phone-enable]
   ```

   OR

   ```
   default eapol multihost [port <portlist>] [non-eap-phone-enable]
   ```

Variable definitions

Use the data in the following table to use the **`eapol multihost [port <portlist>][non-eap-phone-enable]`** command.

Parameter	Description
<portlist>	Specify the port or ports on which you want Avaya IP Phone clients enabled as a non-EAP type. You can enter a single port, several ports or a range of ports.

Table continues…

Parameter	Description
non-eap-phone-enable	Enables Avaya IP Phone clients as a non-EAP type, on the desired port or ports.

Configuring MHSA

To configure MHSA support, do the following:

1. Ensure that:
    a. EAPOL is enabled globally and locally (for the desired interface ports). For more information, see Configuring EAPOL security on page 161.
    b. the desired ports are enabled for multihost mode. For more information, see Configuring multihost support on page 185.
    c. guest VLAN is disabled locally (for the desired interface ports). For more information, see Configuring guest VLANs on page 175.
2. Enable MHSA globally on the switch. For more information, see Enabling support for MHSA globally on page 214.
3. Configure MHSA settings for the interface or for specific ports on the interface. For more information, see Configuring interface and port settings for MHSA on page 215.
    a. Enable MHSA support.
    b. Specify the maximum number of non EAPOL MAC addresses allowed.

By default, MHSA support on EAP-enabled ports is disabled.

Enabling and disabling support for MHSA globally

About this task

Enable support for MHSA globally.

Procedure

1. Enter Global Configuration mode:

    ```
    enable
    ```

    ```
    configure terminal
    ```

2. Enable support for MHSA globally:

    ```
    eapol multihost auto-non-eap-mhsa-enable
    ```

3. Disable support for MHSA globally:

    ```
    no eapol multihost auto-non-eap-mhsa-enable
    ```

    OR

```
default eapol multihost auto-non-eap-mhsa-enable
```

Configuring interface and port settings for MHSA

About this task

Configure MHSA settings for a specific port or for all ports on an interface.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   configure terminal
   interface ethernet <port number>
   ```

2. Configure MHSA settings for a specific port or for all ports on an interface:

   ```
   eapol multihost [port <portlist>] auto-non-eap-mhsa-enable non-eap-mac-max <value>
   ```

Variable definitions

Use the data in the following table to use the **`eapol multihost`** command.

Parameters and variables	Description
<portlist>	Specify the list of ports to which you want the settings to apply.
auto-non-eap-mhsa-enable	Enables MHSA on the port. The default is disabled. To disable MHSA, use the **`no`** or **`default`** keywords at the start of the command.
non-eap-mac-max <value>	Sets the maximum number of non EAPOL clients allowed on the port at one time. • <value> is an integer in the range 1 to 32. The default is 1. **Important:** The configurable maximum number of non EAPOL clients for each port is 32, but Avaya expects that the usual maximum allowed for each port will be lower. Avaya expects that the combined maximum will be approximately 200 for each box and 800 for a stack.

Viewing MHSA settings and activity

For more information about the commands to view MHSA settings and non EAPOL host activity, see Viewing non EAPOL host settings and activity on page 200.

Setting SNMP v1, v2c, v3 Parameters

Earlier releases of SNMP used a proprietary method for configuring SNMP communities and trap destinations for specifying SNMPv1 configuration that included up to four trap destinations and associated community strings that can be configured using SNMP Set requests on the s5AgTrpRcvrTable.

With the support for SNMPv3, you can configure SNMP using the new standards-based method of configuring SNMP communities, users, groups, views, and trap destinations.

The also supports the previous proprietary SNMP configuration methods for backward compatibility.

All the configuration data configured in the proprietary method is mapped into the SNMPv3 tables as read-only table entries. In the new standards-based SNMPv3 method of configuring SNMP, all processes are configured and controlled through the SNMPv3 MIBs. The Command Line Interface commands change or display the single read-only community, read-write community, or four trap destinations of the proprietary method of configuring SNMP. Otherwise, the commands change or display SNMPv3 MIB data.

The software supports MD5 and SHA authentication, as well as AES DES, and 3DES encryption.

The SNMP agent supports exchanges using SNMPv1, SNMPv2c and SNMPv3. Support for SNMPv2c introduces a standards-based GetBulk retrieval capability using SNMPv1 communities. SNMPv3 support introduces high security user authentication and message security. This includes MD5 and SHA-based user authentication and message integrity verification, as well as AES-, DES-, and 3DES-based privacy encryption. Export restrictions on SHA and DES necessitate support for domestic and non domestic executable images or defaulting to no encryption for all customers.

The traps can be configured in SNMPv1, v2, or v3 format. If you do not identify the version (v1, v2, or v3), the system formats the traps in the v1 format. A community string can be entered if the system requires one.

SNMPv3 table entries stored in NVRAM

The number of nonvolatile entries (entries stored in NVRAM) allowed in the SNMPv3 tables are shown in the following list. The system does not allow you to create more entries marked nonvolatile when you reach these limits:

- snmpCommunityTable: 20
- vacmViewTreeFamilyTable: 60
- vacmSecurityToGroupTable: 40
- vacmAccessTable: 40
- usmUserTable: 20
- snmpNotifyTable: 20
- snmpTargetAddrTabel: 20
- snmpTargetParamsTable: 20

Configuring SNMP using ACLI

This section provides information on using the following ACLI commands to configure and manage SNMP.

- show snmp-server
- snmp-server authentication-trap
- no snmp-server authentication-trap
- default snmp-server authentication-trap
- snmp-server community for read or write
- snmp-server community
- no snmp-server community
- default snmp-server community
- snmp-server contact
- no snmp-server contact
- default snmp-server contact
- snmp-server
- no snmp-server
- snmp-server host
- no snmp-server host
- default snmp-server host
- snmp-server location
- no snmp-server location
- default snmp-server location
- snmp-server name
- no snmp-server name
- default snmp-server name
- snmp-server notification-control
- no snmp-server notification-control
- default snmp-server notification-control
- show snmp-server notification-control
- snmp-server user
- no snmp-server user
- snmp-server view
- no snmp-server view
- snmp-server bootstrap

Viewing SNMP configuration

About this task

View SNMP configuration.

Procedure

1. Enter Privileged EXEC mode:

   `enable`

2. View SNMP configuration:

   `show snmp-server`

Example

```
Switch>enable
Switch#show snmp-server
Read-Only Community String: public
Read-Write Community String: private
Trap #1 IP Address:       0.0.0.0
        Community String:
Trap #2 IP Address:       0.0.0.0
        Community String:
Trap #3 IP Address:       0.0.0.0
        Community String:
Trap #4 IP Address:       0.0.0.0
        Community String:
AutoTopology: Enabled
```

Variable definitions

Use the data in the following table to use the **`show snmp-server`** command.

Parameters and variables	Description
host	Displays the trap receivers configured in the SNMPv3 MIBs.
notification-control	Displays the notification control table
notify-filter	Displays the SNMP notify filter configuration
user	Displays the SNMP users, including views accessible to each user.
view	Displays SNMP views.

Enabling and disabling SNMP authentication failure traps

About this task

Enable or disable the generation of SNMP authentication failure traps.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Enable the generation of SNMP authentication failure traps:

   ```
   snmp-server authentication-trap enable
   ```

3. Disable the generation of SNMP authentication failure traps:

   ```
   snmp-server authentication-trap disable
   ```

   OR

   ```
   no snmp-server authentication-trap
   ```

Restoring the SNMP authentication trap configuration to default

About this task

Restore the SNMP authentication trap configuration to the default settings.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Restore the SNMP authentication trap configuration to the default settings:

   ```
   default snmp-server authentication-trap
   ```

Configuring a single read-only or read-write community

About this task

This command configures a single read-only or a single read-write community. A community configured using this command does not have access to the SNMPv3 MIBs. These community strings have a fixed MIB view.

The `snmp-server community` command for read/write modifies the community strings for SNMPv1 and SNMPv2c access.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure a single read-only or a single read-write community:

   ```
   snmp-server community [word{notify-view|read-view|ro|rw|write-view}]
   ```

Variable definitions

Use the data in the following table to use the `snmp-server community` command.

Parameters and variables	Description
word [notify-view|read-view|ro|rw|write-view]	The following list describes the snmp-server community parameters: • notify-view specifies the notify (trap) access view name. • Read-view specifies the read access view name. • ro specifies read-only access with this community string. • rw specifies read-write access with this community string. • write-view specifies the write-access view name. **Important:** Stations with ro access can retrieve MIB objects, and stations with rw access can retrieve and modify MIB objects. If neither ro nor rw is specified, ro is assumed (default).

Creating community strings

About this task

You can use the **`snmp-server community`** command to create community strings with varying levels of read, write, and notification access based on SNMPv3 views. These community strings are separate from those created using the **`snmp-server community`** for read/write command.

This command affects community strings stored in the SNMPv3 snmpCommunity Table, which allows several community strings to be created. These community strings can have any MIB view.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Create community strings:

```
snmp-server community {read-view <view-name>|write-view <view-name>|
notify-view <view-name>}
```

Variable definitions

Use the data in the following table to use the **`snmp-server community`** command.

Parameters and variables	Description
read-view <view-name>	Changes the read view used by the new community string for different types of SNMP operations.

Table continues…

Parameters and variables	Description
	view-name: specifies the name of the view which is a set of MIB objects/instances that can be accessed; enter an alphanumeric string.
write-view <view-name>	Changes the write view used by the new community string for different types of SNMP operations. view-name: specifies the name of the view which is a set of MIB objects/instances that can be accessed; enter an alphanumeric string.
notify-view <view-name>	Changes the notify view settings used by the new community string for different types of SNMP operations. view-name: specifies the name of the view which is a set of MIB objects/instances that can be accessed; enter an alphanumeric string.

Clearing SNMP server community

About this task

Clear the snmp-server community configuration.

If you do not specify a read-only or read-write community parameter, all community strings are removed, including all the communities controlled by the **snmp-server community** command and the **snmp-server community** for read-write command.

If you specify read-only or read-write, then just the read-only or read-write community is removed. If you specify the name of a community string, then the community string with that name is removed.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Clear the snmp-server community configuration:

   ```
   no snmp-server community {ro|rw|<community-string>}
   ```

Variable definitions

Use the data in the following table to use the **no snmp-server community** command.

Parameters and variables	Description
ro |rw|<community-string>	Changes the settings for SNMP: • ro|rw: sets the specified old-style community string value to NONE, thereby disabling it.

Parameters and variables	Description
	- community-string: deletes the specified community string from the SNMPv3 MIBs (that is, from the new-style configuration).

Restoring the community string configuration to default

About this task

Restore the community string configuration to the default settings.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Restore the community string configuration to the default settings:

   ```
   default snmp-server community [ro|rw]
   ```

Variable definitions

Use the data in the following table to use the **`default snmp-server community [ro|rw]`** command.

Parameters and variables	Description
ro|rw	Restores the read-only community to Public, or the read-write community to Private.

Configuring SNMP sysContact value

About this task

Configure SNMP sysContact value.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure SNMP sysContact value:

   ```
   snmp-server contact
   ```

Variable definitions

Use the data in the following table to use the **`snmp-server contact`** command.

Parameters and variables	Description
text	Specifies the SNMP sysContact value.

Clearing or restoring the SNMP sysContact value to default

About this task

Use the following procedure to clear or to restore the sysContact value to its default value.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. To clear the sysContact value, enter the following command:

   ```
   no snmp-server contact
   ```

   OR

   To restore the sysContact value to the default value:

   ```
   default snmp-server contact
   ```

Enabling or disabling the SNMP server

About this task

Enable or disable the SNMP server.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable or disable the SNMP server:

   ```
   snmp-server {enable|disable}
   ```

Disabling SNMP access

About this task

Disable SNMP access.

Important:

If you disable SNMP access you cannot use Enterprise Device Manager for the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable SNMP access:

   ```
   no snmp-server
   ```

Adding trap receivers to SNMPv3 traps

Before you begin

You must previously configure the community string or user that is specified with a notify view.

About this task

Use the following procedure to add a trap receiver to the SNMPv3 tables.

In the proprietary method, the table has a maximum of four entries, and these entries can generate only SNMPv1 traps. This command controls the contents of the s5AgTrpRcvrTable.

Using the new standards-based SNMP method, you can create several entries in this table, and each can generate v1, v2c, or v3 traps.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2.
   ```
   snmp-server host <host-ip> [port <trap-port>] {v1 <community-string>| v2c <community-string> {inform [timeout <1-2147483647>] [retries <0-255>]} |v3 {auth|no-auth|auth-priv} <username>} {inform [timeout <1-2147483647>] [retries <0-255>]}
   ```

Variable definitions

Use the data in the following table to use the **`snmp-server host`** command.

Parameters and variables	Description
host-ip	Enter a dotted-decimal IP address of a host to be the trap destination.

Table continues…

Parameters and variables	Description
community-string	If you are using the proprietary method for SNMP, enter a community string that works as a password and permits access to the SNMP protocol.
port <trap-port>	If you are using the new standards-based tables, enter a value from 1 to 65535 for the SNMP trap port.
v1 <community-string>	To configure the new standards-based tables, using v1 creates trap receivers in the SNMPv3 MIBs. Multiple trap receivers with varying access levels can be created.
v2c <community-string>	To configure the new standards-based tables, using v2c creates trap receivers in the SNMPv3 MIBs. Multiple trap receivers with varying access levels can be created.
v3 {auth|no-auth|auth-priv}	To configure the new standards-based tables, using v3 creates trap receivers in the SNMPv3 MIBs. Multiple trap receivers with varying access levels can be created. The variables are: • auth: auth specifies SNMPv3 traps are sent using authentication and no privacy; • no-auth: no-auth specifies SNMPv3 traps are sent using with no authentication and no privacy. • auth-priv: specifies traps are sent using authentication and privacy; this parameter is available only if the image has full SHA/DES support.
username	To configure the new standards-based tables; specifies the SNMPv3 user name for trap destination; enter an alphanumeric string.
{inform [timeout <1-2147483647>] [retries <0-255>]}	Generates acknowledge Inform requests.

Deleting trap receivers or restoring the SNMPv3 table to defaults

About this task

Use the following procedure to delete trap receivers from the table or to restore the SNMPv3 MIB table to defaults (that is, to clear the table).

Important:

When you delete a specific SNMP-server host with the **`no`** command or delete all configured SNMP-server hosts with the **`default`** command, the associated filters are also deleted.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Delete trap receivers using the proprietary method syntax:

```
no snmp-server host [<host-ip> [community-string>]]
```

3. Delete trap receivers using the standards-based method syntax:

```
no snmp-server host <host-ip> [port <trap-port>] {v1|v2c|v3
<community-string>]
```

4. Restore the table to defaults (to clear the table):

```
default snmp-server host
```

Variable definitions

Use the data in the following table to use the **`no smp-server host`** command.

Parameters and variables	Description
<host-ip> [<community-string>]	In the proprietary method, enter the following variables: • host-ip: the IP address of a trap destination host. • community-string: the community string that works as a password and permits access to the SNMP protocol. If both parameters are omitted, nothing is cleared. If a host IP is included, the community-string is required or an error is reported.
<host-ip>	Using the standards-based method, enter the IP address of a trap destination host.
port <trap-port>	Using the standards-based method, enter the SNMP trap port.
v1 | v2c | v3 <community-string>	Using the standards-based method, specifies trap receivers in the SNMPv3 MIBs. <community-string>: the community string that works as a password and permits access to the SNMP protocol.

Restoring trap receivers configured ports to default

About this task

Restore all trap receivers configured ports to the default port used for listening traps. The default port is 162.

Procedure

1. Enter Global Configuration mode:

```
enable

configure terminal
```

2. Restore all trap receivers configured ports to the default port:

   ```
   default snmp-server port
   ```

Configuring or clearing the SNMP sysLocation value

About this task

Use the following procedure to configure or to clear the SNMP sysLocation value.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the SNMP sysLocation value:

   ```
   snmp-server location <text>
   ```

3. Clear the SNMP sysLocation value:

   ```
   no snmp-server location <text>
   ```

Variable definitions

Use the data in the following table to use the **`[no] snmp-server location`** command.

Parameters	Description
text	Specify the SNMP sysLocation value; enter an alphanumeric string of up to 255 characters.

Restoring the SNMP sysLocation to the default

About this task

Use the following procedure to restore the SNMP sysLocation to the default value.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Restore sysLocation to the default value:

   ```
   default snmp-server location
   ```

Configuring the SNMP sysName value

About this task

Use the following procedure to configure the SNMP sysName value.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the SNMP sysName value:

   ```
   snmp-server name <text>
   ```

Variable definitions

Use the data in the following table to use the **snmp-server name>** command.

Parameters and variables	Description
text	Specify the SNMP sysName value; enter an alphanumeric string of up to 255 characters. ✱ **Note:** On the console, the SNMP server name is truncated. On the Web interface, the full SNMP server name appears.

Clearing the SNMP sysName value

About this task

Clear the sysName value.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Clear the sysName:

   ```
   no snmp-server name
   ```

   OR

   default snmp-server name

Enabling SNMP server notification control

About this task

Use this procedure to enable or disable SNMP traps for specific ports, or for all switch ports.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable SNMP traps for specific ports, or for all switch ports:

   ```
   snmp-server notification-control <WORD> <portlist>
   ```

3. Disable SNMP traps for specific ports, or for all switch ports:

   ```
   no snmp-server notification-control <WORD> <portlist>
   ```

Variable definitions

Use the data in the following table to use the

Variable	Value
<portlist>	Specifies a port or group of ports. If you do not specify a port or group of ports, notification control is enabled for all switch ports.
<WORD>	Specifies a character string or OID describing the notification type. An example of a character string describing the notification type is, **linkDown**, **linkup**. An example of an OID describing the notification type is, **1.3.6.1.6.3.1.1.5.3, 1.3.6.1.6.3.1.1.5.4**.

Setting SNMP server notification control to default

About this task

Use this procedure to set SNMP traps to the default value (disabled).

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Set SNMP server notification control to default:

```
default snmp-server notification-control <WORD> <portlist>
```

Variable definitions

Use the data in the following table to use the

Variable	Value
<portlist>	Specifies a port or group of ports. If you do not specify a port or group of ports, the notification control is set to default globally.
<WORD>	Specifies a character string or OID describing the notification type. An example of a character string describing the notification type is, **linkDown**, **linkup**. An example of an OID describing the notification type is, **1.3.6.1.6.3.1.1.5.3, 1.3.6.1.6.3.1.1.5.4**.

Creating an SNMPv3 user

About this task

Use the following procedure to create an SNMPv3 user.

For each user, you can create three sets of read/write/notify views:

- for unauthenticated access
- for authenticated access
- for authenticated and encrypted access

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   configure terminal
   ```

2. Create an SNMPv3 user.

   ```
   snmp-server user [engine-id <engine-id>] <username>[[read-view
   <view-name>] [write-view <view-name>] [notify-view <view-name>]]
   md5|sha <password> [[read-view <view-name>] [write-view <view-name>]
   [notify-view <view-name>]] {3des|aes|des} <password> [read-view
   <view-name>] [write-view <view-name>] [notify-view <view-name>]
   ```

Variable definitions

Use the data in the following table to use the **`snmp-server user`** command.

Parameters	Description
username	Specifies the user name. Enter an alphanumeric string of up to 255 characters.
md5 <password>	Specifies the use of an md5 password. <password> specifies the new user md5 password; enter an alphanumeric string. If this parameter is omitted, the user is created with only unauthenticated access rights.
read-view <view-name>	Specifies the read view to which the new user has access: • view-name: specifies the viewname; enter an alphanumeric string of up to 32 characters.
write-view <view-name>	Specifies the write view to which the new user has access: • view-name: specifies the viewname; enter an alphanumeric string that can contain at least some of the non alphanumeric characters.
notify-view <view-name>	Specifies the notify view to which the new user has access: • view-name: specifies the viewname; enter an alphanumeric string that can contain at least some of the non alphanumeric characters.
SHA	Specifies SHA authentication.
3DES	Specifies 3DES privacy encryption.
AES	Specifies AES privacy encryption.
DES	Specifies DES privacy encryption.
engine-id	Specifies the SNMP engine ID of the remote SNMP entity.

The **`sha`** and **`3des/aes/des`** parameters are only available if the switch/stack image has SSH support.

For authenticated access, you must specify the md5 or sha parameter. For authenticated and encrypted access, you must also specify the 3des, aes, or des parameter.

For each level of access, you can specify read, write, and notify views. If you do not specify view parameters for authenticated access, the user will have access to the views specified for unauthenticated access. If you do not specify view parameters for encrypted access, the user will have access to the views specified for authenticated access or, if no authenticated views were specified, the user will have access to the views specified for unauthenticated access.

Removing an SNMPv3 user

About this task

Use the following procedure to delete a specified SNMPv3 user.

Procedure

1. Enter Global Configuration mode:

```
enable

configure terminal
```

2. Delete a specified SNMPv3 user:

```
no snmp-server user [engine-id <engineid>] <username>
```

Variable definitions

Use the data in the following table to use the **`no snmp-server user`** command.

Parameters and variables	Description
[engine-id <engine ID>]	Specifies the SNMP engine ID of the remote SNMP entity.
username	Specifies the user to be removed.

Creating an SNMPv3 view

About this task

Use the following procedure to create an SNMPv3 view. The view is a set of MIB object instance that can be assessed.

Procedure

1. Enter Global Configuration mode:

```
enable

configure terminal
```

2. Create an SNMPv3 view:

```
snmp-server view <view-name> <OID> [<OID> [<OID> [<OID> [<OID>
[<OID> [<OID> [<OID> [<OID> [<OID>]]]]]]]]]
```

Variable definitions

Use the data in the following table to use the **`snmp-server view`** command.

Parameters and variables	Description
viewname	Specifies the name of the new view; enter an alphanumeric string.
OID	Specifies Object identifier. OID can be entered as a dotted form OID. Each OID must be preceded by a + or - sign (if this is omitted, a + sign is implied). The + is not optional. For the dotted form, a sub-identifier can be an asterisk, indicating a wildcard. Here are some examples of valid OID parameters: • sysName

Table continues…

Parameters and variables	Description
	• +sysName • -sysName • +sysName.0 • +ifIndex.1 • -ifEntry.*.1 (this matches all objects in the ifTable with an instance of 1; that is, the entry for interface #1) • 1.3.6.1.2.1.1.1.0 (the dotted form of sysDescr) The + or - indicates whether the specified OID is included in or excluded from, respectively, the set of MIB objects that are accessible using this view. For example, if you create a view like this: • snmp-server view myview +system -sysDescr And you use that view for the read-view of a user, then the user can read only the system group except for sysDescr. **Important:** There are ten possible OID values.

Removing an SNMPv3 view

About this task

Use the following procedure to delete an SNMPv3 view.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Delete an SNMPv3 view:

   ```
   no snmp-server view <viewname>
   ```

Variable definitions

Use the data in the following table to use the **`no snmp-server view`** command.

Parameters and variables	Description
viewname	Specifies the name of the view to be removed. If no view is specified, all views are removed.

snmp-server host for old-style table command

The **snmp-server host** for old-style table command adds a trap receiver to the old-style trap-receiver table. The table has a maximum of four entries, and the entries can generate only SNMPv1 traps. This command controls the contents of the s5AGTrpRcvrTable, which is the set of trap destinations controlled by the SNMP Configuration screen in the console interface.

The syntax for the **snmp-server host** for old-style table command is

```
snmp-server host <host-ip> [port <1-65535>] <community-string>
```

Run the **snmp-server host** for old-style table command in Global Configuration command mode.

Table 24: snmp-server host for old-style table command parameters and variables on page 234 describes the parameters and variables for the **snmp-server host** for old-style table command.

Table 24: snmp-server host for old-style table command parameters and variables

Parameters and variables	Description
port <1-65535>	Assign SNMP trap port.
<host-ip>	Enter a dotted-decimal IP address of a host that is the trap destination.
<community-string>	Enter a community string that works as a password and permits access to the SNMP protocol.

snmp-server host for new-style table command

The **snmp-server host** for new-style table command adds a trap receiver to the new-style configuration (that is, to the SNMPv3 tables). You can create several entries in this table, and each can generate v1, v2c, or v3 traps. You must have previously configured the community string or user that is specified with a notify-view. The syntax for the **snmp-server host** for new-style table command is

```
snmp-server host <host-ip> [port <1-65535>] {v1 <community-string>|v2c
<community-string>| v3 {auth|no-auth|auth-priv} <username>}
```

Run the **snmp-server host** for new-style table command in Global Configuration command mode.

Table 25: snmp-server host for new-style table command parameters and variables on page 235 describes the parameters and variables for the **snmp-server host** for new-style table command.

Table 25: snmp-server host for new-style table command parameters and variables

Parameters and variables	Description
<host-ip>	Enter a dotted-decimal IP address of a host (trap destination).
port <1-65535>	Assign SNMP trap port.
v1 <community-string>	Using v1 creates trap receivers in the SNMPv3 MIBs. You can create multiple trap receivers with varying access levels.
v2c <community-string>	Using v2c creates trap receivers in the SNMPv3 MIBs. You can create multiple trap receivers with varying access levels.
v3 {auth|no-auth|auth-priv}	Using v3 creates trap receivers in the SNMPv3 MIBs. You can create multiple trap receivers with varying access levels. Enter the following variables: • **`auth|no-auth`**: specifies whether SNMPv3 traps are authenticated • **`auth-priv`**: this parameter is available if the image has full SHA/DES support.
<username>	The SNMPv3 user name for trap destination; enter an alphanumeric string.

Creating an initial set of configuration data for SNMPv3

About this task

Use the following procedure to create an initial set of configuration data for SNMPv3. This configuration data follows the conventions described in the SNMPv3 standard (in RFC 3414and 3415). The data consists of a set of initial users, groups, and views.

Important:

This command deletes all existing SNMP configurations, so use with caution.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Create an initial set of configuration data:

   ```
   snmp-server bootstrap <minimum-secure>|<semi-secure> |<very-secure>
   ```

Variable definitions

Use the data in the following table to use the **`snmp-server bootstrap`** command.

Parameters and variables	Description
<minimum-secure>	Specifies a minimum security configuration that allows read access and notify access to all processes (or Internet views) using no authentication and no privacy; and write access to all processes using authentication and no privacy.
<semi-secure>	Specifies a partial security configuration that allows read access and notify access but no write access to a small subset of system information (or restricted views) using no authentication and no privacy; and read, write, and notify access to all processes using authentication and no privacy. (Refer to RFCs 3414 and 3415 for a list of the MIB views in the semi-secure restricted set.)
<very-secure>	Specifies a maximum security configuration that allows no access to the users.

RADIUS accounting configuration using ACLI

RADIUS accounting utilizes the same network server settings used for RADIUS authentication. For more information about the commands to configure the RADIUS server settings, see Configuring switch RADIUS server settings on page 156.

The RADIUS accounting UDP port is the RADIUS authentication port +1. By default, the RADIUS accounting UDP port is port 1813.

By default, RADIUS accounting is disabled.

Enabling RADIUS server accounting

About this task

Use this procedure to enable RADIUS accounting for a Global, EAPOL, or non-EAPOL RADIUS server.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable RADIUS accounting for a Global RADIUS server:

   ```
   radius server host [<ipaddr> | <ipv6addr>] acct-enable
   ```

3. Enable RADIUS accounting for an EAPOL RADIUS server:

   ```
   radius server host [<ipaddr> | <ipv6addr>] used-by eapol acct-enable
   ```

4. Enable RADIUS accounting for a non-EAPOL RADIUS server:

   ```
   radius server host [<ipaddr> | <ipv6addr>] used-by non-eapol acct-enable
   ```

Variable definitions

Use the data in the following table to use the **radius server host** command.

Variable	Value
<ipaddr>	Specifies the IPv4 address of the RADIUS server for which you want to enable accounting.
<ipv6addr>	Specifies the IPv6 address of the RADIUS server for which you want to enable accounting.

Disabling RADIUS server accounting

About this task

Use this procedure to disable RADIUS accounting for a Global, EAPOL, or non-EAPOL RADIUS server.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   configure terminal
   ```

2. Disable RADIUS accounting for a Global RADIUS server:

   ```
   no radius server host [<ipaddr> | <ipv6addr>] acct-enable
   ```

3. Disable RADIUS accounting for an EAPOL RADIUS server:

   ```
   no radius server host [<ipaddr> | <ipv6addr>] used-by eapol acct-enable
   ```

4. Disable RADIUS accounting for a non-EAPOL RADIUS server:

   ```
   no radius server host [<ipaddr> | <ipv6addr>] used-by non-eapol acct-enable
   ```

Variable definitions

Use the data in the following table to use the **no radius server host** command.

Variable	Value
<ipaddr>	Specifies the IPv4 address of the RADIUS server for which you want to disable accounting.

Table continues…

Variable	Value
<ipv6addr>	Specifies the IPv6 address of the RADIUS server for which you want to disable accounting.

Setting RADIUS server accounting to default

About this task

Use this procedure to set RADIUS accounting for a Global, EAPOL, or non-EAPOL RADIUS server to default.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Set RADIUS accounting for a Global RADIUS server to default:

   ```
   default radius server host [<ipaddr> | <ipv6addr>] acct-enable
   ```

3. Set RADIUS accounting for an EAPOL RADIUS server to default:

   ```
   default radius server host [<ipaddr> | <ipv6addr>] used-by eapol
   acct-enable
   ```

4. Set RADIUS accounting for a non-EAPOL RADIUS server to default:

   ```
   default radius server host [<ipaddr> | <ipv6addr>] used-by non-eapol
   acct-enable
   ```

Variable definitions

Use the data in the following table to use the **`default radius server host`** command.

Variable	Value
<ipaddr>	Specifies the IPv4 address of the RADIUS server for which you want to set accounting to default.
<ipv6addr>	Specifies the IPv6 address of the RADIUS server for which you want to set accounting to default.

Configuring RADIUS interim accounting updates

About this task

Use this procedure to enable or disable RADIUS interim accounting updates and configure the interval timeout period for the updates. You can also set these parameters to default values.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure RADIUS interim accounting updates.

   ```
   radius accounting interim-updates [enable] [interval <seconds>]
   [use-server-interval]
   ```

3. Disable RADIUS interim accounting updates.

   ```
   no radius accounting interim-updates [enable] [use-server-interval]
   ```

4. Set RADIUS interim accounting updates to default values.

   ```
   default radius accounting interim-updates [enable] [interval] [use-
   server-interval]
   ```

Variable definitions

The following table defines parameters that you can enter with the **`radius accounting interim-updates`** command.

Variable	Value
default	Sets specified parameter(s) to their default values.
no	Disables the specified parameter(s).
enable	Enables or disables RADIUS accounting interim updates for the switch. DEFAULT: disabled
interval <seconds>	Specifies the time interval (in seconds) before RADIUS accounting interim updates times out. DEFAULT: 600
use-server-interval	Enables or disables the use of the RADIUS server applied timeout interval for interim updates. DEFAULT: enabled

Viewing RADIUS interim accounting updates information

About this task

Displays information about RADIUS interim accounting updates configuration.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display RADIUS interim accounting updates information.

   ```
   show radius accounting interim-updates
   ```

Example

```
Switch#show radius accounting interim-updates
RADIUS accounting interim-updates: Disabled
RADIUS accounting interim-updates interval: 600
RADIUS accounting use-server-interfal: Enabled
Switch#
```

TACACS+ configuration using ACLI

This section describes how you configure TACACS+ to perform AAA services for system users.

Configuring switch TACACS+ server settings

About this task

Configures switch TACACS+ server settings to add a TACACS+ server to your system.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure switch TACACS+ server settings.

   ```
   tacacs server { [host <host_addr>] [secondary-host <sec_host_addr>]
   [key <key>] [port <1-65535>] }
   ```

3. Clear switch TACACS+ server settings.

   ```
   no tacacs server { [host] [secondary-host] [key] [port] }
   ```

4. Restore switch TACACS+ server settings to default.

   ```
   default tacacs server { [host] [secondary-host] [key] [port] }
   ```

Variable definitions

The following table defines parameters that you can enter with the **`tacacs server`** command.

Variable	Value
no	Disables or clears the TACACS+ server settings.
default	Restores the TACACS+ server settings to default values.

Table continues…

Variable	Value
host<*host_addr*>	Specifies the IP address of the primary host you want to add or configure.
secondary-host<*sec_host_addr*>	Specifies the IP address of the secondary host. The secondary host is used only if the primary server does not respond.
key	Specifies the secret authentication and encryption key used for all communications between the NAS and the TACACS+ server. The key, also referred to as the shared secret, must be the same as the one identified on the server. You are prompted to confirm the key when you enter it. ❗ **Important:** The key parameter is a required parameter when you create a new server entry. The parameter is optional when you are modifying an existing entry.
port<*1–65535*>	Specifies the TCP port for TACACS+. DEFAULT: 49

Enabling remote TACACS+ services

Before you begin

- Configure a TACACS+ server on the switch

About this task

Enables remoteTACACS+ services to provide services to remove users over serial or Telnet conections.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable remote TACACS+ services for serial connections.

   ```
   cli password serial tacacs
   ```

3. Enable remote TACACS+ services for Telent connections.

   ```
   cli password telnet tacacs
   ```

Enabling or disabling TACACS+ authorization

About this task

Enables or disables TACACS+ authorization globally on the switch.

TACACS+ authorization is disabled by default.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable TACACS+ authorization.

   ```
   tacacs authorization enable
   ```

3. Disable TACACS+ authorization.

   ```
   tacacs authorization disable
   ```

Configuring TACACS+ authorization privilege levels

About this task

Configures TACACS+ authorization privilege levels to specify the privilege levels to which TACACS+ authorization applies.

The default authorization level is NONE.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure TACACS+ authorization privilege levels.

   ```
   tacacs authorization { ALL | <level> | NONE }
   ```

Variable definitions

The following table defines parameters that you can enter with the **`tacacs authorization level`** command.

Variable	Value
ALL	Enables authorization for all privilege levels.

Table continues…

Variable	Value
<level>	Specifies integer values in the range of 0–15, indicating the privilege levels for which authorization is enabled. You can enter a single level, a range of levels, or several levels. For any levels you do not specify, authorization does not apply, and users assigned to these levels can execute all commands.
NONE	Authorization is not enabled for privilege levels. All users can execute commands available on the switch.

Enabling or disabling TACACS+ accounting

About this task

Enables or disables TACACS+ accounting globally on the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable TACACS+ accounting.

   ```
   tacacs accounting enable
   ```

3. Disable TACACS+ accounting.

   ```
   tacacs accounting disable
   ```

Configuring the switch TACACS+ level

About this task

Configures the switch TACACS+ level to select a new level for a switch or use the last configured level.

The default switch TACACS+ level is 15.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure a new TACACS+ level for a switch.

```
tacacs switch level [<1-15>]
```

3. Use the last configured TACACS+ level for a switch.

   ```
   tacacs switch back
   ```

Viewing TACACS+ information

About this task

Displays TACACS+ information.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display TACACS+ information.

   ```
   show tacacs
   ```

Example

```
Switch#show tacacs
Primary Host: 0.0.0.0
Secondary Host: 0.0.0.0
Port: 49
Key: ***************
TACACS+ authorization is disabled
Authorization is enabled on levels : 2-9
TACACS+ accounting is disabled
Switch#
```

Configuring IP Manager

To configure the IP Manager to control management access to the switch:

- Enable IP Manager.
- Configure the IP Manager list.

Enabling or disabling IP Manager

About this task

Enables IP Manager to control Telnet, SNMP, or HTTP access.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

```
configure terminal
```

2. Enable IP Manager control.

   ```
   ipmgr {telnet | snmp | web | ssh }
   ```

3. Disable IP Manager control.

   ```
   no ipmgr {telnet | snmp | web | ssh }
   ```

Variable definitions

The following table defines parameters that you can enter with the **ipmgr** command.

Variable	Value
telnet	Enables the IP Manager list check for Telnet access.
snmp	Enables the IP Manager list check for SNMP, including EDM.
web	Enables the IP Manager list check for web connections.
ssh	Enables IP Manager control over SSH sessions.
no	Disables IP Manager for a management system.

Configuring the IP Manager list

About this task

Specify the source IP addresses or address ranges that have access to the switch or stack when IP Manager is enabled.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Specify the source IP addresses or address ranges that have access to the switch or stack when IP Manager is enabled.

   `ipmgr source-ip <list_ID> <ipv4_addr> [mask <mask>]` for IPv4 entries with list ID between 1 and 50

   OR

   `ipmgr source-ip <list_ID> <ipv6_addr/prefix>` for IPv6 entries with list ID between 51 and 100

3. Deny access to the switch or stack for specified source IP addresses or address ranges.

   ```
   no ipmgr source-ip <list_ID>
   ```

Note:

Variable definitions

The following table defines parameters that you can enter with the **`ipmgr`** command.

Variable	Value
<list_ID>	Specifies an integer value. A value In the range of 1 to 50 uniquely identifies an IPv4 entry in the IP Manager list. A value in the range of 51 to 100 uniquely identifies an IPv6 entry in the IP Manager list.
<ipv4_addr>	Specifies the source IP address from which access is allowed. Enter the IP address either as an integer or in dotted-decimal notation.
<ipv6addr/prefix>	Specifies the source IPv6 address and prefix form which access is allowed.
mask*<mask>*	Specifies the subnet mask from which access is allowed. Enter the IP mask in dotted-decimal notation.
no	Denies access to the switch or stack for specified source IP addresses or address ranges. Both the IP address and mask for the specified entry are set to 255.255.255.255 for IPv4, and to ffff.ffff.ffff.ffff.ffff.ffff.ffff.ffff/128 for IPv6 entries. If you do not specify a <list_ID> value, the command resets the entire list to factory defaults.

Viewing IP Manager settings

About this task

Displays IP Manager settings.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display IP Manager settings.

   ```
   show ipmgr [ IPv4 ] [ IPv6 ]
   ```

Example

```
Switch#show ipmgr IPv4
TELNET Access: Enabled
SNMP Access:   Enabled
WEB Access:    Enabled
SSH Access:    Disabled
```

```
TELNET IP List Access Control: Enabled
SNMP IP List Access Control:   Enabled
WEB IP List Access Control:    Enabled
SSH IP List Access Control:    Enabled
Allowed Source IP Address  Allowed Source Mask
-------------------------  -------------------
1  0.0.0.0                    0.0.0.0
2  255.255.255.255            255.255.255.255
3  255.255.255.255            255.255.255.255
4  255.255.255.255            255.255.255.255
5  255.255.255.255            255.255.255.255
6  255.255.255.255            255.255.255.255
...
Switch#
Switch#show ipmgr ipv6
TELNET Access: Enabled
SNMP Access:   Enabled
WEB Access:    Enabled
SSH Access:    Disabled
TELNET IP List Access Control: Enabled
SNMP IP List Access Control:   Enabled
WEB IP List Access Control:    Enabled
SSH IP List Access Control:    Enabled
Allowed Source IPv6 Address
----------------------------------------------
51 ::/0
52 ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff/128
53 ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff/128
54 ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff/128
55 ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff/128
...
```

Setting the user name and password

The username authentication feature enhances the security level of the switch by adding a user name field to the existing security infrastructure. This feature integrates the local authentication methods in a general and commonly accepted user name — password framework.

Setting user name and password

About this task

Configures the system user name and password for serial console port, Telnet, and EDM access to a switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the system user name and password.

```
username <user-name> <password> [ro|rw]
```

3. Set the read-only and read-write user name to default values.

```
default username [ro|rw]
```

Variable definitions

Use the data in the following table to use the **`username`** command.

Variable	Value
<username> <password>	Enter your user name for the first variable, and your password for the second variable. The default user name values are RO for read-only access and RW for read/write access.
ro | rw	Sets the read-only (ro) user name or the read-write (rw) user name. If you omit this optional variable, the command applies to both read-only and read-write users.

Setting ACLI password

About this task

Assigns passwords for selected types of access using ACLI, Telnet, or RADIUS security.

This procedure changes the password only and does not affect the configured user name.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Change the read-only and read-write passwords for serial console port and Telnet access to a switch.

```
cli password {read-only | read-write} [<password>]
```

3. Change the password authentication type for serial console port or Telnet access to a switch.

```
cli password [serial | telnet ] [local | none | radius | tacacs]
```

Variable definitions

Use the data in the following table to use the **`cli password`** command.

Variable	Value
read-only|read-write	Modify the read only password or the read/write password.
<password>	Specify the password. **Important:** This parameter is not available when Password Security is enabled, in which case the switch prompts you to enter and confirm the new password.
serial | telnet	Modify the password for serial console access or for Telnet access.
switch | stack	Modify the password for a standalone switch or switches in a stack.
none | local | radius | tacacs	Indicates the password type you are modifying: • none: disable the password • local: uses the locally defined password for serial console or Telnet access. • radius: uses RADIUS authenticatin for serial console or Telnet access. • tacacs: uses TACACS+ authentication, authorization, and accounting (AAA) services for serial console or Telnet access.

Viewing the user name and password configuration

About this task

Displays the current user name and password authentication configuration for the switch.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display current user name and password authentication configuration.

   ```
   show cli password [type]
   ```

Example

```
Switch#show cli password type
Console Password Type: Local Password
Telnet Password Type: None
Switch#
```

Variable definitions

Variable	Value
type	Displays the current password type configured for serial console and Telnet access. Values include: • local: the system local password is used • none: no password is used • radius: RADIUS password authentication is used • tacacs: TACACS+ AAA services are used

Changing the RADIUS password

Before you begin

- The switch must be running a secure software image.
- You must have at least one configured and reachable RADIUS server in your network.
- You must have enabled RADIUS encapsulation MS-CHAPv2

About this task

Changes the RADIUS password once connected to the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Change RADIUS password.

   ```
   cli password change
   ```

Example

```
Switch>enable
Switch#config t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#no radius-server encapsulation ms-chap-v2
Switch(config)#cli password change
% Enable radius MSCHAPV2 encapsulation first.
Switch(config)#radius-server encapsulation ms-chap-v2
Switch(config)#cli password change
Changing password for user: rw
Enter old password         : ******
Enter New Password         : *********
Re-enter New Password      : *********
Switch(config)#
```

Configuring password security

ACLI commands detailed in this section are used to manage password security features. These commands can be used in the Global Configuration and Interface Configuration command modes.

Enabling or disabling password security

About this task

Enables or disables the password security feature.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable password security.

   ```
   password security
   ```

3. Disable password security.

   ```
   no password security
   ```

Configuring password retry attempts

About this task

Configures the number of times a user can retry a password. The default is three.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the number of retry attempts.

   ```
   telnet-access retry <1-100>
   ```

Configuring password aging-time

About this task

Use this procedure to configure password validity period. By default, the value is 0 and the password does not age-out.

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`

2. Configure password aging time:

   `password aging-time [username <name>]<0-365>`

3. Return password aging-time to default value:

   `default password aging-time`

4. Verify the settings:

   `show password aging-time`

Example

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#password aging-time 10
Switch(config)#show password aging-time
Global aging time: 10 days
Switch(config)#default password aging-time
Switch(config)#show password aging-time
Global aging time: 0 days
```

Variable definitions

The following table describes variables that you use with the **`password aging-time`** command.

Variable	Definition
<0–365>	Specifies the number of days the password remains valid. By default, the password aging-time is 0 (disabled) and it will not age out. If the password aging-time is 1, the password must be changed every day.
username	Sets the number of days the password remains valid for a specific user.

Configuring password check-repeated

About this task

Use this procedure to allow or forbid repeated consecutive characters within password. For example, aadfjkl, 12245678, bbbbbbbb, and others.

By default, this feature is enabled and repeated characters within password are not allowed.

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`

2. Configure password check-repeated:

   `password check—repeated [enable | disable]`

3. Return check-repeated to default value (enabled):

   `default password check—repeated`

4. Verify the settings:

   `show password check-repeated`

Example

```
Switch# show password check-repeated
Check-repeated-characters option is enabled
```

Variable definitions

The following table describes variables that you use with the **`password check-repeated`** command.

Variable	Definition
disable	Accepts repeated consecutive characters.
enable	Forbids repeated consecutive characters. Default is enabled.

Configuring password check-sequential

About this task

Use this procedure to allow or forbid sequential characters in the password.

By default, this feature is enabled and you cannot create password with sequential characters. For example, password with sequential characters can be abcdefgh, hgfedcba, qwertyui, iuytrewq, 12345678, or 87654321.

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`

2. Configure password check-sequential:

   `password check—sequential [enable | disable]`

3. Return check-sequential to default value (enabled):

   ```
   default password check—sequential
   ```

4. Verify the settings:

   ```
   show password check-sequential
   ```

Example

```
Switch# show password check-sequential
Check-sequential-characters option is enabled
```

Variable definitions

The following table describes variables that you use with the **`password check-sequential`** command.

Variable	Definition
disable	Accepts repeated sequential characters.
enable	Forbids repeated sequential characters. Default is enabled.

Configuring password complexity

About this task

You can configure minimum number of characters that must be used in the password from each character type. The character types are lowercase, uppercase, number and special characters. By default, the value of each character type is 0 and the complexity rule is not applied.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure password complexity:

   ```
   password complexity [lower—case <0–9> | numeric <0–9> | special <0–9> | upper-case <0–9>]
   ```

3. Return password complexity to default value:

   ```
   default password complexity
   ```

4. Verify the settings:

   ```
   show password complexity
   ```

Example

```
Switch>enable
Switch#configure terminal
```

```
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#password complexity lower-case 0
Switch(config)#password complexity numeric 3
Switch(config)#password complexity special 1
Switch(config)#password complexity upper-case 2
Switch(config)#show password complexity
Complexity:2-0-3-1
Upper-case: 2
Lower-case: 0
Numeric: 3
Special: 1
```

Variable definitions

The following table describes variables that you use with the **password complexity** command.

Variable	Definition
0.0.0.0	Complexity default value.
lower-case	Specifies the minimum number of lower-case characters that can be included in the password.
numeric	Specifies the minimum number of numeric characters that can be included in the password.
special	Specifies the minimum number of special characters (!, @, #, $, %, ^, &, *, (,), -, +, =, _) that can be included in the password.
upper-case	Specifies the minimum number of upper-case characters that can be included in the password.

Configuring password delay-time

About this task

Configure the amount of delay time after three failed login attempts. The default value is 60 seconds.

If the delay-time is configured as 0 second, then there is no delay.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure password delay-time:

   ```
   password delay—time <0-3600>
   ```

3. Restore password delay-time to default:

   ```
   default password delay—time
   ```

4. Verify the settings:

```
show password delay-time
```

Example

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#default password delay-time
Switch(config)#show password delay-time
Delay-time is: 60 seconds


Switch(config)#password delay-time 20
Switch(config)#show password delay-time
Delay-time is: 20 seconds
```

Variable definitions

The following table describes variables that you use with the **`password delay-time`** command.

Variable	Definition
<0–3600>	Specifies the amount of delay time after 3 login attempts in seconds. Default is 60 seconds.

Configuring password login failure notification message

About this task

Configure the notification message to users encountering a login failure. By default, there is no notification message.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure password login-failure-notification. The notification message must not have space:

   ```
   password login—failure—notification <message>
   ```

3. Verify the notification message.

   ```
   show password login—failure—notification
   ```

Example

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#password login-failure-notification
ifuhaveforgottonyourpassword,contactadministrator
Switch(config)#show password login-failure-notification
Failure-login-notification is: ifyouhaveforgottonyourpassword,contactadministrator
```

Variable definitions

The following table describes variables that you use with the **`password login-failure-notification`** command.

Variable	Definition
<Word>	Specifies the notification message that the user sees for incorrect login. Maximum 99 characters.

Configuring minimum password length

About this task

Configure minimum password length. By default, the password minimum length is eight characters.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the minimum length for a password:

   ```
   password min-length <8-255>
   ```

3. Restore the minimum length of a password to default value:

   ```
   default password min-length
   ```

4. Verify the settings:

   ```
   show password min-length
   ```

Example

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#password min-length 10
Switch(config)#show password min-length
Minimum password length: 10

Switch(config)#default password min-length
Switch(config)#show password min-length
Minimum password length: 8
```

Variable definitions

The following table describes variables that you use with the **`password min-length`** command.

Variable	Definition
<8-255>	Specifies the length interval. Default is 8.

Configuring password notifications

About this task

Configure the password expiration notifications. The password expiration notification appears when logged on using console, telnet or SSH. By default, the expiry notification appears before 10 days.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure password expiry notifications:

   ```
   password notifications <1–90>
   ```

3. Restore password expiry notification to default value:

   ```
   default password notifications
   ```

4. Verify the settings:

   ```
   show password notifications
   ```

Example

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#password notifications 14
Switch(config)#show password notifications
Pre-expiration notification interval 14 days


Switch(config)#default password notifications
Switch(config)#show password notifications
Pre-expiration notification interval 10 days
```

Variable definitions

The following table describes variables that you use with the **`password notifications`** command.

Variable	Definition
<1–90>	Specifies the notification interval in days before password expires. Default is 10 days.

Configuring force password change on first login

About this task

Configure force password change on first login. By default, the force password change is disabled.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure password change on first login:

   ```
   password password-change-on-first-login [disable | enable]
   ```

3. Restore to default value:

   ```
   default password password-change-on-first-login
   ```

4. Verify the settings:

   ```
   show password password-change-on-first-login
   ```

Example

```
Switch# show password password-change-on-first-login
Password-change-on-first-login option is disabled
```

Variable definitions

The following table describes variables that you use with the **`password password-change-on-first-login`** command.

Variable	Definition
disable	Disables password change on first login. Default is disabled.
enable	Enables password change on first login

Configuring maximum number of password changes

About this task

Configure the maximum number of password changes per day.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure password change rate limiter:

   ```
   password password-change-rate-limiter <1–10>
   ```

3. Restore to default value:

   ```
   default password password-change-rate-limiter
   ```

4. Verify the settings:

   ```
   show password password-change-rate-limiter
   ```

Example

```
Switch# show password password-change-rate-limiter
Maximum number of password changes per day is: 1
```

Variable definitions

The following table describes variables that you use with the **`password password-change-rate-limiter`** command.

Variable	Definition
<1–10>	Specifies the maximum number of password changes allowed per day. Default is 1.

Configuring password history

About this task

Configure the maximum number of passwords retained in history. You can configure the switch to keep a maximum history of the last 12 passwords. Default password history is 1.

For example, if the password history size is 3 and you set the password for the fourth time, you can reuse the password that you used the first time. You cannot reuse a password stored in history.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure password history:

   ```
   password password-history <0–12>
   ```

3. Return password history to default value:

   ```
   default password password-history
   ```

4. Verify the settings:

   ```
   show password password-history
   ```

Example

```
Switch# show password password-history
Maximum number of passwords in history: 1
```

Variable definitions

The following table describes variables that you use with the **`password password-history`** command.

Variable	Definition
<0-12>	Specifies the number of passwords retained in history. Default is 1.

Configuring password unlock timer

About this task

Configure the number of days after which a disabled user account due to inactive period is re-enabled.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure password unlock timer:

   ```
   password unlock-timer <1-365>
   ```

3. Disable or return password unlock timer to default value:

   ```
   default password unlock-timer
   ```

4. Verify the settings:

   ```
   show password unlock-timer
   ```

Example

```
Switch# show password unlock-timer
Unlock-timer value is 1 days
```

Variable definitions

The following table describes variables that you use with the **`password unlock-timer`** command.

Variable	Definition
<1-365>	Specifies the number of days after which a disabled user account due to inactivity period is re-enabled. Default is 7 days.

Configuring username inactive period

Use the following procedure to configure the number of days after witch a user account becomes disabled if he doesn't use the account.

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`

2. Configure username inactive period:

   `username <username> inactive-period <0-360>`

3. Disable or return username inactive period to default value:

   `default username <username>`

4. Verify the settings:

   `show username <username>`

Example

The following example displays sample output for the `username inactive-period` command.

```
Switch# show username RW
Inactive period:    20 days
```

Variable definitions

Use the data in the following table to use the `username inactive period` command.

Variable	Definition
<0-360>	Specifies the number of days after which a user is disabled if he does not use the account. Default is 0 days.

Configuring the lockout retries

Use the following procedure to configure the number of session retries before a user is locked.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the lockout retries:

   ```
   username lockout-retries <0-100>
   ```

Variable definitions

Use the data in the following table to use the **`lockout-retries`** command.

Variable	Value
<0–100>	Specifies the number of retries in a session before a user is locked out.

Configuring multiple local read-write (RW) and read-only (RO) users accounts

Use the following procedure to create, modify and delete local users.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. To create a user, enter the following command:

   ```
   username add <username> role-name [RO|RW] [password]
   ```

3. To delete a user, enter the following command:

   ```
   no username <username>
   ```

4. To enable a user, enter the following command:

   ```
   username <username> enable
   ```

5. To disable a user, enter the following command:

```
no username <username> enable
```

6. To change the password for a specific user, enter the following command:

   ```
   username <username> password
   ```

7. To change the password for the current user, enter the following command:

   ```
   username password
   ```

8. To modify user privileges, enter the following command:

   ```
   username <username> role {RW|RO}
   ```

Variable Definitions

Variable	Value
<username>	Specifies the user name.

Displaying local user information

Use the following procedure to display local user information.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display all users currently logged on to the system:

   ```
   show who
   ```

3. Display all usernames and roles:

   ```
   show username
   ```

4. Display information related to a specific user:

   ```
   show username <username>
   ```

5. Display role-related information:

   ```
   show role {RO|RW}
   ```

Variable Definitions

Variable	Value
<username>	Specifies the user name.

Configuring lockout for failed logon attempts

Use the information in this section to configure the lockout for failed logon attempts feature.

Configuring the number of retries for failed logon attempts

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the number of times the user can enter an incorrect password before it is locked:

   ```
   username lockout-retries <1-100>
   ```

Variable Definitions

Use the data in the following table to use the **lockout-retries** command.

Variable	Value
<1-100>	Specifies the number of retries in a session before a user is locked out. Enter an integer from 0–100. The default number of retries is 0.

Configuring the lockout interval for failed logon attempts

Use the following procedure to configure the lockout interval for failed logon attempts.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the lockout interval:

   ```
   username lockout-time <0-60>
   ```

Variable Definitions

Use the data in the following table to use the **username lockout-time** command.

Variable	Value
<0-60>	Specifies the duration (in minutes) of session lockout which occurs when the threshold on the number of incorrect loggins is exceeded.

Unlocking a locked-out user

Use the following procedure to unlock a locked-out user.

Before you begin

Log on with RW rights.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Unlock a locked-out user:

   ```
   username <username>  unlock
   ```

Variable Definitions

Use the data in the following table to use the **username unlock** command.

Variable	Value
<username>	Specifies the user account to unlock.

Configuring the inactivity timeout for administrative access

Use the following procedure to configure the inactivity timeout for administrative access.

Following an inactivity period, all administrative connections to the switch (telnet, web or SSH) are closed when a timeout value is reached. The default timeout value is 15 minutes.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Set the inactivity timeout value:

```
telnet-access inactive-timeout <0-60>
```

Variable Definitions

Use the data in the following table to use the **`telnet-access inactive-timeout`** command.

Variable	Value
<0-60>	Specifies in minutes the duration before an inactivity session terminates

ACLI Audit log configuration

ACLI Audit provides a means for tracking ACLI commands.

Displaying the ACLI audit log

About this task

Displays the command history audit log stored in NVRAM.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display the ACLI audit log.

   ```
   show audit log [asccfg | config | serial | telnet]
   ```

Example

```
Switch#show audit log config
Audit Log Save To NVRAM: Enabled
Switch#
```

Variable definitions

The following table defines variable parameters that you enter with the **`show audit log`** command.

Variable	Value
asccfg	Displays the audit log for ASCII configuration.
serial	Displays the audit log for serial connections.
telnet	Displays the audit log for Telnet and SSH connections.
config	Displays the status of activation of the Audit log.

Configuring the ACLI audit log

About this task

Enables or disables the ACLI audit log. You can also set the audit log to default (enabled).

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`

2. Enable ACLI audit log.

   `audit log save`

   OR

   `default audit log`

3. Disable ACLI audit log.

   `no audit log`

Example

```
Switch(config)#default audit log
Switch(config)#show audit log config
Audit Log Save To NVRAM: Enabled
Switch(config)#
```

Clearing the ACLI audit log

About this task

Erases the contents of the ACLI audit log.

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`

2. Clear the ACLI audit log.

   `clear audit log`

   Note:

   If the contents of the ACLI audit log are successfully erased, the following message appears:

   ```
   % Audit log was successfully erased
   ```

If the no-erase audit log flag is set on the switch or you are running the secure software image, the following message appears:

```
% Clearing audit log is not authorized
```

Preventing erasure of the ACLI audit log

About this task

Prevents erasure of the ACLI audit log contents when using the standard software image by applying the no-erase flag.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Prevent erasure of the ACLI audit log.

   ```
   audit log noerase enable
   ```

   ⚠ **Warning:**

   Applying the `audit log noerase enable` command on a switch is a one time function which is non-reversible and is only applicable when the switch is running the standard software image. After the no-erase audit log flag is set, you cannot clear the audit log, even if the switch is re-configured to factory defaults. When you enter the command for the first time on a switch running the standard software image, the following warning message appears:

   ```
   % WARNING: Setting the audit log noerase is a non-reversible command
   Do you want to continue (y/n) ?
   ```

   If the no-erase flag is already set on the switch, the following message appears:

   ```
   % Audit log noerase is already enabled
   ```

Secure Socket Layer services

The following table lists ACLI commands available for working with Secure Socket Layer (SSL).

Table 26: SSL commands

Command	Description
[no] ssl	Enables or disables SSL. The Web server operates in a secure mode when SSL is enabled and in non secure mode when the SSL server is disabled.
[no] ssl certificate	Creates or deletes a certificate. The new certificate is used only on the next system reset or SSL server reset. The new certificate is stored in the NVRAM with the file name SSLCERT.DAT. The new certificate file replaces the existing file. On deletion, the certificate in NVRAM is also deleted. The current SSL server operation is not affected by the create or delete operation.
ssl reset	Resets the SSL server. When SSL is enabled: existing SSL connections are closed, the SSL server is restarted and initialized with the certificate that is stored in the NVRAM. When SSL is not enabled: existing non secure connections are closed, the server is restarted, and non secure operation resumes.
show ssl	Shows the SSL server configuration and SSL server state. See Table 27: Server state information on page 270 for more information.
show ssl certificate	Displays the certificate which is stored in the NVRAM and is used by the SSL server.

The following table describes the output for the `show ssl` command.

Table 27: Server state information

Field	Description
WEB Server SSL secured	Shows whether the Web server is using an SSL connection.
SSL server state	Displays one of the following states: • Un-initialized: The server is not running. • Certificate Initialization: The server is generating a certificate during its initialization phase. • Active: The server is initialized and running.
SSL Certificate: Generation in progress	Shows whether SSL is in the process of generating a certificate. The SSL server generates a certificate during server startup initialization, or ACLI user can regenerate a new certificate.
SSL Certificate: Saved in NVRAM	Shows whether an SSL certificate exists in the NVRAM. The SSL certificate is not present if the system is being initialized for the first time or ACLI user has deleted the certificate.

Configuring the web server for client browser requests

Before you begin

- Enable SSL.

About this task

Configures the web server to respond to HTTPS only, or both HTTPS and HTTP client browser requests when SSL is enabled.

The default is https-only.

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`

2. Configure the web server to respond to HTTPS client browser requests only.

   `https-only`

3. Configure the web server to respond to both HTTPS and HTTP client browser requests.

   `no https-only`

Viewing the web server client browser request configuration

About this task

Displays whether the web server is configured to espond to HTTPS ony, or both HTTPS and HTTP client browser requests when SSL is enabled.

Procedure

1. Enter Privileged EXEC mode:

   `enable`

2. Display web server client browser request configuration.

   `show https-only`

Example

```
Switch#show https-only
HTTPS only: enabled
Switch#
```

Secure Shell protocol configuration using ACLI

Secure Shell (SSH) protocol is used to improve Telnet and provide a secure access to the ACLI interface. There are two versions of the SSH Protocol (SSH1 and SSH2). The switch supports SSH2.

You can use the information in this section to configure and manage SSH.

Displaying SSH information using ACLI

Use this procedure to display general SSH settings and information about all active SSH sessions.

Procedure

1. Enter Privileged EXEC mode:

   `enable`

2. Enter the following command:

   `show ssh {download-auth-key | global | session}`

Example

The following example displays sample output for the **`show ssh global`** command:

```
Switch>enable
Switch#show ssh global
Active SSH Sessions      :  0
Version                  :  Version 2 only
Port                     :  22
Authentication Timeout   :  60
DSA Authentication       :  False
RSA Authentication       :  False
Password Authentication :  True
Auth Key TFTP Server     :  172.16.3.2
DSA Auth Key File Name   :
RSA Auth Key File Name   :
DSA Host Keys            :  Exist
RSA Host Keys            :  Exist
Enabled                  :  True
```

The following example displays sample output for the **`show ssh download-auth-key`** command:

```
Switch>enable
Switch#show ssh download-auth-key
Auth Key TFTP Server     :  172.16.3.2
DSA Auth Key File Name   :
RSA Auth Key File Name   :
Last Transfer Result     :  None
```

Variable definitions

Use the data in the following table to use the **`show ssh`** command.

Variable	Value
download-auth-key	Displays authorization key and TFTP server IP address.
global	Displays general SSH settings.
session	Displays SSH session info.

Enabling SSH using ACLI

Use this procedure to enable SSH in a non-secure mode. If the host keys do not exist, they are generated.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable SSH in a non-secure mode:

   ```
   ssh
   ```

3. Disable SSH for the switch:

   ```
   no ssh {dsa-auth|dsa-auth-key|dsa-host-key| rsa-auth | rsa-auth-key
   | rsa-host-key | pass-auth}
   ```

Variable definitions

Use the data in the following table to use the **ssh** command.

Variable	Value
dsa-auth	Disables SSH DSA authentication.
dsa-auth-key	Deletes the SSH DSA authentication key.
dsa-host-key	Deletes the SSH DSA host key.
rsa-auth	Disables SSH RSA authentication.
rsa-auth-key	Deletes the SSH RSA authentication key.
rsa-host-key	Deletes the SSH RSA host key.
pass-auth	Disables SSH password authentication.

Generating a new SSH DSA host key using ACLI

Use this procedure to generate a new SSH DSA host key for the switch.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Generate a new SSH DSA host key for the switch:

   ```
   ssh dsa-host-key
   ```

3. Delete the switch SSH DSA host key:

   ```
   no ssh dsa-host-key
   ```

Generating a new SSH RSA host key using ACLI

Use this procedure to generate a new SSH RSA host key in the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Generate a new SSH RSA host key in the switch:

   ```
   ssh rsa-host-key
   ```

3. Delete the SSH RSA host key on the switch:

   ```
   no ssh rsa-host-key
   ```

Downloading DSA or RSA authentication keys using ACLI

Use this procedure to download the DSA or RSA authentication key into the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Download the DSA or RSA authentication key into the switch:

   ```
   ssh download-auth-key {[address <A.B.C.D > | <WORD>] usb [unit
   <1-8>]}[key-name <WORD>][dsa | rsa ]
   ```

Variable definitions

Use the data in the following table to use the **ssh download-auth-key** command.

Variable	Value
address <*A.B.C.D*> | <*WORD*>	Specifies the address of the TFTP server. • A.B.C.D—specifies the IP address • WORD—specifies the IPv6 address
dsa | rsa	Specifies DSA or RSA authentication key to be downloaded.
key-name <*WORD*>	Specifies the TFTP or USB filename.
unit <*1-8*>	Specifies the unit number in a stack from which to download the SSH auth key using USB.

Deleting the SSH DSA authentication key using ACLI

Use this procedure to delete the SSH DSA authentication key in the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Delete the SSH DSA authentication key in the switch:

   ```
   no ssh dsa-auth-key
   ```

Deleting the SSH RSA authentication key using ACLI

Use this procedure to delete the SSH RSA authentication key in the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Delete the SSH RSA authentication key in the switch:

   ```
   no ssh rsa-auth-key
   ```

Enabling user log-on with an SSH DSA key using ACLI

Use this procedure to enable user log-on with SSH DSA key authentication.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable user log-on with SSH DSA key authentication with either of the following commands:

   ```
   ssh dsa-auth
   ```

   OR

   ```
   default ssh dsa-auth
   ```

3. Disable user log-on with SSH DSA key authentication:

   ```
   no ssh dsa-auth
   ```

Enabling user log-on with an SSH RSA key using ACLI

Use this procedure to enable user log-on with SSH RSA key authentication.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable user log-on with SSH RSA key authentication:

   ```
   ssh rsa-auth
   ```

   OR

   ```
   default ssh rsa-auth
   ```

3. Disable user log-on with SSH RSA key authentication:

   ```
   no ssh rsa-auth
   ```

Enabling user log-on with SSH password authentication using ACLI

Use this procedure to enable user log-on using the SSH password authentication method.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

```
configure terminal
```

2. Enable user log-on using the SSH password authentication method:

   ```
   ssh pass-auth
   ```

   OR

   ```
   default ssh pass-auth
   ```

3. Disable user log-on using the SSH password authentication method:

   ```
   no ssh pass-auth
   ```

Disabling SNMP and Telnet With SSH using ACLI

Use this procedure to disable SNMP and Telnet management interfaces permanently.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   configure terminal
   ```

2. Disable SNMP and Telnet management interfaces permanently:

   ```
   ssh secure [force]
   ```

Variable definitions

Use the data in the following table to use the **`ssh secure`** command.

Variable	Value
force	Skips the confirmation step.

Configuring the TCP port for SSH daemon using ACLI

Use this procedure to configure the TCP port for the SSH daemon.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   configure terminal
   ```

2. Configure the TCP port for the SSH daemon:

   ```
   ssh port <1-65535>
   ```

Variable definitions

Use the data in the following table to use the **`ssh port`** command.

Variable	Value
<1-65535>	Specifies the number of the TCP port to use.

Configuring the default TCP port for the SSH daemon using ACLI

Use this procedure to configure the default TCP port for the SSH daemon.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the default TCP port for the SSH daemon:

   ```
   default ssh port
   ```

Configuring the SSH timeout using ACLI

Use this procedure to configure the SSH authentication timeout, in seconds.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the SSH authentication timeout:

   ```
   ssh timeout <1-120>
   ```

Variable definitions

Use the data in the following table to use the **`ssh timeout`** command.

Variable	Value
<1-120>	Specifies the desired timeout value in seconds.

Configuring the SSH timeout to default using ACLI

Use this procedure to configure the SSH authentication timeout to the default value of 60 seconds.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the SSH authentication timeout to the default value of 60 seconds:

   ```
   default ssh timeout
   ```

Secure Shell Client configuration

Use the procedures in this section to configure and manage Secure Shell Client.

Opening and closing an SSH session involves three actions:

- Connect - make the connection from the CLI user interface.
- Authenticate - the SSH Client uses DSA or RSA authentication keys. If key authentication fails due to non-existent or unaccepted DSA/RSA keys, you can enter a username and password (three tries allowed).
- Close the session - end the SSH session and return to CLI by using by typing a '~' followed by a period (~.).

Configuring SFTP authentication for SSH Client using ACLI

Use this procedure to configure the SFTP authentication method the SSH Client uses for transferring files.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the SFTP authentication method the SSH Client uses for transferring files:

   ```
   sshc authentication {dsa | password | rsa}
   ```

3. Configure the SFTP authentication method SSH Client to the default of DSA:

   ```
   default sshc authentication
   ```

   OR

   ```
   no sshc authentication
   ```

Variable definitions

Use the data in the following table to use the **`sshc authentication`** command.

Variable	Value
dsa	Enables SFTP DSA authentication for SSH Client (default).
password	Enables SFTP password authentication for SSH Client.
rsa	Enables SFTP RSA authentication for SSH Client.

Closing an SSH Client session using ACLI

Use this procedure to close a specific SSH Client session.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Close a specific SSH Client session:

   ```
   sshc close-session <0-8>
   ```

Variable definitions

Use the data in the following table to use the **`sshc close-session`** command.

Variable	Value
<0–8>	Specifies the SSH Client session ID.

Generating an SSH client DSA host key using ACLI

Use the following procedure to generate public and private DSA SSH client host keys for user access authentication.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Generate public and private DSA SSH client host keys for use access authentication:

   ```
   sshc dsa-host-key [force]
   ```

> **Important:**
>
> If you use the **sshc dsa-host-key** command without the *force* option you must remove the current key before you can generate the new key. If a DSA key exists and you use the command without the *force* option the system does not generate a new key. If you use the *force* option, the system generates a new, active DSA key, even in the presence of an existing DSA key. The authentication method remains unchanged.

3. Delete the public or private DSA host keys from NVRAM:

   ```
   no sshc dsa-host-key
   ```

Variable definitions

Use the data in the following table to use the **sshc dsa-host-key** command.

Variable	Value
force	Creates a new DSA key, even in the presence of an existing DSA key.

Generating an SSH client RSA host key using ACLI

Use the following procedure to generate public and private SSH client RSA host keys for user access authentication.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Generate public and private SSH client RSA host keys for user access authentication:

   ```
   sshc rsa-host-key [force]
   ```

   > **Important:**
   >
   > If you use the **sshc rsa-host-key** command without the *force* option you must remove the current key before you can generate the new key. If an RSA key exists and you use the command without the *force* option the system does not generate a new key. If you use the *force* option, the system generates a new, active RSA key, even in the presence of an existing RSA key. The authentication method remains unchanged.

3. Delete public and private RSA host keys from the NVRAM:

   ```
   no sshc rsa-host-key
   ```

   The RSA authentication state remains unchanged.

Variable definitions

Use the data in the following table to use the **`sshc rsa-host-key`** command.

Variable	Value
force	Creates a new RSA key, even in the presence of an existing RSA key.

Connecting SSH to a host using ACLI

Use the following procedure to establish a SSH connection to a host.

About this task

You can use the following command from User EXEC or Privileged EXEC mode.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Establish an SSH connection to a host:

   ```
   ssh <A.B.C.D. | host_name> [username <user_name>] [port <0-65535>]
   ```

   Important:

   When the SSH client connects to a host, if the host is not known to the client, the following message is displayed on the console:

   ```
   The authenticity of host '<host's ip>' can't be established. RSA
   Key with the following SHA256 fingerprint:
   4:90:56:E6:F8:9D:E3:BC:88:10:4F:B4:9B:CD:F4:26:84:6:D6:E1:10:64:
   DD:2E:99:7A:93:27:3B:15:9E:7E. Are you sure you want to continue
   connecting (yes/no)?
   ```

   The first time a user connects to a host, the console displays **fingerprint** and **yes/no** questions for read-write access only. Type `yes` only if the host IP address is reliable (no man-in-the-middle attack happens). After you type `yes`, the following message appears:

   ```
   Warning: Permanently added '<host's IP>' (RSA) to the list of
   known hosts.
   ```

Example

This example displays sample steps for connecting an SSH Client to a host.

```
Switch>enable
Switch#ssh 10.100.54.35
Switch#ssh 10.100.54.35 username laur
Switch#ssh 10.100.54.35 username RW port 22
```

Variable definitions

Use the data in the following table to use the **ssh** command.

Variable	Value
<A.B.C.D. | host_name>	Specifies either the host IP address, or the host name.
username *<user_name>*	Specifies the user name.
port *<0–65535>*	Specifies the TCP port number. Values range from 0 to 65535.

Displaying current SSH client sessions

Use the following procedure to display current SSH client sessions.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display current SSH client sessions:

   ```
   show sshc sessions
   ```

Example

The following example shows sample output for the **show sshc sessions** command.

```
Switch>enable
Switch#show sshc sessions
1 active SSH Session:
----------  -----------------------    ---------------------------
Session ID  Host IP Address            Connection time:
----------  -----------------------    ---------------------------
0               10.100.54.35                   1 minute
```

Displaying SSH client known hosts

Use this procedure to display information about the configuration of SSH client known hosts on the switch.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display information about the configuration of SSH client known hosts on the switch:

   ```
   show sshc known-hosts
   ```

Note:

The **show sshc known-hosts** command is present only on terminals with Read-Write access.

Example

The following example shows sample output for the **show sshc known-hosts** command.

```
Switch>enable
Switch#show sshc known-hosts
IP Address                 SHA-256 Fingerprint
-----------------------    -----------------------------------------------
10.100.54.200              B1:E1:C4:4D:8C:72:3:D:C:16:D6:F7:20:C1:3:C2:
                           DF:83:70:BE:42:EA:AC:6A:5:6F:59:4F:F5:B0:DF:3B
-----------------------    -----------------------------------------------
10.100.54.35               98:62:1:15:90:FD:51:33:98:14:28:DF:BF:28:1B:97:
                           EA:FA:6E:2:75:E9:63:16:69:79:62:DB:8D:CC:2C:55
```

Clearing SSH Client known hosts using ACLI

Use the following procedure to clear the public key of a known host.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Clear the public key of a known host:

   ```
   clear sshc known-host {<A.B.C.D> | <host_name> | <ipv6_address> |
   all}
   ```

Example

The following example displays a sample step for clearing the public key of a known host.

```
Switch>enable
Switch#configure terminal
Switch(config)#clear sshc known-host 172.16.1.12
```

Variable definitions

Use the data in the following table to use the **clear sshc known-host** command.

Variable	Value
all	Specifies the public keys of all known hosts
<A.B.C.D>	Specifies the host IP address.
<host_name>	Specifies the host name.
<ipv6_address>	Specifies the host IPv6 address.

Configuration examples for configuring Secure Shell connections

Establishing an SSH connection to another switch using public key authentication

1. Switch #1: generate a public key using the `sshc dsa-host-key` command.
2. On Switch #1: upload the generated public key using the `sshc upload-auth-key` command.
3. On Switch #2: obtain the public key using the `ssh download-auth-key` command.
4. On Switch #2: verify that SSH DSA authentication is enabled by default by entering the `show sshc` command. If necessary, enable SSH DSA authentication by entering the `ssh dsa-auth` command. Then, enable SSH by entering the `ssh` command.
5. On Switch #1: enter the `<ssh switch two IP> username RW` command.

Establishing an SSH connection to a Linux-PC using public key authentication

1. Generate a public key using the `sshc dsa-host-key` command.
2. Upload the generated public key using the `sshc upload-auth-key` command.
3. On the remote PC, append the public key in the ~user/.ssh/authorized_keys file.
4. On the switch, enter the following command to establish SSH on the PC:

   ```
   ssh <PC IP> username <user>
   ```

Establishing an IPv6 SSH connection to another switch

1. Configure an IPv6 address for each switch, .

   For Switch #1 enter the following commands:

   ```
   ipv6 enable
   int vlan 1
   ipv6 interface enable
   ipv6 address 3000::1000/64
   ```

   For Switch #2 enter the following commands:

   ```
   ipv6 enable
   int vlan 1
   ipv6 interface enable
   ipv6 address 3000::2000/64
   ```

2. Establish a SSH connecting using the IPv6 address.

   - Establish a SSH connection from Switch #1 to Switch #2.
   - On Switch #1 :

     ```
     ssh 3000::2000 user RW
     ```

   - SSH from Switch #1 to Switch #2:
   - On Switch #2:

     ```
     ssh 3000::1000 user RO
     ```

DHCP snooping configuration using ACLI

This section describes how you can configure DHCP snooping to provide security to your network by preventing DHCP spoofing, using ACLI.

⚠ **Warning:**

In Layer 3 mode, you must enable DHCP snooping on the layer 3 VLANs spanning towards the DHCP server. DHCP-relay is also required for the correct functionality.

Configuring DHCP snooping globally using ACLI

Before DHCP snooping can function on a VLAN or port, you must enable DHCP snooping globally. If DHCP snooping is disabled globally, the switch forwards DHCP reply packets to all applicable ports, regardless of whether the port is trusted or untrusted.

Use the following procedure to enable or disable DHCP snooping for the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable DHCP globally.

   ```
   [default] [no] ip dhcp-snooping <enable> <option82>
   ```

Variable definitions

Use the data in the following table to use the **`ip dhcp-snooping`** command.

Variable	Value
<enable>	Enables DHCP snooping globally on the switch.
[default]	Configures DHCP snooping on the switch to default values.
[no]	Disables DHCP snooping globally on the switch.
<option82>	When selected, enables DHCP snooping with Option 82 globally on the switch.

Viewing the global DHCP snooping configuration

Use the following procedure to view the global DHCP snooping configuration to review and confirm the DHCP snooping configuration for the switch.

Procedure

1. Enter User EXEC mode.
2. View the global DHCP snooping configuration.

   ```
   show ip dhcp-snooping
   ```

Configuring VLAN-based DHCP snooping using ACLI

You must enable DHCP snooping separately for each VLAN. If DHCP snooping is disabled on a VLAN, the switch forwards DHCP reply packets to all applicable ports, regardless of whether the port is trusted or untrusted.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable DHCP snooping on a VLAN.

   ```
   [default] [no] ip dhcp-snooping vlan <vidlist> [option82]
   ```

Variable definitions

Use the data in the following table to use the **`ip dhcp-snooping vlan`** command.

Variable	Value
[default]	Configures DHCP snooping on a VLAN to the default value (disabled).
[no]	Disables DHCP snooping on a VLAN. If you do not specify a VLAN ID, DHCP snooping is disabled on all VLANs.
<vidlist>	Specifies the list of preconfigured VLANs on which you want to enable DHCP snooping. The list syntax is (<vlanID> [-<vlanID>][,...]), where each vlan ID is an integer in the range 1–4094.
[option82]	When selected, enables DHCP snooping with Option 82 on a VLAN.

Viewing the VLAN-based DHCP snooping configuration using ACLI

View the VLAN-based DHCP snooping configuration to review and confirm the DHCP snooping configuration for a VLAN.

Procedure

View the VLAN-based DHCP snooping configuration.

```
show ip dhcp-snooping vlan
```

The output displays only the VLANs enabled for DHCP snooping.

Configuring port-based DHCP snooping using ACLI

Configure port-based DHCP snooping to specify whether a port or group of ports are trusted (DHCP replies are forwarded automatically) or untrusted (DHCP replies are filtered through DHCP snooping), and to assign an Option 82 subscriber ID to the port or ports.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Configure port-based DHCP snooping.

   ```
   [default] [no] ip dhcp-snooping [port <portlist>] <trusted|
   untrusted> option82-subscriber-id WORD>
   ```

3. Return DHCP snooping for all interface ports to default values.

   ```
   default ip dhcp-snooping port all
   ```

Variable definitions

The following table defines parameters that you can enter with the **[default] [no] ip dhcp-snooping [port <portlist>] [<trusted|untrusted>] option82-subscriber-id <WORD>** command.

Variable	Value
[default]	Returns a port or range of ports to default DHCP snooping values.
[no]	Removes the Option 82 for DHCP snooping subscriber Id from a port.
<WORD>	Specifies the DHCP Option 82 subscriber Id for the port. Value is a character string between 0 and 64 characters.
<portlist>	Specifies a port or group of ports.
<trusted>	When selected, the port or ports automatically forward DHCP replies.

Table continues…

Variable	Value
<untrusted>	When selected, the port or ports filter DHCP replies through DHCP snooping.

Viewing the port-based DHCP snooping configuration using ACLI

View the port-based DHCP snooping configuration to review and confirm the DHCP snooping configuration for a port or group of ports.

Procedure

View the VLAN-based DHCP snooping configuration

```
show ip dhcp-snooping vlan
```

The output displays only the VLANs enabled for DHCP snooping.

Variable definitions

The following table defines optional parameters that you can enter with the **`show ip dchp-snooping interface [<interface type>] [<portlist>]`** command.

Variable	Value
<interface type>	Specifies the interface type for the port or ports.
<portlist>	Specifies an individual port or list of ports.

Adding static entries to the DHCP binding table using ACLI

Use this procedure to add entries for devices with static IP addresses to the DHCP binding table.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Add entries to the DHCP binding table.

   ```
   ip dhcp-snooping binding <1-4094> <MAC_addr> [ip <IP_addr>] [port
   <LINE>] [expiry <1-4294967295>]
   ```

Variable definitions

The following table defines parameters that you enter with the **`ip dhcp-snooping binding`** command.

Variable	Value
<1-4094>	Specifies the ID of the VLAN that the DHCP client is a member of.
expiry <1-4294967295>	Specifies the time, in seconds, before the DHCP client binding expires.
ip <IP_addr>	Specifies the IP address of the DHCP client.
<MAC_addr>	Specifies the MAC address of the DHCP client.
port <LINE>	Specifies the switch port that the DHCP client is connected to.

Deleting static entries from the DHCP binding table using ACLI

Use this procedure to delete entries for devices with static IP addresses from the DHCP binding table.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Delete entries from the DHCP binding table.

   ```
   no ip dhcp-snooping binding <1-4094> <MAC_addr>
   ```

Variable definitions

The following table defines parameters that you enter with the **`no ip dhcp-snooping binding <1-4094> <MAC_addr>`** command.

Variable	Value
<1-4094>	Specifies the ID of the VLAN that the DHCP client is a member of.
<MAC_addr>	Specifies the MAC address of the DHCP client.

Viewing the DHCP binding table using ACLI

Use this procedure to display DHCP binding table entries.

Procedure

View the DHCP binding table.

```
show ip dhcp-snooping binding
```

Important:

If you apply the **show ip dhcp-snooping binding** command on a large stack with complex configuration, you can experience slow output if this command is executed within 4-5 minutes of the stack being booted or power-cycled. If you wait 5 minutes after the stack is booted or power-cycled before executing this show command, the normal response times will be observed.

Configuring DHCP Snooping external save using ACLI

Use this procedure to save the DHCP Snooping database to an external USB drive or TFTP

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Synchronize the switch with an NTP server.
3. Configure DHCP Snooping external save.

   ```
   ip dhcp-snooping external-save [enable] {[tftp <ipv4address> |
   <ipv6address> | [usb <unit 1-8> ]} filename <filename>
   ```

Variable definitions

The following table defines parameters that you enter with the **`ip dhcp-snooping external-save`** command.

Variable	Value
enable	Enables DHCP Snooping external save.
[tftp <ipv4address> <ipv6address> {<filename>}]	Specifies an IPv4 or IPv6 address for the TFTP server on which to save the DHCP Snooping database, and the name of the file to save.
[usb <1–8>]	Specifies to save the DHCP Snooping database on a USB device and the unit on which the USB drive is located.
filename <filename>	Specifies the filename to apply to the saved DHCP Snooping database.

Configuring DHCP Snooping external save to an SFTP server

Use this procedure to save the DHCP Snooping database to an SFTP server.

Note:

You cannot save the DHCP Snooping database to an SFTP server using a password for authentication, because saving the DHCP snooping database is an automated process, and password authentication requires entering the password each time the saving occurs. Use either RSA key or DSA key authentication for DHCP Snooping external save to an SFTP server.

Before you begin

- Synchronize the switch with an NTP/SNTP server.
- For authentication using an RSA or DSA key, the authentication key must be generated and uploaded to the server.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Save the DHCP Snooping database to an SFTP server If you use an RSA or DSA key for authentication.

   ```
   ip dhcp-snooping external-save sftp <sftp_ip_address> filename
   <filename> username <user_name>
   ```

Variable definitions

Use the data in the following table to use the **`ip dhcp-snooping external-save sftp`** command.

Variable	Value
<sftp_ip_address>	Specifies the IP address for the SFTP server.
<filename>	Specifies the name of the file to save.
<user_name>	Specifies the user name.

Disabling DHCP Snooping external save using ACLI

Use this procedure to disable DHCP Snooping external save for the switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable DHCP Snooping external save.

   ```
   no ip dhcp-snooping external-save enable
   ```

OR

```
default ip dhcp-snooping external-save
```

Restoring the externally-saved DHCP Snooping database using ACLI

Use this procedure to force a restoration of the DHCP Snooping database on the switch from the file previously saved to an external USB drive or TFTP server.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Restore the externally-saved DHCP Snooping database.

   ```
   ip dhcp-snooping external-save restore
   ```

Restoring the externally-saved DHCP Snooping database from an SFTP server

Use this procedure to force a restoration of the DHCP Snooping database on the switch from the file previously saved to an SFTP server.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Restore the externally-saved DHCP Snooping database if you use an RSA or DSA key for authentication.

   ```
   ip dhcp-snooping external-save restore sftp username <user_name>
   ```

   where <user_name> specifies the user name.

   OR

3. Restore the externally-saved DHCP Snooping database if you use a password for authentication.

   ```
   ip dhcp-snooping external-save restore sftp username <user_name>
   password
   ```

   where <user_name> specifies the user name.

Viewing DHCP Snooping external save information using ACLI

Use this procedure to display DHCP Snooping external save configuration information for the switch.

Procedure

Display DHCP Snooping external save configuration information

```
show ip dhcp-Snooping external-save
```

Example

Following is the sample output for the **show ip dhcp-snooping external-save** command.

```
Switch>show ip dhcp-snooping external-save
DHCP Snooping external save: Disabled
DHCP Snooping external device: USB
DHCP Snooping external filename:test1
DHCP Snooping external last sync:
DHCP Snooping external sync flag: True (changes will be synchronized at next write>
Switch>
```

DHCP Snooping Layer 2 configuration using ACLI example

Figure 20: Layer 2 configuration example on page 295 depicts the network setup for this example. PC1 and PC2 act as DHCP clients. The device under test (DUT) is in Layer 2 mode and must be configured with DHCP Snooping to increase network security. The DHCP server and clients must belong to the same L2 VLAN (VLAN #1 by default). You can configure the DHCP client lease time on the DHCP server.

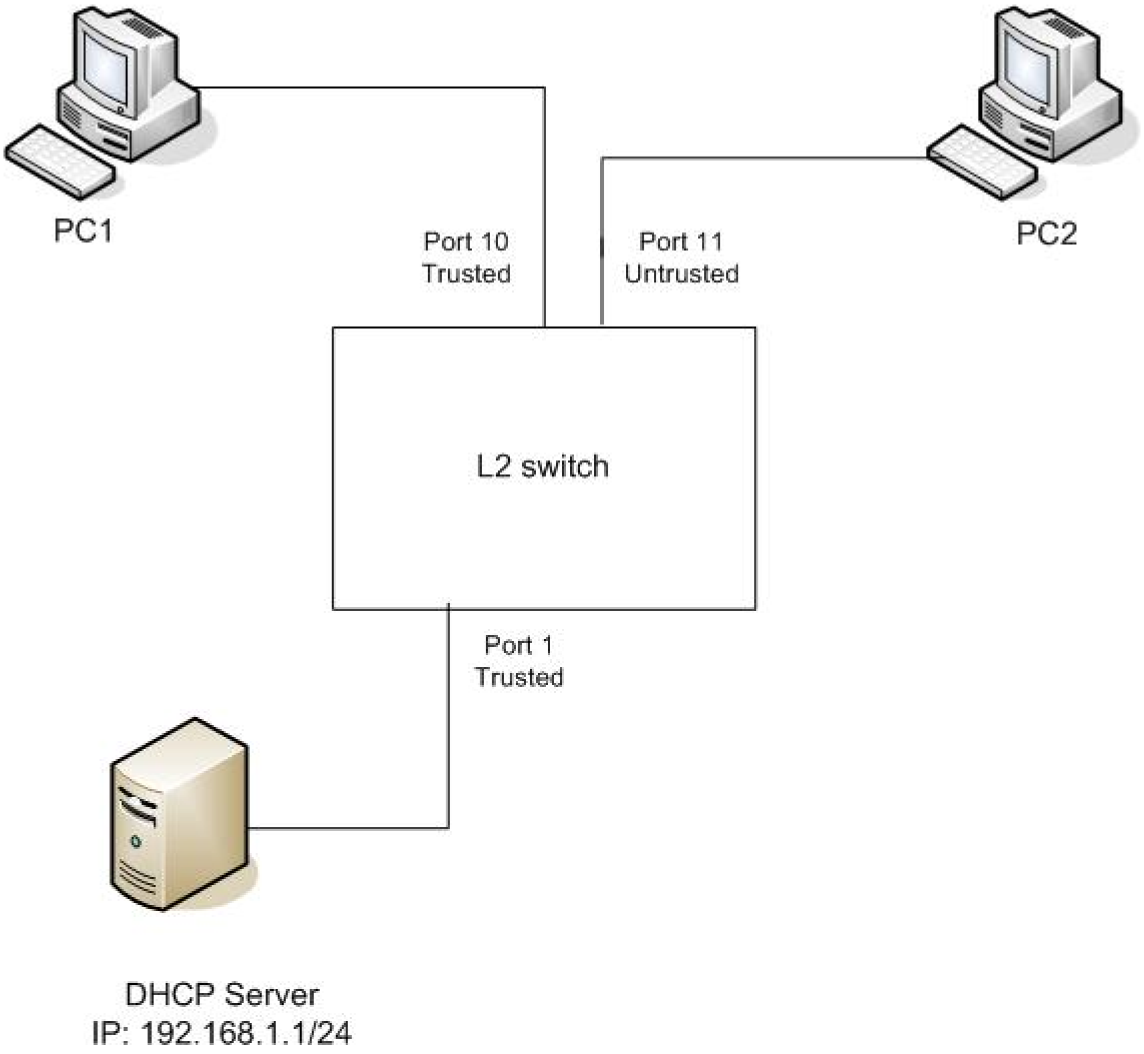


Figure 20: Layer 2 configuration example

The DHCP server port must always be Trusted, because Untrusted DHCP ports drop DHCP replies coming from the DHCP server. All ports are DHCP Untrusted by default. You must connect DHCP clients to Untrusted DHCP ports; however, PC1 is connected to a Trusted port in this configuration example.

This configuration example illustrates a security hole that permits PC1 to install a fake DHCP Server. Port10 (DHCP Trusted) allows DHCP replies to be forwarded to PC2 in this case.

DHCP Snooping configuration commands

The following section describes the detailed ACLI commands required to configure DHCP Snooping for this example.

```
Switch#configure terminal
Switch(config)#ip dhcp-snooping
Switch(config)# ip dhcp-snooping vlan 1
Switch(config)#interface Ethernet 1,10
Switch(config-if)#ip dhcp-snooping trusted
Switch(config-if)#exit
```

Verifying the DHCP Snooping settings

This section describes the commands used to verify the settings and the expected response to each command.

```
Switch(config)#show ip dhcp-snooping
Global DHCP snooping state: Enabled
DHCP
VLAN Snooping
---- --------
1 Enabled
Switch(config)#show ip dhcp-snooping  interface 1,10,11
DHCP
Port Snooping
---- --------
1 Trusted
10 Trusted
11 Untrusted

Switch(config)#show ip dhcp-snooping binding
MAC IP Lease (sec) VID Port
------------------------------------------
Total Entries: 0
Switch#show running-config
! Embedded ASCII Configuration Generator Script
! Model = Ethernet Routing Switch 4826GTX-PWR+
! Software version = v5.1.0.1
enable
configure terminal
!
! *** CORE ***
!
autosave enable
mac-address-table aging-time 300
autotopology
no radius-server
radius-server host 0.0.0.0
radius-server secondary-host 0.0.0.0
radius-server port 1812
! radius-server key ********
radius-server timeout 2
telnet-access login-timeout 1
telnet-access retry 3
telnet-access inactive-timeout 15
telnet-access logging all
cli password stack serial none
cli password stack telnet local
!....
! *** IP ***Note information in this section.
!
ip default-gateway 0.0.0.0
ip address netmask 0.0.0.0
ip address stack 0.0.0.0
ip address switch 0.0.0.0
ip bootp server disable
!....
*** DHCP SNOOPING *** Note information in this section.
!
ip dhcp-snooping
no ip dhcp-snooping vlan
ip dhcp-snooping vlan 1
interface Ethernet ALL
default ip dhcp-snooping
ip dhcp-snooping port 1,10 trusted
```

```
exit
!
! *** ARP INPSECTION *** Note information in this section
!
no ip arp-inspection vlan
interface Ethernet ALL
default ip arp-inspection
exit
! ...
```

Renew the IP addresses for PC1 and PC2. Both PCs obtain IP addresses from the DHCP server. A DHCP binding entry for PC2 appears in the DHCP binding table. No binding entry for PC1 exists because port 10 is DHCP Trusted.

```
Switch(config)#show ip dhcp-snooping binding
MAC IP Lease (sec) VID Port
------------------------------------
00-02-44-ab-2d-f4 192.168.1.10 86460 1 11
Total Entries: 1
```

Configuring dynamic ARP inspection

For more information about the function and operation of dynamic Address Resolution Protocol (ARP) inspection in a network, see Dynamic ARP inspection on page 101.

To configure dynamic ARP inspection, do the following:

1. Enable dynamic ARP inspection on the VLANs. For more information, see Enabling Dynamic ARP Inspection on the VLANs on page 297.
2. Identify the ports as trusted (ARP traffic is not subjected to dynamic ARP inspection) or untrusted (ARP traffic is filtered through dynamic ARP inspection). For more information, see Configuring Trusted and Untrusted Ports on page 298.

Important:

For dynamic ARP inspection to function, DHCP snooping must be globally enabled. For more information about configuring DHCP snooping, see DHCP snooping configuration using ACLI on page 286 or Configuring_global_DHCP_snooping_using_EDM_ on page 397.

Enabling dynamic ARP inspection on the VLANs

You must enable dynamic ARP inspection separately for each VLAN.

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`

2. Enable dynamic ARP inspection on a VLAN.

```
ip arp-inspection vlan <vlanID>
```

where <vlanID> is an integer in the range 1–4094 that specifies the preconfigured VLAN on which you want to enable dynamic ARP inspection.

The default is disabled.

Disabling dynamic ARP inspection on the VLANs

Use the following procedure to disable dynamic ARP inspection on the VLANs.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable dynamic ARP inspection on a VLAN.

   ```
   no ip arp-inspection vlan <vlanID>
   ```

   where <vlanID> is an integer in the range 1–4094 that specifies the preconfigured VLAN on which you want to disable dynamic ARP inspection.

Configuring trusted and untrusted ports

Use this procedure to specify whether a particular port or range of ports is trusted (ARP traffic is not subject to dynamic ARP inspection) or untrusted (ARP traffic is subject to dynamic ARP inspection.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Specify whether a particular port or range of ports is trusted (ARP traffic is not subject to dynamic ARP inspection) or untrusted (ARP traffic is subject to dynamic ARP inspection.

   ```
   ip arp-inspection [port <portlist>] {trusted|untrusted}
   ```

   where <portlist> is the physical port number of the port you want to configure. You can enter a single port, a range of ports, several ranges, or all. If you do not specify a port number, the command applies to the ports specified upon entering the Interface configuration mode.

   The default is untrusted.

Returning a port or range of ports to default values

Use this procedure to return a port or range of ports to default values.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Return a port or range of ports to default values.

   ```
   default ip arp-inspection port <portlist>
   ```

   where <portlist> is the physical port number of the port you want to configure. You can enter a single port, a range of ports, several ranges, or all. If you do not specify a port number, the command applies to the ports specified upon entering the Interface configuration mode.

Returning all ports in the interface to default values

Use this procedure to return all ports to default values.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

2. Return all ports in the interface to default values.

   ```
   default ip arp-inspection port ALL
   ```

Viewing dynamic ARP inspection settings

Use this procedure to view the VLANs on which dynamic ARP inspection has been enabled.

Note:

Either Global Configuration mode or Interface Configuration mode can be used.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. OR

   Enter Interface Configuration mode:

   ```
   enable
   ```

```
configure terminal
```

```
interface ethernet <port number>
```

3. View the VLANs on which dynamic ARP inspection has been enabled.

   ```
   show ip arp-inspection vlan
   ```

   The output lists only the VLANs enabled for dynamic ARP inspection.

Viewing ports and their associated dynamic ARP inspection status (trusted or untrusted)

Follow this procedure to view ports and their associated dynamic ARP inspection status (trusted or untrusted).

The output lists the ports and their associated dynamic ARP inspection status (trusted or untrusted). If you specify the interface type or port as part of the command, the output includes only the ports specified. If you do not specify the interface type or port as part of the command, the output displays all ports.

Note:

Either Global Configuration mode or Interface Configuration mode can be used.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. OR

   Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```

3. View port settings.

   ```
   show ip arp-inspection interface [<interface type>] [<port>]
   ```

Dynamic ARP inspection Layer 2 configuration example

This configuration example uses the same network setup and configuration created in the DHCP snooping configuration using ACLI on page 286 section and illustrated by Figure 21 DHCP Snooping Layer 2 configuration using ACLI example on page 295. To increase security in this network, you must enable Dynamic ARP inspection. If the device under test (DUT) has no IP address assigned, BOOTP must be DISABLED in order for ARP Inspection to work. The DHCP Server port must be ARP Trusted also.

Dynamic ARP inspection configuration commands

The following section details the commands required to configure Dynamic ARP Inspection for this example. The following commands are in addition to those specified in DHCP snooping configuration using ACLI on page 286.

```
configure terminal
Switch(config)#ip bootp server disable
Switch(config)#ip arp-inspection vlan 1
Switch(config)#interface Ethernet 1,10
Switch(config-if)#ip arp-inspection trusted
Switch(config-if)#exit
```

Verifying Dynamic ARP Inspection settings

This section describes the commands used to verify settings, and the expected response to each command.

```
Switch(config)#show ip arp-inspection
ARP
VLAN Inspection
---- ----------
1 Enabled
Switch(config)#show ip arp-inspection  interface 1,10,11
ARP
Port Inspection
---- ----------
1 Trusted
10 Trusted
11 Untrusted
Switch#sho running-config

! Embedded ASCII Configuration Generator Script
! Model = Ethernet Routing Switch 4826GTX-PWR+
! Software version = v5.1.0.0
enable
configure terminal
!
! *** CORE ***
!
autosave enable
mac-address-table aging-time 300
autotopology
no radius-server
radius-server host 0.0.0.0
radius-server secondary-host 0.0.0.0
radius-server port 1812
! radius-server key ********
radius-server timeout 2
telnet-access login-timeout 1
telnet-access retry 3
telnet-access inactive-timeout 15
telnet-access logging all
cli password stack serial none
cli password stack telnet local
!
! *** IP *** Note information in this section.
!
ip default-gateway 0.0.0.0
ip address netmask 0.0.0.0
ip address stack 0.0.0.0
ip address switch 0.0.0.0
ip bootp server disable
```

```
!
! *** DHCP SNOOPING *** Note information in this section.
!
ip dhcp-snooping
no ip dhcp-snooping vlan
ip dhcp-snooping vlan 1
interface Ethernet ALL
default ip dhcp-snooping
ip dhcp-snooping port 1,10 trusted
exit
!
! *** ARP INPSECTION *** Note information in this section.
!
no ip arp-inspection vlan
ip arp-inspection vlan 1
interface Ethernet ALL
default ip arp-inspection
ip arp-inspection port 1,10 trusted
exit
!...
```

Renew the IP addresses for PC1 and PC2. Both PCs will obtain IP addresses from the DHCP server. A DHCP binding entry for PC2 appears in the DHCP binding table although it is ARP Untrusted. No binding entry for PC1 exists because port10 is DHCP Trusted even though it is ARP Trusted.

Now clear the ARP cache on both PCs.

```
>arp -a
```

```
>arp -d <IP-address>
```

Attempt to start communication (use ping) between PCs or between the PCs and the DHCP server. You can establish communication in any direction because ARPs are allowed on port10 (PC1) (that port is ARP Trusted) and on port 11 (PC2) because ARP packets coming from PC2 have an entry for ARP Untrusted port 11 that matches the IP-MAC from the DHCP binding table.

Next make a link-down/link-up for port 11 (PC2) or change PC2 IP address to a static one and set port10(PC1) as ARP Untrusted. Clear the ARP cache on both PCs and the DHCP server. Attempt to start communication (use ping) between PCs or between the PCs and the DHCP server. The PCs and DHCP server are unable to communicate with one another.

IP Source Guard configuration using ACLI

This section describes how you configure IP Source Guard using the Avaya Command Line Interface (ACLI).

Important:

Avaya recommends that you do not enable IP Source Guard on trunk ports.

Important:

Avaya recommends that you carefully manage the number of applications running on the switch that use filters. For example, if you configure ADAC on ports and attempt to configure IP Source

Guard on those same ports, the IP Source Guard configuration can fail due to the limited number of filters available.

Prerequisites

Before you can configure IP Source Guard, you must ensure the following:

- Dynamic Host Control Protocol (DHCP) snooping is globally enabled.

  For information, see Configuring DHCP Snooping Globally Using ACLI on page 286.
- The port is a member of a Virtual LAN (VLAN) configured with DHCP snooping and dynamic Address Resolution Protocol (ARP) Inspection.
- The port is an untrusted DHCP snooping and dynamic ARP Inspection port.
- The bsSourceGuardConfigMode MIB object exists.

  This MIB object is used to control the IP Source Guard mode on an interface.
- The following applications are not enabled:
  - Baysecure
  - Extensible Authentication Protocol over LAN (EAPOL)

Important:

Hardware resources can run out if IP Source Guard is enabled on trunk ports with a large number of VLANs that have DHCP snooping enabled. If this happens, traffic sending can be interrupted for some clients. Avaya recommends that IP Source Guard not be enabled on trunk ports.

Enabling IP Source Guard using ACLI

Enable IP Source Guard to add a higher level of security to the desired port by preventing IP spoofing.

Important:

The IP addresses are obtained from DHCP binding table entries defined automatically for the port. A maximum of 10 IP addresses from the binding table are allowed. The rest are dropped.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface ethernet <port number>
   ```
2. Enable IP Source Guard.

```
ip verify source [interface {[<interface type>] [<interface id>]}]
```

Variable definitions

The following table defines parameters that you enter with the **ip verify source** command.

Variable	Value
<interface id>	Identifies the ID of the interface on which you want IP Source Guard enabled.
<interface type>	Identifies the interface on which you want IP Source Guard enabled.

Viewing IP Source Guard port configuration information using ACLI

To view IP Source Guard port configuration information, open the TACACs configuration screen by selecting Applications > configuration settings for interfaces.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. View IP Source Guard port configuration.

   ```
   show ip verify source [interface {<interface type>] [<interface id>]
   ```

Variable definitions

The following table defines parameters that you enter with the **show ip verify source** command.

Variable	Value
<interface id>	Identifies the ID of the interface for which you want to view IP Source Guard information.
<interface type>	Identifies the interface for which you want to view IP Source Guard information.

Viewing IP Source Guard-allowed addresses using ACLI

View IP Source Guard-allowed addresses to display a single IP address or a group of IP addresses that IP Source Guard allows

Procedure

1. Enter Privileged EXEC mode:

```
enable
```

2. View IP Source Guard-allowed addresses.

```
show ip source binding [<A.B.C.D.>] [interface {[<interface type>]
[<interface id>]}]
```

Variable definitions

The following table defines parameters that you enter with the **`show ip source binding`** command.

Variable	Value
<A.B.C.D>	Identifies the IP address or group of addresses that IP Source Guard allowed.
<interface id>	Identifies the ID of the interface for which you want IP Source Guard-allowed addresses displayed.
<interface type>	Identifies the type of interface for which you want IP Source Guard-allowed addresses displayed.

Disabling IP Source Guard using ACLI

Follow this procedure to disable IP Source Guard to allow all IP traffic to go through without being filtered.

Procedure

1. Enter Interface Configuration mode:

```
enable
```

```
configure terminal
```

```
interface ethernet <port number>
```

2. Disable IP Source Guard.

```
no ip verify source [interface {[<interface type>] [<interface
id>]}]
```

Variable definitions

The following table defines variables that you enter with the **`no ip verify source`** command.

Variable	Value
<interface id>	Identifies the ID of the interface on which you want IP Source Guard disabled.
<interface type>	Identifies the interface on which you want IP Source Guard disabled.

Configuring the trace feature using ACLI

This section describes procedures to display, configure, and disable the trace level feature. This troubleshooting feature provides dynamic detailed error and event information.

Displaying trace information using ACLI

Follow this procedure to show trace level information for the modules and the supported module list.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Show trace level information for the modules.

   ```
   show trace level
   ```

   OR

   Show the supported module list.

   ```
   show trace modid-list
   ```

Configuring trace using ACLI

Use this procedure to configure trace level and trace output to the console.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the trace level.

   ```
   trace level <1-7> <0-4>
   ```

OR

Set trace screen on or off.

```
trace screen <enable|disable>
```

Note:

The default is disable (off).

Variable definitions

The following table describes the parameters for configuring the **trace** command.

Variable	Value
<1–7>	Module ID
<0–4>	Enter the level you want to set for the module. There are five verbose levels for each module: • 0 (NO_DISPLAY) to suppress displaying any information • 1 (VERY_TERSE) to display minimal information • 2 (TERSE) to display some information • 3 (VERBOSE) to display additional information • 4 (VERY_VERBOSE) to display most information **Note:** For **trace** to display any information, the trace level must be different from 0 for at least one module, and trace output must be enabled.
<enable | disable>	Enable indicates the trace feature is on. Disable is the default and indicates the trace screen is off. **Note:** For troubleshooting purposes, the trace screen should be on (enable).

Disabling trace using ACLI

Use this procedure to disable the trace for all modules.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable the trace for all modules.

```
trace shutdown
```

RADIUS Request use Management IP configuration using ACLI

You can enable or disable the use of Management VLAN IP by RADIUS requests, using ACLI.

Enabling the RADIUS Request to use Management IP address

Perform this procedure to enable the RADIUS requests to use the Management VLAN IP address.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable RADIUS Request to use the Management IP address.

   ```
   radius use-management-ip
   ```

3. Verify the settings.

   ```
   show radius use-management-ip
   ```

Disabling the RADIUS Request to use the Management IP address

Follow this procedure to disable the RADIUS requests to use the Management VLAN IP address.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable the RADIUS Request to use the Management IP address.

   ```
   no radius use-management-ip
   ```

3. Verify the settings.

   ```
   show radius use-management-ip
   ```

Setting the RADIUS Request use the Management IP address to default mode

Follow this procedure to set the RADIUS Request to use the Management IP address to default mode.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Set the RADIUS Request to use the Management IP address to default mode.

   ```
   default radius use-management-ip
   ```

3. Verify the settings.

   ```
   show radius use-management-ip
   ```

Storm control configuration

This section describes the procedures to configure storm control using ACLI.

Configuring storm control globally

Follow this procedure to configure storm control globally.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure storm control.

   ```
   storm-control [broadcast | multicast | unicast | all] [low-watermark
   <10-100000000>] [high-watermark <10-100000000>] [poll interval
   <5-300>][action] [none | drop | shutdown ]] [trap-interval <0-1000>]
   [enable]
   ```

3. Disable storm control.

   ```
   no storm-control [broadcast | multicast | unicast | all] enable
   ```

4. Restore default storm control settings.

   ```
   default storm-control [broadcast | multicast | unicast | all] [low-
   watermark] [high-watermark] [poll interval] [action] [trap-interval]
   ```

Variable definitions

The following table defines parameters that you enter with the **`storm-control`** command.

Variable	Description
action	Specifies the storm control action: • **drop**: Set storm control action to drop • **none**: • **shutdown**: Set storm control action to shut down
enable	Enables storm control.
high-watermark <10-100000000>	Specifies the high-watermark value in packets per second (pps). Range: 10 to 100000000 Default: 1000
low-watermark <10-100000000>	Specifies the low-watermark value in packets per second (pps). Range: 10 to 100000000 Default: 100
poll-interval<5-300>	Specifies the interval for watermark checking; the value varies in seconds. Range: 5 to 300 Default: 5
trap-interval<0-1000>	Specifies the interval for sending traps when the poll-intervals exceed. Range: 0 to 1000 **Note:** Value 0 means disabled (high watermark traps will not be repeated) Default: 0

Displaying storm control

Follow this procedure to display storm control configuration.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display storm control settings.

   ```
   show storm-control [broadcast | multicast | unicast | all]
   ```

3. Display storm control settings for an interface or list of ports.

   `show storm-control interface [Ethernet [<port_list>] | <port_list>]`

Example

```
Switch#show storm-control all
Storm Control Status   High Wm    Low Wm    Poll    Action      Trap
--------------------   --------   --------  -----   ---------   ----
Unicast     Disabled   1000       100        5       none        0
Broadcast   Disabled   1000       100        5       none        0
Multicast   Disabled   1000       100        5       none        0
Switch#
Switch#show storm-control interface 1,2
Unit/Pt Storm Control Status   High Wm     Low Wm     Poll    Action      Trap
------- --------------------   -------     --------   -----   ---------   ----
1         Unicast   Disabled   1000        100        5       none        0
        Broadcast   Disabled   1000        100        5       none        0
        Multicast   Disabled   1000        100        5       none        0
2         Unicast   Disabled   1000        100        5       none        0
        Broadcast   Disabled   1000        100        5       none        0
        Multicast   Disabled   1000        100        5       none        0
```

Chapter 6: Ignition Server configuration using ACLI

This chapter describes how to configure the switch as a network access device in the Identity Engine Ignition Server solution using ACLI.

Configuring Ignition Server as a RADIUS server using ACLI

Use this procedure to configure Ignition Server to act as the RADIUS server for your switches and access points.

For more information about configuring the Ignition Server for RADIUS, see *Administering Avaya Identity Engines Ignition Server*, NN47280-600.

Before you begin

Ensure the following conditions are met.

- Ignition Server installed and configured in your network
- Configure the following policies for your switch on Ignition Server:
  - Access
  - User Authentication
  - User Authorization
- Configure the following optional policies for your switch on Ignition Server:
  - Provisioning Polices that set network session and switch parameters for users.
  - Client Posture Policies that require laptops meet a minimum standard of system health.
  - VLAN Assignments that assign each user to an appropriate VLAN.
  - Windows machine authentication that checks connecting devices to ensure they are known to the Active Directory before the system permits connection.
  - MAC authentication that allows operator-less devices to connect and records with which device a user connected.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Configure the reachability of the RADIUS server.

```
radius reachability use-radius [username <username> password
<password>]
```

3. Configure RADIUS server account information on the switch.

```
radius server host {<A.B.C.D> | <WORD>} [acct-enable] [acct-port <1-
65535>] [key{key}] [port <1-65535>] [retry <1-5>] [secondary]
[timeout <1-60>] [used-by {eapol|non-eapol}]
```

Variable definitions

The following table describes variables that you use with the **`radius reachability`** command

Variable	Value
password <password>	Specifies a password for the RADIUS request.
use-radius	Uses dummy RADIUS requests to determine reachability of the RADIUS server.
username <username>	Specifies a user name for the RADIUS request.

Variable definitions

The following table describes variables that you use with the **`radius server host`** command

Variable	Value
<A.B.C.D>	Specifies the IPv4 address of the primary server you want to add or configure. **Important:** A value of 0.0.0.0 indicates that a primary RADIUS server is not configured.
<WORD>	Specifies the IPv6 address of the primary server you want to add or configure. **Important:** A value of 0.0.0.0 indicates that a primary RADIUS server is not configured.
acct-enable	Enables RADIUS accounting for a RADIUS server instance.

Table continues…

Variable	Value
acct-port <1–65535>	Specifies the UDP accounting port number for clients to use when trying to contact the RADIUS server at the corresponding Global RADIUS Server IP address. Values range from 1 to 65535.
key <key>	Specifies the secret authentication and encryption key used for all communications between the NAS and the RADIUS server. The key, also referred to as the shared secret, must be the same as the one defined on the server. You are prompted to enter and confirm the key.
port <1–65535>	Specifies the UDP port number for clients to use when trying to contact the RADIUS server at the corresponding RADIUS server IP address. Values range from 1 to 65535. The default port number is 1812.
retry <1–5>	Specifies the number of RADIUS retry attempts for a RADIUS Server instance. Values range from 1 to 5.
secondary	Specifies the RADIUS server you are configuring as the secondary server. The system uses the secondary server only if the primary server is not configured or is not reachable.
timeout <1–60>	Specifies the timeout interval between each retry for service requests to the RADIUS server. Values range from 1 to 60 seconds. The default value is 2 seconds.
used-by <eapol | non-eapol>	Specifies the RADIUS server as an EAP RADIUS Server or a Non-EAP (NEAP) RADIUS Server. • eapol—configures the RADIUS server to process EAP client requests only. • non-eapol—configures the RADIUS server to process Non-EAP client requests only.

Configuring Ignition Server as an EAP RADIUS server using ACLI

Use this procedure to configure Ignition Server to act as the EAP RADIUS server for your switches and access points.

For more information about configuring the Ignition Server for RADIUS, see *Administering Avaya Identity Engines Ignition Server*, NN47280-600.

Before you begin

Ensure the following:

- Ignition Server installed and configured in your network
- Configure the following policies for your switch on Ignition Server:
  - Access
  - User Authentication
  - User Authorization
- Configure the following optional policies for your switch on Ignition Server:
  - Provisioning Polices that set network session and switch parameters for users.
  - Client Posture Policies that require laptops meet a minimum standard of system health.
  - VLAN Assignments that assign each user to an appropriate VLAN.
  - Windows machine authentication that checks connecting devices to ensure they are known to the Active Directory before the system permits connection.
  - MAC authentication that allows operator-less devices to connect and records with which device a user connected.
- EAP configured on your switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the reachability of the EAP RADIUS server.

   ```
   radius reachability use-radius [username <username> password
   <password>]
   ```

3. Configure EAP RADIUS server account information on the switch.

   ```
   radius server host {<A.B.C.D> | <WORD>} [acct-enable] [acct-port <1-
   65535>] [key{key}] [port <1-65535>] [retry <1-5>] [secondary]
   [timeout <1-60>] used-by eapol
   ```

Variable definitions

The following table describes variables that you use with the **`radius reachability`** command

Variable	Value
password <password>	Specifies a password for the RADIUS request.

Table continues…

Variable	Value
use-radius	Uses dummy RADIUS requests to determine reachability of the RADIUS server.
username <username>	Specifies a user name for the RADIUS request.

Variable definitions

The following table describes variables that you use with the **radius server host** command

Variable	Value
<A.B.C.D>	Specifies the IPv4 address of the primary server you want to add or configure. ❗ **Important:** A value of 0.0.0.0 indicates that a primary RADIUS server is not configured.
<WORD>	Specifies the IPv6 address of the primary server you want to add or configure. ❗ **Important:** A value of 0.0.0.0 indicates that a primary RADIUS server is not configured.
acct-enable	Enables RADIUS accounting for a RADIUS server instance.
acct-port <1–65535>	Specifies the UDP accounting port number for clients to use when trying to contact the RADIUS server at the corresponding RADIUS Server IP address. Values range from 1 to 65535.
key <key>	Specifies the secret authentication and encryption key used for all communications between the NAS and the RADIUS server. The key, also referred to as the shared secret, must be the same as the one defined on the server. You are prompted to enter and confirm the key.
port <1–65535>	Specifies the UDP port number for clients to use when trying to contact the RADIUS server at the corresponding RADIUS server IP address. Values range from 1 to 65535. The default port number is 1812.
retry <1–5>	Specifies the number of RADIUS retry attempts for a RADIUS Server instance. Values range from 1 to 5.
secondary	Specifies the RADIUS server you are configuring as the secondary server. The system uses the

Table continues…

Variable	Value
	secondary server only if the primary server is not configured or is not reachable.
timeout <1–60>	Specifies the timeout interval between each retry for service requests to the RADIUS server. Values range from 1 to 60 seconds. The default value is 2 seconds.
used-by eapol	Specifies the RADIUS server as an EAP RADIUS Server to process EAP client request only.

Configuring Ignition Server as a non-EAP RADIUS server using ACLI

Use this procedure to configure Ignition Server to act as the non-EAP RADIUS server for your switches and access points.

For more information about configuring the Ignition Server for RADIUS, see *Administering Avaya Identity Engines Ignition Server*, NN47280-600.

Before you begin

Ensure the following:

- Ignition Server installed and configured in your network
- Configure the following policies for your switch on Ignition Server:
  - Access
  - User Authentication
  - User Authorization
- Configure the following optional policies for your switch on Ignition Server:
  - Provisioning Polices that set network session and switch parameters for users.
  - Client Posture Policies that require that laptops meet a minimum standard of system health.
  - VLAN Assignments that assign each user to an appropriate VLAN.
  - Windows machine authentication that checks connecting devices to ensure they are known to the Active Directory before the system permits connection.
  - MAC authentication that allows operator-less devices to connect and records with which device a user connected.
- Non-EAP configured on your switch.

About this task

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

```
configure terminal
```

2. Configure the reachability of the non-EAP RADIUS server.

```
radius reachability use-radius [username <username> password
<password>]
```

3. Configure non-EAP RADIUS server account information on the switch.

```
radius server host {<A.B.C.D> | <WORD>} [acct-enable] [acct-port <1–
65535>] [key{key}] [port <1–65535>] [retry <1–5>] [secondary]
[timeout <1-60>] used-by non-eapol
```

Variable definitions

The following table describes variables that you use with the **radius reachability** command

Variable	Value
password <password>	Specifies a password for the RADIUS request.
use-radius	Uses dummy RADIUS requests to determine reachability of the RADIUS server.
username <username>	Specifies a user name for the RADIUS request.

Variable definitions

The following table describes variables that you use with the **radius server host** command

Variable	Value
<A.B.C.D>	Specifies the IPv4 address of the primary server you want to add or configure. ❗ **Important:** A value of 0.0.0.0 indicates that a primary RADIUS server is not configured.
<WORD>	Specifies the IPv6 address of the primary server you want to add or configure. ❗ **Important:** A value of 0.0.0.0 indicates that a primary RADIUS server is not configured.
acct-enable	Enables RADIUS accounting for a RADIUS server instance.
acct-port <1–66535>	Specifies the UDP accounting port number for clients to use when trying to contact the RADIUS server at

Table continues…

Variable	Value
	the corresponding RADIUS Server IP address. Values range from 1 to 65535.
key <key>	Specifies the secret authentication and encryption key used for all communications between the NAS and the RADIUS server. The key, also referred to as the shared secret, must be the same as the one defined on the server. You are prompted to enter and confirm the key.
port <1–65535>	Specifies the UDP port number for clients to use when trying to contact the RADIUS server at the corresponding RADIUS server IP address. Values range from 1 to 65535. The default port number is 1812.
retry <1–5>	Specifies the number of RADIUS retry attempts for a RADIUS Server instance. Values range from 1 to 5.
secondary	Specifies the RADIUS server you are configuring as the secondary server. The system uses the secondary server only if the primary server is not configured or is not reachable.
timeout <1–60>	Specifies the timeout interval between each retry for service requests to the RADIUS server. Values range from 1 to 60 seconds. The default value is 2 seconds.
used-by non-eapol	Specifies the RADIUS server as an non-EAP (NEAP) RADIUS Server to process Non—EAP client request only.

Configuring Ignition Server as a TACACS+ server using ACLI

You can configure Ignition Server to act as the TACACS+ authentication and authorization server, and you can use it as the TACACS+ accounting server.

For more information , see *Administering Avaya Identity Engines Ignition Server*, NN47280-600

Before you begin

Ensure the following:

- Ignition Server is installed and configured in your network.
- Configure the following policies for your switch on Ignition Server:
  - Access
  - User Authentication
  - User Authorization

- Configure the following optional policies for your switch on Ignition Server:
    - Provisioning Polices that set network session and switch parameters for users.
    - Client Posture Policies that require that laptops meet a minimum standard of system health.
    - VLAN Assignments that assign each user to an appropriate VLAN.
    - Windows machine authentication that checks connecting devices to ensure they are known to the Active Directory before the system permits connection.
    - MAC authentication that allows operator-less devices to connect and records with which device a user connected.
- Configure an Ignition Server authentication record with a TACACS+ policy

  Note:

  If you use Ignition Server for TACACS+ authorization, you must use Ignition Server for TACACS+ authentication.
- Configure the TACACS+ server to be added to your system.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure switch TACACS+ server settings.

   ```
   tacacs server host <A.B.C.D> port <1-65535> secondary-host <A.B.C.D>
   key <key>
   ```

Variable definitions

The following table describes variables that you use with the **`tacacs server`** command

Variable	Value
host <A.B.C.D>	Specifies the IP address of the primary server you want to add or configure
key <key>	Specifies the secret authentication and encryption key used for all communications between the NAS and the TACACS+ server. The key, also referred to as the shared secret, must be the same as the one defined on the server. You are prompted to enter and confirm the key when you enter it. **Important:** The key parameter is a required parameter when you create a new server entry. The

Table continues…

Variable	Value
	parameter is optional when you are modifying an existing entry.
port <1–65535>	Specifies the TCP port for TACACS+. <port> is an integer in the range of 1 to 65535. The default port number is 49.
secondary host <A.B.C.D>	Specifies the IP address of the secondary server. The secondary server is used only if the primary server does not respond.

Chapter 7: IPv6 FHS configuration using ACLI

This chapter describes how to configure IPv6 First Hop Security (FHS) on the switch and how to protect the network by mitigating the various types of attacks, such as address spoofing, remote address resolution cache exhaustion (denial of service attacks) using ACLI.

Note:

FHS does not solve all cases of denial of services like blocking flooding of the IPv6 messages.

Related links

FHS configuration on page 322
RA-guard configuration on page 328
DHCPv6–guard policy configuration on page 334
ND-inspection configuration on page 340

FHS configuration

Configure IPv6 FHS features to enable IPv6 link security and management over the Layer 2 links.

Related links

IPv6 FHS configuration using ACLI on page 322
Enabling or disabling FHS globally on page 322
Managing the FHS IP access list on page 323
Displaying FHS IPv6 access list information on page 324
Managing the FHS MAC access list on page 325
Displaying FHS MAC access list information on page 326
Displaying current FHS configuration on page 327

Enabling or disabling FHS globally

About this task

You must enable First Hop Security for FHS RA-guard or DHCPv6–guard to be operational.

Enabling FHS globally installs the required filters for FHS. Disabling FHS, uninstalls FHS. By default, FHS is disabled.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable IPv6.

   ```
   ipv6 enable
   ```

3. Enable First Hop Security globally.

   ```
   ipv6 fhs enable
   ```

4. Disable First Hop Security globally.

   ```
   no ipv6 fhs enable
   ```

   OR

   ```
   default ipv6 fhs enable
   ```

Related links

FHS configuration on page 322

Managing the FHS IP access list

About this task

You can create an FHS IP access list or add IP prefixes to an existing IP access list.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Create an FHS IP access list or add IP prefixes to an existing IP access list.

   ```
   ipv6 fhs ipv6-access-list <ip-access-list-name> <ip-prefix>/<ip-mask-length> [ge <ip-mask-length>] [le <ip-mask-length>] [mode <allow | deny>]
   ```

3. Delete an FHS IP access list or delete a particular ip-prefix from the IP access list.

   ```
   no ipv6 fhs ipv6-access-list <ip-access-list-name> [<ip-prefix>/<ip-mask-length>]
   ```

   OR

```
default ipv6 fhs ipv6-access-list <ip-access-list-name> [<ip-prefix>/<ip-mask-length>]
```

Example

```
Switch>enable
Switch#config t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#ipv6 fhs ipv6-access-list ACCName fe80::221:2fff:fe31:5376/24
Switch(config)#
```

Variable definitions

Use the data in the following table to use the **`ipv6 fhs ipv6-access-list`** command.

Variable	Description
<ip-access-list-name>	Specifies the IP access list name.
<ip-prefix>/<ip-mask-length>>	Specifies the IP prefix and IP mask length to be added to the IP access list.
ge *<ip-prefix>/<ip-mask-length>>*	Specifies the IP range start mask length. By default, the value is 0.
le *<ip-prefix>/<ip-mask-length>>*	Specifies the IP range end mask length. By default, the value is 0.
mode <*allow* | *deny*>	Specifies the access mode. By default, the value is allow.

Displaying FHS IPv6 access list information

About this task

Displays the current FHS IPv6 access list information.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display the current FHS IPv6 access list information.

   ```
   show ipv6 fhs ipv6-access-list [<access-list-name>]
   ```

Example

```
Switch#show ipv6 fhs ipv6-access-list


     Access list name : AccName
ip_prefix         : fe80::221:2fff:fe31:5376
mask_len          : 24
mask_range_from   : 0
mask_range_to     : 0
mode              : Allow
Switch#
```

Related links

[FHS configuration](#) on page 322

[Job aid](#) on page 325

Job aid

The following table shows the field descriptions for the **`show ipv6 fhs ipv6-access-list`** command.

Field	Description
Access list name	Indicates the IP access list name.
ip_prefix	Indicates the IP prefix added to the IP access list.
mask_len	Indicates prefix mask length added to the IP access list.
mask_range_from	Indicates the IP range start mask length.
mask_range_to	Indicates the IP range end mask length.
mode	Indicates the access mode.

Related links

[Displaying FHS IPv6 access list information](#) on page 324

Managing the FHS MAC access list

About this task

You can create an FHS MAC access list or add MAC addresses to an existing MAC access list.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Create an FHS MAC access list or add MAC addresses to an existing MAC access list.

   ```
   ipv6 fhs mac-access-list <mac-access-list-name> <MAC-address> [mode
   <allow | deny>]
   ```

3. Delete an FHS MAC access list or delete a particular MAC address from the MAC access list.

   ```
   no ipv6 fhs mac-access-list <mac-access-list-name> [<MAC-address>]
   ```

   OR

   ```
   default ipv6 fhs mac-access-list <mac-access-list-name> [<MAC-
   address>]
   ```

Variable definitions

Use the data in the following table to use the **`ipv6 fhs mac-access-list`** command.

Variable	Description
<mac-access-list-name>	Specifies the MAC access list name.
<MAC-Address>	Specifies the MAC address to be added or deleted.
mode <*allow* | *deny*>	Specifies the access mode. By default, the value is Allow

Displaying FHS MAC access list information

About this task

Displays the current FHS MAC access list information.

Procedure

1. Enter Privileged EXEC mode:

   ```
   enable
   ```

2. Display the current FHS MAC access list information.

   ```
   show ipv6 fhs mac-access-list [<mac-list-name>]
   ```

Example

```
Switch#show ipv6 fhs mac-access-list


     Access list name : MACList
S.No   MAC-Address        ACL-Mode
1      10:20:30:40:50:60  Allow
Switch#
```

Related links

FHS configuration on page 322
Job aid on page 326

Job aid

The following table shows the field descriptions for the **`show ipv6 fhs mac-access-list`** command.

Field	Description
Access list name	Indicates the FHS access list name.
MAC-Address	Indicates the MAC address.
ACL-Mode	Indicates the ACL mode.

Related links

Displaying FHS MAC access list information on page 326

Displaying current FHS configuration

About this task

Displays the current FHS configuration.

Procedure

1. Enter Privileged EXEC mode:

   `enable`

2. Display the current FHS configuration.

   `show ipv6 fhs capture-policy [interface <port_list>]`

Example

```
Switch#show ipv6 fhs capture-policy
--------------------------------------------------------------------
port  Protocol     Policy Name              PktsRcv PktsDrop DynLearn
---------------------------------------------------------------------
 1      DHCP         dhcpg                    0       0        -
        NDI          None                     9       1       TRUE
 2      NDI          None                     0       0       TRUE
```

Related links

FHS configuration on page 322

Job aid on page 327

Job aid

The following table shows the field descriptions for the **`show ipv6 fhs capture-policy`** command.

Field	Description
port	Indicates the port number.
Protocol	Indicates the protocol.
Policy Name	Indicates the policy name.
PktsRcv PktsDrop	Indicates the received and dropped packets.
DynLearn	Indicates the dynamically learnt neighbor source IP address. If there is a rogue, you can add a static entry to the SBT for legitimate reachability and disable dynamic learning. The rogue ND packets arriving at this port are dropped allowing only the ND packets matching the statically configured SBT entry.

Related links

Displaying current FHS configuration on page 327

RA-guard configuration

IPv6 RA-guard provides support to the administrator to block or reject unwanted RA-guard messages that arrive at the network switch platform. The routers use Router Advertisements (RAs) to announce themselves on the link. The RA-guard feature analyzes these RAs and filters out bogus RAs sent by unauthorized routers. The RA-guard feature compares configuration information on the Layer 2 device with the information found in the received RA frame. After the Layer 2 device validates the content of the RA frame and router redirect frame against the configuration, it forwards the RA to its destination. If the RA frame content is not validated, the RA is dropped.

Enabling or disabling RA–guard globally

About this task

Enables the RA-guard globally. By default, RA-guard is disabled.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable IPv6.

   ```
   ipv6 enable
   ```

3. Enable FHS globally.

   ```
   ipv6 fhs enable
   ```

4. Enable RA-guard globally.

   ```
   ipv6 nd raguard enable
   ```

5. Disable RA–guard globally.

   ```
   no ipv6 nd raguard enable
   ```

Managing the RA-guard policy

About this task

Configure or modify RA-guard policy. This command also enables the RA-guard configuration mode.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Create the RA-guard policy.

   ```
   ipv6 nd raguard policy <policy-name>
   ```

3. Delete the RA-guard policy.

   ```
   no ipv6 nd raguard policy <policy-name>
   ```

   OR

   ```
   default ipv6 nd raguard policy <policy-name>
   ```

   ✱ **Note:**

   You cannot delete a policy that is attached to an interface.

Variable definitions

Use the data in the following table to use the **`ipv6 nd raguard policy`** command.

Variable	Description
<policy_name>	Specifies the name of the RA-guard policy to be created or deleted. This is a mandatory parameter in this command.

Clearing RA-guard statistics

About this task

Clears the RA-guard statistics.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Clear the DHCP guard statistics.

   ```
   ipv6 nd raguard clear stats [<port-number>]
   ```

Variable definitions

Use the data in the following table to use the **`ipv6 nd raguard clear stats`** command.

Variable	Description
<port_list>	Specifies the list of ports. If you do not specify any port, the DHCP guard statistics are cleared for all ports.

Managing RA-guard on an interface

About this task

Applies or detaches a RA-guard policy on the specific interface.

Procedure

1. Enter Ethernet Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface Ethernet <port>
   ```

2. Apply a RA-guard policy.

   ```
   ipv6 nd raguard attach-policy <policy-name>
   ```

3. Detach a RA-guard policy from an interface.

   ```
   no ipv6 nd raguard attach-policy <policy-name>
   ```

   OR

   ```
   default ipv6 nd raguard attach-policy <policy-name>
   ```

Variable definitions

Use the data in the following table to use the **`ipv6 nd raguard attach-policy`** command.

Variable	Description
<policy_name>	Specifies the name of the RA-guard policy to be attached or detached.

Configuring RA-guard in raguard mode

About this task

Configures RA-guard under the raguard mode.

Procedure

1. Enter RA-guard Configuration mode.

   ```
   enable
   ```

```
configure terminal
```

```
ipv6 nd raguard policy <policy-name>
```

2. Enable device role verification attached to the port. By default, router is selected.

   ```
   device-role {router | host}
   ```

3. Specify the IPv6 access list to verify IPv6 addresses.

   ```
   match ipv6 access-list <ipv6-access-list-name>
   ```

4. Remove RA-guard filtering for the sender’s IPv6 addresses.

   ```
   no match ipv6 access-list <ipv6-access-list-name>
   ```

   OR

   ```
   default match ipv6 access-list <ipv6-access-list-name>
   ```

5. Specify the IPv6 prefix list to verify advertised prefixes.

   ```
   match ra prefix-list <ipv6-access-list-name>
   ```

6. Remove RA-guard filtering for the advertised prefixes.

   ```
   no match ra prefix-list <ipv6-access-list-name>
   ```

   OR

   ```
   default match ra prefix-list <ipv6-access-list-name>
   ```

7. Enable verification of the sender MAC address against the configured mac-access-list.

   ```
   match mac-access-list <mac-access-list-name>
   ```

8. Remove the source MAC address-based RA-guard filtering.

   ```
   no match mac-access-list <mac-access-list-name>
   ```

   OR

   ```
   default match mac-access-list <mac-access-list-name>
   ```

9. Enable managed address configuration flag verification in the advertised RA packet.

   ```
   managed-config-flag <none |on | off>
   ```

10. Enable advertised hop count limit verification.

    ```
    hop-limit {maximum | minimum} <0-255>
    ```

11. Enable the advertised default router-preference parameter value verification.

    ```
    router-preference maximum {none | high | low | medium}
    ```

Variable definitions

Use the data in the following table to use the **raguard** configuration mode commands.

Variable	Description
match ipv6 access-list <*ipv6-access-list-name*>	Verifies sender’s IPv6 address in the inspected messages against the configured authorized device source access list. **Note:** Inspection is not done if the access-list is not attached. If the list is attached and if it does not match any ip-prefix in the list, then the RA packet is dropped. To change this behavior, add a dummy ip-prefix “0::0/0” with the Allow option. The default value changes from Drop to Allow.
{no | default} match ipv6 access-list <*ipv6-access-list-name*>	Removes the sender’s IPv6 address-based RA-guard filtering.
match ra prefix-list <*ipv6-access-list-name*>	Verifies the advertised prefixes in the inspected messages against the configured authorized prefix list. **Note:** Inspection is not done if the access-list is not attached. If the list is attached and if it does not match any ip-prefix in the list, then the RA packet is dropped. To change this behavior, add a dummy ip-prefix “0::0/0” with Allow option. The default value changes from Drop to Allow.
{no | default} match ra prefix-list <*ipv6-access-list-name*>	Removes the advertised prefix-based RA-guard filtering
match mac-access-list <*mac-access-list-name*>	Verifies sender’s source MAC address against the configured mac-access-list. **Note:** Inspection is not done if the access-list is not attached. If the list is attached and if it does not match any MAC in the list, then the RA packet is dropped. To change the behavior, add a dummy MAC “0:0:0:0:0:0” to the list with Allow option. The default value changes from Drop to Allow.
{no | default} match mac-access-list <*mac-access-list-name*>	Removes the source MAC address-based RA-guard filtering for the specified MAC address access list names.
managed-config-flag <*none* | *on* | *off*>	Verifies managed address configuration flag in the advertised RA packet.

Table continues…

Variable	Description
	By default, the value is none and check is bypassed.
hop-limit {maximum | minimum} *<0–255>*	Verifies the advertised hop count limit. The limit value range is from 0 to 255. While changing the minimum or maximum value, ensure the maximum value is greater than the minimum value. By default, the minimum and maximum limit are 0. In this case, the hop-limit check is bypassed.
router-preference maximum {none | high | low | medium}	Verifies if the advertised default router-preference parameter value is lower than or equal to a specified limit. By default, the value is none and the check is bypassed.

Displaying RA-guard configuration

About this task

Displays configured RA-guard policy information.

Procedure

1. Log on to ACLI to enter User EXEC mode.
2. Display configured RA-guard policy information.

   `show ipv6 nd raguard policy <policy-name>`

Example

```
Switch(config)#show ipv6 nd raguard policy
Ra guard policy name :rag
Device role : Router
Source ip ACL policy : None
Ip prefix ACL policy : None
Source MAC ACL policy : None
Managed config : None
Router preference : None
Minimum hop limit : 0
Maximum hop limit : 0
```

Variable definitions

Use the data in the following table to use the **`show ipv6 nd raguard policy`** command.

Variable	Description
<policy-name>	Displays the RA-guard policy for the specified policy-name. By default, all the configured RA-guard policies are displayed.

Job aid

The following table shows the field descriptions for the **`show ipv6 nd raguard policy`** command.

Field	Description
Ra guard policy name	Indicates the RA-guard policy name.
Device role	Indicates if the device role is router or host.
Source ip ACL policy	Indicates if the received RA router packet source IP matches the configured IP ACL.
Ip prefix ACL policy	Indicates if the received RA prefix in the packet matches the configured IP ACL.
Source MAC ACL policy	Indicates if the received RA router packet source MAC address matches the configured MAC ACL.
Managed config	Indicates the managed address configuration flag status in the advertised RA packet.
Router preference	Indicates the advertised default router preference value.
Minimum hop limit	Indicates the advertised hop count minimum limit.
Maximum hop limit	Indicates the advertised hop count maximum limit.

DHCPv6–guard policy configuration

DHCP-DHCPv6–guard policy blocks DHCP reply and advertisement messages that originate from unauthorized DHCP servers and relay agents that forward DHCP packets from servers to clients.

Enabling or disabling DHCPv6–guard globally

About this task

Enabling DHCPv6–guard globally installs filters on the configured interfaces. By default, the filters are disabled.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable IPv6.

   ```
   ipv6 enable
   ```

3. Enable FHS globally.

```
ipv6 fhs enable
```

4. Enable DHCPv6–guard globally.

```
ipv6 dhcp guard enable
```

5. Disable DHCPv6–guard globally.

```
no ipv6 dhcp guard enable
```

Managing the DHCP Guard policy

About this task

Configure or modify the DHCP-guard policy.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Create a DHCP guard policy.

```
ipv6 dhcp guard policy <policy_name>
```

3. Delete a DHCP guard policy.

```
no ipv6 dhcp guard policy <policy_name>
```

OR

```
default ipv6 dhcp guard policy <policy_name>
```

Note:

You cannot delete a policy that is already attached to an interface.

Variable definitions

Use the data in the following table to use the **ipv6 dhcp guard policy** command.

Variable	Description
<policy_name>	Specifies the created or deleted DHCP guard policy name.

Clearing the DHCP Guard statistics

About this task

Clears the DHCP guard statistics.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Clear the DHCP guard statistics.

   ```
   ipv6 dhcp guard clear stats [<port_list>]
   ```

Variable definitions

Use the data in the following table to use the **ipv6 dhcp guard clear stats** command.

Variable	Description
<port_list>	Specifies the list of ports. If the ports are not specified, the DHCP guard statistics are cleared for all ports.

Managing a DHCP Guard policy on an interface

About this task

Applies a DHCP-guard policy to a specific interface.

Procedure

1. Enter Ethernet Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   interface Ethernet <port>
   ```

2. Apply a DHCP guard policy.

   ```
   ipv6 dhcp guard attach-policy <policy_name>
   ```

3. Detach a DHCP guard policy from an interface.

   ```
   no ipv6 dhcp guard attach-policy <policy_name>
   ```

   OR

   ```
   default ipv6 dhcp guard attach-policy <policy_name>
   ```

Variable definitions

Use the data in the following table to use the **ipv6 dhcp guard attach-policy** command.

Variable	Description
<policy_name>	Specify the name of the DHCP guard policy to be attached or detached.

Configuring DHCP Guard in dhcp-guard mode

About this task

Configures DHCP guard under dhcp-guard mode.

Procedure

1. Enter DHCP Guard Configuration mode.

   ```
   enable
   ```

   ```
   configure terminal
   ```

   ```
   ipv6 dhcp guard policy <policy-name>
   ```

2. Enable verification of the role of the device attached to the port.

   ```
   device-role { client | server }
   ```

3. Specify IPv6 access list to verify IPv6 addresses.

   ```
   match server access-list <ipv6-access-list-name>
   ```

4. Remove DHCP guard filtering for the sender's IPv6 addresses.

   ```
   no match server access-list <ipv6-access-list-name>
   ```

   OR

   ```
   default match server access-list <ipv6-access-list-name>
   ```

5. Specify IPv6 prefix list to verify advertised prefixes.

   ```
   match reply prefix-list <ipv6-prefix-list-name>
   ```

6. Remove DHCP guard filtering for advertised prefixes.

   ```
   no match reply prefix-list <ipv6-prefix-list-name>
   ```

   OR

   ```
   default match reply prefix-list <ipv6-prefix-list-name>
   ```

7. Specify the minimum limit for verification of the advertised preference.

   ```
   preference min limit <0-255>
   ```

8. Set the minimum limit for verification of the advertised preference to its default value.

   ```
   default preference min limit
   ```

9. Specify the maximum limit for verification of the advertised preference.

   ```
   preference max limit <0-255>
   ```

10. Set the maximum limit for verification of the advertised preference to its default value.

    ```
    default preference max limit
    ```

Variable definitions

Use the data in the following table to use the `dhcp-guard` configuration mode commands.

Variable	Description
match server access-list *<ipv6–access-list-name>*	Enables verification of the sender's IPv6 address in inspected messages from the configured authorized device source access list specified. **Note:** If the access-list is not attached, the inspection does not occur. If the list is attached and it does not match any IP prefixes in the list, the switch drops the DHCPv6 packet. If you wish to change this behavior, add a dummy ip-prefix "0.0.0.0/0" with the Allow option, which changes the default drop to default Allow.
{ no | default } match server access-list *<ipv6–access-list-name>*	Removes the sender's IPv6 address based DHCPv6–guard filtering.
match reply prefix-list *<ipv6–prefix-list-name>*	Enables verification of the advertised prefixes in DHCP reply messages from the configured authorized prefix list. If prefix-list is not configured, this check is bypassed. An empty prefix list is treated as a permit. **Note:** If the access-list is not attached, the inspection does not occur. If the list is attached and it does not match any IP prefixes in the list, the switch drops the DHCPv6 packet. If you wish to change this behavior, add a dummy ip-prefix "0.0.0.0/0" with the Allow option, which changes the default drop to default Allow.
{ no | default } match reply prefix-list *<ipv6–prefix-list-name>*	Removes the advertised prefix-based DHCP-guard filtering.
preference min limit*<0–255>*	Enables verification if the advertised preference (in preference option) is greater than the specified limit. If preference is not specified, this check is bypassed. While changing the preference limit, ensure the maximum limit is greater than the minimum limit.
default preference min limit	Sets the specified limit to its default value. By default, the value is 0.
preference max limit*<0–255>*	Enables verification if the advertised preference (in preference option) is less than the specified limit. If preference is not specified, this check is bypassed. **Note:** The preference check is ignored if the minimum and maximum values are zero.
default preference max limit	Sets the specified limit to its default value.

Table continues…

Variable	Description
	By default, the value is 0.

Displaying DHCPv6–guard policy

About this task

Displays DHCP-guard policy information for all the configured DHCP-guard policies or a particular policy name.

Procedure

1. Log on to ACLI to enter User EXEC mode.
2. Display DHCP-guard policy information.

   `show ipv6 dhcp guard policy <policy-name>`

Example

```
Switch#show ipv6 dhcp guard policy dhcpg
DHCP guard policy name :dhcpg
Device role : Client
Server ip ACL Policy : None
Reply ip prefix ACL Policy : None
Router preference minimum limit : 0
Router preference maximum limit : 0
```

Variable definitions

Use the data in the following table to use the `show ipv6 dhcp guard policy` command.

Variable	Description
<policy-name>	Displays DHCP-guard policy information for all the configured DHCP-guard policies. Policy name is an optional parameter. If policy name is provided, only the DHCP-guard policy of the specified policy-name is displayed.

Job aid

The following table shows the field descriptions for the **`show ipv6 dhcp guard policy`** command.

Field	Description
DHCP guard policy name	Indicates the DHCPv6-guard policy name.
Device role	Indicates if the device role is client or server.
Server ip ACL Policy	Indicates if the received DHCP-server packet source IP matches the configured IP ACL.

Table continues…

Field	Description
Reply ip prefix ACL Policy	Indicates if the received DHCP-server prefix in the packet matches the configured IP ACL.
Router preference minimum limit	Indicates the advertised router preference minimum limit.
Router preference maximum limit	Indicates the advertised router preference maximum limit.

ND-inspection configuration

IPv6 ND inspection learns and secures bindings for stateless autoconfiguration addresses in Layer 2 neighbor tables. IPv6 ND inspection analyzes neighbor discovery messages in order to build a trusted Source Binding Table (SBT) database; IPv6 neighbor discovery messages that do not conform are dropped.

The SBT learns the neighbor source address connected to the FHS switch dynamically or statically. These neighbors source addresses can be dynamically learned in different ways. Depending on the security level, SBT blocks unwanted messages such as Router Advertisements (RA) or Dynamic Host Configuration Protocol (DHCP) replies. This database, or binding table is used by various IPv6 guard features to validate the link-layer address (LLA), the IPv4 address, or the IPv6 address of the neighbors to prevent spoofing and redirect attacks.

Enabling or disabling ND-inspection

Before you begin

Enable FHS globally.

About this task

Enables ND-inspection globally. By default, ND-inspection is disabled.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable ND-inspection globally.

   ```
   ipv6 nd inspection enable
   ```

3. Disable ND-inspection.

   ```
   no ipv6 nd inspection enable
   ```

   OR

```
default ipv6 nd inspection enable
```

Note:

When ND-inspection is deleted, all the corresponding dynamically-learned SBT entries are also deleted.

Managing entries in SBT

About this task

The Source Binding Table (SBT) learns the neighbor source address connected to the FHS switch dynamically or statically.

Neighbor source IP address are learned on the ports where ND-inspection is enabled. A maximum of 1024 dynamic source IP address are allowed to be learned.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Add a static entry to the SBT.

   ```
   ipv6 neighbor binding vlan <vlan-id> <ipv6-address> interface
   <interface-type> <port> <mac-address>
   ```

3. Delete a static or dynamic entry from SBT.

   ```
   no ipv6 neighbor binding vlan <vlan-id> <ipv6-address> interface
   <interface-type> <port> <mac-address>
   ```

4. Specify the maximum number of dynamic entries that can be inserted in the SBT.

   ```
   ipv6 neighbor binding max-entrie <1 - 1024>
   ```

5. Clear all the dynamically-learned SBT entries.

   ```
   ipv6 neighbor binding clear
   ```

6. Change the default SBT entry from 1024 to 512.

   ```
   default ipv6 neighbor binding max-entries
   ```

Variable definitions

Use the data in the following table to use the **`ipv6 neighbor binding`** command.

Variable	Description
vlan <*vlan-id*> <*ipv6-address*> interface <*interface-type*> <*port*> <*mac-address*>	Adds a static entry to the SBT.

Table continues…

Variable	Description
	The IPv6 address 0::0 and Link-Layer MAC 0:0:0:0:0:0 are not allowed. **Note:** The static entry replaces the dynamic entry (matching the source IP address). If there is an existing static SBT entry (matching the source IP address) and if you try to add a static SBT entry with a different MAC address or port, then those entries are not overwritten. The same SBT entry can be added in a different VLAN.
max-entrie <*1 - 1024*>	Specifies the maximum number of dynamic entries that are allowed to be inserted in the SBT. By default, the maximum number of dynamic entries that can be entered is 512. The value of dynamic entries ranges from 1 to 1024. The maximum number of static entries is 100 and this configuration excludes the static entry of 100. If there are more entries in the SBT than the configured maximum entries, then those configurations are not allowed until the SBT is cleared
clear	Clears all the dynamically-learned SBT entries. The SBT static entries are not cleared and the learned information, such as DHCP and other learned information, is not cleared.

Managing SBT entry lifetime

About this task

Incomplete, Reachable, Stale, and Down are the four states for an SBT entry. You can modify the lifetime of these states.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Specify the maximum Reachable lifetime for a dynamically-learned SBT entry.

   ```
   ipv6 neighbor binding reachable-lifetime [<30 – 86400 seconds> |
   infinite]
   ```

3. Change the Reachable lifetime to the default value. The default value is 300 seconds.

   ```
   default ipv6 neighbor binding reachable-lifetime
   ```

4. Specify the maximum Stale lifetime for a dynamically-learned SBT entry.

   ```
   ipv6 neighbor binding stale-lifetime [ <30 – 86400 seconds> |
   infinite]
   ```

5. Change the Stale lifetime to the default value. The default value is 86400 seconds.

   ```
   default ipv6 neighbor binding stale-lifetime
   ```

6. Specify the maximum Down lifetime for a dynamically-learned SBT entry.

   ```
   ipv6 neighbor binding down-lifetime [ <30 – 86400 seconds> |
   infinite]
   ```

7. Change the Down lifetime to the default value. The default value is 86400 seconds.

   ```
   default ipv6 neighbor binding down-lifetime
   ```

Variable definitions

Use the data in the following table to use the **`ipv6 neighbor binding`** command.

Variable	Description
reachable-lifetime [<*30 – 86400 seconds*> | *infinite*]	Specifies the maximum REACHABLE lifetime for a dynamically-learned SBT entry. After time-out, the entry moves from REACHABLE to a STALE state, or if the interface is down before this timer expires, then the state moves to a DOWN state. In this state, if the switch receives any ND packets with the matching entry in the SBT, then without validation the state moves to REACHABLE. Similarly, when the switch receives any ND packets matching the entry in the SBT, then this aging timer is refreshed. By default, the REACHABLE lifetime is 300 seconds. In the case of the `infinite` option, the SBT entry state never moves from the REACHABLE state to the other state. If the timer value is changed from infinite to a finite value, then the timer restarts and expires after the finite value in seconds. **Note:** The granularity of the timer is five seconds.
stale-lifetime [<*30 – 86400 seconds*> | *infinite*]	Specifies the maximum STALE lifetime for a dynamically-learned SBT entry.

Table continues…

Variable	Description
	In this state, if the switch receives any ND message matching the information as the SBT entry, then validation is not done on that packet; instead, this entry directly moves to a REACHABLE state. After this timer expiry, this entry is deleted from the SBT By default, the STALE lifetime is 86400 seconds. In the case of the `infinite` option, the SBT entry state is never deleted. If the timer value is changed from infinite to a finite value, then the timer restarts and expires after the finite value in seconds. **Note:** The granularity of the timer is 5 seconds.
down-lifetime [*<30 – 86400 seconds>* | *infinite*]	Specifies the maximum DOWN lifetime for a dynamically-learned SBT entry. In this state, if the switch receives any ND message matching the information as the SBT entry, then validation is not done on that packet; instead, this entry directly moves to a REACHABLE state. After this timer expiry, this entry is deleted from the SBT. By default, the DOWN lifetime is 86400 seconds. In the case of the `infinite` option, the SBT entry state is never deleted. If the timer value is changed from infinite to a finite value, then the timer restarts and expires after the finite value in seconds. **Note:** The granularity of the timer is 5 seconds.

Clearing ND-inspection statistics

About this task

Clears the ND-inspection statistics.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Clear the ND-inspection statistics and SBT entry drop status.

   ```
   ipv6 nd inspection clear stats [<port-number>]
   ```

3. Clear ND-inspection statistics globally.

```
ipv6 fhs nd inspection stats clear
```

Note:

The SBT entry overflow statistics are also deleted.

Variable definitions

Use the data in the following table to use the **`ipv6 nd inspection clear stats`** command.

Variable	Description
<port-number>	Clears the ND-inspection statistics as well as SBT entry drop status. If port number is mentioned, then only the statistics for that particular port is cleared.

Enabling or disabling ND-inspection on an interface

About this task

Enables or disables the ND-inspection on an interface.

Procedure

1. Enter Interface Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

   `interface Ethernet <port>` or `interface vlan <1-4094>`

2. Enable the ND-inspection on an interface.

   ```
   ipv6 nd inspection [dynamic-learning enable]
   ```

3. Disable the ND-inspection on an interface.

   ```
   no ipv6 nd inspection [dynamic-learning enable]
   ```

   OR

   ```
   default ipv6 nd inspection [dynamic-learning enable]
   ```

Variable definitions

Use the data in the following table to use the **`ipv6 nd inspection`** command.

Variable	Description
ipv6 nd inspection [dynamic-learning enable]	Enables the ND-inspection on an interface. The option `dynamic-learning` enables the FHS module to learn the neighbor source IP address in the SBT table.

Table continues…

Variable	Description
	By default, ND-inspection is disabled and dynamic-learning is enabled. **Note:** ND-inspection is not done on the packets if the port belongs to the trunk.
[no] [default] ipv6 nd inspection [dynamic-learning enable]	Disables the ND inspection on an interface. The option `dynamic-learning` prevents the FHS module from learning the SBT entries dynamically on the configured port. In this case, ND packets are forwarded only if static SBT entries are configured. In the case of disabling ND-inspection or dynamic-learning, all the corresponding dynamic SBT entries are learned on the port that must be deleted.

Displaying ND-inspection SBT entries

About this task

Display SBT entries and other timer values.

Procedure

1. Log on to ACLI to enter User EXEC mode.
2. Display SBT entries and timer values.

   `show ipv6 neighbor binding [vlan <vlan-id> | interface <`*`type`*`> <`*`number`*`> | ipv6 <`*`ipv6-address`*`>]`

Example

```
Switch(config)#show ipv6 neighbor binding
Binding Table has 2 entries, 2 dynamic
Reachable-timer: 300 sec, Stale-timer: 86300 sec, Down-timer 86300 sec
Codes: S - Static, ND - Neighbor Discovery, DH - DHCP
Preflevel values in Hex (prlvl):
0001:Access 0002:MAC & LLA match 0008:DAD Learnt 0010:DHCP Learnt
0020:Learnt from Non-ND-inspect Port(Trusted-port)
Type IPv6-Addr LL-Addr
=================================================================
port vlan prlvl state Age (sec)
=================================================================
ND 500::111 00:50:56:84:00:20
1/8 1 0003 REACH 86
ND 501::333 00:50:56:84:00:1e
3/14 1 0003 REACH 60
```

Variable definitions

Use the data in the following table to use the **`show ipv6 neighbor binding`** command.

Variable	Description
[vlan <*vlan-id*> | interface <*type*> number | ipv6 <*ipv6-address*>	Displays SBT entries and other timer values.

Job aid

The following table shows the field descriptions for the **`show ipv6 neighbor binding`** command.

Field	Description
Reachable-timer	Indicates the default reachable lifetime for a dynamically learnt SBT entry.
Stale-timer	Indicates the default stale lifetime for a dynamically learnt SBT entry.
Down-timer	Indicates the default down lifetime for a dynamically learnt SBT entry.
Preflevel values in Hex (prlvl)	Indicates the source IP preference value learnt by the switch. SBT entry prefers the highest preference value . On a VLAN, if there is a same IP address from two different pots, the switch prefers only one SBT entry depending on the value learnt during the SBT learning process.
Type	Indicates the following SBT learning types: • ND - discovers SBT entry by processing only the ND packets. • DHCP - discovers SBT entry by snooping the DHCP IP assignment. • STATIC - statically configured.
IPv6-Addr	Indicates the IPv6 address.
LL-Addr	Indicates the MAC address corresponding to the learnt SBT entry.
port	Indicates the port on which the SBT entry is learnt.
vlan	Indicates the VLAN on which the SBT entry is learnt.
prlvl	Indicates the preference level values in hexadecimal.
state	Indicates different stages of the SBT learning process.
Age (sec)	Indicates the ellapsed time on the present state.

Chapter 8: Security configuration and management using Enterprise Device Manager

This chapter describes the methods and procedures necessary to configure security on the switch using Enterprise Device Manager (EDM).

EAPOL configuration using EDM

This section describes how you can configure network access control on an internal Local Area Network (LAN) with Extensible Authentication Protocol over LAN (EAPOL), using EDM.

Important:

You must enable EAPOL before you enable UDP Forwarding, IP Source Guard, and other features that use QoS policies.

Configuring EAPOL globally using EDM

Use the following procedure to configure EAPOL globally to configure EAPOL parameters for the switch.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **802.1X/EAP**.
3. On the **EAPOL** tab, configure the EAPOL parameters as required.
4. On the toolbar, click **Apply**.

Variable definitions

Use the data in the following table to configure EAPOL globally.

Variable	Value
DefaultEapAll	Resets all EAP settings.
SystemAuthControl	Enables or disables port access control on the switch.
UserBasedPoliciesEnabled	Enables the User Based Policies.
UserBasedPoliciesFilterOnMac	Enables the User Based Policies filtering on MAC addresses.
GuestVlanEnabled	Enables or disables the Guest VLAN.
GuestVlanId	Sets the VLAN ID of the Guest VLAN.
MultiHostAllowNonEapClient	Enables or disables support for non EAPOL hosts on EAPOL-enabled ports.
MultiHostSingleAuthEnabled	Enables or disables Multiple Host Single Authentication (MHSA). When selected, non EAPOL hosts are allowed on a port if there is one authenticated EAPOL client on the port.
MultiHostRadiusAuthNonEapClient	Enables or disables RADIUS authentication of non EAPOL hosts on EAPOL-enabled ports.
MultiHostAllowNonEapPhones	Enables or disables Avaya IP Phone clients as another non-EAP type.
MultiHostAllowRadiusAssignedVlan	Enables or disables the use of RADIUS-assigned VLAN values in the Multihost mode.
MultiHostAllowNonEapRadiusAssignedVlan	Enables or disables support for RADIUS-assigned VLANs in multihost-eap mode for non-EAP clients.
MultiHostUseMostRecentRadiusAssignedVlan	Enables or disables the Last Assigned VLAN on a port.
MultiHostMultiVlan	Enables or disables the multiple VLAN capability for EAP and non-EAP hosts. The default is disabled.
MultiHostEapPacketMode	Enables or disables the choice of packet mode (unicast or multicast) in the Multihost mode.
MultiHostEapProtocolEnabled	Enables or disables the processing of EAP protocol packets.
MultiHostFailOpenVlanEnabled	Enables or disables the EAPOL multihost Fail Open VLAN. **Important:** The switch does not validate that RADIUS Assigned VLAN attribute is not the same as the Fail_Open VLAN. This means that if you configure the Fail_Open VLAN name or ID the same as one of the VLAN names or IDs which can be returned from the RADIUS server, then EAP or NEAP clients cannot be assigned to the Fail_Open VLAN even though no failure to connect to the RADIUS server has occurred.
MultiHostFailOpenVlanId	Sets the VLAN ID of the Fail Open VLAN.
MultiHostFailOpenVlanContinuityModeEnabled	Enables or disables the EAPOL multihost Fail Open VLAN Continuity mode.
NonEapRadiusPasswordAttributeFormat	Configures the format of the RADIUS server password attribute for Non-EAP clients.

Table continues…

Variable	Value
MultiHostNonEapRadiusPasswordFreeformKey	Sets the user-configurable key for Non-EAP RADIUS password.
ConfirmMultiHostNonEapRadiusPasswordFreeformKey	Confirms the user-configurable key for Non-EAP RADIUS password.
NonEapUserBasedPoliciesEnabled	Enables Non-EAP User Based Policies settings.
NonEapUserBasedPoliciesFilterOnMac	Enables Non-EAP filtering on MAC addresses.
MultiHostAdacNonEapEnabled	Enables Non-EAP Multihost ADAC settings.
MultiHostNeapReauthenticationEnabled	Enables Multihost NEAP reauthentication.
MultiHostBlockDifferentVlanAuth	Enables or disables the block subsequent MAC authentication feature.

Enabling or disabling non-EAP client re-authentication using EDM

Use this procedure to enable or disable Non-EAP (NEAP) re-authentication for the switch.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **802.1X/EAP**.
3. In the work area, click the **EAPOL** tab.
4. Select **MultiHstNeapReauthenticationEnabled** to enable NEAP reauthentication.

   OR

   Clear **MultiHstNeapReauthenticationEnabled** to disable NEAP reauthentication.
5. On the toolbar, click **Apply**.

Port-based EAPOL configuration using EDM

Use the following procedures to configure EAPOL security parameters for single or multiple port.

Configuring port-based EAPOL for an individual port

About this task

Configure EAPOL security parameters for an individual port.

Procedure

1. On the **Device Physical View** select a port.
2. Right-click the port.
3. From the drop-down menu, click **Edit** or from the navigation tree, select **Edit** > **Chassis** > **Port**.

4. In the work area, click the **EAPOL** tab.
5. Configure the parameters as required.
6. In the toolbar, click **Apply**.

Variable definitions

Use the data in the following table to configure EAPOLsecurity parameters for an individual port.

Variable	Value
PortProtocolVersion	Specifies the EAP Protocol version running on this port.
PortCapabilities	Specifies the Port Access Entity (PAE) functionality implemented on this port. Always returns dot1xPaePortAuthCapable(0).
PortInitialize	Initializes the port EAPOL state. **Important:** Set this attribute to True to initialize the port EAPOL state.
PortReauthenticateNow	Reauthenticates the client. **Important:** Set this attribute to True to reauthenticate the client.
PaeState	Specifies the current authenticator PAE state machine state value.
BackendAuthState	Specifies the current state of the Backend Authentication state machine.
AdminControlledDirections	Specifies the current value of the administrative controlled directions parameter for the port. Available options are: • both • in Default is in.
OperControlledDirections	Specifies the current value of the operational controlled directions parameter for the port.
AuthControlledPortStatus	Specifies the current value of the controlled port status parameter for the port.
AuthControlledPortControl	Specifies the current value of the controlled port control parameter for the port. Available options are: • forcedUnauthorized • auto

Table continues…

Variable	Value
	• forcedAuthorized Default is forcedAuthorized.
QuietPeriod	Specifies the current value of the time interval between authentication failure and new authentication start. Value ranges between 0 and 65535 seconds. Default value is 60 seconds.
SupplicantTimeout	Specifies the time period to wait for a response from the supplicant for all EAP packets except EAP Request/Identity. The default is 30 seconds. The time interval can be between 1 and 65535.
ServerTimeout	Specifies the time period to wait for a response from the RADIUS server. The default is 30 seconds. The time interval can be between 1 and 65535 seconds.
MaximumRequests	Specifies the number of allowed retries while sending packets to the supplicant. The default is 2 seconds. The number of retries can be between 1.
ReAuthenticationPeriod	Specifies the time interval between successive reauthentications. The default is 3600 seconds. The time interval can be between 1 and 604800.
ReAuthenticationEnabled	Specifies if reauthentication is required. **Important:** Set this attribute to True to reauthenticate an existing supplicant at the time interval specified in the ReauthenticationPeriod field.
KeyTxEnabled	Specifies the value of the KeyTranmissionEnabled constant currently in use by the Authenticator PAE state machine. This always returns a value of False because key transmission is irrelevant.
LastEapolFrameVersion	Specifies the protocol version number carried in the most recently received EAPOL frame.
LastEapolFrameSource	Specifies the source MAC address carried in the most recently received EAPOL frame.

Configuring port-based EAPOL for multiple ports

About this task

You can configure the EAPOL security parameters on multiple ports using the Security or Edit folder from the navigation tree.

Procedure

1. Do any one of the following:
   a. On the **Device Physical View** use CTRL+ click to select more than one port.
   b. Right-click the port or group of ports.

c. From the drop-down menu, select **Edit** or from the navigation tree, select **Edit** > **Chassis** > **Port**.

d. On the work area, click the **EAPOL** tab.

Or

a. From the navigation tree, double-click **Security**.

b. In the Security tree, double-click **802.1X/EAP**.

c. In the work area, click the **EAPOL Ports** tab.

2. Optionally, to configure parameters for multiple ports, you can use the Make Selection section as below.
3. In the work area, in the Make Selection section of the Multiple Port Configuration pane, click the Switch/Stack/Ports ellipsis (...) to open the Port Editor dialog.
4. In the Port Editor window, click the ports you want to configure.

   ✱ **Note:**

   If you want to configure all ports, click **All**.
5. Click **OK** to return to the Make Selection pane.

   The ports you selected appear in the Switch/Stack/Ports box.
6. To change the configuration of the selected ports, in the Multiple Port Configuration pane, double-click the cell beneath the column heading that represents the parameter you want to change and do one of the following:
   - If applicable, select a value from a drop-down list.
   - Otherwise, type a value in the cell.
7. In the Make Selection pane, click **Apply Selection**.

   The changes appear in the table.
8. **(Optional)** Click **Clear Selection** to clear Multiple Port Configurations or click **Hide Non-Editable** to display only those parameters that are editable in the Multiple Port Configuration pane for the selected ports.

Variable definitions

Variable	Value
PortNumber	Indicates the port number.
AdminControlledDirections	Indicates the current value of the administrative controlled directions parameter for the port.
OperControlledDirections	Indicates the current value of the operational controlled directions parameter for the port.
AuthControlledPortStatus	Indicates the current value of the controlled port status parameter for the port.

Table continues…

Variable	Value
AuthControlledPortControl	Indicates the current value of the controlled port control parameter for the port.
QuietPeriod	Indicates the current value of the time interval between authentication failure, and the start of a new authentication.
SupplicantTimeout	Indicates the time to wait for response from supplicant for all EAP packets except EAP Request/Identity.
ServerTimeout	Indicates the time to wait for a response from the RADIUS server
MaximumRequests	Indicates the number of times to retry sending packets to the supplicant.
ReAuthenticationPeriod	Indicates the time interval between successive reauthentications.
ReAuthenticationEnabled	Indicates whether to reauthenticate or not. Setting this object to Enabled causes reauthentication of existing supplicant at the time interval specified in the Re-authentication Period field.

Configuring advanced port-based EAPOL using EDM

About this task

Configure advanced EAPOL security parameters for an individual port or multiple ports.

Procedure

1. Follow one of the following paths:
   - From the **Device Physical View**, select a port, or use Ctrl-click to select more than one port, right-click **Edit** then click the **EAPOL Advance** tab.
   - From the **Device Physical View**, select a port, or use Ctrl-click to select more than one port, then follow the navigation tree to **Edit > Chassis > Ports > EAPOL Advance** tab.
   - From the navigation tree, select **Security > 802.1X/EAP**, and click the **EAPOL Advance Ports** tab.
2. Configure the parameters as required.
3. Optionally, to configure parameters for multiple ports, you can use the Multiple Port Configuration section as below.
4. In the work area, in the Make Selection section of the Multiple Port Configuration pane, click the Switch/Stack/Ports ellipsis (...) to open the Port Editor dialog. If there is no Switch/Stack/Ports selection and you have already selected ports from the **Device Physical View**, proceed to the next step.

   a. In the Port Editor window, click the ports you want to configure. If you want to configure all ports, click **All**.

   b. Click **OK** to return to the Make Selection pane.

   The ports you selected appear in the Switch/Stack/Ports box.

5. To change the configuration of the selected ports, in the Multiple Port Configuration pane, double-click the cell beneath the column heading that represents the parameter you want to change and do one of the following:
   - If applicable, select a value from a drop-down list.
   - Otherwise, type a value in the cell.
6. In the Make Selection pane, click **Apply Selection**.

   The changes appear in the table.
7. **(Optional)** Click **Clear Selection** to clear Multiple Port Configurations or click **Hide Non-Editable** to display only those parameters that are editable in the Multiple Port Configuration pane for the selected ports.
8. In the toolbar, click **Apply**.

Variable definitions

Variable	Value
PortNumber	Indicates the port number.
DefaultEapAll	Enables or disables the default EAP settings.
GuestVlanEnabled	Enables or disables Guest VLAN functionality.
GuestVlanId	Specifies the VLAN ID of the VLAN that acts as the Guest VLAN. The default is 0. The Guest VLAN ID can be between 0 and 4094. **Important:** Use 0 to indicate a global Guest VLAN ID.
MultiHostMaxMacs	Specifies the maximum number of clients allowed on this port. The default is 1. The maximum number can be between 1 and 64.
MultiHostEnabled	Enables or disables Multiple Host/MAC support with Multiple Authentication (MHMA).
MultiHostEapMaxNumMacs	Specifies the maximum number of EAPOL-authenticated clients allowed on this port. The default is 1. The maximum number can be between 1 and 32
MultiHostAllowNonEapClient	Enables or disables support for non EAPOL clients using local authentication.
MultiHostNonEapMaxNumMacs	Specifies the maximum number of non EAPOL clients allowed on this port. The default is 1. The maximum number can be between 1 and 32.
MultiHostSingleAuthEnabled	Enables or disables Multiple Host with Single Authentication (MHSA) support for non EAPOL clients.

Table continues…

Variable	Value
MultiHostSingleAuthNoLimit	Specifies whether there is a limit on the number of auto-authenticated non-EAPOL clients. A value of true indicates no limit, false indicates there is a limit. DEFAULT: false
MultiHostRadiusAuthNonEapClient	Enables or disables support for non EAPOL clients using RADIUS authentication.
MultiHostAllowNonEapPhones	Enables or disables support for Avaya IP Phone clients as another non-EAP type.
MultiHostAllowRadiusAssignedVlan	Enables or disables support for VLAN values assigned by the RADIUS server.
MultiHostAllowNonEapRadiusAssignedVlan	Enables or disables support for RADIUS-assigned VLANs in multihost-EAP mode for non-EAP clients.
MultiHostUseMostRecentRadiusAssignedVlan	Enables or disables the use of most recent RADIUS VLAN.
MultiHostEapPacketMode	Specifies the mode of EAPOL packet transmission (multicast or unicast).
EapProtocolEnabled	Enables or disables EAP protocol.
MultiHostBlockDifferentVlanAuth	Enables or disables the block subsequent MAC authentication feature.
ProcessRadiusRequestsServerPackets	Enables or disables the processing of RADIUS requests-server packets that are received on this port.
MultiHostClearNeap	Clears authenticated NEAP clients from a specified port. To clear a specific authenticated NEAP client from the specified port, type the MAC address of that client in the box. To clear all authenticated NEAP clients from the specified port, type a MAC address of 00:00:00:00:00:00 in the box.
MultiHostAdacNonEapEnabled	Enables or disables Non-EAP Multihost ADAC settings.

Graphing port EAPOL statistics using EDM

Use this procedure to display and graph port EAPOL statistics.

Procedure

1. From the Device Physical View, click a port.
2. From the navigation pane, double-click **Graph**.
3. In the Graph tree, double-click **Port**.

4. In the work area, click the **EAPOL Stats** tab.
5. On the toolbar, select a **Poll Interval** from the list.
6. On the toolbar, you can click **Clear Counters** to reset the IP statistics counters.
7. To select statistics to graph, click a statistic type row under a column heading.
8. On the toolbar, click **Line Chart**, **Area Chart**, **Bar Chart**, or **Pie Chart**.

Variable definitions

Use the data in the following table to help you understand port EAPOL statistics.

Variable	Value
EapolFramesRx	The number of valid EAPOL frames of any type that are received by this authenticator.
EapolFramesTx	The number of EAPOL frame types of any type that are transmitted by this authenticator.
EapolStartFramesRx	The number of EAPOL start frames that are received by this authenticator.
EapolLogoffFramesRx	The number of EAPOL Logoff frames that are received by this authenticator.
EapolRespIdFramesRx	The number of EAPOL Resp/Id frames that are received by this authenticator.
EapolRespFramesRx	The number of valid EAP Response frames (Other than Resp/Id frames) that are received by this authenticator.
EapolReqIdFramesTx	The number of EAPOL Req/Id frames that are transmitted by this authenticator.
EapolReqFramesTx	The number of EAP Req/Id frames (Other than Req/Id frames) that are transmitted by this authenticator.
InvalidEapolFramesRx	The number of EAPOL frames that are received by this authenticator in which the frame type is not recognized.
EapLengthError FramesRx	The number of EAPOL frames that are received by this authenticator in which the packet body length field is not valid.

Graphing port EAPOL diagnostics using EDM

Use this procedure to display and graph port EAPOL diagnostic statistics.

Procedure

1. From the Device Physical View, click a port.
2. From the navigation pane, double-click **Graph**.
3. In the Graph tree, double-click **Port**.
4. In the work area, click the **EAPOL Diag** tab.

5. On the toolbar, select a **Poll Interval** from the list.
6. On the toolbar, you can click **Clear Counters** to reset the IP statistics counters.
7. To select statistics to graph, click a statistic type row under a column heading.
8. On the toolbar, click **Line Chart**, **Area Chart**, **Bar Chart**, or **Pie Chart**.

Variable definitions

Use the data in the following table to help you understand EAPOL diagnostic statistics.

Variable	Value
EntersConnecting	Counts the number of times that the state machine transitions to the connecting state from any other state.
EapLogoffsWhileConnecting	Counts the number of times that the state machine transitions from connecting to disconnecting because of receiving an EAPOL-Logoff message.
EntersAuthenticating	Counts the number of times that the state machine transitions from connecting to authenticating, because of an EAP-Response or Identity message being received from the Supplicant.
AuthSuccessWhile Authenticating	Counts the number of times that the state machine transitions from authenticating to authenticated, because of the Backend Authentication state machine indicating a successful authentication of the Supplicant.
AuthTimeoutsWhile Authenticating	Counts the number of times that the state machine transitions from authenticating to aborting, because of the Backend Authentication state machine indicating an authentication timeout.
AuthFailWhileAuthenticating	Counts the number of times that the state machine transitions from authenticating to held, because of the Backend Authentication state machine indicating an authentication failure.
AuthReauthsWhile Authenticating	Counts the number of times that the state machine transitions from authenticating to aborting, because of a reauthentication request.
AuthEapStartsWhile Authenticating	Counts the number of times that the state machine transitions from authenticating to aborting, because of an EAPOL-Start message being received from the Supplicant.
AuthEapLogoffWhile Authenticating	Counts the number of times that the state machine transitions from authenticating to aborting, because of an EAPOL-Logoff message being received from the Supplicant.
AuthReauthsWhile Authenticated	Counts the number of times that the state machine transitions from authenticated to connecting, because of a reauthentication request.

Table continues…

Variable	Value
AuthEapStartsWhile Authenticated	Counts the number of times that the state machine transitions from authenticated to connecting, because of an EAPOL-Start message being received from the Supplicant.
AuthEapLogoffWhile Authenticated	Counts the number of times that the state machine transitions from authenticated to disconnected, because of an EAPOL-Logoff message being received from the Supplicant.
BackendResponses	Counts the number of times that the state machine sends an initial Access-Request packet to the Authentication server. Indicates that the Authenticator attempted communication with the Authentication Server.
BackendAccessChallenges	Counts the number of times that the state machine receives an initial Access-Challenge packet from the Authentication server. Indicates that the Authentication Server has communication with the Authenticator.
BackendOtherRequestsTo Supplicant	Counts the number of times that the state machine sends an EAP-Request packet, other than an Identity, Notification, Failure or Success message, to the Supplicant. Indicates that the Authenticator chooses an EAP-method.
BackendNonNakResponses FromSupplicant	Counts the number of times that the state machine receives a response from the Supplicant to an initial EAP-Request, and the response is something other than EAP-NAK. Indicates that the Supplicant can respond to the EAP-method that the Authenticator chooses.
BackendAuthSuccesses	Counts the number of times that the state machine receives an EAP-Success message from the Authentication Server. Indicates that the Supplicant has successfully authenticated to the Authentication Server.
BackendAuthFails	Counts the number of times that the state machine receives an EAP-Failure message from the Authentication Server. Indicates that the Supplicant has not authenticated to the Authentication Server.

Viewing Multihost status information using EDM

Use the following procedure to view Multihost status information to display multiple host status for a port.

Important:

The **Multi Hosts** button is not available when you select multiple ports before clicking the EAPOL Advance tab. You can select only one port to use the Multi Hosts option.

Procedure

1. From the **Device Physical View**, select a port.

2. From the navigation tree, double-click **Edit**.
3. In the Edit tree, double-click **Chassis**.
4. In the Chassis tree, double-click **Ports**.
5. In the work area, click the **EAPOL Advance** tab.
6. On the toolbar, click **Multi Hosts**.

Variable definitions

Use the data in the following table to view Multihost status information.

Variable	Value
PortNumber	Indicates the port number in use.
ClientMACAddr	Indicates the MAC address of the client.
PaeState	Indicates the current state of the authenticator PAE state machine.
BackendAuthState	Indicates the current state of the Backend Authentication state machine.
Reauthenticate	Indicates the current reauthentication state of the machine. When the reauthenticate attribute is set to True, the client reauthenticates.
Vid	Indicates the VLAN assigned to the client.
Pri	Indicates the priority of the client.

Viewing Multihost session information using EDM

Use the following procedure to view Multihost session information to display multiple host session information for a port.

Important:

The **Multi Hosts** button is not available when you select multiple ports before clicking the EAPOL Advance tab. You can select only one port to use the Multi Hosts option.

Procedure

1. From the **Device Physical View**, select a port.
2. From the navigation tree, double-click **Edit**.
3. In the Edit tree, double-click **Chassis**.
4. In the Chassis tree, double-click **Ports**.
5. In the work area, click the **EAPOL Advance** tab.
6. On the toolbar, click **Multi Hosts Multi Host Session** tab.

Variable definitions

Use the data in the following table to view Multihost session information.

Variable	Value
PortNumber	Indicates the port number in use.
ClientMACAddr	Indicates the MAC address of the client.
Id	Indicates the unique identifier for the session, in the form of a printable ASCII string of at least three characters.
AuthenticMethod	Indicates the authentication method used to establish the session.
Time	Indicates the elapsed time of the session.
TerminateCause	Indicates the cause of the session termination.
UserName	Indicates the user name representing the identity of the supplicant PAE.

Viewing Multihost DHCP authenticated information using EDM

Use this procedure to view multiple host DHCP authenticated information for a port.

Note:

The Multi Hosts and Non-EAP MAC buttons are not available when configuring multiple ports on the EAPOL Advance tab. To make use of these two options, you can select only one port.

Procedure

1. In the **Device Physical View**, select a port.
2. From the navigation tree, double-click **Edit**.
3. In the Edit tree, double-click **Chassis**.
4. In the Chassis tree, double-click **Ports**.
5. In the work area, click the **EAPOL Advance** tab.
6. On the toolbar, click **Multi Hosts DHCP Authenticated** tab.

Variable definitions

Use the data in the following table to view Multihost DHCP Authenticated session information.

Field	Description
PortNumber	Specifies the port number in use.
ClientMACAddr	Specifies the MAC address of the client.
Username	Specifies the client user name.

Allowed non-EAP MAC address list configuration using EDM

This section describes the procedures to configure the allowed non-EAP MAC address list to view and configure the list of MAC addresses for non-EAPOL clients that are authorized to access the port.

Adding a MAC address to the allowed non-EAP MAC address list using EDM

Use the following procedure to add a MAC address to the allowed non-EAP MAC address list to insert a new MAC address to the list of MAC addresses for non-EAPOL clients that are authorized to access the port.

Important:

The **Non-EAP MAC** button is not available when you select multiple ports before clicking the EAPOL Advance tab. You can select only one port to use the Non-EAP MAC option.

Procedure

1. From the **Device Physical View**, select a port.
2. From the navigation tree, double-click **Edit**.
3. In the Edit tree, double-click **Chassis**.
4. In the Chassis tree, double-click **Ports**.
5. In the work area, click the **EAPOL Advance** tab.
6. In the table, click the port you want to edit.
7. In the tool bar, click the **Non-EAP MAC** button.
8. On the **Allowed non-EAP MAC** table, in the **ClientMACAddr** column, click a client MAC Address to insert.
9. In the ClientMACAddr box, enter a MAC address to add to the list of allowed non-EAPOL clients.
10. Click **Insert**.
11. On the tool bar, click **Apply** to confirm the addition.
12. On the tool bar, you can click **Refresh** to see the results of your addition.

Deleting a MAC address from the allowed non-EAP MAC address list using EDM

Procedure

1. From the **Device Physical View**, select a port.
2. From the navigation tree, double-click **Edit**.
3. In the Edit tree, double-click **Chassis**.

4. In the Chassis tree, double-click **Ports**.
5. In the work area, click the **EAPOL Advance** tab.
6. In the table, click the port you want to edit.
7. In the tool bar, Click the **Non-EAP MAC** button.

   Important:

   The **Non-EAP MAC** button is not available when you select multiple ports before clicking the EAPOL Advance tab. You can select only one port to use the Non-EAP MAC option.
8. On the **Allowed non-EAP MAC** table, in the **ClientMACAddr** column, click a client MAC Address to insert.
9. On the toolbar, click **Delete**.
10. Click **Yes** to confirm the deletion.
11. On the tool bar, you can click **Refresh** to see the results of your addition.

Variable definitions

Use the data in the following table to delete a MAC address from the allowed non-EAP MAC address list.

Variable	Value
PortNumber	Indicates the port number in use.
ClientMACAddr	Indicates the MAC address of the client.

Viewing port non-EAP host support status using EDM

Use the following procedure to display the status of non-EAP host support on the port.

Procedure

1. From the **Device Physical View**, select a port.
2. From the navigation tree, double-click **Edit**.
3. In the Edit tree, double-click **Chassis**.
4. In the Chassis tree, double-click **Ports**.
5. In the work area, click the **EAPOL Advance** tab.
6. In the tool bar, click the **Non-EAP MAC** button.
7. Click the **Non-EAP Status** tab.

Variable definitions

The following table describes the fields of the **Non-EAP Status** tab.

Variable	Value
PortNumber	Indicates the port number in use.
ClientMACAddr	Indicates the MAC address of the client.
State	Indicates the authentication status. Possible values are: • rejected: the MAC address cannot be authenticated on this port • locallyAuthenticated: the MAC address was authenticated using the local table of allowed clients • radiusPending: the MAC address is awaiting authentication by a RADIUS server • radiusAuthenticated: the MAC address was authenticated by a RADIUS server • adacAuthenticated: the MAC address was authenticated using ADAC configuration tables • mhsaAuthenticated: the MAC address was autoauthenticated on a port following a successful authentication of an EAP client
Reauthenticate	Indicates the value used to reauthenticate the MAC address of the client on the port.
Vid	Indicates the VLAN assigned to the client.
Pri	Indicates the priority of the client.

Enabling VoIP VLAN using EDM

Use the following procedure to activate the VoIP VLAN.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **802.1X/EAP**.
3. In the work area, click the **EAP VoIP Vlan** tab.
4. In the table, double-click the cell under the column header you want to edit.
5. Select a parameter or value from the drop-down list.

   Repeat Step 4 and Step 5 until all required parameters have been amended.
6. On the toolbar, click **Apply**.

Variable Definitions

The following table defines variables you can use to enable VoIP VLAN.

Variable	Value
MultiHostVoipVlanIndex	Indicates the multihost VoIP VLAN index. Range is 1–5.
MultiHostVoipVlanEnabled	Enables (true) or disables (false) the multihost VoIP VLAN.
MultiHostVoipVlanId	Indicates the VLAN ID; value ranges from 1–4094.

Setting the switch HTTP/HTTPS port using EDM

Use the following procedure to configure HTTP/HTTPS port parameters for the switch.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **General**.
3. On the **Http/Https** tab, configure the HTTP/HTTPS parameters as required.
4. On the toolbar, click **Apply**.

Variable definitions

The following table describes the fields of the Http/Https tab.

Variable	Value
HttpPort	Specifies a value for the switch HTTP port, ranging from 1024 to 65535. The default value is 80.
HttpsPort	Specifies a value for the switch HTTPS port, ranging from 1024 to 65535. The default value is 443.
SecureOnly	Configures the Web server to respond to HTTPS only, or respond to both HTTPS and HTTP client browser requests. **Important:** If you configure the Web server to respond to HTTPS client browser requests only, all existing non-secure connections with the browser are terminated.

Configuring general switch security using EDM

Use the following procedure to configure general switch security and to configure and manage general security parameters for the switch.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **MAC Security**.
3. On the **MAC Security** tab, configure general switch security parameters as required.
4. On the toolbar, click **Apply**.

Variable definitions

Use the data in the following table to configure general switch security.

Variable	Value
AuthSecurityLock	If this parameter is listed as locked, the agent refuses all requests to modify the security configuration. Entries also include: • other • notlocked
AuthCtlPartTime	Indicates the duration of time for port partitioning in seconds. Default: 0 (zero). When the value is zero, port remains partitioned until it is manually reenabled.
SecurityStatus	Indicates whether or not the switch security feature is enabled.
SecurityMode	Indicates the mode of switch security. Entries include: • macList—Indicates that the switch is in the MAC-list mode. You can configure more than one MAC address for a port. • autoLearn—Indicates that the switch learns the MAC addresses on each port as allowed addresses of that port.
SecurityAction	Indicates the actions performed by the software when a violation occurs (when SecurityStatus is enabled). The security action specified here applies to all ports of the switch. A blocked address causes the port to be partitioned when unauthorized access is attempted. Selections include: • noAction—Port does not have security assigned to it, or the security feature is turned off. • trap—Listed trap. • partitionPort—Port is partitioned.

Table continues…

Variable	Value
	• partitionPortAndsendTrap—Port is partitioned and traps are sent to the trap receive station. • daFiltering—Port filters out the frames where the destination address field is the MAC address of unauthorized Station. • daFilteringAndsendTrap—Port filters out the frames where the destination address field is the MAC address of unauthorized station. Traps are sent to trap receive stations. • partitionPortAnddaFiltering— Port is partitioned and filters out the frames where the destination address field is the MAC address of unauthorized station. • partitionPortdaFilteringAndsendTrap—Port is partitioned and filters out the frames where the destination address field is the MAC address of unauthorized station. Traps are sent to trap receive stations. **Important:** da means destination addresses.
CurrNodesAllowed	Indicates the current number of entries of the nodes allowed in the AuthConfig tab.
MaxNodesAllowed	Indicates the maximum number of entries of the nodes allowed in the AuthConfig tab.
PortSecurityStatus	Indicates the set of ports for which security is enabled.
PortLearnStatus	Indicates the set of ports where autolearning is enabled.
CurrSecurityLists	Indicates the current number of entries of the Security listed in the SecurityList tab
MaxSecurityLists	Indicates the maximum entries of the Security listed in the SecurityList tab.
AutoLearningAgingTime	Indicates the MAC address age-out time, in minutes, for the autolearned MAC addresses. A value of zero (0) indicates that the address never ages out.
AutoLearningSticky (sticky-mac)	Enables or disables MAC security auto-learning sticky mode.
SecurityLockoutPortList	Controls the list of ports that are locked so they are excluded from MAC-based security. **Important:** You must disable autolearning before you change the **SecurityLockoutPortList**.

Security list configuration using EDM

Use the procedures in this section to configure the security list to manage the port members in a security list.

Adding ports to a security list using EDM

Use the following procedure to add ports to the security list to insert new port members into a security list.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **MAC Security**.
3. In the work area, click the **Security List** tab.
4. On the toolbar, click the **Insert** button.

   The **Insert SecurityList** dialog box displays.
5. Type a number for the security list in the **SecurityListIndx** box.
6. Click the SecurityListMembers ellipsis **[...]**, and select ports to add to the security list.

   OR

   Click **All** to select all ports.
7. Click **Ok**.
8. Click **Insert**.

Variable definitions

Use the data in the following table to add ports to the security list.

Variable	Value
SecurityListIndx	Indicates a numerical identifier for a security list. Values range from 1–32.
SecurityListMembers	Defines the security list port members.

Deleting specific ports from a security list using EDM

Use the following procedure to delete specific ports from a security list to remove specific existing port members from a security list.

Procedure

1. From the navigation tree, double-click **Security**.

2. In the Security tree, double-click **MAC Security**.
3. In the work area, click the **SecurityList** tab.
4. Double-click the **SecurityListMembers** box for a security list.
5. Clear security list port members as required.
6. Click **Ok**.
7. Click **Apply**.

Variable definitions

Use the data in the following table to delete specific ports from a security list.

Variable	Value
SecurityListIndx	Indicates the numerical identifier for a security list. Values range from 1–32.
SecurityListMembers	Defines the security list port members.

Deleting all ports from a security list using EDM

Use the following procedure to delete all ports from a security list to remove all existing port members from a security list.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **MAC Security**.
3. In the work area, click the **SecurityList** tab.
4. Click the **SecurityListMembers** box for a security list.
5. Click **Delete**.
6. Click **Yes**.

Variable definitions

Use the data in the following table to delete all ports from a security list.

Variable	Value
SecurityListIndx	Indicates the numerical identifier for a security list. Values range from 1–32.
SecurityListMembers	Defines the security list port members.

AuthConfig list configuration using EDM

This section describes how you can add entries to or remove entries from a list of boards, ports and MAC addresses that have the security configuration.

Adding entries to the AuthConfig list using EDM

Use the following procedure to add information to the list of boards, ports, and MAC addresses that have the security configuration.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **MAC Security**.
3. In the work area, click the **AuthConfig** tab.
4. On the toolbar, click **Insert**.

   The **Insert AuthConfig** dialog box displays.
5. Type a value in the **BrdIndx** box.
6. Type a value in the **PortIndx** box.
7. Type a value in the **MACIndx** box.
8. Select the **AutoLearningSticky** check box to enable Sticky MAC address.

   OR

   Clear the **AutoLearningSticky** check box, if selected, to disable Sticky MAC address.
9. Select **AccessCtrlType** to allow a MAC address on multiple ports.

   OR

   Clear **AccessCtrlType** to disallow a MAC address on multiple ports.
10. Type a value in the **SecureList** box.

    OR

    Type a value in the **Trunk** box.
11. Click **Insert**.

Variable definitions

Use the data in the following table to add entries to the list of boards, ports and MAC addresses that have the security configuration.

Variable	Value
BrdIndx	Indicates the index of the board. This corresponds to the unit. **Important:** If a BrdIndx is specified, the SecureList field is 0.
PortIndx	Indicates the index of the port. **Important:** If a PortIndx is specified, the SecureList field is 0.
MACIndx	Indicates the index of MAC addresses that are designated as `allowed` (station).
AutoLearningSticky (sticky-mac)	Enables or disables the storing of automatically learned MAC addresses across switch reboots. **Important:** When the AutoLearningSticky check box is selected, you cannot modify AccessCtrlType and SecureList.
AccessCtrlType	Displays the node entry `node allowed` . A MAC address can be allowed on multiple ports.
SecureList	Indicates the index of the security list. This value is meaningful only if BrdIndx and PortIndx values are set to zero. For other board and port index values, this field can also have the value of zero. The corresponding MAC address of this entry is allowed or blocked on all ports of this port list.
Source	Indicates the method used by the MAC security and MAC address tables to learn MAC addresses. Values include: • **Static** • **Sticky** • **AutoLearn**
Lifetime	Indicates the time period before the system automatically deletes an AuthConfig entry.
Trunk	Indicates the trunk ID. **Note:** You cannot specify a trunk ID and a security list at the same time.

Deleting entries from the AuthConfig list using EDM

Use the following procedure to remove information from the list of boards, ports, and MAC addresses that have security configuration.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **MAC Security**.
3. In the work area, click the **AuthConfig** tab.
4. Select a list entry.
5. Click **Delete**.
6. Click **Yes**.

Configuring MAC Address AutoLearn using EDM

Use the following procedure to configure MAC Address AutoLearn to configure the MAC Address auto-learning properties of switch ports.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **MAC Security**.
3. In the work area, click the **AutoLearn** tab.
4. Double-click the **Enabled** box for a port.
5. Select **true** to enable AutoLearn on the port.

   OR

   Select **false** to disable AutoLearn on the port.
6. Double-click the **MaxMacs** box for a port.
7. Type a value between 1 and 25.
8. Click **Apply**.

Variable definitions

Use the data in the following table to configure MAC Address AutoLearn.

Variable	Value
Unit	Identifies the unit.
Port	Identifies the port.
Enabled	Enables or disables AutoLearning on a port. Values are true or false.

Table continues…

Variable	Value
MaxMacs	Defines the maximum number of MAC Addresses that the port can learn.

Viewing AuthStatus information using EDM

Use the following procedure to view AuthStatus information to display authorized boards and port status data collection information. Displayed information includes actions to be performed when an unauthorized station is detected and the current security status of a port.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **MAC Security**.
3. Click the **AuthStatus** tab to view the status information.

Variable definitions

Use the data in the following table to view AuthStatus information.

Variable	Value
AuthStatusBrdIndx	Indicates the index of the board. This corresponds to the index of the slot containing the board if the index is greater than zero.
AuthStatusPortIndx	Indicates the index of the port on the board. This corresponds to the index of the last manageable port on the board if the index is greater than zero.
AuthStatusMACIndx	Indicates the index of MAC address on the port. This corresponds to the index of the MAC address on the port if the index is greater than zero.
CurrentAccessCtrlType	Displays whether the node entry is `node allowed` or `node blocked type`.
CurrentActionMode	Indicates the value representing the type of information contained, including: • noAction—Port does not have security assigned to it, or the security feature is turned off. • partitionPort—Port is partitioned. • partitionPortAndsendTrap— Port is partitioned and traps are sent to the trap receive station. • Filtering—Port filters out the frames, where the destination address field is the MAC address of unauthorized station.

Table continues…

Variable	Value
	• FilteringAndsendTrap—Port filters out the frames, where the destination address field is the MAC address of unauthorized station. Trap are sent to trap receive station. • sendTrap—A trap is sent to trap receive stations. • partitionPortAnddaFiltering— Port is partitioned and will filter out the frames where the destination address field is the MAC address of unauthorized station. • partitionPortdaFilteringAndsendTrap—Port is partitioned and will filter out the frames where the destination address field is the MAC address of unauthorized station. Traps are sent to trap receive stations.
CurrentPortSecurStatus	Displays the security status of the current port, including: • If the port is disabled, notApplicable is returned. • If the port is in a normal state, portSecure is returned. • If the port is partitioned, portPartition is returned.

Viewing AuthViolation information using EDM

Use the following procedure to view AuthViolation information to display a list of boards and ports where network access violations have occurred, and to display the identity of the offending MAC addresses.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **MAC Security**.
3. Click the **AuthViolation** tab to view the AuthViolation information.

Variable definitions

Use the data in the following table to view AuthViolation information.

Variable	Value
BrdIndx	Indicates the index of the board. This corresponds to the slot containing the board. The index is 1 where it is not applicable.
PortIndx	Indicates the index of the port on the board. This corresponds to the port on that a security violation was seen.
MACAddress	Indicates the MAC address of the device attempting unauthorized network access (MAC address-based security).

Viewing MacViolation information using EDM

Use the following procedure to view MacViolation information to display a list of boards and ports where network access violations have occurred, and to display the identity of the offending MAC addresses.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **MAC Security**.
3. Click the **MacViolation** tab.

Variable definitions

Use the data in the following table to view MacViolation information.

Variable	Value
Address	Indicates the MAC address of the device attempting unauthorized network access (MAC address-based security).
Brd	Indicates the index of the board. This corresponds to the slot containing the board. The index is 1 when it is not applicable.
Port	Indicates the index of the port on the board. This corresponds to the port on which a security violation was seen.

Filtering packets from specified MAC DAs

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **MAC Security**.
3. Click the **MAC DA Filters** tab.

Variable definitions

Use the data in the following table to view MAC DA Filters information.

Variable	Value
MACAddress	Specifies the MAC destination addresses filtered. All packets with one of the specified MAC addresses as the DAs are dropped regardless of the ingress port, source address intrusion, or virtual local area network (VLAN) membership.

Variable	Value
	Up to 10 MAC DAs can be filtered.

Configuring Secure Shell protocol using EDM

Use the following procedure to configure the Secure Shell (SSH) protocol to replace Telnet and provide secure access to the ACLI interface.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **SSH/SSL**.
3. In the work area, click the **SSH** tab.
4. Configure SSH parameters as required.
5. On the toolbar, click **Apply**.

Variable definitions

Variable	Value
Enable	Enables, disables, or selects secure mode for SSH authentication. • false • true • secure
Version	Displays the SSH version.
Port	Defines the SSH connection port. Values range from 1 to 65535.
Timeout	Defines the SSH connection timeout in seconds. Values range from 1 to 120 seconds.
KeyAction	Specifies the SSH key action. • generateDsa • generateRsa • deleteDsa • deleteRsa
RsaAuth	Enables or disables SSH RSA authentication
DsaAuth	Enables or disables SSH DSA authentication.

Table continues…

Variable	Value
PassAuth	Enables or disables SSH password authentication.
RsaAuthKeyName	Indicates the authentication key name.
DsaAuthKeyName	Indicates the authentication key name.
RsaHostKeyStatus	Indicates the current status of the SSH RSA host key. Values include: • noSuchInstance_OID • notGenerated • generated • generating
DsaHostKeyStatus	Indicates the current status of the SSH DSA host key. Values include: • noSuchInstance_OID • notGenerated • generated • generating
TftpServerInetAddressType	Indicates the type of address stored in the TFTP server. Values include: • ipv4 • ipv6
TftpServerInetAddress	Specifies the IP address of the TFTP server for all TFTP operations.
TftpFile	Indicates the name of file for the TFTP transfer.
TftpAction	Specifies the action for the TFTP transfer. Values include: • none • downloadSshDsaPublicKeys • deleteSshDsaAuthKey • downloadSshRsaPublicKeys • deleteSshRsaAuthKey
TftpResult	Displays the result of the last TFTP action request.
SshAuthKeyFilename	Specifies the SSH authentication key file to download.
UsbTargetUnit	Specifies the unit number of the USB port to use for file uploads and downloads. Values range from 0 to 9. Value 0 applies to the TFTP server. Values 1 to 8 apply to a USB port in a switch stack. Value 9 applies to a standalone switch.

Table continues…

Variable	Value
Action	• none • dnldSshDsaAuthKeyFromUsb—when selected, specifies to download the SSH DSA authentication key using the USB port. • dnldSshRsaAuthKeyFromUsb—when selected, specifies to download the SSH RSA authentication key using the USB port.
Status	Indicates the status of the latest SSH authentication key download using the USB port. Values include the following: • other—no action taken since the switch boot up • inProgress—authentication key download is in progress • success—authentication key download completed successfully • fail—authentication key download failed

Viewing SSH Sessions information using EDM

Use the following procedure to display currently active SSH session information.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **SSH/SSL**.
3. In the work area, click the **SSH Sessions** tab.

Variable definitions

Variable	Value
SshSessionInetAddressType	Indicates the type of IP address of the SSH client that opened the SSH session.
SshSessionInetAddress	Indicates the IP address of the SSH client that opened the SSH session.

Configuring an SSH Client using EDM

Use this procedure to configure and manage a Secure Shell (SSH) Client.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **SSH/SSL**.
3. In the work area, click the **SSHC/SFTP** tab.
4. Configure SSHC parameters as required.
5. Click **Apply**.

Variable definitions

Variable	Value
KeyAction	Specifies the action to take for the SSH Client host key. Values include: • none—take no host key action. • generateDsa—generates a DSA host key for the SSH Client. • generateRsa—generates an RSA host key for the SSH Client. • deleteDsa—deletes the SSH Client DSA host key. • deleteRsa—deletes the SSH Client RSA host key. • generateDsaForce—generates a new, active DSA host key, even in the presence of an existing DSA key. • generateRsaForce—generates a new, active RSA host key, even in the presence of an existing RSA key.
KeyFileName	Specifies the a SSH Client host key file name.
TftpAction	Specifies the type of SSH Client authentication key to upload using TFTP. Values include: • none—do not upload an SSH Client authentication key using TFTP. • uploadSshcDsaAuthKey—uploads a DSA SSH Client authentication key using TFTP. • uploadSshcRsaAuthKey—uploads an RSA SSH Client authentication key using TFTP.
TftpServerInetAddressType	Indicates the type of address stored in the TFTP server. Values include: • ipv4 • ipv6

Table continues…

Variable	Value
TftpServerInetAddress	Specifies the IP address of the TFTP server for TFTP operations.
UsbAction	Specifies the type of SSH Client authentication key to upload using USB. Values include: • none—do not upload an SSH Client authentication key using USB. • uploadSshcDsaAuthKey—uploads a DSA SSH Client authentication key using USB. • uploadSshcRsaAuthKey—uploads an RSA SSH Client authentication key using USB.
UsbTargetUnit	Specifies the unit number of the USB port to use for file uploads and downloads. Values range from 0 to 9. Value 0 applies to the TFTP server. Values 1 to 8 apply to a USB port in a switch stack. Value 9 applies to a standalone switch.
DsaKeySize	Specifies the DSA key size. Values range from 512 to 1024.
RsaKeySize	Specifies the RSA key size. Values range from 1024 to 2048.
DsaHostKeyStatus	Indicates the current status of the SSH Client DSA host key. Values include: • notGenerated • generated • generating
RsaHostKeyStatus	Indicates the current status of the SSH Client RSA host key. Values include: • notGenerated • generated • generating
SFTP	
Port	Specifies the TCP port number for the SFTP file transfer. Values range from 1 to 65535.
Authentication	Specifies the SSH authentication type. Values include: • DsaAuthentication • RsaAuthentication • PasswordAuthentication

Table continues…

Variable	Value
SftpServerInetAddressType	Indicates the type of address stored in the SFTP server. Values include: • ipv4 • ipv6
SftpServerInetAddress	Specifies the IP address of the SFTP server for SFTP operations.
UserName	Specifies the user name.
SftpServerPassword	Specifies the SFTP server password.
Confirm SftpServerPassword	Confirms the SFTP server password.

Configuring SSL using EDM

Use the following procedure to configure Secure Socket Layer (SSL) to provide your network with a secure Web management interface.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **SSH/SSL**.
3. In the work area, click the **SSL** tab.
4. Configure SSL parameters as required.
5. Click **Apply**.

Variable definitions

Variable	Value
Enabled	Indicates whether SSL is enabled or disabled
CertificateControl	Creates or deletes SSL certificates. The last value set is displayed until you change the selection. The default value is **other**, which indicates that the object was never set.
CertificateExists	Indicates whether a valid SSL certificate is created. Values include: • true—indicates that a valid certificate is created. • false—indicates that no valid certificate is created, or that the certificate is deleted.

Table continues…

Variable	Value
CertificateControlStatus	Indicates the status of the most recent attempt to create or delete a certificate. The possible status messages are as follows: • inProgress—the operation is not yet completed • success—the operation is complete • failure—the operation failed • other—CertificateControl was never set
ServerControl	Resets the SSL server. Values are reset and other. The default is other. **Important:** You cannot reset the SSL server while creating the SSL certificate.

Configuring RADIUS globally using EDM

Remote users can change their account passwords when RADIUS server is configured and enabled in their network.

When RADIUS servers are configured in a network, they provide centralized authentication, authorization, and accounting for network access. The MS-CHAPv2 encapsulation method can be enabled to permit RADIUS password change for the user accounts.

Use the following procedure to configure RADIUS security and encapsulation for the switch.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **RADIUS**.
3. In the work area, click the **Globals** tab.
4. In the RADIUS section, select the **UseMgmtIp** checkbox, to enable RADIUS request use management.

   OR

   In the RADIUS section, clear the **UseMgmtIp** checkbox to disable RADIUS request use management.
5. In the RADIUS section, select the **PasswordFallbackEnabled** checkbox. to enable RADIUS password fallback.

   OR

In the RADIUS section, clear the **PasswordFallbackEnabled** checkbox to disable RADIUS password fallback.

6. In the RADIUS section, select the **DynAuthReplayProtection** checkbox, to enable RADIUS replay protection.

   OR

   In the RADIUS section, clear the **DynAuthReplayProtection** checkbox to disable RADIUS replay protection.

7. In the RADIUS section, click a **Reachability** radio button.
8. In the RADIUS section, type the reachability user name in the **ReachabilityUserName** dialog box.
9. In the RADIUS section, type the reachability password in the **ReachabilityPassword** dialog box.
10. In the RADIUS section, type the reachability password again to confirm in the **Confirm ReachabilityPassword** dialog box.
11. In the RADIUS Encapsulation section, click an **EncapsulationProtocol** radio button.
12. On the toolbar, click **Apply**.

Variable definitions

Use the data in the following table configure RADIUS security and encapsulation for the switch

Variable	Value
UseMgmtIp	When selected, RADIUS uses the system management IP address as the source address for RADIUS requests.
PasswordFallbackEnabled	When selected, enables RADIUS password fallback.
DynAuthReplayProtection	When selected, enables RADIUS replay protection.
Reachability	Specifies the RADIUS server reachability mode. Values include: • useradius—uses dummy RADIUS requests to determine reachability of the RADIUS server. • useicmp—uses ICMP packets to determine reachability of the RADIUS server (default).
ReachabilityUserName	Specifies a user identification name for RADIUS reachability.
ReachabilityPassword	Specifies a user password for RADIUS reachability.
Confirm ReachabilityPassword	Re-enter the user password for verification.

Table continues…

Variable	Value
EncapsulationProtocol	Specifies the type of encapsulation for the RADIUS packets. Values include: • pap — Password Authentication Protocol. • ms-chap-v2 — Microsoft Challenge Handshake Authentication Protocol Version 2.

Configuring RADIUS accounting using EDM

Use the following procedure to enable or disable RADIUS accounting and to configure RADIUS accounting interim updates for the switch.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **RADIUS**.
3. In the work area, click the **Globals** tab.
4. In the RADIUS Accounting section, select the **InterimUpdates** checkbox, to enable RADIUS accounting interim updates.

   OR

   In the RADIUS Accounting section, clear the **InterimUpdates** checkbox, to disable RADIUS accounting interim updates.
5. In the RADIUS Accounting section, type an interval value in the **InterimUpdatesInterval** dialog box.
6. In the RADIUS Accounting section, select a radio button in the **InterimUpdatesIntervalSource** section.
7. On the toolbar, click **Apply**.

Variable definitions

Use the data in this table to enable or disable RADIUS accounting and to configure RADIUS accounting interim updates.

Variable	Value
InterimUpdates	Enables or disables RADIUS accounting interim updates for the switch.
InterimUpdatesInterval	Specifies the time interval (in seconds) before RADIUS accounting interim updates times out.

Table continues…

Variable	Value
	Values range from 60–3600 seconds. The default is 600 seconds.
InterimUpdatesIntervalSource	Specifies the source of the interim updates timeout interval. • configuredValue—uses the value in the RadiusAccountingInterimUpdatesInterval dialog box • radiusServer—uses the value applied by the RADIUS server

Configuring the Global RADIUS Server using EDM

Use this procedure to configure a Global RADIUS Server for processing client requests without designating separate EAP or Non-EAP requests.

Note:

If Global RADIUS server is same as the EAP and NEAP RADIUS, only Global RADIUS server must be configured.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **RADIUS**.
3. In the work area, click the **Global RADIUS Server** tab.
4. Choose an address type in the **PrimaryRadiusServerAddressType** box.
5. Type an IP address in the **PrimaryRadiusServer** box.
6. Choose an address type in the **SecondaryRadiusServerAddressType** box.
7. Type an IP address in the **SecondaryRadiusServer** box.
8. Type a UDP port number in the **RadiusServerUdpPort** box.
9. Type a timeout value In the **RadiusServerTimeout** field.
10. To change the shared secret key, type a value in the **SharedSecret(Key)** box.
11. Confirm the new shared secret value in the **Confirm SharedSecret(Key)** box.
12. To enable accounting, select the **AccountingEnabled** checkbox.

    OR

    To disable accounting, clear the **AccountingEnabled** checkbox.
13. Type a value in the **AccountingPort** box.

14. Type a value in the **RetryLimit** box.
15. On the toolbar, click **Apply**.

Variable definitions

Use the data in this table to configure a Global RADIUS Server for processing client requests without designating separate EAP or Non-EAP requests.

Variable	Value
PrimaryRadiusServerAddressType	Specifies the type of IP address type for the primary Global RADIUS server. Values include unknown, ipv4, and ipv6.
PrimaryRadiusServer	Specifies the IPv4 or IPv6 address for the primary Global RADIUS Server. The default address is 0.0.0.0. **Important:** An IPv4 address value of 0.0.0.0 indicates that a primary Global RADIUS Server is not configured. An IPv6 value of 00:00:00:00:00:00:00:00 indicates that a primary Global RADIUS Server is not configured.
SecondaryRadiusServerAddressType	Specifies the IP address type for the secondary Global RADIUS Server. Values include unknown, ipv4, and ipv6.
SecondaryRadiusServer	Specifies the IP address for the secondary Global RADIUS Server. The default address is 0.0.0.0. The secondary Global RADIUS Server is used only if the primary Global RADIUS Server is unavailable or unreachable. **Important:** An IPv4 address value of 0.0.0.0 indicates that a secondary Global RADIUS Server is not configured. An IPv6 value of 00:00:00:00:00:00:00:00 indicates that a secondary Global RADIUS Server is not configured.
RadiusServerUdpPort	Specifies the UDP port number for clients to use when trying to contact the Global RADIUS Server at the corresponding Global RADIUS Server IP address. Values range from 1 to 65535. The default port number is 1812.
RadiusServerTimeout	Specifies the timeout interval between each retry for service requests to the Global RADIUS Server. The default is 2 Seconds. Values range from 1 to 60 seconds.
SharedSecret(Key)	Specifies a new value for the Global RADIUS Server shared secret key, to a maximum of 16 characters.
Confirm SharedSecret(key)	Confirms the value typed in the shared secret key box. If you do not change the Global RADIUS Server shared secret key, you do not have to type a value in this box.

Table continues…

Variable	Value
AccountingEnabled	Enables or disables RADIUS accounting for a Global RADIUS Server instance.
AccountingPort	Specifies the UDP accounting port number for clients to use when trying to contact the RADIUS server at the corresponding Global RADIUS Server IP address. Values range from 0 to 65535.
RetryLimit	Specifies the number of RADIUS retry attempts for a Global RADIUS Server instance. Values range from 1 to 5.

Configuring the EAP RADIUS server using EDM

Use this procedure to configure an EAP RADIUS Server for processing EAP client requests only

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **RADIUS**.
3. In the work area, click the **EAP RADIUS Server** tab.
4. Choose an address type in the **PrimaryRadiusServerAddressType** box.
5. Type an IPv4 or IPv6 address in the **PrimaryRadiusServer** field.
6. Choose an address type in the **SecondaryRadiusServerAddressType** box.
7. Type an IPv4 or IPv6 address in the **SecondaryRadiusServer** box.
8. Type a UDP port number in the **RadiusServerUdpPort** box.
9. Type a timeout value In the **RadiusServerTimeout** box.
10. Type a value in the **SharedSecret(Key)** box to change the shared secret key.
11. Confirm the new shared secret value in the **ConfirmSharedSecret(Key)** box.
12. Select the **AccountingEnabled** checkbox to enable accounting.

    OR

    Clear the **AccountingEnabled** checkbox to disable accounting.
13. Type a value in the **AccountingPort** box.
14. Type a value in the **RetryLimit** box.
15. On the toolbar, click **Apply**.

Variable definitions

Use the data in this table to configure an EAP RADIUS Server for processing EAP client requests.

Variable	Value
PrimaryRadiusServerAddressType	Specifies the type of IP address type for the primary EAP RADIUS Server. Values include unknown, ipv4, and ipv6.
PrimaryRadiusServer	Specifies the IPv4 or IPv6 address for the primary EAP RADIUS Server. The default address is 0.0.0.0. **Important:** An IPv4 address value of 0.0.0.0 indicates that a primary EAP RADIUS Server is not configured. An IPv6 value of 00:00:00:00:00:00:00:00 indicates that a primary EAP RADIUS Server is not configured.
SecondaryRadiusServerAddressType	Specifies the IP address type for the secondary EAP RADIUS Server. Values include unknown, ipv4, and ipv6.
SecondaryRadiusServer	Specifies the IP address for the secondary EAP RADIUS Server. The default address is 0.0.0.0. The secondary EAP RADIUS Server is used only if the primary EAP RADIUS Server is unavailable or unreachable. **Important:** An IPv4 address value of 0.0.0.0 indicates that a secondary EAP RADIUS Server is not configured. An IPv6 value of 00:00:00:00:00:00:00:00 indicates that a secondary EAP RADIUS Server is not configured.
RadiusServerUdpPort	Specifies the UDP port number for clients to use when trying to contact the EAP RADIUS Server at the corresponding EAP RADIUS Server IP address. Values range from 1 to 65535. The default port number is 1812.
RadiusServerTimeout	Specifies the timeout interval between each retry for service requests to the EAP RADIUS Server. The default is 2 Seconds. Values range from 1 to 60 seconds.
SharedSecret(Key)	Specifies a new value for the EAP RADIUS Server shared secret key, to a maximum of 16 characters.
ConfirmedSharedSecret(key)	Confirms the value typed in the shared secret key box. If you do not change the EAP RADIUS Server shared secret key, you do not have to type a value in this box.
AccountingEnabled	Enables or disables RADIUS accounting for an EAP RADIUS Server instance.
AccountingPort	Specifies the UDP accounting port number for clients to use when trying to contact the EAP RADIUS Server at the

Table continues…

Variable	Value
	corresponding EAP RADIUS Server IP address. Values range from 1 to 65535.
RetryLimit	Specifies the number of RADIUS retry attempts for an EAP RADIUS Server instance. Values range from 1 to 5.

Configuring the NEAP RADIUS server using EDM

Use this procedure to configure a Non-EAP (NEAP) RADIUS Server for processing NEAP client requests only.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **RADIUS**.
3. In the work area, click the **NEAP RADIUS Server** tab.
4. Choose an address type in the **PrimaryRadiusServerAddressType** box.
5. Type an IPv4 or Ipv6 address in the **PrimaryRadiusServer** box.
6. Choose an address type in the **SecondaryRadiusServerAddressType** box.
7. Type an Ipv4 or Ipv6 address in the **SecondaryRadiusServer** box.
8. Type a UDP port number in the **RadiusServerUdpPort** box.
9. Type a time-out value In the **RadiusServerTimeout** box.
10. To change the shared secret key, type a value in the **SharedSecret(Key)** box.
11. Confirm the new shared secret value in the **ConfirmSharedSecret(Key)** box.
12. To enable accounting, select the **AccountingEnabled** checkbox.

    OR

    To disable accounting, clear the **AccountingEnabled** checkbox.
13. Type a value in the **AccountingPort** box.
14. Type a value in the box **RetryLimit**.
15. On the toolbar, click **Apply**.

Variable definitions

Use the data in this table to configure a Non-EAP (NEAP) RADIUS Server for processing NEAP client requests only.

Variable	Value
PrimaryRadiusServerAddressType	Specifies the type of IP address type for the primary NEAP RADIUS server. Values include unknown, ipv4, and ipv6.
PrimaryRadiusServer	Specifies the IPv4 or IPv6 address for the primary NEAP RADIUS Server. The default address is 0.0.0.0. Important: **Important:** An IPv4 address value of 0.0.0.0 indicates that a primary NEAP RADIUS Server is not configured. An IPv6 value of 00:00:00:00:00:00:00:00 indicates that a primary NEAP RADIUS server is not configured.
SecondaryRadiusServerAddressType	Specifies the IP address type for the secondary NEAP RADIUS Server. Values include unknown, ipv4, and ipv6.
SecondaryRadiusServer	Specifies the IP address for the secondary NEAP RADIUS Server. The default address is 0.0.0.0. The secondary NEAP RADIUS Server is used only if the primary NEAP RADIUS Server is unavailable or unreachable. **Important:** An IPv4 address value of 0.0.0.0 indicates that a secondary NEAP RADIUS Server is not configured. An IPv6 value of 00:00:00:00:00:00:00:00 indicates that a secondary NEAP RADIUS server is not configured.
RadiusServerUdpPort	Specifies the UDP port number for clients to use when trying to contact the NEAP RADIUS Server at the corresponding NEAP RADIUS Server IP address. Values range from 1 to 65535. The default port number is 1812.
RadiusServerTimeout	Specifies the timeout interval between each retry for service requests to the NEAP RADIUS Server. The default is 2 Seconds. Values range from 1 to 60 seconds.
SharedSecret(Key)	Specifies a new value for the NEAP RADIUS Server shared secret key, to a maximum of 16 characters.
ConfirmedSharedSecret(key)	Confirms the value typed in the shared secret key box. If you do not change the NEAP RADIUS Server shared secret key, you do not have to type a value in this box.
AccountingEnabled	Enables or disables RADIUS accounting for a NEAP RADIUS Server instance.
AccountingPort	Specifies the UDP accounting port number for clients to use when trying to contact the NEAP RADIUS Server at the corresponding NEAP RADIUS Server IP address. Values range from 0 to 65535.
RetryLimit	Specifies the number of RADIUS retry attempts for a NEAP RADIUS Server instance. Values range from 1 to 5.

Viewing RADIUS Dynamic Authorization server information using EDM

Use the following procedure to display RADIUS Dynamic Authorization server information for the switch.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **802.1X/EAP**.
3. In the work area, click the **RADIUS Dynamic Auth. Server** tab.

Variable definitions

Use the data in the following table to view the number of Disconnect and CoA Requests received from unknown addresses.

Variable	Value
Identifier	Indicates the Network Access Server (NAS) identifier of the RADIUS Dynamic Authorization Server.
DisconInvalidClientAddresses	Indicates the number of Disconnect-Request packets received from unknown addresses.
CoAInvalidClientAddresses	Indicates the number of CoA-Request packets received from unknown addresses.

Creating an 802.1X dynamic authorization extension (RFC 3576) client using EDM

Use the following procedure to create an RADIUS Dynamic Authorization client for the switch.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **RADIUS**.
3. In the work area, click the **RADIUS Dynamic Auth. Client** tab.
4. Click **Insert**.

   The Insert RADIUS Dynamic Auth. Client dialog box displays.
5. In the **AddressType** section, select a radio button.
6. In the **Address** dialog box, type an IP address.

7. To enable the RADIUS Dynamic Authorization client, select the **Enabled** check box.

   OR

   To disable the RADIUS Dynamic Authorization client, clear the **Enabled** check box.
8. In the **UdpPort** dialog box, type a port number.
9. To enable change of authorization request processing, select the **ProcessCoARequests** check box.

   OR

   To disable change of authorization request processing, clear the **ProcessCoARequests** check box.
10. To enable disconnect request processing, select the **ProcessDisconnectRequests** check box.

    OR

    To disable disconnect request processing, clear the **ProcessDisconnectRequests** check box.
11. To enable reauthentication request processing, select the **ProcessReAuthRequests** check box.

    OR

    To disable disconnect reauthentication processing, clear the **ProcessReAuthRequests** check box.
12. In the **Secret** dialog box, type a shared secret word.
13. Click **Insert**.
14. On the toolbar, click **Apply**.

Variable definitions

Use the data in the following table to configure the RADIUS Dynamic Authorization client.

Variable	Value
AddressType	Defines the IP address type for the RADIUS Dynamic Authorization Client.
Address	Defines the IP address of the RADIUS Dynamic Authorization Client.
Enabled	Enables or disables packet receiving from the RADIUS Dynamic Authorization Client.
UdpPort	Configures the server and NAS UDP port to listen for requests from the RADIUS Dynamic Authorization Client. Values range from 1025–65535.

Table continues…

Variable	Value
ProcessCoARequests	Enables or disables change of authorization (CoA) request processing.
ProcessDisconnectRequests	Enables or disables disconnect request processing.
ProcessReAuthRequests	Enables or disables reauthentication request processing.
Secret	Defines the secret word shared between the RADIUS Dynamic Authorization Client and the RADIUS server.

Deleting an 802.1X dynamic authorization extension (RFC 3576) client configuration using EDM

Use the following procedure to delete an existing RADIUS Dynamic Authorization client configuration.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **802.1X/EAP**.
3. In the work area, click the **RADIUS Dynamic Auth. Client** tab.
4. To select a RADIUS Dynamic Authorization client to delete, click the client row.
5. Click **Delete**.

Viewing the 802.1X dynamic authorization extension (RFC 3576) client configuration using EDM

Use the following procedure to display existing RADIUS Dynamic Authorization client configurations for the switch.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **RADIUS**.
3. In the work area, click the **RADIUS Dynamic Auth. Client** tab.

Variable definitions

Use the data in the following table to understand the RADIUS Dynamic Authorization client configurations for the switch.

Variable	Value
AddressType	Indicates the IP address type for the RADIUS Dynamic Authorization Client.
Address	Indicates the IP address of the RADIUS Dynamic Authorization Client.
Enabled	Indicates whether packet receiving from the RADIUS Dynamic Authorization Client is enabled (true) or disabled (false).
UdpPort	Indicates the server and NAS UDP port to listen for requests from the RADIUS Dynamic Authorization Client. Values range from 1025–65535.
ProcessCoARequests	Indicates whether change of authorization (CoA) request processing is enabled or disabled.
ProcessDisconnectRequests	Indicates whether disconnect request processing is enabled or disabled.
ProcessReAuthRequests	Indicates whether reauthentication request processing is enabled or disabled.
Secret	Indicates the secret word shared between the RADIUS Dynamic Authorization Client and the RADIUS server.

Modifying the 802.1X dynamic authorization extension (RFC 3576) client configuration using EDM

Use the following procedure to edit an existing RADIUS Dynamic Authorization client configuration.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **RADIUS**.
3. In the work area, click the **RADIUS Dynamic Auth. Client** tab.
4. To select a RADIUS Dynamic Authorization client to edit, click the client row.
5. In the client row, double-click the cell in the **Enabled** column.
6. Select a value from the list—**true** to enable RADIUS Dynamic Authorization client, or **false** to disable RADIUS Dynamic Authorization client for the VLAN.

7. In the client row, double-click the cell in the **UdpPort** column.
8. Edit the UDP port number as required.
9. In the client row, double-click the cell in the **ProcessCoARequests** column.
10. Select a value from the list—**true** to enable CoA request processing, or **false** to
11. In the client row, double-click the cell in the **ProcessDisconnectRequests** column.
12. Select a value from the list—**true** to enable disconnect request processing, or **false** to disable disconnect request processing.
13. In the client row, double-click the cell in the **ProcessReAuthRequests** column.
14. Select a value from the list—**true** to enable reauthentication request processing, or **false** to disable reauthentication request processing.
15. On the toolbar, click **Apply**.

Variable definitions

Use the data in the following table to modify an existing RADIUS Dynamic Authorization client

Variable	Value
AddressType	Indicates the IP address type for the RADIUS Dynamic Authorization Client. This is a read-only cell.
Address	Indicates the IP address of the RADIUS Dynamic Authorization Client. This is a read-only cell.
Enabled	Enables or disables packet receiving from the RADIUS Dynamic Authorization Client. • enable—true • disable—false
UdpPort	Defines the server and NAS UDP port to listen for requests from the RADIUS Dynamic Authorization Client. Values range from 1024 to 65535.
ProcessCoARequests	Enables or disables change of authorization (CoA) request processing.
ProcessDisconnectRequests	Enables or disables disconnect request processing.
ProcessReAuthRequests	Enables or disables reauthentication request processing.
Secret	The RADIUS Dynamic Authorization Client secret word. This cell remains empty.

Changing the 802.1X dynamic authorization extension (RFC 3576) client secret word using EDM

Use the following procedure to change the existing RADIUS Dynamic Authorization client secret word.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **802.1X/EAP**.
3. In the work area, click the **RADIUS Dynamic Auth. Client** tab.
4. Click **Change Secret**.
5. In the **Secret** dialog box, type a new secret word.
6. In the **Confirmed Secret** dialog box, retype the new secret word.
7. Click **Apply**.

Viewing RADIUS Dynamic Server statistics using EDM

Use the following procedure to display RADIUS Dynamic Server statistical information.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **802.1X/EAP**.
3. In the work area, click the **RADIUS Dynamic Server Stats** tab.

Variable definitions

Use the data in the following table to help you understand the RADIUS Dynamic Server statistics display.

Variable	Value
ClientIndex	Indicates the RADIUS Dymanic Server client index.
ClientAddressType	Indicates the type of RADIUS Dymanic Server address. Values are ipv4 or ipv6.
ClientAddress	Indicates the IP address of the RADIUS Dymanic Server.
ServerCounterDiscontinuity	Indicates a count of RADIUS Dymanic Server discontinuity instances.

Graphing RADIUS Dynamic Server statistics using EDM

Use the following procedure to graph statistics for a RADIUS Dynamic Server client.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **802.1X/EAP**.
3. In the work area, click the **RADIUS Dynamic Server Stats** tab.
4. To select a VLAN to edit, click the client row.
5. On the toolbar, click **Graph**.
6. Click and drag your cursor to highlight all RADIUS Dynamic Server statistical information to graph.
7. Click **Line Chart**, **Area Chart**, **Bar Chart**, or **Pie Chart**.

DHCP snooping configuration using EDM

This section describes how you can configure DHCP snooping to provide security to your network by preventing DHCP spoofing, using Enterprise EDM (EDM).

Configuring global DHCP snooping using EDM

Use the following procedure to configure global DHCP snooping to enable or disable DHCP snooping parameters for the switch.

⚠ **Warning:**

DHCP snooping must be enabled on Layer 3 VLANs spanning toward DHCP servers in Layer 3 mode. DHCP relay is also required for correct operation.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **DHCP Snooping**.
3. In the work area, click the **DHCP Snooping Globals** tab.
4. To enable DHCP snooping globally, select the **Enabled** checkbox in the DHCP Snooping section.

   OR

   To disable DHCP Snooping globally, clear the **Enabled** checkbox in the DHCP Snooping section.

5. To enable Option 82 for DHCP snooping, select the **Option82Enabled** checkbox in the DHCP Snooping section.

   OR

   To Disable Option 82 for DHCP Snooping, clear the **Option82Enabled** checkbox in the DHCP Snooping section.
6. On the toolbar, click **Apply**.

Configuring DHCP Snooping external save using EDM

Use the following procedures to store the DHCP Snooping database to:

- an external TFTP server. See Configuring DHCP Snooping external save to an external TFTP server on page 398.
- an external SFTP server. See Configuring DHCP Snooping external save to an external SFTP server on page 399.
- a USB drive. See Configuring DHCP Snooping external save to a USB drive on page 401.

Configuring DHCP Snooping external save to an external TFTP server

Use this procedure to store the DHCP Snooping database to an external TFTP server.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **DHCP Snooping**.
3. In the work area, click the **DHCP Snooping Globals** tab.
4. In the DHCP Snooping External Save section, select the **Enabled** check box to enable DHCP Snooping external save.

   OR

   In the DHCP Snooping External Save section, clear the **Enabled** check box to disable DHCP Snooping external save.
5. Click a**TftpServerAddressType** button.
6. Type a value in the **TftpServerAddress** box.
7. Type 0 in the **UsbTargetUnit** box.
8. Type a value in the **Filename** box.
9. To force a binding table restore, click the **ForceRestore** button.
10. On the toolbar, click **Apply**.

Variable definitions

Variable	Value
DHCP Snooping External Save	
Enabled	Enables or disables DHCP Snooping External Save.
SyncFlag	Indicates if changes in the DHCP Snooping binding table are synchronized on the external device. Values include: • true—changes will be synchronized at the next write operation • false—changes will not be synchronized at the next write operation
LastSyncTime	Displays the UTC time when the switch last backed up the DHCP Snooping binding table.
TftpServerAddressType	Specifies the IP address type of the TFTP server on which to save the DHCP Snooping binding file. Values include ipv4 or ipv6.
TftpServerAddress	Specifies the IPv4 or IPv6 address of the TFTP server on which to save the DHCP Snooping binding file.
SftpServerAddressType	Specifies the IP address type of the SFTP server on which to save the DHCP Snooping binding file. Values include ipv4 or ipv6.
SftpServerAddress	Specifies the IPv4 or IPv6 address of the SFTP server on which to save the DHCP Snooping binding file.
UsbTargetUnit	Specifies the unit number of the USB port to use in file save or restore operations.
Filename	Specifies the name of the DHCP Snooping database that is saved externally.
ForceRestore	Forces the restoration of the DHCP Snooping database on the switch from the file previously saved to an external USB drive or TFTP server.

Configuring DHCP Snooping external save to an external SFTP server

Use this procedure to store the DHCP Snooping database to an external SFTP server.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **DHCP Snooping**.
3. In the work area, click the **DHCP Snooping Globals** tab.
4. In the DHCP Snooping External Save section, select the **Enabled** check box to enable DHCP Snooping external save.

   OR

   In the DHCP Snooping External Save section, clear the **Enabled** check box to

5. Click an **SftpServerAddressType** button.
6. Type a value in the **SftpServerAddress** box.
7. Type `10` in the **UsbTargetUnit** box.
8. Type a value in the **Filename** box.
9. To force a binding table restore, click the **ForceRestore** button.
10. On the toolbar, click **Apply**.

Next steps

To store the DHCP Snooping database to an external SFTP server, you must also make the following configurations:

- Choose an authentication method.
- Generate a DSA/RSA key.
- Configure the sshc user name.
- Configure the sshc password if it is needed for restore.

Variable definitions

Variable	Value
DHCP Snooping External Save	
Enabled	Enables or disables DHCP Snooping External Save.
SyncFlag	Indicates if changes in the DHCP Snooping binding table are synchronized on the external device. Values include: • true—changes will be synchronized at the next write operation • false—changes will not be synchronized at the next write operation
LastSyncTime	Displays the UTC time when the switch last backed up the DHCP Snooping binding table.
TftpServerAddressType	Specifies the IP address type of the TFTP server on which to save the DHCP Snooping binding file. Values include ipv4 or ipv6.
TftpServerAddress	Specifies the IPv4 or IPv6 address of the TFTP server on which to save the DHCP Snooping binding file.
SftpServerAddressType	Specifies the IP address type of the SFTP server on which to save the DHCP Snooping binding file. Values include ipv4 or ipv6.
SftpServerAddress	Specifies the IPv4 or IPv6 address of the SFTP server on which to save the DHCP Snooping binding file.
UsbTargetUnit	Specifies the unit number of the USB port to use in file save or restore operations.

Table continues…

Variable	Value
Filename	Specifies the name of the DHCP Snooping database that is saved externally.
ForceRestore	Forces the restoration of the DHCP Snooping database on the switch from the file previously saved to an external USB drive or TFTP server.

Configuring DHCP Snooping external save to a USB drive

Use this procedure to store the DHCP Snooping database to a USB drive.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **DHCP Snooping**.
3. In the work area, click the **DHCP Snooping Globals** tab.
4. In the DHCP Snooping External Save section, select the **Enabled** check box to enable DHCP Snooping external save.

   OR

   In the DHCP Snooping External Save section, clear the **Enabled** check box to disable DHCP Snooping external save.
5. Type a value in the **UsbTargetUnit** box (the unit number on which the USB stick is inserted).
6. Type a value in the **Filename** box.
7. To force a binding table restore, click the **ForceRestore** button.
8. On the toolbar, click **Apply**.

Variable definitions

Variable	Value
DHCP Snooping External Save	
Enabled	Enables or disables DHCP Snooping External Save.
SyncFlag	Indicates if changes in the DHCP Snooping binding table are synchronized on the external device. Values include: • true—changes will be synchronized at the next write operation • false—changes will not be synchronized at the next write operation
LastSyncTime	Displays the UTC time when the switch last backed up the DHCP Snooping binding table.
TftpServerAddressType	Specifies the IP address type of the TFTP server on which to save the DHCP Snooping binding file. Values include ipv4 or ipv6.

Table continues…

Variable	Value
TftpServerAddress	Specifies the IPv4 or IPv6 address of the TFTP server on which to save the DHCP Snooping binding file.
SftpServerAddressType	Specifies the IP address type of the SFTP server on which to save the DHCP Snooping binding file. Values include ipv4 or ipv6.
SftpServerAddress	Specifies the IPv4 or IPv6 address of the SFTP server on which to save the DHCP Snooping binding file.
UsbTargetUnit	Specifies the unit number of the USB port to use in file save or restore operations.
Filename	Specifies the name of the DHCP Snooping database that is saved externally.
ForceRestore	Forces the restoration of the DHCP Snooping database on the switch from the file previously saved to an external USB drive or TFTP server.

Configuring DHCP snooping on a VLAN using EDM

Use the following procedure to configure DHCP snooping on a VLAN through to enable or disable DHCP snooping and DHCP snooping with Option 82 for a VLAN.

Important:

You must enable DHCP snooping separately for each Vlan ID.

Important:

If DHCP snooping is disabled on a VLAN, the switch forwards DHCP reply packets to all applicable ports, whether the port is trusted or untrusted.

Procedure

1. From the Device Physical View, select a port.
2. From the navigation tree, double-click **Security**.
3. In the Security tree, double-click **DHCP Snooping**.
4. In the work area, click the **DHCP Snooping-VLAN** tab.
5. To select a VLAN to edit, click the VLAN ID.
6. In the VLAN row, double-click the cell in the **DhcpSnoopingEnabled** column.
7. Select a value from the list: select **true** to enable DHCP snooping for the VLAN, or select **false** to disable DHCP snooping for the VLAN.
8. In the VLAN row, double-click the cell in the **VlanOption82Enabled** column.
9. Select a value from the list: select **true** to enable DHCP snooping with Option 82 for the VLAN, or select **false** to disable DHCP snooping with Option 82 for the VLAN.

10. Click **Apply**.

Configuring DHCP snooping on a port using EDM

Use the following procedure to configure DHCP snooping on a port to configure port trust and to enable or disable DHCP snooping with Option 82 for a port. Ports are untrusted by default.

Procedure

1. Proceed with one of the following paths:
   - From the navigation tree, double-click **Security**, click **DHCP Snooping**, then select the **DHCP Snooping-port** tab.
   - From the **Device Physical View**, use Ctrl-click to select more than one port, right-click **Edit** then click the **DHCP Snooping** tab.
   - From the **Device Physical View**, use Ctrl-click to select more than one port, then follow the navigation tree to **Edit > Chassis > Ports > DHCP Snooping** tab.
2. In the port row, double-click the cell in the **DhcpSnoopingIfTrusted** column.
3. Select a value from the list: select **trusted** or **untrusted**.
4. Double-click the **DhcpSnoopingIfOption82SubscriberId** for a port.
5. Type a subscriber ID value for the port.
6. Click **Apply**.

Variable definitions

Use the data in the following table to configure DHCP snooping on ports.

Variable	Value
Port	Indicates the port on the switch.
DhcpSnoopingIfTrusted	Specifies whether the port is trusted or untrusted. Default is false.
DhcpSnoopingIfOption82SubscriberId	Specifies the DHCP Option 82 subscriber Id for the port. Value is a character string between 0 and 64 characters.

DHCP binding configuration using EDM

Use the information in this section to:.

- view DHCP client lease static entries. See Viewing DHCP binding information using EDM on page 404.
- create DHCP client lease static entries. See Creating static DHCP binding table entries using EDM on page 404.

- delete DHCP client lease static entries. See Deleting DHCP binding table entries using EDM on page 405.

Viewing DHCP binding information using EDM

Use the following procedure to view DHCP binding information.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security Routing tree, double-click **DHCP Snooping**.
3. In the work area, click the **DHCP Bindings** tab.

Variable definitions

Use the data in the following table to help you understand the DHCP binding information display.

Variable	Value
VlanId	Indicates the ID of the VLAN that the DHCP client is a member of.
MacAddress	Indicates the MAC address of the DHCP client.
AddressType	Indicates the MAC address type of the DHCP client.
Address	Indicates IP address of the DHCP client.
Interface	Indicates the interface to which the DHCP client is connected.
LeaseTime(sec)	Indicates the lease time (in seconds) of the DHCP client binding. Values range from 0 to 4294967295.
TimeToExpiry(sec)	Indicates the time (in seconds) before a DHCP client binding expires.
Source	Indicates the source of the binding table entry

Creating static DHCP binding table entries using EDM

Use the following procedure to add entries for devices with static IP addresses to the DHCP binding table.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **DHCP Snooping**.
3. In the work area, click the **DHCP Bindings** tab.
4. Click **Insert**.

The **Insert DHCP Bindings** dialog box displays.

5. Click the VlanId elipsis **(...)**, and select the **DHCP client VLAN ID**.
6. Click **Ok**.
7. In the **MacAddress** dialog box, type the DHCP client MAC address.
8. In the **AddressType** section, select a radio button.
9. In the **Address** dialog box, type the DHCP client IP address.
10. Click the Interface elipsis **(...)**.
11. From the list, select an interface port.
12. Click **Ok**.
13. In the **Lease Time(sec)** field, type a lease time.
14. Click **Insert**.
15. On the toolbar, click **Apply**.

Variable definitions

Use the data in the following table to add static entries to the DHCP binding table.

Variable	Value
VlanId	Specifies the ID of the VLAN that the DHCP client is a member of.
MacAddress	Specifies the MAC address of the DHCP client.
AddressType	Specifies the IP address type of the DHCP client.
Address	Specifies IP address of the DHCP client.
Interface	Specifies the interface to which the DHCP client is connected.
LeaseTime(sec)	Specifies the lease time (in seconds) for the DHCP client binding. Values range from 0 to 4294967295.

Deleting DHCP binding table entries using EDM

Use the following procedure to delete static IP addresses from the DHCP binding table.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **DHCP Snooping**.
3. Select the **DHCP Bindings** tab.
4. Click the VLAN ID.
5. On the toolbar, click **Delete**.

6. Click **Yes** to confirm that you want to delete the entry.

Configuring dynamic ARP inspection on VLANs using EDM

Use the following procedure to configure ARP inspection on a VLAN to enable or disable ARP inspection on one or more VLANs.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **Dynamic ARP Inspection (DAI)**.
3. In the work area, click the **ARP Inspection-VLAN** tab.
4. Double-click the **ARPInspectionEnabled** box for a VLAN.
5. Select **true** to enable ARP Inspection-VLAN.

   OR

   Select **false** to disable ARP Inspection-VLAN.
6. Repeat Step 3 through Step 5 for additional VLANs as required.
7. Click **Apply**.

Configuring dynamic ARP inspection on ports using EDM

Use this procedure to configure dynamic ARP inspection for one or more switch ports as trusted (ARP traffic is not subject to dynamic ARP inspection) or untrusted (ARP traffic is subject to dynamic ARP inspection).

Procedure

1. Proceed with one of the following paths:
   - From the navigation tree, double-click **Security**, click **Dynamic ARP Inspection (DAI)**, then select the **ARP Inspection-port** tab.
   - From the **Device Physical View**, use Ctrl-click to select more than one port, right-click **Edit** then click the **ARP Inspection** tab.
   - From the **Device Physical View**, use Ctrl-click to select more than one port, then follow the navigation tree to **Edit > Chassis > Ports > ARP Inspection** tab.
2. From the list, select **trusted** or **untrusted**.
3. Repeat steps **3** and **4** for additional ports as required.

4. Click **Apply**.

IP Source Guard configuration using EDM

This section describes how to configure IP Source Guard to add a higher level of security to a port or ports by preventing IP spoofing

Important:

Avaya recommends that you do not enable IP Source Guard on trunk ports.

Important:

Avaya recommends that you carefully manage the number of applications running on the switch that use filters. For example, if you configure ADAC on ports and attempt to configure IP Source Guard on those same ports, the IP Source Guard configuration can fail due to the limited number of filters available.

Prerequisites

- Open one of the supported browsers.
- Enter the IP address of the switch to open an EDM session.
- Dynamic Host Control Protocol (DHCP) snooping is globally enabled.

  For more information, see DHCP snooping configuration using EDM on page 397.
- The port is a member of a Virtual LAN (VLAN) configured with DHCP snooping and dynamic Address Resolution Protocol (ARP) Inspection.
- The port is an untrusted DHCP snooping and dynamic ARP Inspection port.
- The bsSourceGuardConfigMode MIB object exists.

  This MIB object is used to control the IP Source Guard mode on an interface.
- The following applications are not enabled:
  - Baysecure
  - Extensible Authentication Protocol over LAN (EAPOL)

Important:

Hardware resources can run out if IP Source Guard is enabled on trunk ports with a large number of VLANs, which have DHCP snooping enabled. If this happens, traffic sending can be interrupted for some clients. Avaya recommends that IP Source Guard not be enabled on trunk ports.

Configuring IP Source Guard on a port using EDM

Use this procedure to configure IP Source Guard to enable or disable a higher level of security on a port.

Procedure

1. Follow one of the following paths:
    - From the **Device Physical View**, select a port, or use Ctrl-click to select more than one port, right-click **Edit** then click the **IP Source Guard** tab.
    - From the **Device Physical View**, select a port, or use Ctrl-click to select more than one port, then follow the navigation tree to **Edit > Chassis > Ports > IP Source Guard** tab.
    - In the navigation tree, go to **Security > IP Source Guard (IPSG) > IP Source Guard-port** tab.
2. Double-click the **Mode** box for a port.
3. Select **ip** from the list to enable IP Source Guard.

    OR

    Select **disabled** from the list to disable IP Source Guard.
4. Repeat the above steps to configure IP Source Guard for additional ports.
5. On the toolbar, click **Apply**.
6. On the toolbar, click **Refresh** to update the IP Source Guard-port dialog box display.

Variable definitions

Use the data in the following table to enable IP Source Guard on a port.

Variable	Value
Port	Identifies the port number.
Mode	Identifies the Source Guard mode for the port. The mode can be disabled or ip. The default mode is disabled.

Configuring IP Source Guard on multiple ports using EDM

Use this procedure to configure IP Source Guard to enable or disable a higher level of security on multiple ports.

Procedure

1. From the Device Physical View, click one or more ports.
2. From the navigation tree, double-click **Edit**.

3. In the Edit tree, double-click **Chassis**.
4. In the Chassis tree, double click **Ports**.
5. Click the **IP Source Guard** tab.
6. Double-click the **Mode** box for a port.
7. Select **ip** from the list to enable IP Source Guard.

   OR

   Select **disabled** from the list to disable IP Source Guard.
8. On the toolbar, click **Apply**.
9. On the toolbar, click **Refresh** to update the IP Source Guard-port dialog box display.

Variable definitions

Use the data in the following table to enable IP Source Guard on a port.

Variable	Value
Port	Identifies the port number.
Mode	Identifies the Source Guard mode for the port. The mode can be disabled or ip. The default mode is disabled.

Filtering IP Source Guard addresses using EDM

Use the following procedure to filter IP Source Guard addresses to display IP Source Guard information for specific IP addresses.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **IP Source Guard (IPSG)**.
3. In the work area, click the **IP Source Guard-addresses** tab.
4. Select an entry in the table.
5. On the toolbar, click **Filter**.
6. In the **IP Source Guard-addresses - Filter** dialog box, select the required parameters for displaying port IP Source Guard information.
7. Click **Filter**.

   IP Source Guard information for the specified IP addresses is displayed in the **IP Source Guard-addresses** dialog box.

Variable definitions

Use the data in the following table to filter IP Source Guard addresses.

Variable	Value
Condition	Defines the search condition. Values are: • AND: Includes keywords specified in both the Port and Address fields while filtering results. • OR: Includes either one of the keywords specified in the Port and Address fields while filtering results.
Ignore Case	Ignores the letter case while searching.
Column	Specifies the content of the column search. Values are • Contains • Does not contain • Equals to
All records	Displays all entries in the table.
Port	Searches for the specified port.
Address	Searches for the specified IP address.

Use the data in the following table to display IP Source Guard information for filtered addresses.

Variable	Value
Port	Indicates the port number.
Type	Indicates the internet address type.
Address	Indicates the IP address allowed by IP Source Guard.
Source	Indicates the source of the address.

Viewing IP Source Guard port statistics using EDM

View IP Source Guard port statistics to display dropped packet statistics for IP Source Guard enabled ports.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **IP Source Guard (IPSG)**.
3. In the work area, click the **IP Source Guard-stats** tab to view the IP Source Guard port statistics.

Variable definitions

Use the data in the following table to understand the IP Source Guard statistics display.

Variable	Value
IfIndex	Identifies the slot and port number of the IP Source Guard enabled ports.
DroppedPackets	Displays the number of instances of dropped packets that occur on IP Source Guard enabled ports.

TACACS+ configuration using EDM

This section describes how to configure, enable, and disable TACACS+ servers in the system.

Configuring TACACS+ services using EDM

Use the following procedure to configure a TACACS+ services.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **TACACS+**.
3. In the **Globals** tab, configure the parameters as required.
4. On the toolbar, click **Apply**.

Variable definitions

Use the data in the following table to configure TACACS+ services.

Variable	Value
Accounting	Enables or disables TACACS+ accounting.
Authentication	Indicates the authentication status.
AuthorizationEnabled	Enables or disables TACACS+ authorization.
AuthorizationLevels	Indicates the TACACS+ authorization level.

Adding a TACACS+ server using EDM

Use the following procedure to add TACACS+ server in the system.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **TACACS+**.
3. In the work area, click the **TACACS+ Server** tab.

4. On the toolbar, click **Insert**.

   The **Insert TACACS+ Server** dialog box displays.
5. Type the address in the **Address** field.
6. Type the port number in the **PortNumber** field.
7. Type the key in the **Key** field.
8. Retype the key in the **Confirm Key** field.
9. Choose the priority in the **Priority** field.
10. Click **Insert**.

Variable definitions

Use the data in the following table to add a TACACS+ server.

Variable	Value
AddressType	Specifies the type of IP address used on the TACACS+ server.
Address	Indicates the IP address of the TACACS+ server in use.
PortNumber	Indicates the TCP port on which the client establishes a connection to the server.
Key	Indicates the secret key to be shared with this TACACS+ server. Key length zero indicates no encryption is being used.
Confirm Key	Indicates the key in use.
Priority	Determines the order in which the TACACS+ servers are used. Available options are—primary or secondary.

Deleting a TACACS+ server using EDM

Use the following procedure to delete a TACACS+ server from the system.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **TACACS+**.
3. In the work area, click the **TACACS+ Server** tab.
4. In the table, select the TACACS+ server entry you want to delete.
5. On the toolbar, click **Delete**.
6. Click **Yes** to confirm.

Configuring the Web and Telnet password using EDM

Use the following procedure to configure a password for Web and Telnet access to a stack, or standalone switch.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, click **Web/Telnet/Console**.
3. In the work area, click the **Web/Telnet** tab.
4. Click the arrow on the **Web/Telnet Switch Password Type** box.
5. Select a password type from the list.
6. Type the password for read-only access in the **Read-Only Stack Password** box.
7. Type the same password for read-only access in the **Re-enter to verify** box.
8. Type the password for read-write access in the **Read-Write Switch Password** box.
9. Type the same password for read-write access in the **Re-enter to verify** box.
10. On the toolbar, click **Apply**.

Variable definitions

Variable	Value
Web/Telnet Stack Password Type	Specifies the type of the password to use. Values include: • none—disables the password • Local Password— uses the locally defined password for Web and Telnet access. • RADIUS Authentication— uses RADIUS password authentication for Web and Telnet access. • TACACS Authentication— uses TACACS+ authentication, authorization, and accounting (AAA) services authentication for Web and Telnet access.
Read-Only Stack Password	Specifies the read-only password for stack or switch access. The maximum length of the password is 15 characters.
Read-Write Switch Password	Specifies the read-write password for stack or switch access. The maximum length of the password is 15 characters.

Configuring the console password using EDM

Use the following procedure to configure a password for serial console access to a stack, or standalone switch.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **Web/Telnet/Console**.
3. In the work area, click the **Console Password** tab.
4. Click the arrow on the **Console Stack Password Type** box.
5. Select a password type from the list.
6. Type the password for read-only access in the **Read-Only Stack Password** box.
7. Type the same password for read-only access in the **Re-enter to verify** box.
8. Type the password for read-write access in the **Read-Write Stack Password** box.
9. Type the same password for read-write access in the **Re-enter to verify** box.
10. On the toolbar, click **Apply**.

Variable definitions

Use the data in the following table to configure the console switch password.

Variable	Value
Console Stack Password Type	Specifies the type of password to use. Values include: • none—disables the password • Local Password— uses the locally defined password for serial console access. • RADIUS Authentication— uses RADIUS authentication for serial console access. • TACACS Authentication— uses TACACS+ authentication, authorization, and accounting (AAA) services authentication for console access.
Read-Only Stack Password	Specifies the read-only password for stack or switch access.
Read-Write Stack Password	Specifies the read-write password for stack or switch access.

SNMP configuration using EDM

This section describes the configuration options available for SNMP in EDM.

Viewing the SNMP configuration using EDM

Follow this procedure to display information about SNMP on your switch.

Procedure

1. From the navigation tree, double-click **Edit**.
2. In the Edit tree, double-click **Chassis**.
3. In the Chassis tree, double-click **Chassis**.
4. In the work area, click the **SNMP** tab.

Variable definitions

The following table describes fields on the SNMP tab.

Table 28: SNMP tab fields

Field	Description
LastUnauthenticatedInetAddressType	Indicates the type of IP address that was not authenticated by the device last.
LastUnauthenticatedInetAddress	Indicates the last IP address that was not authenticated by the device.
LastUnauthenticatedCommunityString	Indicates the last community string that was not authenticated by the device.
RemoteLoginInetAddressType	Indicates the type of IP address to last remotely log on to the system.
RemoteLoginInetAddress	Indicates the last IP address to remotely log on to the system.
TrpRcvrMaxEnt	Indicates the maximum number of trap receiver entries.
TrpRcvrCurEnt	Indicates the current number of trap receiver entries.
TrpRcvrNext	Indicates the next trap receiver entry to be created.

Creating an SNMP user using EDM

User the following procedure to create an SNMP user.

Procedure

1. From the navigation tree, double-click **Edit**.
2. In the Edit tree, double-click **Snmp Server**.
3. In the Snmp Server tree, double-click **User**.
4. On the toolbar, click **Insert** to open the Insert User dialog.
5. Configure the parameters as required.
6. Click **Insert**.

Variable definitions

Use the data in the following table to create an SNMP user.

Variable	Value
EngineID	Indicates the administratively-unique identifier of SNMP engine.
Name	Indicates the user name.
Auth Protocol	Indicates the registration point for standards-track authentication protocols used in SNMP Management Frameworks.
AuthPassword	Specifies the current authorization password.
ConfirmPassword	Reenter the password to confirm.
Priv Protocol	To assign a privacy protocol, select one of the following from the list: • None • DES • 3DES • AES
PrivacyPassword	Specifies the current privacy password.
ConfirmPassword	Re-enter the password to confirm.
ReadViewName	Specifies the name of the MIB View to which the user is assigned read access.
WriteViewName	Specifies the name of the MIB View to which the user is assigned write access.
NotifyViewName	Specifies the name of the MIB View from which the user receives notifications.
Storage Type	Specifies whether this table entry is stored in one of the following memory types: • volatile—entry does not persist if switch loses power • nonVolatile—entry persists if switch loses power

Viewing the user details using EDM

Use the following procedure to view information about an SNMP user.

Procedure

1. From the navigation tree, double-click **Edit**.
2. In the Edit tree, double-click **Snmp Server**.
3. In the Snmp Server tree, double-click **User**.
4. In the table, select the user you want to view.
5. On the toolbar, click **Details** to view the details of selected user.

Variable definitions

The following table describes the fields of User Details tab.

Field	Value
Name	Indicates the user name.
ContextPrefix	Indicates the context prefix in use.
SecurityModel	Indicates the security model in use.
SecurityLevel	Indicates the minimum level of security in use.
ReadViewName	Indicates name of the MIB view of the SNMP context that has read access.
WriteViewName	Indicates the name of the MIB view of the SNMP context that has write access.
NotifyViewName	Indicates the name of the MIB view of the SNMP context that has access for notifications.
Storage Type	Indicates the memory storage type.

Viewing MIBs assigned to an object using EDM

Use the following procedure to view the MIBs assigned to an object.

Procedure

1. From the navigation tree, double-click **Edit**.
2. In the Edit tree, double-click **Snmp Server**.
3. In the Snmp Server tree, double-click **MIB View**.
4. On the toolbar, click **Insert** to open the Insert MIB View dialog.
5. Configure the parameter as required.
6. Click **Insert**.

Variable definitions

The following table describes the fields of MIB View tab.

Field	Value
ViewName	Indicates the name of the family of view subtrees.
Subtree	Indicates the MIB subtree.
Type	Indicates whether the subtree is included or excluded from the MIB view.
Storage Type	Indicates the storage type.

Creating a community using EDM

Use the following procedure to create an SNMP community.

Procedure

1. From the navigation tree, double-click **Edit**.
2. In the Edit tree, double-click **Snmp Server**.
3. In the Snmp Server tree, double-click **Community**.
4. On the toolbar, click **Insert**.

   The Insert Community dialog box appears.
5. Configure the parameter as required.
6. Click **Insert**.

Variable definitions

The following table describes the fields of Community tab.

Field	Value
Index	Indicates the unique identifier of community.
Name	Indicates the name of the community.
ContextEngineID	Indicates the engine ID of the context.
Storage Type	Indicates the storage type.

Deleting a community using EDM

Use the following procedure to delete a community.

Procedure

1. From the navigation tree, double-click **Edit**.
2. In the Edit tree, double-click **Snmp Server**.
3. In the Snmp Server tree, double-click **Community**.
4. In the table, select the community you want to delete.

5. On the toolbar, click **Delete**.

Viewing the details of a community using EDM

Use the following procedure to view the details of a community.

Procedure

1. From the navigation tree, double-click **Edit**.
2. In the Edit tree, double-click **Snmp Server**.
3. In the Snmp Server tree, double-click **Community**.
4. In the table, select the community you want to view.
5. On the toolbar, click **Details** to view the details of the selected community.

Variable definitions

The following table describes the fields on the Community Details tab.

Field	Value
Name	Indicates the community name.
ContextPrefix	Indicates the context prefix in use.
SecurityModel	Indicates the security model in use.
SecurityLevel	Indicates the minimum level of security in use.
ReadViewName	Indicates name of the community that has read access.
WriteViewName	Indicates the name of the community that has write access.
NotifyViewName	Indicates the name of the community has access for notifications.
Storage Type	Indicates the storage type.

Configuring an SNMP host using EDM

Use the following procedure to configure an SNMP host notification control.

Procedure

1. From the navigation tree, double-click **Edit**.
2. In the Edit tree, double-click **Snmp Server**.
3. In the Snmp Server tree, double-click **Host**.
4. On the toolbar, click **Insert** to open the Insert Host dialog.
5. Configure the parameter as required.
6. Click **Insert**.

Variable definitions

The following table describes the fields on the Community Details tab.

Field	Value
Domain	Indicates the transport type of the address in the snmpTargetAddrTAddress object.
DestinationAddr : Port	Indicates the transport address (in IPv4 Address : port format).
Timeout	Indicates the time interval that an application waits for a response.
RetryCount	Indicates the number of retries to be attempted when a response is not received for a generated message.
Type	Indicates the type of the message.
Storage Type	Indicates the storage type.

Configuring notifications (traps) from the list using EDM

Use the following procedure to enable and disable SNMP trap control.

Procedure

1. From the navigation tree, double-click **Edit**.
2. In the Edit tree, double-click **Snmp Server**.
3. In the Snmp Server tree, double-click **Host**.
4. In the table, select an entry.
5. On the toolbar, click **Notification** to display a list of traps.
6. Clear the trap that you do not want the switch to send.

   By default all the traps are selected.
7. Click **Apply**.

Configuring SNMP notification control using EDM

Use the following procedure to enable or disable SNMP traps.

Notification Control is the Trap Web Page.

Procedure

1. From the navigation tree, double-click **Edit**.
2. From the Edit tree, double-click **Snmp Server**.
3. From the Snmp Server tree, double-click **Notification Control**.
4. To select an SNMP trap to edit, click a **NotifyControlType** row.

5. In the NotifyControlType row, double-click the cell in the **NotifyControlEnabled** column.
6. Select a value from the list — **true** to enable the trap, **false** to disable the trap.
7. On the toolbar, click the **Enable All** button to enable all SNMP traps available on the switch.

   OR

   OR

   8 On the toolbar, click the **Disable All** button to disable all SNMP traps available on

   the switch.
8. On the toolbar, click **Apply**.

Variable definitions

Use the data in the following table to configure SNMP notification control

Variable	Value
NotifyControlType	Lists the SNMP trap names.
Notify Control Type (oid)	Lists the object identifiers for the SNMP traps.
NotifyControlEnabled	Enables (true) or disables (false) the SNMP trap.
NotifyControlPortListEnabled	Indicates the port list for which the notification is enabled or disabled. Whether or not this field is configurable depends on the NotifyControlType value.

Configuring SNMP traps for ports using EDM

Use this procedure to enable or disable SNMP traps for specific ports, or for all switch ports.

Procedure

1. From the navigation tree, double-click **Edit**.
2. From the Edit tree, double-click **Snmp Server**.
3. From the Snmp Server tree, click **Notification Control** .
4. In the work area, click a **NotifyControlType** row for supported notifications, to select an SNMP trap.
5. Double-click the cell in the **NotifyControlPortListEnabled** column.
6. To enable or disable the trap for specific ports, select or deselect one or more port numbers.

   OR

   To enable or disable the trap for all switch ports, click **All**.
7. Click **Ok**.
8. On the toolbar, click **Apply**.

Variable definitions

Use the data in this table to enable or disable SNMP traps for specific ports, or for all switch ports.

Variable	Value
NotifyControlType	Lists the SNMP trap names.
Notify Control Type (OID)	Lists the object identifiers for the SNMP traps.
NotifyControlEnabled	Enables (true) or disables (false) the SNMP trap.
NotifyControlPortListEnabled	Specifies the port list for which the SNMP trap is enabled or disabled. Whether or not this field is configurable depends on the NotifyControlType value.

Graphing SNMP statistics using EDM

Use this procedure to display and graph SNMP statistics.

Procedure

1. From the navigation pane, double-click **Graph** to open the navigation tree.
2. In the Graph tree, double-click **Chassis**.
3. In the work area, click the **SNMP** tab.
4. On the toolbar, select a **Poll Interval** from the list.
5. On the toolbar, you can click **Clear Counters** to reset the IP statistics counters.
6. To select statistics to graph, click a statistic type row under a column heading.
7. On the toolbar, click **Line Chart**, **Area Chart**, **Bar Chart**, or **Pie Chart**.

Variable definitions

Use the data in the following table to help you understand SNMP statistics.

Variable	Value
InPkts	The total number of messages delivered to the SNMP from the transport service.
OutPkts	The total number of SNMP messages passed from the SNMP protocol to the transport service.
InTotalReqVars	The total number of MIB objects retrieved successfully by the SNMP protocol as the result of receiving valid SNMP Get-Request and Get-Next PDUs.

Table continues…

Variable	Value
InTotalSetVars	The total number of MIB objects altered successfully by the SNMP protocol as the result of receiving valid SNMP Set-Request PDUs.
InGetRequests	The total number of SNMP Get-Request PDUs that are accepted and processed by the SNMP protocol.
InGetNexts	The total number of SNMP Get-Next PDUs that are accepted and processed by the SNMP protocol.
InSetRequests	The total number of SNMP Set-Request PDUs that are accepted and processed by the SNMP protocol.
InGetResponses	The total number of SNMP Get-Response PDUs that are accepted and processed by the SNMP protocol.
OutTraps	The total number of SNMP Trap PDUs generated by the SNMP protocol.
OutTooBigs	The total number of SNMP PDUs generated by the SNMP protocol for which the value of the error-status field is tooBig.
OutNoSuchNames	The total number of SNMP PDUs generated by the SNMP protocol for which the value of the error-status field is noSuchName.
OutBadValues	The total number of SNMP PDUs generated by the SNMP protocol for which the value of the error-status field is badValue.
OutGenErrs	The total number of SNMP PDUs generated by the SNMP protocol for which the value of the error-status field is genErr.
InBadVersions	The total number of SNMP messages delivered to the SNMP protocol for an unsupported SNMP version.
InBadCommunity Names	The total number of SNMP messages delivered to the SNMP protocol that used an unknown SNMP community name.
InBadCommunity Uses	The total number of SNMP messages delivered to the SNMP protocol that represented an SNMP operation not allowed by the SNMP community named in the message.
InASNParseErrs	The total number of ASN.1 or BER errors encountered by the SNMP protocol when decoding received SNMP messages.
InTooBigs	The total number of SNMP PDUs delivered to the SNMP protocol for which the value of the error-status field is tooBig.
InNoSuchNames	The total number of SNMP PDUs delivered to the SNMP protocol for which the value of the error-status field is noSuchName.
InBadValues	The total number of SNMP PDUs delivered to the SNMP protocol for which the value of the error-status field is badValue.
InReadOnlys	The total number of SNMP PDUs delivered to the SNMP protocol for which the value of the error-status field is readOnly. It is a protocol error to generate an SNMP PDU containing the value readOnly in the error-status field. This object is provided to detect incorrect implementations of the SNMP.
InGenErrs	The total number of SNMP PDUs delivered to the SNMP protocol for which the value of the error-status field is genErr.

Storm control configuration using EDM

Use the procedures in this section to configure storm control globally and for specific traffic types.

Configuring storm control globally

About this task

Use the following procedure to globally configure Storm Control using EDM

Procedure

1. In the navigation tree, double-click **Edit** to open the Edit tree.
2. In the Edit tree, click **Storm Control**.
3. In the work area, click the **Globals** tab.
4. Configure the Storm Control parameters as required.
5. On the toolbar, click **Apply**.

Variable definitions

Variable	Description
TrafficType	Indicates the different types of traffic for Storm Control Settings: • **unicast**: Indicates the unicast storm control settings • **broadcast**: Indicates the broadcast Storm Control settings • **multicast**: Indicates the multicast Storm Control settings
Enabled	Indicates the current setting for the port. Values include: • **true**: enables Storm Control on the port • **false**: disables Storm Control on the port
LowWatermark(pps)	Indicates the low-watermark value for the port in packets per second (pps). Range: 10 to 100000000 Default: 100
HighWatermark(pps)	Indicates the high-watermark value for the port in packets per second (pps). Range: 10 to 100000000

Table continues…

Variable	Description
	Default: 1000
PollInterval(secs)	Indicates the interval for watermark checking, the value varies in seconds. Range: 5 to 300 Default: 5
TrapInterval	Indicates the interval for sending traps when the poll-intervals exceed. Range: 0 to 1000 **Note:** Value 0 means disabled (high watermark traps will not be repeated) Default: 0
ActionType	Indicates the Storm Control action for the specified port: • **drop**: Set Storm Control action to drop • **none** • **shutdown**: Set Storm Control action to shutdown

Configuring broadcast storm control

About this task

Use the following procedure to configure the broadcast storm control settings.

Procedure

1. In the navigation tree double-click **Edit** to open the Edit tree.
2. In the Edit tree, click **Storm Control**.
3. In the work area, click the **Broadcast** tab.
4. To select a port to configure, click the port **Index**.
5. In the port row, double-click the cell in the **Enabled** column.
6. Set a value from the drop-down list: **true** to enable Storm Control, or **false** to disable Storm Control for the specified port.
7. In the port row, double-click the cell in the **LowWatermark(pps)** column, and enter a value in the range `<10–100000000>`.
8. In the port row, double-click the cell in the **HighWatermark(pps)** column, and enter a value in the range `<10–100000000>`.

9. In the port row, double-click the cell in the **PollInterval(secs)** column, and enter a value in the range `<5–300>`.
10. In the port row, double-click the cell in the **TrapInterval** column, and enter a value in the range `<0–1000>`.
11. In the port row, double-click the cell in the **ActionType** column.
12. Set a value from the drop-down list: **none** to take no action, **drop**, or **shutdown** to shutdown Storm Control for the specified port.
13. Click **Apply Selection**.
14. On the toolbar, click **Apply**.

Variable definitions

Variable	Description
Index	Indicates the port number.
Enabled	Indicates the current setting for the port. Values include: • **true**: enables Storm Control on the port • **false**: disables Storm Control on the port
LowWatermark(pps)	Indicates the low-watermark value for the port in packets per second (pps). Range: 10 to 100000000 Default: 100
HighWatermark(pps)	Indicates the high-watermark value for the port in packets per second (pps). Range: 10 to 100000000 Default: 1000
PollInterval(secs)	Indicates the interval for watermark checking, the value varies in seconds. Range: 5 to 300 Default: 5
TrapInterval	Indicates the interval for sending traps when the poll-intervals are exceeded. Range: 0 to 1000 **Note:** Value 0 means disabled (high watermark traps will not be repeated) Default: 0

Table continues…

Variable	Description
ActionType	Indicates the Storm Control action for the specified port: • **drop**: Set Storm Control action to drop • **none**: • **shutdown**: Set Storm Control action to shutdown

Configuring multicast storm control

About this task

Use the following procedure to configure the multicast storm control setting.

Procedure

1. In the navigation tree double-click **Edit** to open the Edit tree.
2. In the Edit tree, click **Storm Control**.
3. In the work area, click the **Multicast** tab.
4. To select a port to configure, click the port **Index**.
5. In the port row, double-click the cell in the **Enabled** column.
6. Set a value from the drop-down list: **true** to enable Storm Control, or **false** to disable Storm Control for the specified port.
7. In the port row, double-click the cell in the **LowWatermark(pps)** column, and enter a value in the range `<10–100000000>`.
8. In the port row, double-click the cell in the **HighWatermark(pps)** column, and enter a value in the range `<10–100000000>`.
9. In the port row, double-click the cell in the **PollInterval(secs)column**, and enter a value in the range `<5–300>`.
10. In the port row, double-click the cell in the **TrapIntervalcolumn**, and enter a value in the range `<0–1000>`.
11. In the port row, double-click the cell in the **ActionType** column.
12. Set a value from the drop-down list: **none** to take no action, **drop** , or **shutdown** to shutdown Storm Control for specified port.
13. Click **Apply Selection**.
14. On the toolbar, click **Apply**.

Variable definitions

Variable	Description
Index	Indicates the unique identifier allocated to an Aggregator by the local system. This is a read-only cell.
Enabled	Indicates the current setting for the port. Values include: • **true**: enables Storm Control on the port • **false**: disables Storm Control on the port
LowWatermark(pps)	Indicates the low-watermark value for the port in packets per second (pps). Range: 10 to 100000000 Default: 100
HighWatermark(pps)	Indicates the high-watermark value for the port in packets per second (pps). Range: 10 to 100000000 Default: 1000
PollInterval(secs)	Indicates the interval for watermark checking, the value varies in seconds. Range: 5 to 300 Default: 5
TrapInterval	Indicates the interval for sending traps when the poll-intervals are exceeded. Range: 0 to 1000 **Note:** Value 0 means disabled (high watermark traps will not be repeated) Default: 0
ActionType	Indicates the Storm Control action for the specified port: • **drop**: Set Storm Control action to drop • **none** • **shutdown**: Set Storm Control action to shutdown

Configuring unicast storm control

About this task

Use the following procedure to configure the unicast storm control settings.

Procedure

1. In the navigation tree, double-click **Edit** to open the Edit tree.
2. In the Edit tree, click **Storm Control**.
3. In the work area, click the **Unicast** tab.
4. To select a port to configure, click the port **Index**.
5. In the port row, double-click the cell in the **Enabled** column.
6. Set a value from the drop-down list: **true** to enable Storm Control, or **false** to disable Storm Control for the specified port.
7. In the port row, double-click the cell in the **LowWatermark(pps)** column, and enter a value in the range `<10–100000000>`.
8. In the port row, double-click the cell in the **HighWatermark(pps)** column, and enter a value in the range `<10–100000000>`.
9. In the port row, double-click the cell in the **PollInterval(secs)** column, and enter a value in the range `<5–300>`.
10. In the port row, double-click the cell in the **TrapIntervalcolumn**, and enter a value in the range `<0–1000>`.
11. In the port row, double-click the cell in the **ActionType** column.
12. Set a value from the drop-down list: **none** to take no action, **drop** , or **shutdown** to shutdown Storm Control for specified port.
13. Click **Apply Selection**.
14. On the toolbar, click **Apply**.

Variable definitions

Variable	Description
Index	Indicates the unique identifier allocated to an Aggregator by the local system. This is a read-only cell.
Enabled	Indicates the current setting for the port. Values include: • **true**: enables Storm Control on the port • **false**: disables Storm Control on the port

Table continues…

Variable	Description
LowWatermark(pps)	Indicates the low-watermark value for the port in packets per second (pps). Range: 10 to 100000000 Default: 100
HighWatermark(pps)	Indicates the high-watermark value for the port in packets per second (pps). Range: 10 to 100000000 Default: 1000
PollInterval(secs)	Indicates the interval for watermark checking, the value varies in seconds. Range: 5 to 300 Default: 5
TrapInterval	Indicates the interval for sending traps when the poll-intervals are exceeded. Range: 0 to 1000 **Note:** Value 0 means disabled (high watermark traps will not be repeated) Default: 0
ActionType	Indicates the Storm Control action for the specified port: • **drop**: Set Storm Control action to drop • **none** • **shutdown**: Set Storm Control action to shutdown

Configuring port-based storm control

About this task

Use the following procedure to configure Storm Control on an individual port or multiple ports.

Procedure

1. From the Device Physical View, click one or more ports.
2. From the navigation tree, double-click **Edit**.
3. In the Edit tree, double-click **Chassis**.
4. In the Chassis tree, click **Ports**.
5. In the work area, click the **Storm Control** tab.

Variable definitions

Variable	Description
Index	Indicates the unique identifier allocated to an Aggregator by the local system. This is a read-only cell.
Enabled	Indicates the current setting for the port. Values include: • **true**: enables Storm Control on the port • **false**: disables Storm Control on the port
LowWatermark(pps)	Indicates the low-watermark value for the port in packets per second (pps). Range: 10 to 100000000 Default: 100
HighWatermark(pps)	Indicates the high-watermark value for the port in packets per second (pps). Range: 10 to 100000000 Default: 1000
PollInterval(secs)	Indicates the interval for watermark checking, the value varies in seconds. Range: 5 to 300 Default: 5
TrapInterval	Indicates the interval for sending traps when the poll-intervals are exceeded. Range: 0 to 1000 **Note:** Value 0 means disabled (high watermark traps will not be repeated) Default: 0
ActionType	Indicates the Storm Control action for the specified port: • **drop**: Set Storm Control action to drop • **none** • **shutdown**: Set Storm Control action to shutdown

Chapter 9: Ignition Server configuration using Enterprise Device Manager

This chapter describes how to configure the switch as a network access device in the Identity Engine Ignition Server solution using Enterprise Device Manager (EDM).

Configuring Ignition Servers as a RADIUS server using EDM

You can configure Ingition Server to act as the RADIUS server for your switches and access points. For more information about configuring the Ignition Server for RADIUS, see *Administering Avaya Identity Engines Ignition Server*, NN47280-600.

Before you begin

Ensure the following prerequisites have been met:

- Ignition Server installed and configured in your network.
- Configure the following policies for your switch on Ignition Server:
  - Access
  - User Authentication
  - User Authorization
- Configure the following optional policies for your switch on Ignition Server:
  - Provisioning Polices that set network session and switch parameters for users.
  - Client Posture Policies that require that laptops meet a minimum standard of system health.
  - VLAN Assignments that assign each user to an appropriate VLAN.
  - Windows machine authentication that checks connecting devices to ensure they are known to the Active Directory before the system permits connection.
  - MAC authentication that allows operator-less devices to connect and records which device a user connected with.

Procedure

1. From the Configuration tree, double-click **Security**.
2. From the Security tree, click **RADIUS**.
3. On the work area, click the **Globals** tab.
4. In the **Reachability** box select **useRadius**.
5. **Optional**: in the **RADIUS Accounting** section, select values to configure RADIUS.
6. On the work area, click the **Global RADIUS Server** tab.
7. In the **PrimaryRadiusServerAddressType** field, select the address type
8. In the **PrimaryRadiusServer** field, enter the Ignition Server RADIUS service IP address.
9. **Optional**: In the **SecondaryRadiusServerAddressType** , select the address type.
10. Optional: In the **SecondaryRadiusServer** field, enter the Ignition Server secondary RADIUS service IP address.
11. In the **RadiusServerUdpPort** field, enter the port number for the UDP port.
12. In the **RadiusServerTimeout** field, enter a timeout value.
13. In the **SharedSecret(Key)** field, enter the RADIUS shared secret (also known as the *key* or *encryption key*).
14. **Optional**: In the **Confirm SharedSecret(Key)** field, re-enter the RADIUS shared secret from the preceding step.
15. **Optional**: Select the **AccountingEnabled** field to enable RADIUS Accounting.
16. **Optional**: In the **AccountingPort** field, enter a port number.
17. **Optional**: In the **RetryLimit** field, enter a value.
18. On the tool bar, click **Apply**.

Variable definitions

The following table describes the Globals tab fields.

Variable	Value
UseMgmtIp	When selected, RADIUS uses the system management IP address as the source address for RADIUS requests.
PasswordFallbackEnabled	When selected, enables RADIUS password fallback.
DynAuthReplayProtection	When selected, enables RADIUS replay protection.

Table continues…

Variable	Value
Reachability	Specifies the RADIUS server reachability mode. Values include: • use-radius — uses dummy RADIUS requests to determine reachability of the RADIUS server. • use-icmp — uses ICMP packets to determine reachability of the RADIUS server (default).
InterimUpdates	Enables or disables RADIUS accounting interim updates for the switch.
InterimUpdatesInterval	Specifies the time interval (in seconds) before RADIUS accounting interim updates times out. Values range from 60–3600 seconds. DEFAULT: 600 seconds.
InterimUpdatesIntervalSource	Specifies the source of the interim updates timeout interval. • configuredValue — uses the value in the RadiusAccoutingInterimUpdatesInterval dialog box • radiusServer — uses the value applied by the RADIUS server
EncapsulationProtocol	Specifies the type of encapsulation for the RADIUS packets. Values include: • pap — Password Authentication Protocol. • ms-chap-v2 — Microsoft Challenge Handshake Authentication Protocol Version 2.

Variable definitions

The following table describes the Global RADIUS Server tab fields.

Variable	Value
PrimaryRadiusServerAddressType	Specifies the type of IP address type for the primary Global RADIUS server. Values include unknown, ipv4, and ipv6.
PrimaryRadiusServer	Specifies the IPv4 or IPv6 address for the primary Global RADIUS Server. The default address is 0.0.0.0. **Important:** An IPv4 address value of 0.0.0.0 indicates that a primary Global RADIUS Server is not configured. An IPv6 value of

Table continues…

Variable	Value
	00:00:00:00:00:00:00:00 indicates that a primary Global RADIUS Server is not configured.
SecondaryRadiusServerAddressType	Specifies the IP address type for the secondary Global RADIUS Server. Values include unknown, ipv4, and ipv6.
SecondaryRadiusServer	Specifies the IP address for the secondary Global RADIUS Server. The default address is 0.0.0.0. The secondary Global RADIUS Server is used only if the primary Global RADIUS Server is unavailable or unreachable. **Important:** An IPv4 address value of 0.0.0.0 indicates that a secondary Global RADIUS Server is not configured. An IPv6 value of 00:00:00:00:00:00:00:00 indicates that a secondary Global RADIUS Server is not configured.
RadiusServerUdpPort	Specifies the UDP port number for clients to use when trying to contact the Global RADIUS Server at the corresponding Global RADIUS Server IP address. Values range from 1 to 65535. The default port number is 1812.
RadiusServerTimeout	Specifies the timeout interval between each retry for service requests to the Global RADIUS Server. The default is 2 Seconds. Values range from 1 to 60 seconds.
SharedSecret(Key)	Specifies a new value for the Global RADIUS Server shared secret key, to a maximum of 16 characters.
ConfirmedSharedSecret(key)	Confirms the value typed in the shared secret key box. If you do not change the Global RADIUS Server shared secret key, you do not have to type a value in this box.
AccountingEnabled	Enables or disables RADIUS accounting for a Global RADIUS Server instance
AccountingPort	Specifies the UDP accounting port number for clients to use when trying to contact the RADIUS server at the corresponding Global RADIUS Server IP address. Values range from 0 to 65535.
RetryLimit	Specifies the number of RADIUS retry attempts for a Global RADIUS Server instance. Values range from 1 to 5

Configuring Ignition Server as an EAP RADIUS server using EDM

You can configure Ingition Server to act as the EAP RADIUS server for your switches and access points. For more information about configuring the Ignition Server for RADIUS, see *Administering Avaya Identity Engines Ignition Server*, NN47280-600.

Before you begin

Ensure the following prerequisites have been met:

- Ignition Server installed and configured in your network.
- Configure the following policies for your switch on Ignition Server:
  - Access
  - User Authentication
  - User Authorization
- Configure the following optional policies for your switch on Ignition Server:
  - Provisioning Polices that set network session and switch parameters for users.
  - Client Posture Policies that require that laptops meet a minimum standard of system health.
  - VLAN Assignments that assign each user to an appropriate VLAN.
  - Windows machine authentication that checks connecting devices to ensure they are known to the Active Directory before the system permits connection.
  - MAC authentication that allows operator-less devices to connect and records which device a user connected with.
- EAP configured on your switch.

Procedure

1. From the Configuration tree, double-click **Security**.
2. From the Security tree, click **RADIUS**.
3. On the work area, click the **Globals** tab.
4. In the **Reachability** box, select **useRadius**.
5. **Optional**: in the **RADIUS Accounting** section, select values to configure RADIUS Accounting.
6. On the work area, click the **EAP RADIUS Server** tab.
7. In the **PrimaryRadiusServerAddressType** field, select the address type.
8. In the **PrimaryRadiusServer** field, enter the Ignition Server RADIUS service IP address.
9. **Optional**: In the **SecondaryRadiusServerAddressType** , select the address type.
10. **Optional**: In the **SecondaryRadiusServer** field, enter the Ignition Server secondary RADIUS service IP address.
11. In the **RadiusServerUdpPort** field, enter the port number for the UDP port.

12. In the **RadiusServerTimeout** field, enter a timeout value.
13. In the **SharedSecret(Key)** field, enter the RADIUS shared secret (also known as the *key* or *encryption key*).
14. **Optional**: In the **Confirm SharedSecret(Key)** field, re-enter the RADIUS shared secret from the preceding step.
15. **Optional**: Select the **AccountingEnabled** field to enable RADIUS Accounting.
16. **Optional**: In the **AccountingPort** field, enter a port number.
17. Optional: In the **RetryLimit** field, enter a value.
18. On the tool bar, click **Apply**.

Variable definitions

The following table describes the Globals tab fields.

Variable	Value
UseMgmtIp	When selected, RADIUS uses the system management IP address as the source address for RADIUS requests.
PasswordFallbackEnabled	When selected, enables RADIUS password fallback.
DynAuthReplayProtection	When selected, enables RADIUS replay protection.
Reachability	Specifies the RADIUS server reachability mode. Values include: • use-radius — uses dummy RADIUS requests to determine reachability of the RADIUS server. • use-icmp — uses ICMP packets to determine reachability of the RADIUS server (default).
InterimUpdates	Enables or disables RADIUS accounting interim updates for the switch.
InterimUpdatesInterval	Specifies the time interval (in seconds) before RADIUS accounting interim updates times out. Values range from 60–3600 seconds. DEFAULT: 600 seconds.
InterimUpdatesIntervalSource	Specifies the source of the interim updates timeout interval. • configuredValue — uses the value in the RadiusAccoutingInterimUpdatesInterval dialog box • radiusServer — uses the value applied by the RADIUS server

Table continues…

Variable	Value
EncapsulationProtocol	Specifies the type of encapsulation for the RADIUS packets. Values include: • pap — Password Authentication Protocol. • ms-chap-v2 — Microsoft Challenge Handshake Authentication Protocol Version 2.

Variable definitions

The following table describes the EAP RADIUS Server tab fields.

Variable	Value
PrimaryRadiusServerAddressType	Specifies the type of IP address type for the primary EAP RADIUS server. Values include unknown, ipv4, and ipv6.
PrimaryRadiusServer	Specifies the IPv4 or IPv6 address for the primary EAP RADIUS Server. The default address is 0.0.0.0. **Important:** An IPv4 address value of 0.0.0.0 indicates that a primary EAP RADIUS Server is not configured. An IPv6 value of 00:00:00:00:00:00:00:00 indicates that a primary EAP RADIUS Server is not configured.
SecondaryRadiusServerAddressType	Specifies the IP address type for the secondary EAP RADIUS Server. Values include unknown, ipv4, and ipv6.
SecondaryRadiusServer	Specifies the IP address for the secondary EAP RADIUS Server. The default address is 0.0.0.0. The secondary EAP RADIUS Server is used only if the primary EAP RADIUS Server is unavailable or unreachable. **Important:** An IPv4 address value of 0.0.0.0 indicates that a secondary EAP RADIUS Server is not configured. An IPv6 value of 00:00:00:00:00:00:00:00 indicates that a secondary EAP RADIUS Server is not configured.
RadiusServerUdpPort	Specifies the UDP port number for clients to use when trying to contact the EAP RADIUS Server at the corresponding EAP RADIUS Server IP address.

Table continues…

Variable	Value
	Values range from 1 to 65535. The default port number is 1812.
RadiusServerTimeout	Specifies the timeout interval between each retry for service requests to the EAP RADIUS Server. The default is 2 Seconds. Values range from 1 to 60 seconds.
SharedSecret(Key)	Specifies a new value for the EAP RADIUS Server shared secret key, to a maximum of 16 characters.
ConfirmedSharedSecret(key)	Confirms the value typed in the shared secret key box. If you do not change the EAP RADIUS Server shared secret key, you do not have to type a value in this box.
AccountingEnabled	Enables or disables RADIUS accounting for an EAP RADIUS Server instance
AccountingPort	Specifies the UDP accounting port number for clients to use when trying to contact the RADIUS server at the corresponding EAP RADIUS Server IP address. Values range from 0 to 65535.
RetryLimit	Specifies the number of RADIUS retry attempts for a EAP RADIUS Server instance. Values range from 1 to 5

Configuring Ignition Server as a non-EAP RADIUS server using EDM

You can configure Ingition Server to act as the non-EAP RADIUS server for your switches and access points. For more information about configuring the Ignition Server for RADIUS, see *Administering Avaya Identity Engines Ignition Server*, NN47280-600.

Before you begin

Ensure the following prerequisites have been met:

- Ignition Server installed and configured in your network.
- Configure the following policies for your switch on Ignition Server:
  - Access
  - User Authentication
  - User Authorization
- Configure the following optional policies for your switch on Ignition Server:
  - Provisioning Polices that set network session and switch parameters for users.
  - Client Posture Policies that require that laptops meet a minimum standard of system health.
  - VLAN Assignments that assign each user to an appropriate VLAN.

  - Windows machine authentication that checks connecting devices to ensure they are known to the Active Directory before the system permits connection.
  - MAC authentication that allows operator-less devices to connect and records which device a user connected with.
- Non-EAP configured on your switch.

Procedure

1. From the Configuration tree, double-click **Security**.
2. From the Security tree, click **RADIUS**.
3. On the work area, click the **Globals** tab.
4. In the **Reachability** box select **useRadius**.
5. **Optional**: in the **RADIUS Accounting** section, select values to configure RADIUS
6. On the work area, click the **NEAP RADIUS Server** tab.
7. In the **PrimaryRadiusServerAddressType** field, select the address type
8. In the **PrimaryRadiusServer** field, enter the Ignition Server RADIUS service IP address.
9. **Optional**: In the **SecondaryRadiusServerAddressType** , select the address type.
10. **Optional**: In the **SecondaryRadiusServer** field, enter the Ignition Server secondary RADIUS service IP address.
11. In the **RadiusServerUdpPort** field, enter the port number for the UDP port.
12. In the **RadiusServerTimeout** field, enter a timeout value.
13. In the **SharedSecret(Key)** field, enter the RADIUS shared secret (also known as the *key* or *encryption key*).
14. **Optional**: In the **Confirm SharedSecret(Key)** field, re-enter the RADIUS shared secret from the preceding step.
15. **Optional**: Select the **AccountingEnabled** field to enable RADIUS Accounting.
16. **Optional**: In the **AccountingPort** field, enter a port number.
17. **Optional**: In the **RetryLimit** field, enter a value.
18. On the tool bar, click **Apply**.

Variable definitions

The following table describes the Globals tab fields.

Variable	Value
UseMgmtIp	When selected, RADIUS uses the system management IP address as the source address for RADIUS requests.
PasswordFallbackEnabled	When selected, enables RADIUS password fallback.
DynAuthReplayProtection	When selected, enables RADIUS replay protection.
Reachability	Specifies the RADIUS server reachability mode. Values include: • use-radius — uses dummy RADIUS requests to determine reachability of the RADIUS server. • use-icmp — uses ICMP packets to determine reachability of the RADIUS server (default).
InterimUpdates	Enables or disables RADIUS accounting interim updates for the switch.
InterimUpdatesInterval	Specifies the time interval (in seconds) before RADIUS accounting interim updates times out. Values range from 60–3600 seconds. DEFAULT: 600 seconds.
InterimUpdatesIntervalSource	Specifies the source of the interim updates timeout interval. • configuredValue — uses the value in the RadiusAccoutingInterimUpdatesInterval dialog box • radiusServer — uses the value applied by the RADIUS server
EncapsulationProtocol	Specifies the type of encapsulation for the RADIUS packets. Values include: • pap — Password Authentication Protocol. • ms-chap-v2 — Microsoft Challenge Handshake Authentication Protocol Version 2.

Variable definitions

The following table describes the NEAP RADIUS Server tab fields.

Variable	Value
PrimaryRadiusServerAddressType	Specifies the type of IP address type for the primary NEAP RADIUS server. Values include unknown, ipv4, and ipv6.
PrimaryRadiusServer	Specifies the IPv4 or IPv6 address for the primary NEAP RADIUS Server. The default address is 0.0.0.0.

Table continues…

Variable	Value
	❗ **Important:** An IPv4 address value of 0.0.0.0 indicates that a primary NEAP RADIUS Server is not configured. An IPv6 value of 00:00:00:00:00:00:00:00 indicates that a primary NEAP RADIUS Server is not configured.
SecondaryRadiusServerAddressType	Specifies the IP address type for the secondary NEAP RADIUS Server. Values include unknown, ipv4, and ipv6.
SecondaryRadiusServer	Specifies the IP address for the secondary NEAP RADIUS Server. The default address is 0.0.0.0. The secondary NEAP RADIUS Server is used only if the primary NEAP RADIUS Server is unavailable or unreachable. ❗ **Important:** An IPv4 address value of 0.0.0.0 indicates that a secondary NEAP RADIUS Server is not configured. An IPv6 value of 00:00:00:00:00:00:00:00 indicates that a secondary NEAP RADIUS Server is not configured.
RadiusServerUdpPort	Specifies the UDP port number for clients to use when trying to contact the NEAP RADIUS Server at the corresponding NEAP RADIUS Server IP address. Values range from 1 to 65535. The default port number is 1812.
RadiusServerTimeout	Specifies the timeout interval between each retry for service requests to the NEAP RADIUS Server. The default is 2 Seconds. Values range from 1 to 60 seconds.
SharedSecret(Key)	Specifies a new value for the NEAP RADIUS Server shared secret key, to a maximum of 16 characters.
ConfirmedSharedSecret(key)	Confirms the value typed in the shared secret key box. If you do not change the NEAP RADIUS Server shared secret key, you do not have to type a value in this box.
AccountingEnabled	Enables or disables RADIUS accounting for a NEAP RADIUS Server instance
AccountingPort	Specifies the UDP accounting port number for clients to use when trying to contact the NEAP RADIUS server at the corresponding NEAP RADIUS Server IP address. Values range from 0 to 65535.

Table continues…

Variable	Value
RetryLimit	Specifies the number of RADIUS retry attempts for a NEAP RADIUS Server instance. Values range from 1 to 5

Configuring Ignition Server as a TACACS+ server using EDM

You can configure Ingition Server to act as theTACACS+S authentication and authentication server, and you can use it as the TACACS+ accounting server. For more information , see *Administering Avaya Identity Engines Ignition Server*, NN47280-600.

Before you begin

Ensure the following Prerequisites have been met:

- Ignition Server installed and configured in your network
- Configure the following policies for your switch on Ignition Server
  - Access
  - User Authentication
  - User Authorization
- Configure the following optional policies for your switch on Ignition Server:
  - Provisioning Polices that set network session and switch parameters for users
  - Client Posture Policies that require that laptops meet a minimum standard of system health
  - VLAN Assignments that assign each user to an appropriate VLAN
  - Windows machine authentication that checks connecting devices to ensure they are known to the Active Directory before the system permits connection
  - MAC authentication that allows operator-less devices to connect and records which device a user connected with
- Configure an Ignition Server authentication record with a TACACS+ policy **NOTE**: If you use Ignition Server for TACACS+ authorization, you must use Ignition Server for TACACS+ authentication.

Procedure

1. From the navigation tree, double-click **Security**.
2. In the Security tree, double-click **TACACS+**.
3. In the work area, click the **TACACS+ Server** tab.
4. On the toolbar, click **Insert**.

   The Insert TACACS+ Server dialog box displays.
5. Type the address in the **Address** field.

6. Type the port number in the **PortNumber** field.
7. Type the key in the **Key** field.
8. Retype the key in the **Confirm Key** field.
9. Choose the priority in the **Priority** field.
10. Click **Insert**.

Variable definitions

Variable	Value
AddressType	Specifies the type of IP address used on the TACACS+ server.
Address	Indicates the IP address of the TACACS+ server in use.
PortNumber	Indicates the TCP port on which the client establishes a connection to the server.
Key	Indicates the secret key to be shared with this TACACS+ server. Key length zero indicates no encryption is being used.
Confirm Key	Indicates the key in use.
Priority	Determines the order in which the TACACS+ servers are used. Available options are—primary or secondary.

Chapter 10: IPv6 FHS configuration using EDM

This chapter describes how to configure IPv6 First Hop Security (FHS) on the Avaya Ethernet Routing Switch 4800 Series and protect the network by mitigating the various types of attacks such as address spoofing, remote address resolution cache exhaustion (denial of service attacks), and others, using Enterprise Device Manager (EDM).

Note:

FHS does not solve all cases of denial of services like blocking flooding of the IPv6 messages.

Configuring FHS Globals

About this task

Use this procedure to enable FHS to enable DHCPv6-guard, RA-guard, or ND-inspection policy globally, and to configure the lifetime for these policies.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **Globals** tab.
4. Configure FHS globals.
5. On the toolbar, click **Apply** to save the changes.
6. On the toolbar, click **Refresh** to update the results.

Variable definitions

The following table describes the Globals tab fields.

Variable	Description
Admin	Enables or disables the FHS policy.

Table continues…

Variable	Description
RAGuardAdmin	Enables or disables the RA–guard policy.
DHCPv6GuardAdmin	Enables or disables the DHCPv6–guard policy.
NDInspectAdmin	Enables or disables ND–inspection policy.
MaxDynSBTEntries	Specifies the maximum dynamic SBT entries. The value range is from 0 to 1024. The default value for the maximum dynamic SBT entry is 512.
SBTReachLifeTime	Specifies the maximum REACHABLE lifetime for a dynamically-learned SBT entry. The value range is from 0 (infinite) or 30 to 864000 seconds. The default value for the SBT REACHABLE lifetime is 300 seconds. After time-out, the entry moves from REACHABLE to STALE state or if the interface is down before this timer expires, then the state moves to DOWN state. In this state, if the switch receives any ND packets with the matching entry in the SBT, then without validation the state moves to the REACHABLE. Similarly, when the switch receives any ND packets matching the entry in the SBT, then this aging timer is refreshed.
SBTStaleLifeTime	Specifies the maximum STALE lifetime for a dynamically learnt SBT entry. The value range is from 0 (infinite) or 30 to 86400 seconds. The default value for the SBT STALE lifetime is 86400 seconds. In this state, if the switch receives any ND message matching the information as the SBT entry, then validation is not done on that packet; rather, this entry directly moves to the REACHABLE state. After this timer expiry, this entry is deleted from the SBT.
SBTDownLifeTime	Specifies the maximum DOWN lifetime for a dynamically-learned SBT entry. The value range is from 0 to 86400 seconds. The default value for the SBT DOWN lifetime is 86400 seconds. In this state, if the switch receives any ND message matching the information as the SBT entry, then validation is not done on that packet; rather, this entry directly moves to the REACHABLE state. After this timer expiry, this entry gets deleted from the SBT
SBTTblOverFlow	Specifies SBT overflow.

IPv6 access list configuration

An IPv6 access list is created to verify the sender's IPv6 address in the inspected messages. You can configure, view, or delete an IPv6 access list.

Creating IPv6 access list

About this task

Use this procedure to create an FHS IP access list or add IP prefixes to the existing IP access list

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **IPv6 Access List** tab.
4. On the toolbar, click **Insert**.
5. Configure the parameters for the IPv6 access list.
6. Click **Insert**.

Variable definitions

The following table describes the IP Access List tab fields.

Variable	Description
Name	Specify the IP access list name to create the IP access list.
Prefix	Specify the IP prefix for adding it to the IP access list.
PrefixMaskLen	Specify the prefix mask length for adding it to the IP access list. The value range is from 0 to 128. By default, the value is 0.
MaskLenFrom	Specify the start mask length for providing the IP range. The value range is from 0 to 128. By default, the value is 0.
MaskLenTo	Specify the end mask length for providing the IP range. The value range is from 0 to 128. By default, the value is 0.
AccessType	Select the access type to allow or deny the entry. By default, the access type is allow.

Viewing IPv6 access list

About this task

Use this procedure to display the IPv6 access list.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **IPv6 Access List** tab.

Variable definitions

The following table describes the IP Access List tab fields.

Variable	Description
Name	Specify the IP access list name to create the IP access list.
Prefix	Specify the IP prefix for adding it to the IP access list.
PrefixMaskLen	Specify the prefix mask length for adding it to the IP access list. The value range is from 0 to 128. By default, the value is 0.
MaskLenFrom	Specify the start mask length for providing the IP range. The value range is from 0 to 128. By default, the value is 0.
MaskLenTo	Specify the end mask length for providing the IP range. The value range is from 0 to 128. By default, the value is 0.
AccessType	Select the access type to allow or deny the entry. By default, the access type is allow.

Deleting the IPv6 access list

About this task

Use this procedure to delete the created IPv6 access list.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **IPv6 Access List** tab.
4. Select a row from the IPv6 access list to delete.

5. Click **Delete**.

MAC access list configuration

A MAC access list is created to verify the sender's MAC address in the inspected messages. You can view, create, or delete a MAC access list.

Creating MAC access list

About this task

Use this procedure to create a MAC access list or add a MAC address to the existing MAC access list.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **MAC Access List** tab.
4. On the toolbar, click **Insert**.
5. Configure the parameters for the MAC access list.
6. Click **Insert**.

Variable definitions

The following table describes the MAC Access List tab fields.

Variable	Description
Name	Specify a name to create a MAC access list.
Mac	Specify the MAC address to add the address to the MAC access list.
AccessType	Specify allow or deny. By default, the access type is allow.

Viewing a MAC access list

About this task

Use this procedure to display a configured MAC access list.

Procedure

1. From the navigation tree, double-click **IPv6**.

2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **MAC Access List** tab.

Variable definitions

The following table describes the MAC Access List tab fields.

Variable	Description
Name	Specify a name to create a MAC access list.
Mac	Specify the MAC address to add the address to the MAC access list.
AccessType	Specify allow or deny. By default, the access type is allow.

Deleting a MAC access list

About this task

Use this procedure to delete the created MAC access list.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **MAC Access List** tab.
4. Select a row from the MAC access list to delete.
5. Click **Delete**.

DHCPv6-guard policy configuration

Configure the DHCP-DHCPv6 guard policy to block DHCP reply and advertisement messages that originate from unauthorized DHCP servers and relay agents that forward DHCP packets from servers to clients. You can view, create, or delete a DHCPv6 guard policy.

Creating DHCPv6-guard policy

About this task

Use this procedure to create the DHCPv6-guard policy to block DHCP reply and advertisement messages that originate from unauthorized DHCP servers and relay agents.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **DHCPv6 Guard Policy** tab.
4. On the toolbar, click **Insert**.
5. Configure the parameters for the DHCPv6-guard policy.
6. Click **Insert**.
7. On the toolbar, click **Refresh** to update the results.

Variable definitions

The following table describes the DHCPv6 Guard Policy tab fields.

Variable	Description
PolicyName	Specify the policy name to create or modify DHCPv6-guard policy.
DeviceRole	Select client or server to enable verification of the role of the device attached to the port. By default, no device is selected.
ServerAccessListName	Enables verification of the sender's IPv6 address in the inspected messages from the configured authorized device source access-list specified. ✱ **Note:** If the access-list is not attached, the inspection does not occur. If the list is attached and it does not match any IP prefixes in the list, the switch drops the DHCPv6 packet. To change this behavior, add a dummy ip-prefix 0.0.0.0/0 with the Allow option, which changes the default drop to default Allow.
ReplyPrefixListName	Enables verification of the advertised prefixes in DHCP reply messages from the configured authorize prefix list. If not configured, this check is bypassed. An empty prefix list is treated as a permit. ✱ **Note:** If the access-list is not attached, the inspection does not occur. If the list is attached and it does not match any IP prefixes in the list, the switch drops the DHCPv6 packet. To change this behavior, add a dummy ip-prefix 0.0.0.0/0 with the Allow option, which changes the default drop to default Allow.

Table continues…

Variable	Description
PrefLimitMin	Enables verification if the advertised preference (in reference option) is greater than the specified limit. If not specified, this check does not occur. The value range is from 0 to 255.
PrefixLimitMax	Enables verification if the advertised preference (in preference option) is less than the specified limit. If not specified, this check does not occur. The value range is from 0 to 255. **Note:** If both the maximum and minimum limit is 0, this preference check is ignored.

Viewing a DHCPv6-guard policy

About this task

Use this procedure to display configured DHCPv6-guard policies.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **DHCPv6 Guard Policy** tab.

Variable definitions

The following table describes the DHCPv6 Guard Policy tab fields.

Variable	Description
PolicyName	Specify the policy name to create or modify DHCPv6-guard policy.
DeviceRole	Select client or server to enable verification of the role of the device attached to the port. By default, no device is selected.
ServerAccessListName	Enables verification of the sender’s IPv6 address in the inspected messages from the configured authorized device source access-list specified. **Note:** If the access-list is not attached, the inspection does not occur. If the list is attached and it does not match any IP prefixes in the list, the switch drops the DHCPv6 packet. To change this

Table continues…

Variable	Description
	behavior, add a dummy ip-prefix 0.0.0.0/0 with the Allow option, which changes the default drop to default Allow.
ReplyPrefixListName	Enables verification of the advertised prefixes in DHCP reply messages from the configured authorize prefix list. If not configured, this check is bypassed. An empty prefix list is treated as a permit. **Note:** If the access-list is not attached, the inspection does not occur. If the list is attached and it does not match any IP prefixes in the list, the switch drops the DHCPv6 packet. To change this behavior, add a dummy ip-prefix 0.0.0.0/0 with the Allow option, which changes the default drop to default Allow.
PrefLimitMin	Enables verification if the advertised preference (in reference option) is greater than the specified limit. If not specified, this check does not occur. The value range is from 0 to 255.
PrefixLimitMax	Enables verification if the advertised preference (in preference option) is less than the specified limit. If not specified, this check does not occur. The value range is from 0 to 255. **Note:** If both the maximum and minimum limit is 0, this preference check is ignored.

Deleting a DHCPv6–guard policy

About this task

Use this procedure to delete the created DHCPv6-guard policy.

Note:

If this policy is already attached to an interface, then this policy cannot be deleted.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **DHCPv6 Guard Policy** tab.
4. Select a row from DHCPv6 Guard policies to delete.

5. Click **Delete**.

RA-guard policy configuration

Configure IPv6 RA-guard to block or reject unwanted or rogue RA guard messages that arrive at the network device platform. You can view, create, or delete RA-guard policy.

Port policy mapping configuration

This feature allows you to map the port with FHS, DHCPv6-guard, or RA-guard policy. You can view, create or delete the mappings.

Creating port to policy mapping

About this task

Use this procedure to map a port to a RA-guard or DHCPv6-guard policy and to clear the ND-inspection, DHCPv6-guard or RA-guard statistics.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **Port Policy Mapping** tab.
4. On the toolbar, click **Insert**.
5. Configure the parameters for the port policy mapping.
6. Click **Insert**.
7. On the toolbar, click **Refresh** to update the results.

Variable definitions

The following table describes the Port Policy Mapping tab fields.

Variable	Description
Ports	Specify the ports.
DHCPv6GuardPolicyName	Enter already-created DHCPv6-guard policy name to map it with the port.

Table continues…

Variable	Description
RAGuardPolicyName	Enter already-created RA-guard policy name to map it with the port.
NDAdmin	Enable ND-inspection for the selected ports.

Viewing port policy mapping

About this task

Use this procedure to display port policy mapping information.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **Port Policy Mapping** tab.

Variable definition

The following table describes the Port Policy mapping tab fields.

Variable	Description
IfIndex	Specifies the port.
DHCPv6GuardPolicyName	Specifies the DHCPv6-guard policy name associated with the port.
RAGuardPolicyName	Specifies the RA-guard policy name associated with the port.
NDAdmin	Specifies whether ND-inspection is enabled or disabled.
SBTDynLearnAdmin	Specifies if dynamic learning is enabled or disabled on a port. If dynamic learning is disabled, the ND packets are forwarded only through static SBT entries on those ports. By default, SBT dynamic learning is enabled. **Note:** Dynamic learning is not supported for ND packets with IPv6 any-cast address. A static SBT configuration is required.
TotalDHCPv6PktRcv	Specifies total number of DHCPv6 packets received on the DHCPv6-guard enabled interface.
TotalDHCPv6PktDropped	Specifies total number of DHCPv6 packets dropped due to DHCPv6-guard filtering.

Table continues…

Variable	Description
TotalRAPktRcv	Specifies total number of RA packets received on the RA-guard enabled interface.
TotalRAPktDropped	Specifies total number of RA packets dropped due to RA-guard filtering.
TotalNDPktRcv	Specifies total number of ND packets received on the ND-inspection enabled interface.
TotalNDPktDropped	Specifies total number of ND packets dropped on the ND-inspection enabled interface.
ClearDHCPGuardStats	Specifies the DHCPv6-guard statistics cleared for the port number.
ClearRAGuardStats	Specifies the RA-guard statistics cleared for the port number.
ClearNDInspectStats	Specifies the ND-inspection statistics cleared for the port number.

Deleting port policy mapping

About this task

Use this procedure to delete the created port policy mapping.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **Port Policy Mapping** tab.
4. Select a row from Port Policy Mapping to delete.
5. Click **Delete**.
6. Click **Apply**.

Source Binding Table configuration

The Source Binding Table (SBT) learns the Neighbor source IP address on the ports where ND-inspection is enabled. The maximum number of dynamic source IP addresses allowed to be learned is 1024.

You can view, create or delete an SBT.

Configuring the SBT

About this task

Use this procedure to add a static or dynamic entry to the SBT.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **Source Binding Table** tab.
4. On the toolbar, click **Insert**.
5. Configure the parameters for the SBT.
6. Click **Insert**.
7. On the toolbar, click **Refresh** to update the results.

Variable definitions

The following table describes the Source Binding Table tab fields.

Variable	Description
InterfaceIndex	Specify the ports.
Vlan	Enter the VLAD ID.
SrcIp	Enter the source IP address attached to the particular port or VLAN.
LinkLayerAddress	Specify the IPv6 address for learning the neighbor link layer address.

Viewing the SBT

About this task

Use this procedure to display all dynamically-learned neighbor source IP addresses and the statically-configured source IP address entries in the SBT.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **Source Binding Table** tab.

Variable definitions

The following table describes the Source Binding Table tab fields.

Variable	Description
InterfaceIndex	Specify the ports.
Vlan	Specifies the VLAN ID.
SrcIp	Specifies the source IP address.
LinkLayerAddress	Specifies the link layer address.
LearnType	Specifies whether the source IP is learned statically or dynamically
LearnPriority	Specifies the learning priority for the source IP address attached to the particular port or VLAN.
LearnState	Specifies the SBT entry state.
LearnAge	Specifies the learning age for the source IP address attached to the particular port or VLAN.

Deleting the SBT

About this task

Use this procedure to delete the created SBT.

Procedure

1. From the navigation tree, double-click **IPv6**.
2. In the IPv6 tree, double-click **FHS**.
3. On the work area, click the **Port Policy Mapping** tab.
4. Select a row from Port Policy Mapping to delete.
5. Click **Delete**.

Chapter 11: Configuring Enhanced Secure Mode

Use the procedures in this section to configure Enhanced Secure Mode.

Enabling Enhanced Secure Mode

Use the following procedure to enable Enhanced Secure Mode.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable Enhanced Secure Mode:

   ```
   enhanced-secure-mode enable
   ```

3. Restart the switch.

Disabling Enhanced Secure Mode

Use the following procedure to disable Enhanced Secure Mode.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable Enhanced Secure Mode:

   ```
   enhanced-secure-mode disable
   ```

3. Restart the switch.

Creating a group of commands

Use the following procedure to create a group of commands.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Create a group of commands:

   ```
   cli-command-group <group_name>
   ```

Variable Definitions

The following table describes the parameters for the `cli-command-group` command.

Variable	Value
<group_name>	Specifies the command group name.

Configuring the TFTP protocol

Use the following procedure to enable or disable the TFTP protocol on switch.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable TFTP protocol:

   ```
   tftp-access enable
   ```

3. Disable TFTP protocol:

   ```
   tftp-access disable
   ```

   OR

   ```
   default tftp-access
   ```

Assigning commands to a group of commands

Use the following procedure to assign commands and subcommands to a command group.

Before you begin

Create the command group for which to assign commands.

About this task

Note:

Assigning to a group a command already present in another group removes that command from the latter group.

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`

2. Assign a command to a group of commands:

   `cli-command-group <group_name> [<ACLI_command_name>  [ALL | hint | <ACLI_subcommand_name> ALL | hint]]`

Example

The following example displays sample output for the `cli-command-group` command.

```
Switch(config)#cli-command-group MyCmdGroup hint

----------------------------------------------
User Executive subcommands
----------------------------------------------
Exec commands:
  blink-leds              Blink the LEDs on the display panel to identify the
                          unit
  boot                    Reset the switch/stack
  clear                   Clear system parameters
  clock                   Execute clock time setting
  configure               Enter configuration mode
  copy                    Copy files
  disable                 Turn off privileged commands
  download                Download and run new image
  enable                  Turn on privileged commands
  energy-saver            Manually activate or deactivate energy saver
  exit                    Exit from the EXEC
  help                    Description of the interactive help system
  install                 Quick Install & Setup Script
  ip                      IP operations
  l2                      Trigger a CFM message
  logout                  Exit from the EXEC and end the current session

Switch(config)#cli-command-group MyCmdGroup banner ALL
% Command moved from security-cmds-group to MyCmdGroup

Switch(config)#
```

Variable Definitions

The following table describes the parameters for the `cli-command-group` command.

Variable	Value
<group_name>	Specifies the command group name.
<ACLI_command_name>	Specifies the command to assign to a group of commands. Use the `hint` parameter to check the available commands.
<ACLI_subcommand_name>	Specifies the subcommand to assign to a group of commands. Use the `hint` parameter to check the available commands.
hint	Lists available commands or subcommands.
ALL	Adds all subcommands.

Removing commands from a command group

Use the following procedure to remove commands or subcommands from a command group.

About this task

Note:

You cannot delete or modify commands that belong to the `cli-basic-group` command group.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Remove a command or subcommand from a group of commands:

```
no cli-command-group <group_name>  [<command_name>  [ALL |
<subcommand_name> ALL]]
```

Variable Definitions

The following table describes the parameters for the `no cli-command-group` command.

Variable	Value
<group_name>	Specifies the group from which to remove a command or subcommand.

Table continues…

Variable	Value
<command_name>	Specifies the name of a command to remove from the group of commands.
<subcommand_name>	Specifies the name of a subcommand to remove from the group of commands.
ALL	Removes all commands or subcommands from the group of commands.

Removing a command group

Use the following procedure to remove a command group.

About this task

Note:

You cannot remove the default command groups.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Remove the group of commands:

   ```
   no cli-command-group <group_name>
   ```

3. Confirm group deletion.

Variable Definitions

The following table describes the parameters for the `no cli-command-group` command.

Variable	Value
<group_name>	Specifies the command group to be removed.

Displaying command group information

Use the following procedure to display all command groups or all commands from a command group.

About this task

Procedure

1. Log on to ACLI to enter User EXEC mode.
2. Display all existing command groups:

   `show cli-command-group`

3. Display all commands from a command group:

   `show cli-command-group <group_name>`

Example

The following example displays sample output for the `show cli-command-group` command.

```
Switch(config)#show cli-command-group
    CLI command groups:
    cli-basic-group
    security-cmds-group
    system-cmds-group
    audit-cmds-group
    MyCmdGroup
Switch(config)#show cli-command-group MyCmdGroup
    CLI commands:
    fa proxy
    vlan *

Switch(config)#
```

Variable Definitions

The following table describes the parameters for the `show cli-command-group` command.

Variable	Value
<group_name>	Specifies the command group for which to display information.

Restoring command groups to default

Use the following procedure to restore a command group or all command groups to the default set of commands.

About this task

Note:

Restoring all command groups to default removes all custom command groups. Restoring a custom command group to default removes all commands from that group.

Procedure

1. Enter Global Configuration mode:

   `enable`

```
configure terminal
```

2. Restore a command group to default commands:

```
default cli-command-group <group_name>
```

3. Restore all command groups to default:

```
default cli-command-group
```

Variable Definitions

The following table describes the parameters for the `default cli-command-group` command.

Variable	Value
<group_name>	Specifies the command group for which to restore default commands.

Creating a role

Use the following procedure to create a custom role.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Create a custom role:

```
role <role_name>
```

Variable Definitions

The following table describes the parameters for the `role` command.

Variable	Value
<role_name>	Specifies the name of the custom role.

Assigning a group of commands to a role

Use the following procedure to assign a group of commands to a role.

Before you begin

Create the role for which to assign commands if it does not exist.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Assign a group of commands to a role:

   ```
   role <role_name> [show-only <command_group_A> | show-config
   <command_group_B>]
   ```

Variable Definitions

The following table describes the parameters for the `role` command.

Variable	Value
<role_name>	Specifies the role for which to assign commands.
show-only <command_group_A>	Specifies the group of commands for which the specified role will have show-only privileges.
show-config <command_group_B>	Specifies the group of commands for which the specified role will have full privileges (show, configure, no and default).

Displaying role information

Use the following procedure to display the command groups assigned with a role and the role rights for each group.

Procedure

1. Log on to ACLI to enter User EXEC mode.
2. Display command groups assigned to a role:

   ```
   show role
   ```

Example

The following example displays sample output for the `show role` command.

```
Switch(config)#show role
Roles                            Groups                           Rights
-------------------------------- -------------------------------- ------------
app_administrator                cli-basic-group                  show-config
                                 system-cmds-group                show-only
security_administrator           cli-basic-group                  show-config
                                 security-cmds-group              show-config
```

```
                                 system-cmds-group                show-config
                                 audit-cmds-group                 show-config
system_administrator             cli-basic-group                  show-config
                                 system-cmds-group                show-config
                                 audit-cmds-group                 show-only
emergency_administrator          cli-basic-group                  show-config
                                 security-cmds-group              show-config
                                 system-cmds-group                show-config
                                 audit-cmds-group                 show-config
MyRoleA                          cli-basic-group                  show-config
                                 security-cmds-group              show-config
                                 audit-cmds-group                 show-only
Switch(config)#
```

Creating a user

Use the following procedure to create a new user.

About this task

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Create a new user:

   ```
   username add <user_name> password <user_password>
   ```

3. Create a new user and specify access parameters at creation time:

   ```
   username add <user_name> {daily-access-interval access-start-hour
   <0-24> access-stop-hour <0-24> | inactive-period <1-360> | max-
   number-of-sessions <1-12> | role-name <role_name>} password
   <user_password>
   ```

4. Confirm the password.

Variable Definitions

The following table describes the parameters for the `username add` command.

Variable	Value
<user_name>	Specifies the user name.
<user_password>	Specifies the user password.
daily-access-interval	Specifies the day interval during which the user can access the switch. The default interval is 0-24.

Table continues…

Variable	Value
inactive-period	Specifies the period during which the user must access the switch in order to not be locked out. The default value is 360 days.
max-number-of-sessions	Specifies the number of concurrent sessions allowed for a user. The default value is 12.
role-name <role_name>	Specifies the role for the new user.

Displaying user information

Use the following procedure to display user information.

Procedure

1. Log on to ACLI to enter User EXEC mode.
2. Display information related to a specific user:

   ```
   show username <user_name>
   ```

3. Display all existing users and their roles.

   ```
   show username
   ```

4. Display all users currently logged into the system:

   ```
   show who
   ```

Example

The following example displays sample output for the `show username` command.

```
Switch:(config)#show username

Lockout timeout: 60 min
Lockout retries: 5
Emergency account timeout: not set

Username:           systemadmn
-------------------------------------------
ntp authentication-key 100 type md5/sha1
Enabled:            Yes
Password aging-time:  90 days
Lockout status: Available
Verify the NTP key:
FED1(config)#sh ntp key
Key Id      Key                     Key Type
--------------------------------------------
100         ********                MD5
200         ********                SHA1
SSH access: Enabled
TELNET access: Enabled

Username:           security_adm
-------------------------------------------
Role name:          security_administrator
```

```
Enabled:            Yes
Password aging-time:  90 days
Lockout status: Available
Access-start-hour:  0
Access-stop-hour:   24
Inactive period:    360 days
Maximum number of sessions: 12
SSH access: Enabled
TELNET access: Enabled
```

Variable definitions

The following table describes the parameters for the `show username` command.

Variable	Value
<user_name>	Specifies the user name.

Removing a user

Use the following procedure to remove a user.

Procedure

1. Enter Global Configuration mode:

   `enable`

   `configure terminal`

2. Remove a user:

   `no username <user_name>`

Variable definitions

The following table describes the parameters for the `no username` command.

Variable	Value
<user_name>	Specifies the user name.

Assigning a role to a user

Use this procedure to assign a role to a user.

Following are the default roles:

- `app_administrator`
- `security_administrator`
- `system_administrator`
- `emergency_administrator`

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Assign a role to a user:

   ```
   username <user_name>  role-name  <role_name>
   ```

Variable definitions

The following table describes the parameters for the `username <user_name>  role-name <role_name>` command.

Variable	Value
<user_name>	Specifies the user name.
<role_name>	Specifies the role name.

Enabling a user

Use the following procedure to enable a user.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable a user:

   ```
   username <user_name> enable
   ```

   OR

   ```
   default username <user_name> enable
   ```

Variable definitions

The following table describes the parameters for the `username <user_name> enable` command.

Variable	Value
<user_name>	Specifies the user name.

Disabling a user

Use the following procedure to disable a user.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Disable a user:

   ```
   no username <user_name> enable
   ```

Variable definitions

The following table describes the parameters for the `no username <user_name> enable` command.

Variable	Value
<user_name>	Specifies the user name.

Configuring user access parameters

Use the following procedure to configure access parameters for a user.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure daily access intervals:

   ```
   username <user_name>  daily-access-interval access-start-hour
   <0-24>access-end-hour <0-24>
   ```

3. Remove daily restrictions:

   ```
   no username <user_name> daily-access-interval
   ```

4. Reset the daily access interval to default:

   ```
   default username <user_name> daily-access-interval
   ```

5. Configure the maximum inactive period before the user is locked-out:

   ```
   username  <user_name>   inactive-period <1-360>
   ```

6. Reset the inactive period for a user to default:

   ```
   default username <user_name>  inactive-period
   ```

7. Configure the maximum number of concurrent sessions:

   ```
   username <user_name> max-number-of-sessions <1-12>
   ```

8. Reset the number of concurrent sessions to default:

   ```
   default username <user_name> max-number-of-sessions
   ```

Variable definitions

The following table describes the parameters for the `username` command.

Variable	Value
<user_name>	Specifies the user name.
daily-access-interval	Specifies the day interval during which the user can access the switch. The default interval is 0-24.
inactive-period	Specifies the period during which the user must access the switch in order to not be locked out. The default value is 360 days.
max-number-of-sessions	Specifies the number of concurrent sessions allowed for a user. The default value is 12.

Configuring SSH access for a user

Use the following procedure to configure SSH access for a user.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Enable SSH access for a user:

   ```
   username <user_name> ssh-access enable
   ```

3. Disable SSH access for a user:

   ```
   username <user_name> ssh-access disable
   ```

   OR

   ```
   no username <user_name> ssh-access
   ```

Variable definitions

The following table describes the parameters for the `username <user_name> ssh-access` command.

Variable	Value
<user_name>	Specifies the user name.

Configuring telnet access for a user

Use the following procedure to configure telnet access for a user.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enable SSH access for a user:

   ```
   username <user_name> telnet-access enable
   ```

3. Disable telnet access for a user:

   ```
   username <user_name> telnet-access disable
   ```

   OR

   ```
   no username <user_name> telnet-access
   ```

Variable definitions

The following table describes the parameters for the `username <user_name> telnet-access` command.

Variable	Value
<user_name>	Specifies the user name.

Changing the password for the current user

Use the following procedure to change the password for the current user:

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Change the password for the current user:

   ```
   username password
   ```

Configuring the lockout interval

Use the following procedure to configure the lockout interval for all users.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the lockout interval:

   ```
   username lockout-time <0-60>
   ```

3. Reset the lockout interval to default value:

   ```
   default username lockout-time
   ```

Variable definitions

The following table describes the parameters for the `username lockout-time` command.

Variable	Value
<0-60>	Specifies the duration of session lockout, in minutes. Session lockout occurs when the threshold on the number of incorrect logins is exceeded.

Configuring emergency account timeout

Use the following procedure to configure the timeout for the emergency account.

About this task

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Configure the timeout for the emergency account:

```
username  emergency_account_timeout   <1-360>
```

Variable definitions

The following table describes the parameters for the `username  emergency_account_timeout` command.

Variable	Value
<1-360>	Specifies the period during which the emergency user must access the switch in order to not be locked out.

Configure the audit log encryption key

Use the following procedure to change the audit encryption key.

Procedure

1. Enter Global Configuration mode:

```
enable
```

```
configure terminal
```

2. Change the audit encryption key:

   ```
   audit encryption-key aes-cbc
   ```

Configuring password security restrictions

Use the following procedure to configure password security restrictions in enhanced secure mode.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Configure the password validity period:

   ```
   password aging-time [username <name>]<0-365>
   ```

3. Configure the password change interval:

   ```
   password change-interval <1-999>
   ```

4. Configure whether the switch accepts repeated consecutive characters in the password:

   ```
   password check—repeated [enable | disable]
   ```

5. Configure whether the switch accepts sequential characters in a password

   ```
   password check—sequential [enable | disable]
   ```

6. Configure password complexity

   ```
   password complexity [lower—case <0-9> | numeric <0-9> | special <0-9> | upper-case <0-9>]
   ```

7. Configure the password delay-time:

   ```
   password delay—time <0-3600>
   ```

8. Configure the password encryption key:

   ```
   password encryption-key aes-cbc
   ```

9. Configure the interval for post-expiration log in:

   ```
   password grace-period <1-365>
   ```

10. Configure the failure notification message:

    ```
    password login-failure-notification "<message>"
    ```

11. Configure the minimum length for a password:

```
password min-length <8-255>
```

12. Configure password expiry notifications:

    ```
    password notifications <1-90>
    ```

13. Configure whether the switch enforces a password change on first login

    ```
    password password-change-on-first-login [disable | enable]
    ```

14. Configure the maximum number of password changes per day:

    ```
    password password-change-rate-limiter <1-10>
    ```

15. Configure the maximum number of passwords retained in history:

    ```
    password password-history <0-12>
    ```

16. Configure the number of post-expiration logins:

    ```
    password post-expiration-login <0-10>
    ```

17. Configure the number of days after which a disabled user account due to inactive period is re-enabled.

    ```
     password unlock-timer <1-365>
    ```

18. Verify password security restrictions:

    ```
    show password {aging-time | change-interval | check-repeated |
    check-sequential | complexity | delay-time | grace-period | login-
    failure-notification | min-length | notifications | password-change-
    on-first-login | password-change-rate-limiter | password-history |
    post-expiration-login | unlock-timer}
    ```

19. Reset password security restrictions to default values:

    ```
    default password {aging-time | change-interval | check-repeated |
    check-sequential | complexity | delay-time | grace-period | min-
    length | notifications | password-change-on-first-login | password-
    change-rate-limiter | password-history | post-expiration-login |
    unlock-timer}
    ```

Variable definitions

The following table describes the parameters for the `password` command.

Variable	Value
aging-time <0-365>	Specifies the number of days the password remains valid. The default value is 0.
aging-time [username]	Specifies the user for which you configure the aging time.
change-interval <1-999>	Specifies the password change interval, in hours.

Table continues…

Variable	Value
check-repeated [enable | disable]	Specifies whether the switch accepts repeated characters in a password: • disable—Accepts repeated consecutive characters. • enable—Forbids repeated consecutive characters. The default value is enabled.
check-sequential [enable | disable]	Specifies whether the switch accepts sequential characters in a password: • disable—Accepts repeated sequential characters. • enable—Forbids repeated sequential characters. The default value is enabled.
lower-case <0–9>	Specifies the minimum number of lower-case characters that can be included in the password.
numeric <0–9>	Specifies the minimum number of numeric characters that can be included in the password.
special <0–9>	Specifies the minimum number of special characters (!, @, #, $, %, ^, &, *, (,), -, +, =, _) that can be included in the password.
upper-case <0–9>	Specifies the minimum number of upper-case characters that can be included in the password.
delay-time <0–3600>	Specifies the amount of delay time after 3 login attempts, in seconds. Default is 60 seconds.
encryption-key aes-cbc	Enables internal password encryption.
grace-period <1-365>	Specifies the interval in which the user can login after his password expires.
login-failure-notification "<message>"	Specifies the notification message that the user sees after an incorrect login. The maximum length is 99 characters.
min-length <8–255>	Specifies the minimum length for a password
notifications <1–90>	Specifies the notification interval in days before the password expires. Default is 10 days.
password-change-on-first-login [disable | enable]	Specifies whether the switch enforces a password change on first login: • disable—Disables password change on first login. • enable—Enables password change on first login. The default value is disabled.
password-change-rate-limiter <1-10>	Specifies the maximum number of password changes allowed per day. Default is 1.
password-history <0-12>	<0-12> Specifies the number of passwords retained in history. Default is 1.
post-expiration-login <0-10>	Specifies the number of allowed post-expiration logins.

Table continues…

Variable	Value
unlock-timer <1–365>	<1-365> Specifies the number of days after which a disabled user account due to inactivity period is re-enabled. Default is 7 days.

Chapter 12: Configuration examples

TACACS+ server configuration examples and supported SNMP MIBs

This section contains information about the following topics:

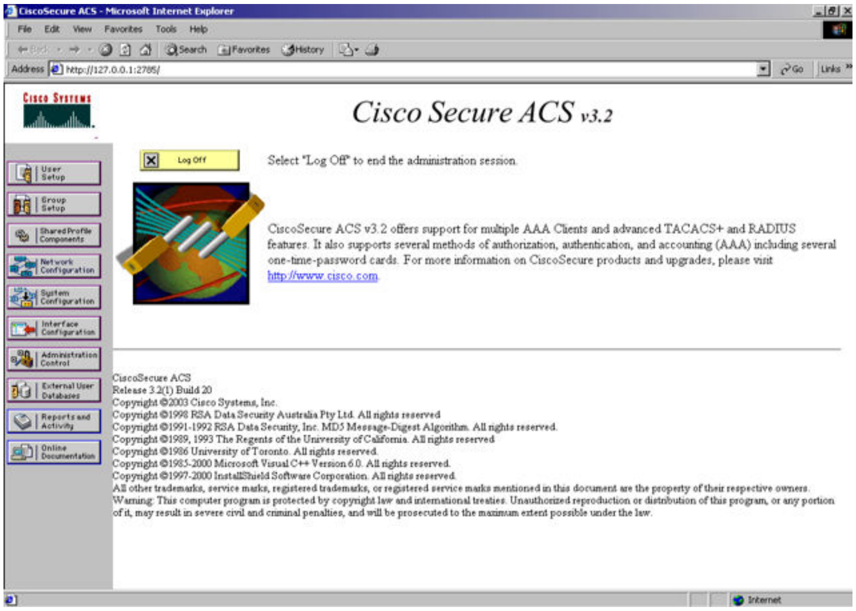
- TACACS+ server configuration examples
- Supported SNMP MIBs and traps

TACACS+ server configuration examples

This section describes basic configuration examples of the TACACS+ server:

Configuration example: Cisco ACS (version 3.2) server

The following figure shows the main administration window.



Cisco Secure ACS v3.2

Select "Log Off" to end the administration session.

CiscoSecure ACS v3.2 offers support for multiple AAA Clients and advanced TACACS+ and RADIUS features. It also supports several methods of authorization, authentication, and accounting (AAA) including several one-time-password cards. For more information on CiscoSecure products and upgrades, please visit http://www.cisco.com

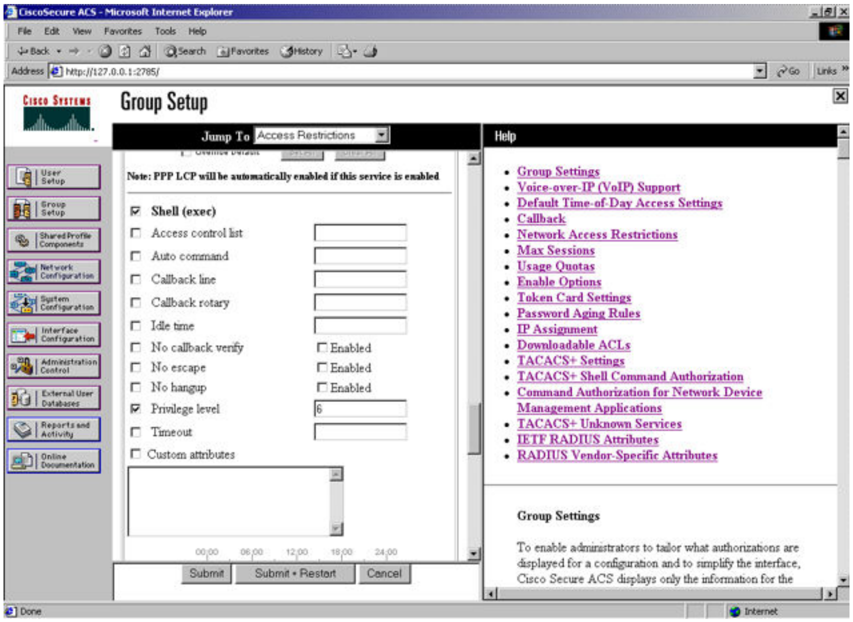
CiscoSecure ACS
Release 3.2(1) Build 20
Copyright ©2003 Cisco Systems, Inc.
Copyright ©1998 RSA Data Security Australia Pty Ltd. All rights reserved
Copyright ©1991-1992 RSA Data Security, Inc. MD5 Message-Digest Algorithm. All rights reserved.
Copyright ©1989, 1993 The Regents of the University of California. All rights reserved
Copyright ©1986 University of Toronto. All rights reserved.
Copyright ©1985-2000 Microsoft Visual C++ Version 6.0. All rights reserved.
Copyright ©1997-2000 InstallShield Software Corporation. All rights reserved.
All other trademarks, service marks, registered trademarks, or registered service marks mentioned in this document are the property of their respective owners.
Warning: This computer program is protected by copyright law and international treaties. Unauthorized reproduction or distribution of this program, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.

Figure 21: Cisco ACS (version 3.2) main administration window

1. Define the users and the corresponding authorization levels.

If you map users to default group settings, it is easier to remember which user belongs to each group. For example, the rwa user belongs to group 15 to match Privilege level 15. All rwa user settings are picked up from group 15 by default.

The following figure shows a sample Group Setup window.



Group Setup

Note: PPP LCP will be automatically enabled if this service is enabled

☑ **Shell (exec)**

☐ Access control list

☐ Auto command

☐ Callback line

☐ Callback rotary

☐ Idle time

☐ No callback verify ☐ Enabled

☐ No escape ☐ Enabled

☐ No hangup ☐ Enabled

☑ Privilege level 6

☐ Timeout

☐ Custom attributes

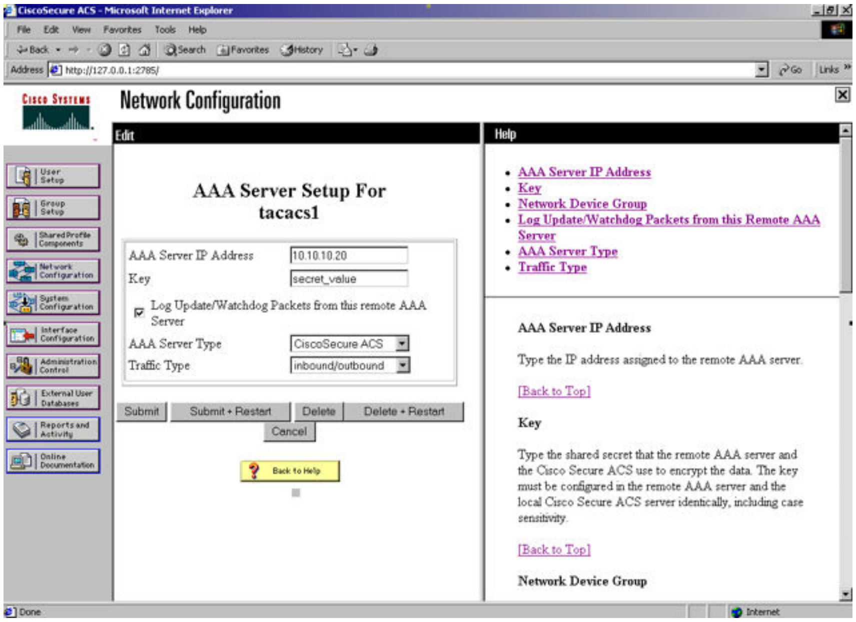
Group Settings

To enable administrators to tailor what authorizations are displayed for a configuration and to simplify the interface, Cisco Secure ACS displays only the information for the

Figure 22: Group Setup window - Cisco ACS server configuration

2. Configure the server settings.

   The following figure shows a sample Network Configuration window to configure the authentication, authorization, and accounting (AAA) server for TACACS+.



Network Configuration

AAA Server Setup For tacacs1

AAA Server IP Address 10.10.10.20

Key secret_value

☑ Log Update/Watchdog Packets from this remote AAA Server

AAA Server Type CiscoSecure ACS

Traffic Type inbound/outbound

AAA Server IP Address

Type the IP address assigned to the remote AAA server.

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Key

Type the shared secret that the remote AAA server and the Cisco Secure ACS use to encrypt the data. The key must be configured in the remote AAA server and the local Cisco Secure ACS server identically, including case sensitivity.

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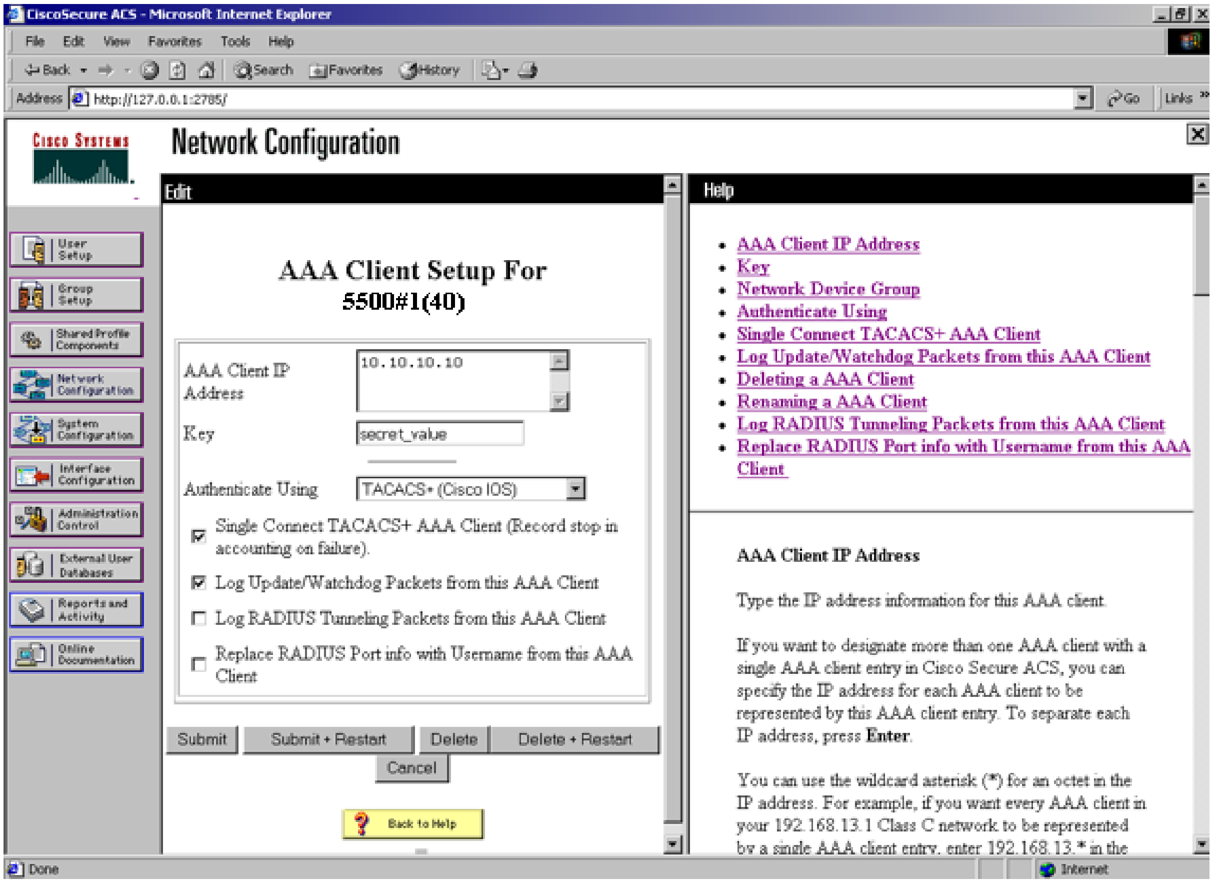
Network Device Group

Figure 23: Network Configuration window - server setup

3. Define the client.

   The following figure shows a sample Network Configuration window to configure the client. Authenticate using TACACS+. You can use a single-connection, but this must match the configuration on the Avaya switch.



AAA Client Setup For
5500#1(40)

AAA Client IP Address: 10.10.10.10

Key: secret_value

Authenticate Using: TACACS+ (Cisco IOS)

☑ Single Connect TACACS+ AAA Client (Record stop in accounting on failure).

☑ Log Update/Watchdog Packets from this AAA Client

☐ Log RADIUS Tunneling Packets from this AAA Client

☐ Replace RADIUS Port info with Username from this AAA Client

- AAA Client IP Address
- Key
- Network Device Group
- Authenticate Using
- Single Connect TACACS+ AAA Client
- Log Update/Watchdog Packets from this AAA Client
- Deleting a AAA Client
- Renaming a AAA Client
- Log RADIUS Tunneling Packets from this AAA Client
- Replace RADIUS Port info with Username from this AAA Client

AAA Client IP Address

Type the IP address information for this AAA client.

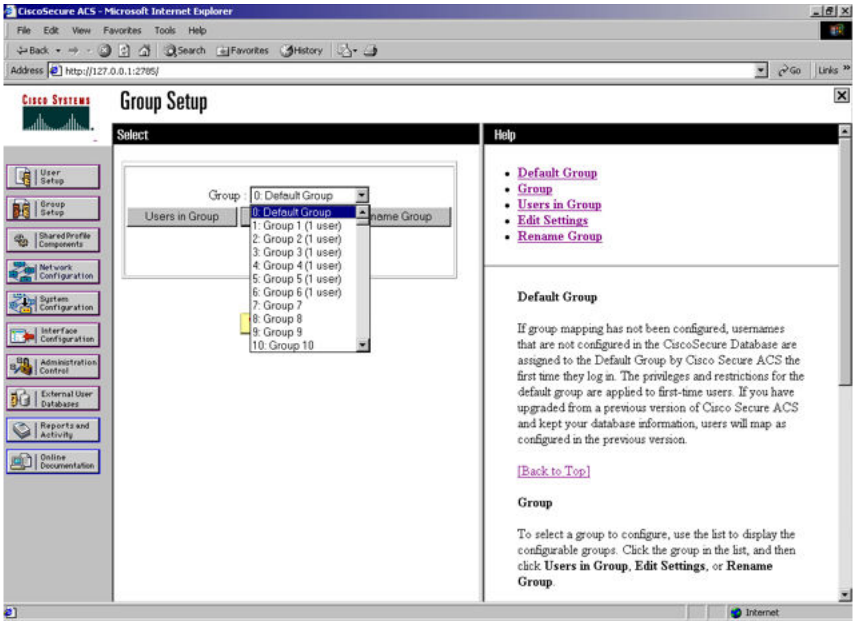
If you want to designate more than one AAA client with a single AAA client entry in Cisco Secure ACS, you can specify the IP address for each AAA client to be represented by this AAA client entry. To separate each IP address, press **Enter**.

You can use the wildcard asterisk (*) for an octet in the IP address. For example, if you want every AAA client in your 192.168.13.1 Class C network to be represented by a single AAA client entry, enter 192.168.13.* in the

Figure 24: Network Configuration window - client setup

4. Verify the groups you have configured.

   In this example, the user is associated with a user group. For more information, see Figure 25: Group Setup window - viewing the group setup on page 483. The rwa account belongs to group 15, and its privilege level corresponds to the settings for group 15. The ro accounts belong to group 0 and L1 accounts belong to group 2.



Group : 0: Default Group

0: Default Group
1: Group 1 (1 user)
2: Group 2 (1 user)
3: Group 3 (1 user)
4: Group 4 (1 user)
5: Group 5 (1 user)
6: Group 6 (1 user)
7: Group 7
8: Group 8
9: Group 9
10: Group 10

- Default Group
- Group
- Users in Group
- Edit Settings
- Rename Group

Default Group

If group mapping has not been configured, usernames that are not configured in the CiscoSecure Database are assigned to the Default Group by Cisco Secure ACS the first time they log in. The privileges and restrictions for the default group are applied to first-time users. If you have upgraded from a previous version of Cisco Secure ACS and kept your database information, users will map as configured in the previous version.

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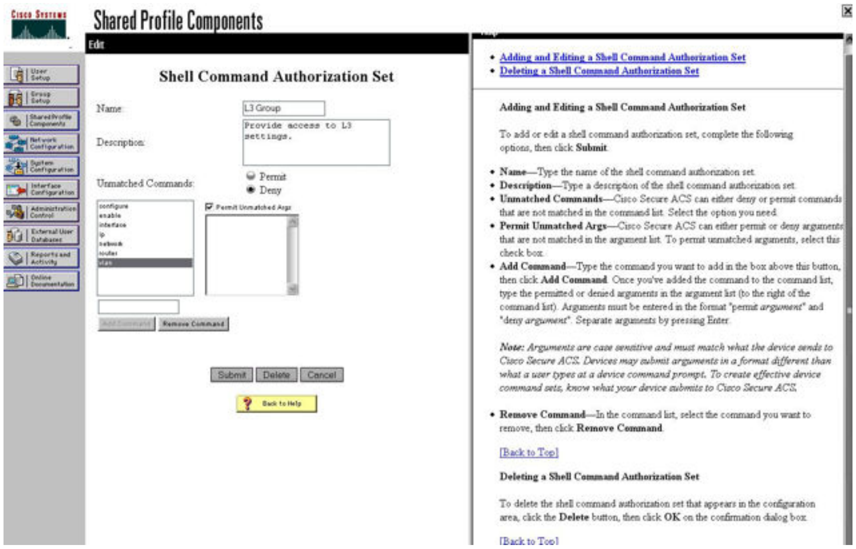
Group

To select a group to configure, use the list to display the configurable groups. Click the group in the list, and then click **Users in Group**, **Edit Settings**, or **Rename Group**.

Figure 25: Group Setup window - viewing the group setup

5. Go to **Shared Profile Components , Shell Command Authorization Set**.

   The Shell Command Authorization Set screen appears.



Shell Command Authorization Set

Name: L3 Group

Description: Provide access to L3 settings.

Unmatched Commands: ○ Permit ● Deny

configure
enable
interface
ip
network
router
vlan

☑ Permit Unmatched Args

- Adding and Editing a Shell Command Authorization Set
- Deleting a Shell Command Authorization Set

Adding and Editing a Shell Command Authorization Set

To add or edit a shell command authorization set, complete the following options, then click **Submit**.

- **Name**—Type the name of the shell command authorization set.
- **Description**—Type a description of the shell command authorization set.
- **Unmatched Commands**—Cisco Secure ACS can either deny or permit commands that are not matched in the command list. Select the option you need.
- **Permit Unmatched Args**—Cisco Secure ACS can either permit or deny arguments that are not matched in the argument list. To permit unmatched arguments, select this check box.
- **Add Command**—Type the command you want to add in the box above this button, then click **Add Command**. Once you've added the command to the command list, type the permitted or denied arguments in the argument list (to the right of the command list). Arguments must be entered in the format "permit *argument*" and "deny *argument*". Separate arguments by pressing Enter.

  ***Note:** Arguments are case sensitive and must match what the device sends to Cisco Secure ACS. Devices may submit arguments in a format different than what a user types at a device command prompt. To create effective device command sets, know what your device submits to Cisco Secure ACS.*

- **Remove Command**—In the command list, select the command you want to remove, then click **Remove Command**.

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Deleting a Shell Command Authorization Set

To delete the shell command authorization set that appears in the configuration area, click the **Delete** button, then click **OK** on the confirmation dialog box.

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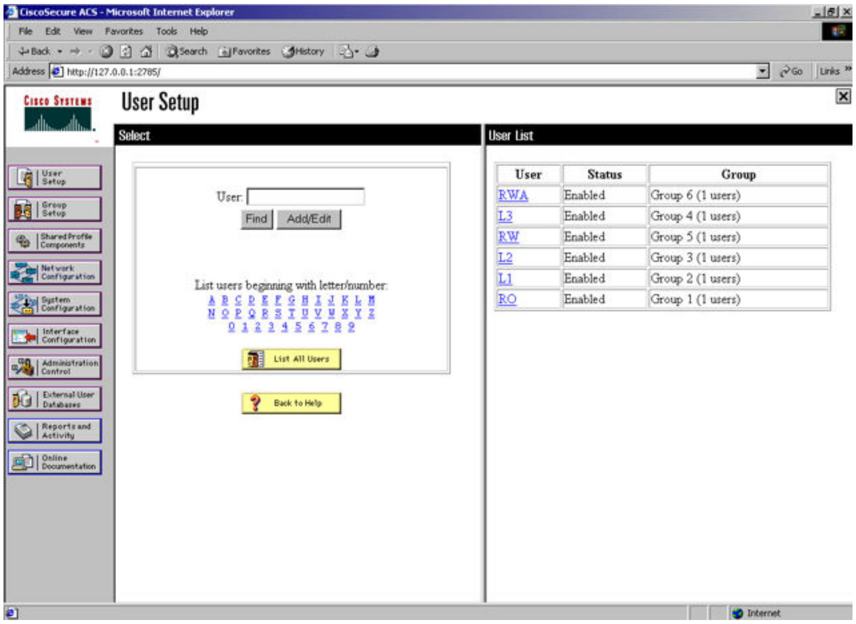
Figure 26: Shared Profile Components window - defining the command set

6. Select the commands to be added to the command set, and specify whether the action is permit or deny.
7. View users, their status, and the corresponding group to which each belongs.

   The following figure shows a sample User Setup window. You can use this window to find, add, edit, and view users settings.



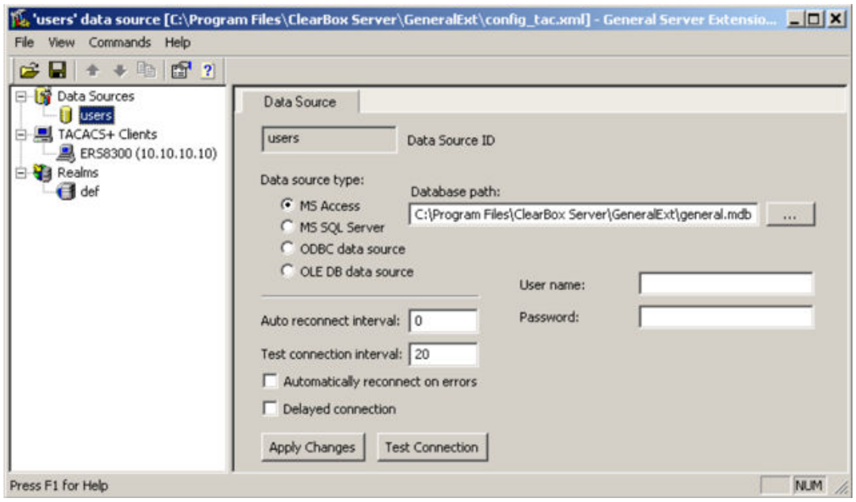
User	Status	Group
RWA	Enabled	Group 6 (1 users)
L3	Enabled	Group 4 (1 users)
RW	Enabled	Group 5 (1 users)
L2	Enabled	Group 3 (1 users)
L1	Enabled	Group 2 (1 users)
RO	Enabled	Group 1 (1 users)

Figure 27: User Setup window - Cisco ACS server configuration

Configuration example: ClearBox server

1. Run the General Extension Configurator and configure the user data source.

   In this example, Microsoft Access was used to create a database of user names and authorization levels; the general.mdb file needs to include these users.

   'users' data source [C:\Program Files\ClearBox Server\GeneralExt\config_tac.xml] - General Server Extensio...

   Data Source ID: users

   Data source type: ● MS Access

   Database path: C:\Program Files\ClearBox Server\GeneralExt\general.mdb

   Auto reconnect interval: 0

   Test connection interval: 20

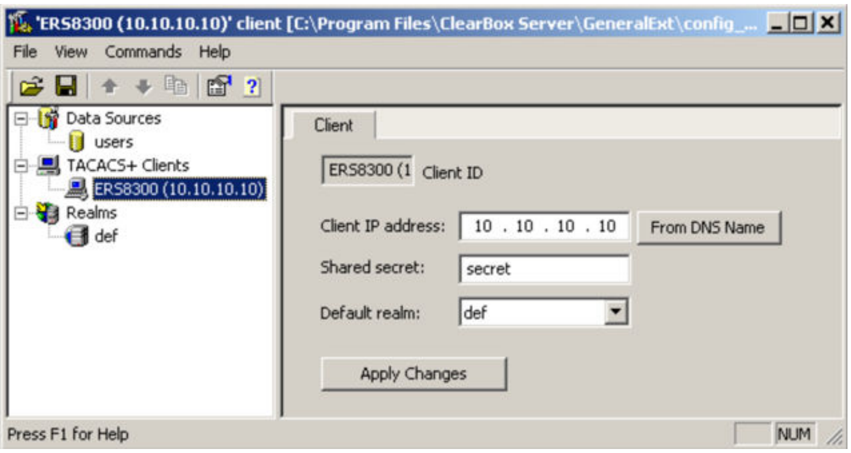
   □ Automatically reconnect on errors

   □ Delayed connection

   Figure 28: General Extension Configurator

2. Create a Client entry for the switch management IP address by right-clicking the **TACACS+ Clients** item.

   In this case, the TACACS+ Client is the Avaya switch. Enter the appropriate information. The shared secret must match the value configured on the Avaya switch.



ERS8300 (1 Client ID

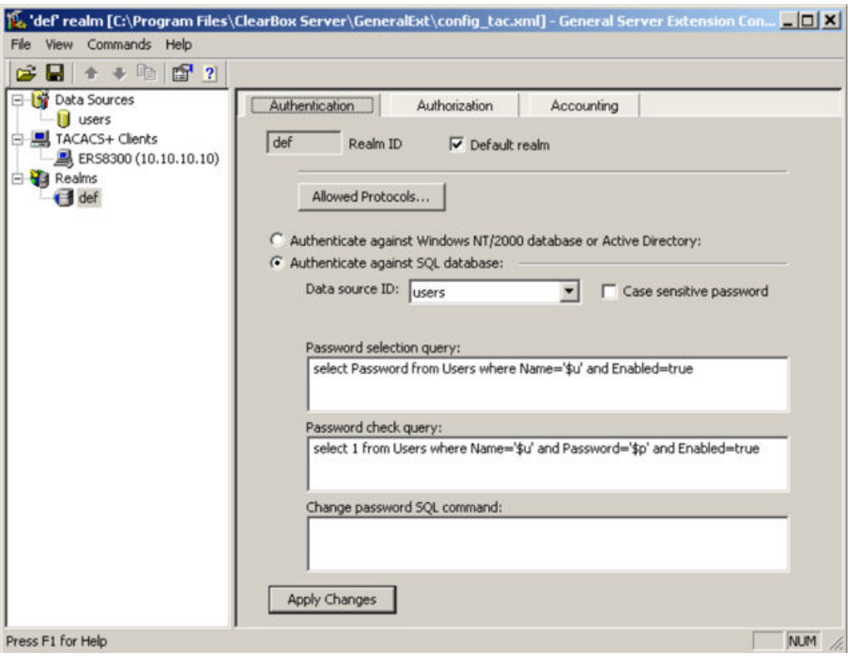
Client IP address: 10 . 10 . 10 . 10

Shared secret: secret

Default realm: def

Figure 29: Creating a client entry

The default realm Authentication tab looks like the following figure.



def Realm ID ☑ Default realm

○ Authenticate against Windows NT/2000 database or Active Directory:

● Authenticate against SQL database:

Data source ID: users ☐ Case sensitive password

Password selection query:

select Password from Users where Name='$u' and Enabled=true

Password check query:

select 1 from Users where Name='$u' and Password='$p' and Enabled=true

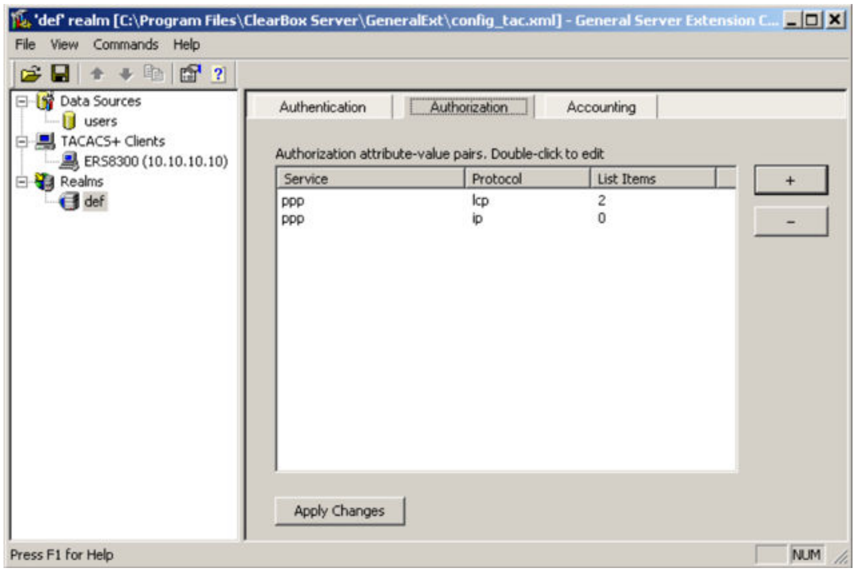
Change password SQL command:

Figure 30: Default realm - Authentication tab

3. Click the **Realms** , **def** , **Authorization** tab.

   A new service is required that allows the server to assign certain levels of access.

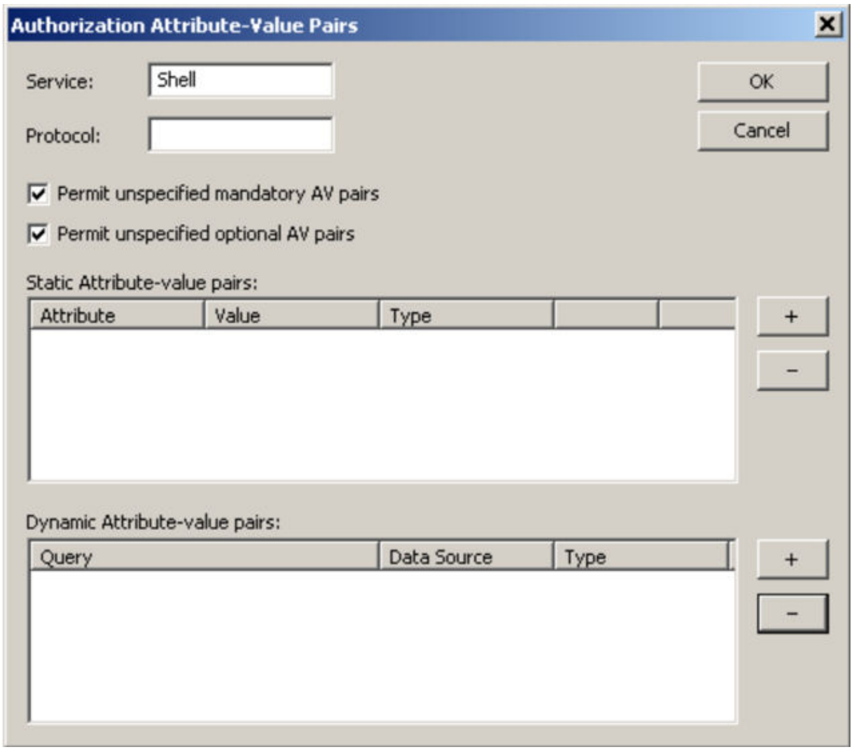
4. Click the **+** button to add an attribute-value pair for privilege levels.


'def' realm [C:\Program Files\ClearBox Server\GeneralExt\config_tac.xml] - General Server Extension C...
File View Commands Help
Data Sources
users
TACACS+ Clients
ERS8300 (10.10.10.10)
Realms
def
Authentication
Authorization
Accounting
Authorization attribute-value pairs. Double-click to edit
+
-
Apply Changes
Press F1 for Help
NUM

Service	Protocol	List Items
ppp	lcp	2
ppp	ip	0

Figure 31: Default realm - Authorization tab

5. Enter information in the window as shown in the following figure to specify the query parameters.


Authorization Attribute-Value Pairs
OK
Cancel
Static Attribute-value pairs:
Attribute
Value
Type
+
-
Dynamic Attribute-value pairs:
Query
Data Source
Type
+
-

Service: Shell

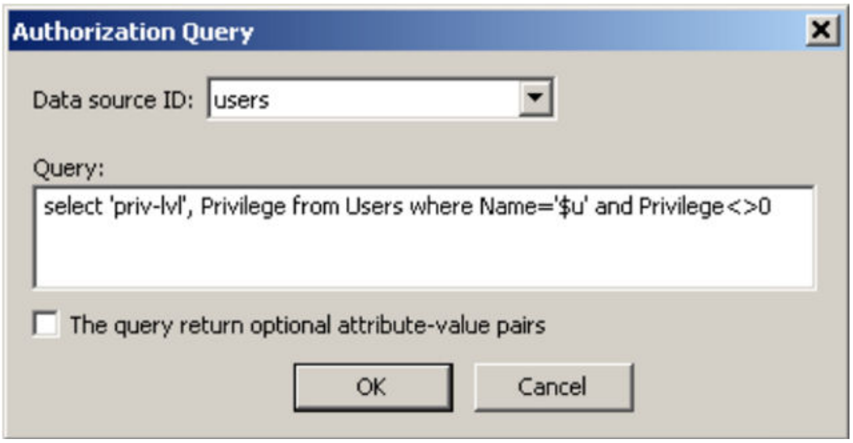
Protocol:

☑ Permit unspecified mandatory AV pairs

☑ Permit unspecified optional AV pairs

Figure 32: Adding parameters for the query

6. Click **+** to add the parameters to the query.
7. Use the string shown in the following figure for the authorization query.



Authorization Query

Data source ID: users

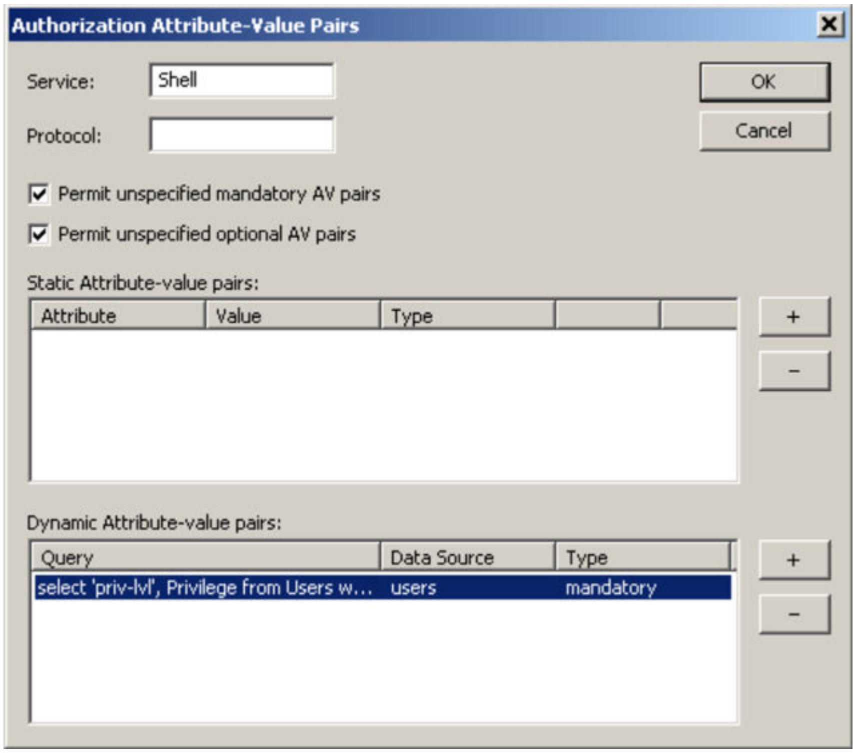
Query:

select 'priv-lvl', Privilege from Users where Name='$u' and Privilege<>0

□ The query return optional attribute-value pairs

Figure 33: Authorization Query window

The following figure shows the final window.



Authorization Attribute-Value Pairs

Service: Shell

Protocol:

☑ Permit unspecified mandatory AV pairs

☑ Permit unspecified optional AV pairs

Static Attribute-value pairs:

Attribute	Value	Type		

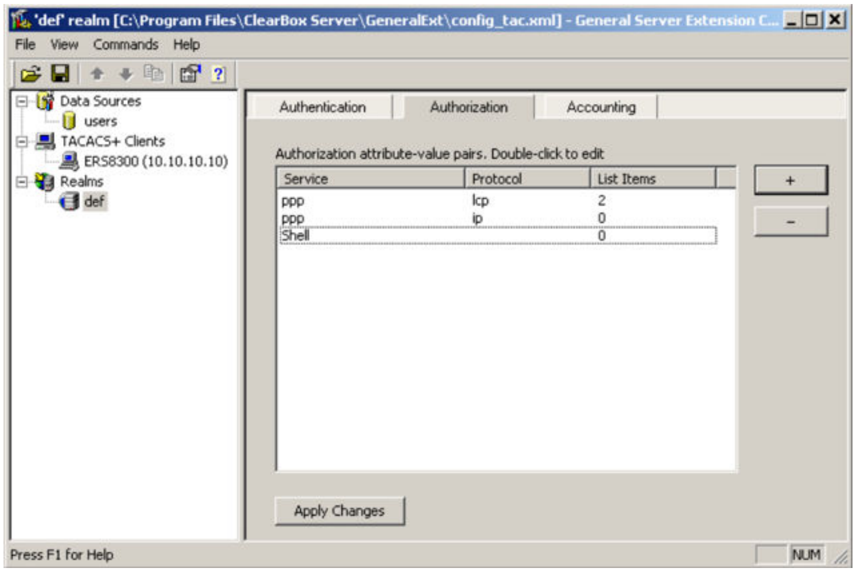
Dynamic Attribute-value pairs:

Query	Data Source	Type
select 'priv-lvl', Privilege from Users w...	users	mandatory

Figure 34: Query parameters added to Authorization Attribute-Value Pairs window

8. Click **OK**.

   The information appears on the Authorization tab.



Authorization attribute-value pairs. Double-click to edit

Service	Protocol	List Items
ppp	lcp	2
ppp	ip	0
Shell		0

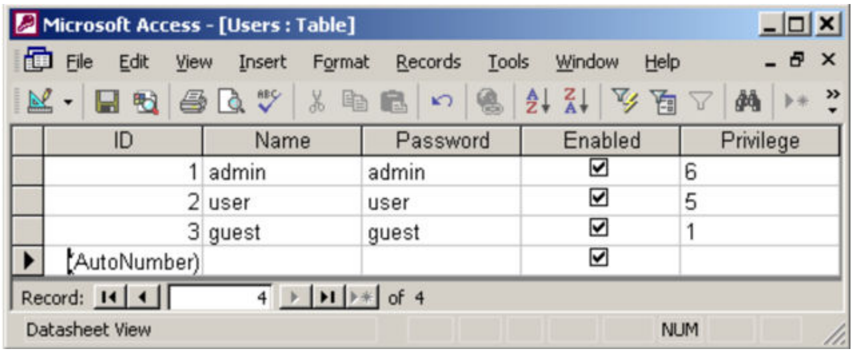
Figure 35: Authorization attribute-value pairs added to Authorization tab

9. Browse the general.mdb file as specified earlier.

   The user table can look like the one shown in the following figure. If the Privilege column does not exist, create one and populate it according to the desired access level.

   Microsoft Access or third-party software is required to read this file.

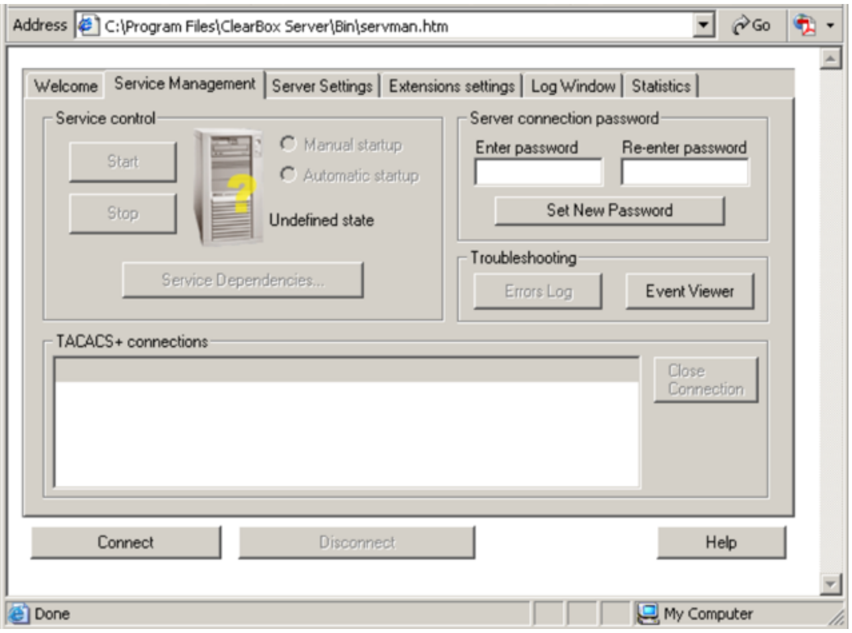
   If you use the 30-day trial for ClearBox, the user names cannot be more than four characters in length.



ID	Name	Password	Enabled	Privilege
1	admin	admin	☑	6
2	user	user	☑	5
3	guest	guest	☑	1
(AutoNumber)			☑	

Figure 36: Users table - Microsoft Access

10. Run the Server Manager.



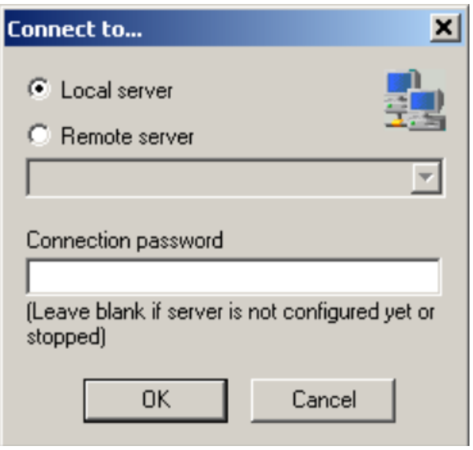
C:\Program Files\ClearBox Server\Bin\servman.htm

Undefined state

Figure 37: ClearBox Server Manager

11. Click **Connect**.

    The Connect to... dialog box appears.



● Local server

○ Remote server

Connection password

(Leave blank if server is not configured yet or stopped)

Figure 38: Connect to... dialog box

12. Click **OK** (do not fill in fields).
13. Click **OK** at the warning message.
14. Click **Start**.

    The Server Manager can now look like the following figure. Changes to the General Server Extension Configurator require that the server be restarted.

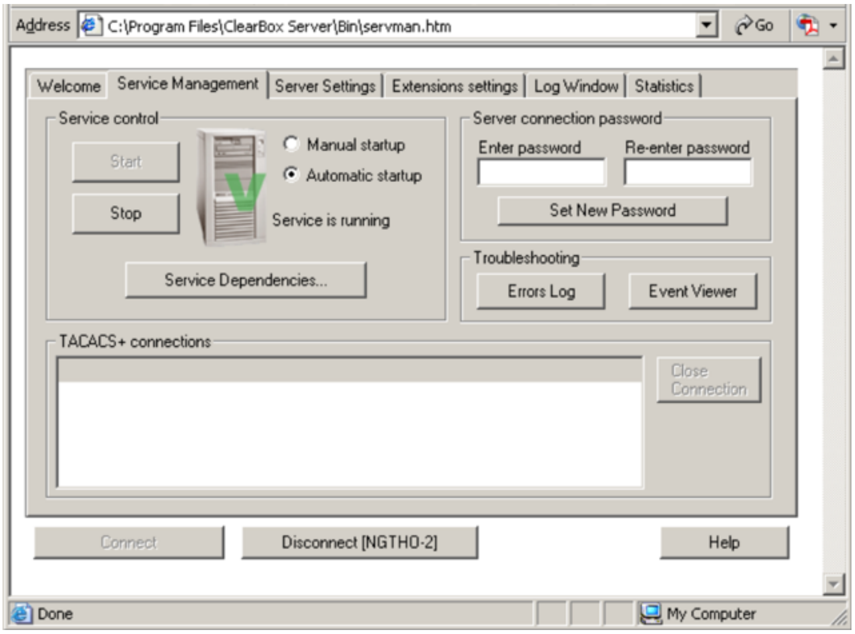


Figure 39: TACACS+ server connected

Configuration example: Linux freeware server

1. After TACACS+ is installed on the Linux server, change the directory to

   `$cd /etc/tacacs`

2. Open the configuration file tac_plus.cfg:

   `$vi tac_plus.cfg`

3. Comment out all the existing lines in the configuration file. Add new lines similar to the following:

   ```
   # Enter your NAS key and user name
   key = <secret key>
   user = <user name> {
   default service = permit
   service = exec {
   priv-lvl = <Privilege level 1 to 15>
   }
   login = <Password type> <password>
   }
   # Set the location to store the accounting records
   ```

   - where

     <secret key> is the key that is to be configured on the switch when creating the TACACS+ server entry

     <user name> is the user name used to log on to the switch

     <Privilege level> specifies the privilege level (for example rwa = 6; rw = 5; ro = 1)

     <Password type> specifies the type of password -- for example, the password can be clear text or from the Linux password file, and so on

     <Password> if the password type is clear text, the password itself

The following is a sample config file.

```
$vi tac_plus.cfg

# Created by Joe SMITH(jsmit@isp.net)
# Read user_guide and tacacs+ FAQ for more information
#
# Enter your NAS key
key = secretkey u
user = smithJ {

default service = permit
service = exec {
priv-lvl = 15
}
login = cleartext M5xyH8
```

4. Save the changes to the tac_plus.cfg file.
5. Run the TACACS+ daemon using the following command:

   ```
   $/usr/local/sbin/tac_plus -C /etc/tacacs/tac_plus.cfg &
   ```

   where

   - tac_plus is stored under /usr/local/sbin
   - the configuration file you just edited is stored at /etc/tacacs/

   The TACACS+ server on Linux is ready to authenticate users.

Supported SNMP MIBs and traps

This section contains information about:

- Supported MIBs on page 491
- Supported traps on page 493

Supported MIBs

The following tables list supported SNMP MIBs.

Table 29: SNMP Standard MIB support

MIB name	RFC	File name
RMON-MIB	2819	rfc2819.mib
RFC1213-MIB	1213	rfc1213.mib
IF-MIB	2863	rfc2863.mib
SNMPv2-MIB	3418	rfc3418.mib
EtherLike-MIB	2665	rfc2665.mib

Table continues…

MIB name	RFC	File name
ENTITY-MIB	2737	rfc2737.mib
BRIDGE-MIB	4188	rfc4188.mib
P-BRIDGE-MIB	4363	rfc4363-p.mib
Q-BRIDGE-MIB	4363	rfc4363-q.mib
IEEE8021-PAE-MIB	n/a	eapol-d10.mib
SMIv2-MIB	2578	rfc2578.mib
SMIv2-TC-MIB	2579	rfc2579.mib
SNMPv2-MIB	3418	rfc3418.mib
SNMP-FRAMEWORK-MIB	3411	rfc3411.mib
SNMP-MPD-MIB	3412	rfc3412.mib
SNMP-NOTIFICATION-MIB	3413	rfc3413-notif.mib
SNMP-TARGET-MIB	3413	rfc3413-tgt.mib
SNMP-USER-BASED-MIB	3414	rfc3414.mib
SNMP-VIEW-BASED-ACM-MIB	3415	rfc3415.mib
SNMP-COMMUNITY-MIB	3584	rfc3584.mib

Table 30: SNMP proprietary MIB support

MIB name	File name
S5-AGENT-MIB	s5age.mib
S5-CHASSIS.MIB	s5cha.mib
S5-CHASSIS-TRAP.MIB	s5ctr.trp
S5-ETHERNET-TRAP.MIB	s5etr.trp
RAPID-CITY-MIB	rapidCity.mib
S5-SWITCH-BAYSECURE-MIB	s5sbs.mib
BN-IF-EXTENSIONS-MIB	s5ifx.mib
BN-LOG-MESSAGE-MIB	bnlog.mib
S5-ETH-MULTISEG-TOPOLOGY-MIB	s5emt.mib
NTN-QOS-POLICY-EVOL-PIB	pibNtnEvol.mib
BAY-STACK-NOTIFICATIONS-MIB	bsn.mib

Table 31: Application and related MIBs

Application	Related MIBs	File name
Autotopology	S5-ETH-MULTISEG-TOPOLOGY-MIB	s5emt.mib
BaySecure	S5-SWITCH-BAYSECURE-MIB	s5sbs.mib
Extensible Authentication Protocol over LAN (EAPOL)	IEEE8021-PAE-MIB	eapol-d10.mib

Table continues…

Application	Related MIBs	File name
IP multicast (IGMP snooping/ proxy)	RAPID-CITY-MIB (rcVlanIgmp group)	rcVlan.mib
Link Aggregation Control Protocol (LACP)	IEEE8023-LAG-MIB; BAY-STACK-LACP-EXT-MIB	ieee8023-lag.mib; bayStackLacpExt.mib
Link Layer Discovery Protocol (LLDP)	LLDP-MIB; LLDP-EXT-DOT1-MIB; LLDP-EXT-DOT3-MIB;	lldp.mib; lldpExtDot1.mib; lldpExtDot3.mib;
MIB-2	RFC1213-MIB	rfc1213.mib
MultiLink Trunking (MLT)	RAPID-CITY-MIB (rcMlt group)	rcMlt.mib
Policy management	NTN-QOS-POLICY-EVOL-PIB	pibNtnEvol.mib
RMON-MIB	RMON-MIB	rfc2819.mib
SNMPv3	SNMP-FRAMEWORK-MIB	rfc3411.mib
	SNMP-MPD-MIB	rfc3412.mib
	SNMP-NOTIFICATION-MIB	rfc3413-notif.mib
	SNMP-TARGET-MIB	rfc3413-tgt.mib
	SNMP-USER-BASED-SM-MIB	rfc3414.mib
	SNMP-VIEW-BASED-ACM-MIB	rfc3415.mib
	SNMP-COMMUNITY-MIB	rfc3584.mib
Spanning Tree	BRIDGE-MIB	rfc4188.mib
for MSTP	NORTEL-NETWORKS-MULTIPLE-SPANNING-TREE-MIB	nnmst.mib
for RSTP	NORTEL-NETWORKS-RAPID-SPANNING-TREE-MIB	nnrst.mib
System log	BN-LOG-MESSAGE-MIB	bnlog.mib
VLAN	RAPID-CITY-MIB (rcVlan group)	rcVlan.mib

Supported traps

The following table lists supported SNMP traps.

Table 32: Supported SNMP traps

Trap name	Configurable	Sent when
RFC 2863 (industry standard):		
linkUp	Per port	A port link state changes to up.
linkDown	Per port	A port link state changes to down.
RFC 3418 (industry standard):		
authenticationFailure	System wide	There is an SNMP authentication failure.
coldStart	Always on	The system is powered on.

Table continues…

Trap name	Configurable	Sent when
warmStart	Always on	The system restarts due to a management reset.
s5CtrMIB (Avaya proprietary traps):		
s5CtrUnitUp	Always on	A unit is added to an operational stack.
s5CtrUnitDown	Always on	A unit is removed from an operational stack.
s5CtrHotSwap	Always on	A unit is hot-swapped in an operational stack.
s5CtrProblem	Always on	• Base unit fails • AC power fails or is restored • RPSU (DC) power fails or is restored • Fan fails or is restored
s5EtrSbsMacAccessViolation	Always on	A MAC address security violation is detected.
entConfigChange	Always on	A hardware change—unit added or removed from stack, GBIC inserted or removed.
risingAlarm fallingAlarm	Always on	An RMON alarm threshold is crossed.
bsnConfigurationSavedToNvram	Always on	Each time the system configuration is saved to NVRAM.
bsnEapAccessViolation	Always on	An EAP access violation occurs.
bsnStackManagerReconfiguration	System-wide	There has been a stack configuration.
LLDP-MIB		
lldpRemTablesChange	System-wide	The value of lldpStatsRemTableLast ChangeTime changes.
NORTEL-NETWORKS-RAPID-SPANNING-TREE-MIB:		
nnRstGeneralEvent	Always on	A general event, such as protocol up or protocol down, occurs.
nnRstErrorEvent	System-wide	An error event occurs. Error events include memory failure, buffer failure, protocol migration, new root, and topology change.
nnRstNewRoot	System-wide	A new root bridge is selected in the topology.
nnRstTopologyChange	System-wide	A topology change is detected.
nnRstProtocolMigration	Per port	Port protocol migration occurs.
NORTEL-NETWORKS-MULTIPLE-SPANNING-TREE-MIB:		

Table continues…

Trap name	Configurable	Sent when
nnMstGeneralEvent	System-wide	A general event, such as protocol up or protocol down occurs. The event can be port based or instance based.
nnMstErrorEvent	System-wide	An error event occurs. Error events include memory failure, buffer failure, protocol migration, new root, and topology change.
nnMstNewRoot	System-wide	A new root bridge is selected in the topology.
nnMstTopologyChange	System-wide	A topology change is detected.
nnMstProtocolMigration	Per port	Port protocol migration occurs.
nnMstRegionConfigChange	System-wide	The MST region configuration identifier changes.

Supported EAP modes and configuration examples

This section provides configuration examples that are compatible with various operating modes and scenarios.

Note:

`mac-max` restricts the maximum number of EAP and NEAP clients allowed per port. Because the limit set by **`mac-max`** is set by default to 1, and because **`mac-max`** takes precedence over **`eap-mac-max`** or **`non-eap-mac-max`**, some configuration examples could function improperly if used with Software Release 5.7.

SHSA authentication mode with or without RADIUS additional attributes with or without Multihost MultiVLAN

The configuration example in this section applies to the following client port settings when:

- 802.1X is disabled on the port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
- an unauthenticated client is on the port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
- an authenticated client is on the port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs but no RADIUS attribute is received, or an invalid RADIUS attribute is received, for the client
- an authenticated client is on the port—the port is included in the RADIUS VLAN ID and it uses the RADIUS VLAN PVID so that valid RADIUS attributes are received for the client

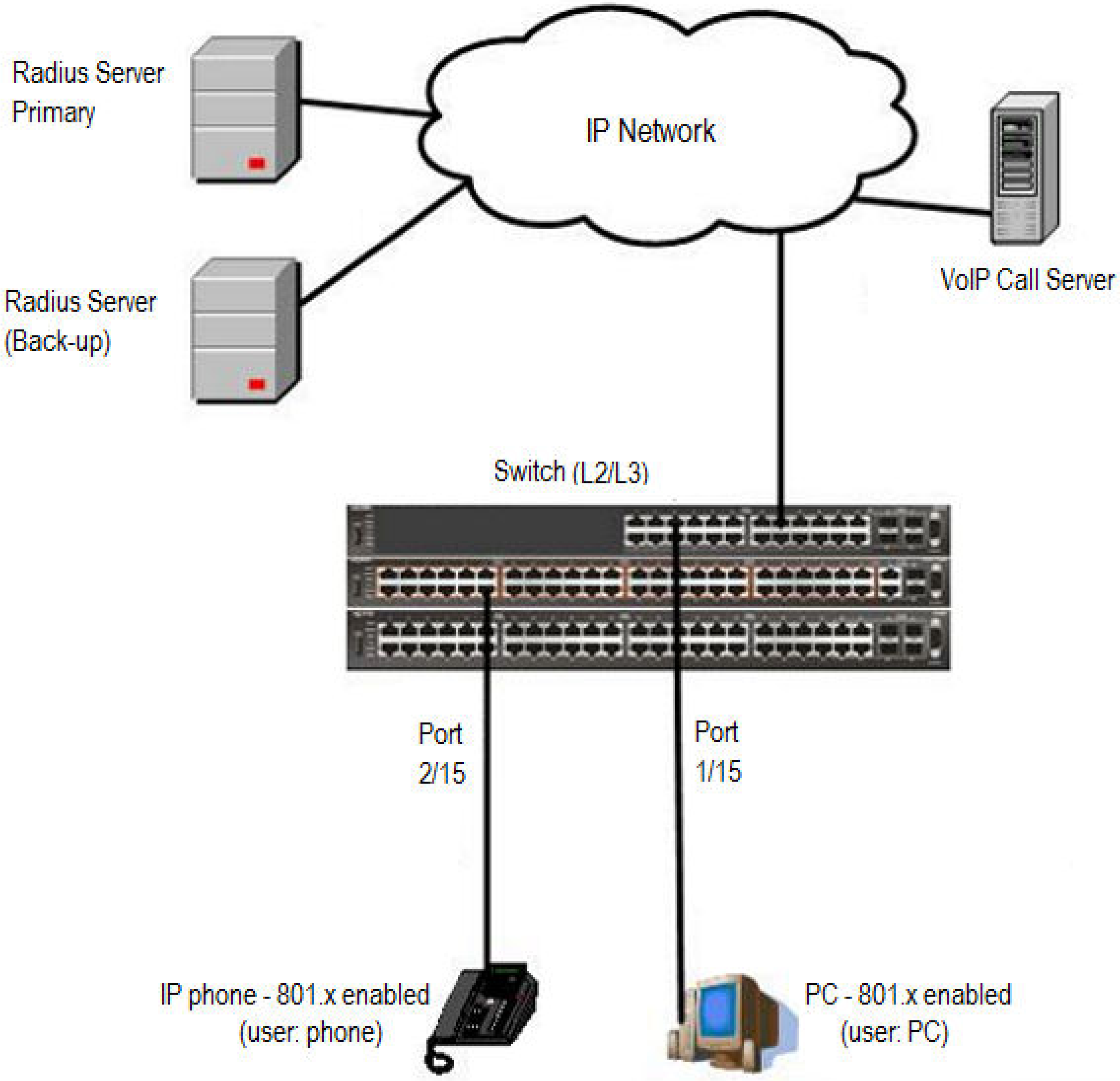


Figure 40: SHSA authentication mode with or without RADIUS additional attributes with or without Multihost MultiVLAN

Scenario

Assume the following settings:

- Primary RADIUS server configured with two users:
  - user: phone with attribute VLAN ID: 200, Port priority: 6
  - user: PC with attribute VLAN ID: 300, Port priority: 2
- Backup RADIUS server configured with the same two users:
  - user: phone with attribute VLAN ID: 200, Port priority: 6

  - user: PC with attribute VLAN ID: 300, Port priority: 2
- Port 2/15—801.x enabled IP phone connected - (user: phone)
  - Initial VLAN ID = 100
  - RADIUS VLAN ID = 200
- Port 1/15—801.x enabled PC connected - (user: PC)
  - Initial VLAN ID = 50
  - RADIUS VLAN ID = 300
- 802.1x phone client VLAN ID/PVID port 2/15 settings:
  - 801.x disabled on port 100/100
  - Unauthenticated client on port 100/100
  - Authenticated (user: phone):
    - 100/100 (No RADIUS attribute received or Invalid RADIUS attributes received)
    - 200/200 (Valid RADIUS attributes received)
- 802.1x PC client VLAN ID/PVID port 1/15 settings:
  - 801.x disabled on port 50/50
  - Unauthenticated client on port 50/50
  - Authenticated client on port (user: PC):
    - 50/50 (No RADIUS attribute received or Invalid RADIUS attributes received)
    - 300/300 (Valid RADIUS attributes received)

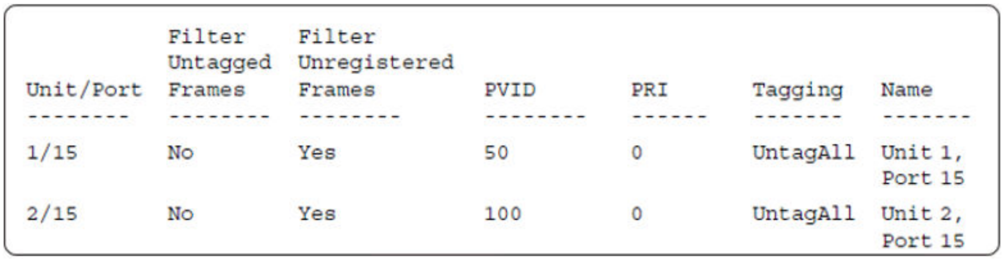
Configuration example

1. Configure the RADIUS servers and VLAN settings.

```
Switch(config)#ip address 10.100.68.254 netmask 255.255.255.0 default-gateway 10.100.68.1
Switch(config)#radius-server host 10.100.68.2
Switch(config)#radius-server secondary-host 10.100.68.3
Switch(config)#radius-server key
Enter key: RadiusKey
Enter key: RadiusKey
Switch(config)#vlan configcontrol automatic
Switch(config)#vlan create 50 type port
Switch(config)#vlan create 100 type port
Switch(config)#vlan create 200 type port
Switch(config)#vlan create 300 type port
Switch(config)#vlan members add 50 1/15
Switch(config)#vlan members add 100 2/15
```

2. Confirm the VLAN interface settings.

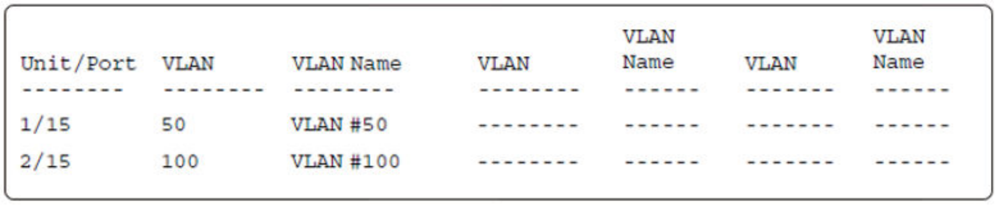
```
Switch(config)#sho vlan interface info 1/15,2/15
```



```
                Filter     Filter
                Untagged   Unregistered
Unit/Port       Frames     Frames        PVID      PRI     Tagging    Name
---------       --------   --------      --------  ------  -------    -------
1/15            No         Yes           50        0       UntagAll   Unit 1,
                                                                      Port 15
2/15            No         Yes           100       0       UntagAll   Unit 2,
                                                                      Port 15
```

3. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
                                                      VLAN              VLAN
Unit/Port   VLAN       VLAN Name     VLAN             Name     VLAN     Name
--------    --------   --------      --------         ------   -------  ------
1/15        50         VLAN #50      --------         ------   -------  ------
2/15        100        VLAN #100     --------         ------   -------  ------
```

4. Verify connectivity with the Primary RADIUS server and back-up RADIUS server (if back-up server is used). Firewalls may filter ICMP packets. In this case it is recommended to verify RADIUS server logs for authentication request sent by device.

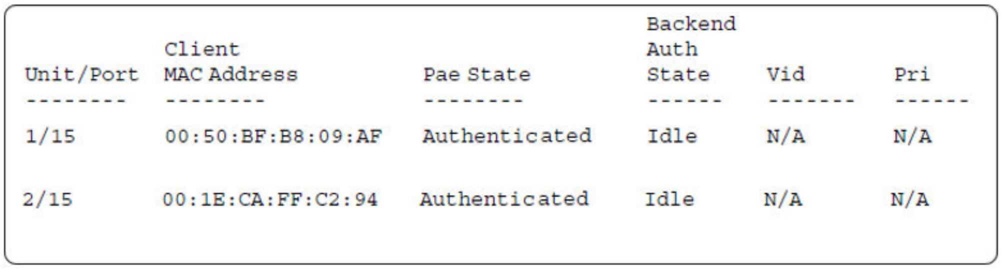
```
Switch(config)#ping 10.100.68.2
 (Host is reachable)
Switch(config)#ping 10.100.68.3
 (Host is reachable)
```

5. Set the EAPOL status.

```
Switch(config)#interface Ethernet 1/15,2/15
Switch(config-if)#eapol status auto
Switch(config-if)#exit
Switch(config)#eapol enable
```

6. After EAP clients are authenticated, confirm the EAPOL MultiHost status.

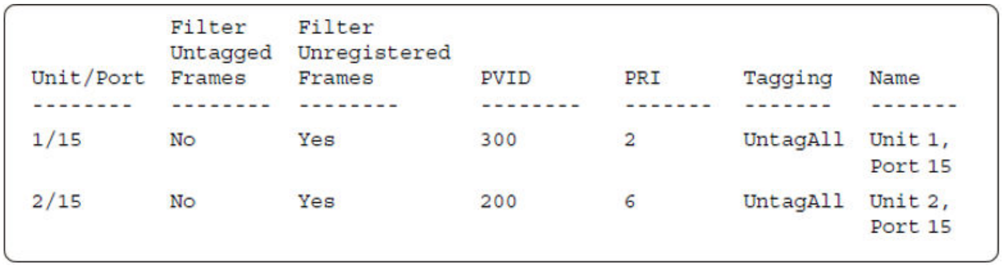
```
Switch(config)#show eapol multihost status
```



```
                                                    Backend
             Client                                 Auth
Unit/Port    MAC Address          Pae State         State     Vid       Pri
--------     --------             --------          ------    -------   ------
1/15         00:50:BF:B8:09:AF    Authenticated     Idle      N/A       N/A

2/15         00:1E:CA:FF:C2:94    Authenticated     Idle      N/A       N/A
```

7. Confirm the VLAN interface settings.

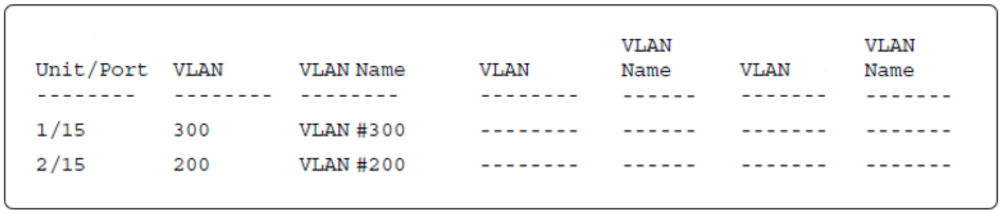
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI      Tagging   Name
--------   --------  --------      --------  -------  -------   -------
1/15       No        Yes           300       2        UntagAll  Unit 1,
                                                                Port 15
2/15       No        Yes           200       6        UntagAll  Unit 2,
                                                                Port 15
```

8. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



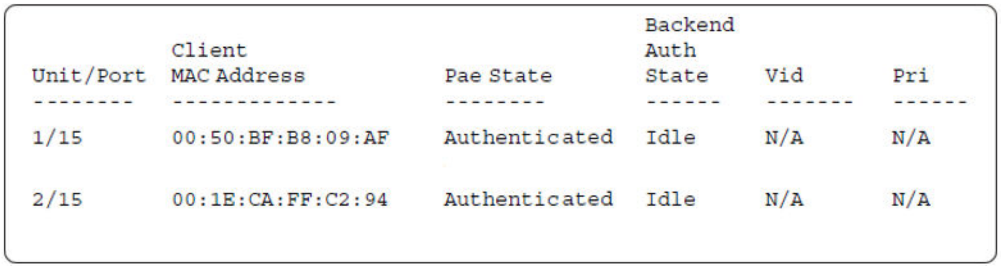
```
                                             VLAN             VLAN
Unit/Port  VLAN      VLAN Name   VLAN        Name    VLAN     Name
--------   --------  --------    --------    ------  -------  -------
1/15       300       VLAN #300   --------    ------  -------  -------
2/15       200       VLAN #200   --------    ------  -------  -------
```

9. Enable EAPOL MultiHost MultiVLAN.

```
Switch(config)#eapol disable
Switch(config)#eapol multihost multivlan enable
Switch(config)#eapol enable
```

10. Confirm EAPOL MultiHost status.

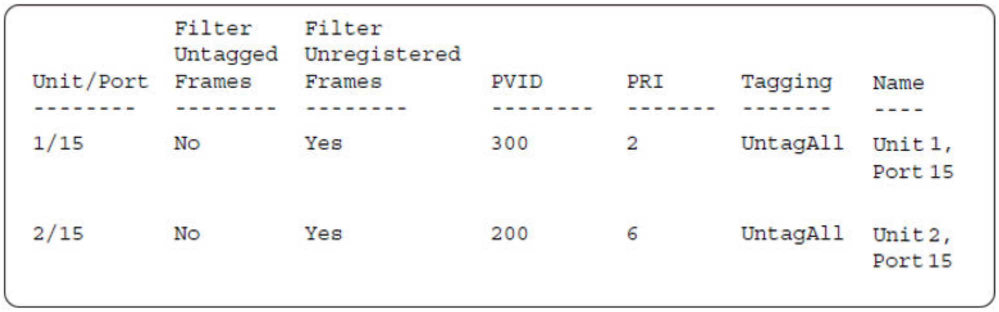
```
Switch(config)#show eapol multihost status
```



```
                                                Backend
           Client                               Auth
Unit/Port  MAC Address        Pae State         State    Vid      Pri
--------   -------------      --------          ------   -------  ------
1/15       00:50:BF:B8:09:AF  Authenticated     Idle     N/A      N/A

2/15       00:1E:CA:FF:C2:94  Authenticated     Idle     N/A      N/A
```

11. Confirm the VLAN interface settings.

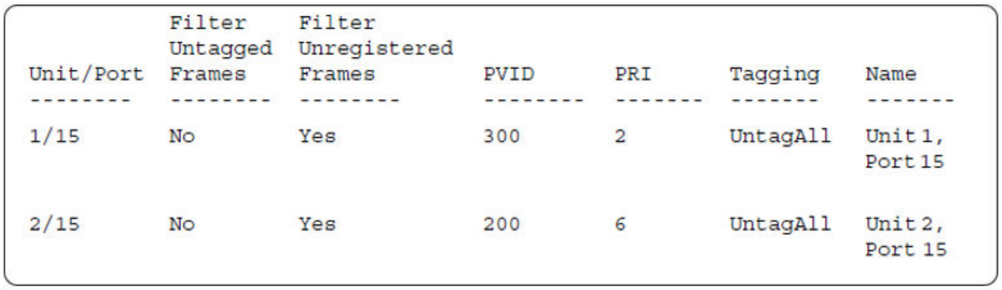
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI      Tagging   Name
--------   --------  --------      --------  -------  -------   ----
1/15       No        Yes           300       2        UntagAll  Unit 1,
                                                                Port 15

2/15       No        Yes           200       6        UntagAll  Unit 2,
                                                                Port 15
```

12. Confirm the VLAN interface settings.

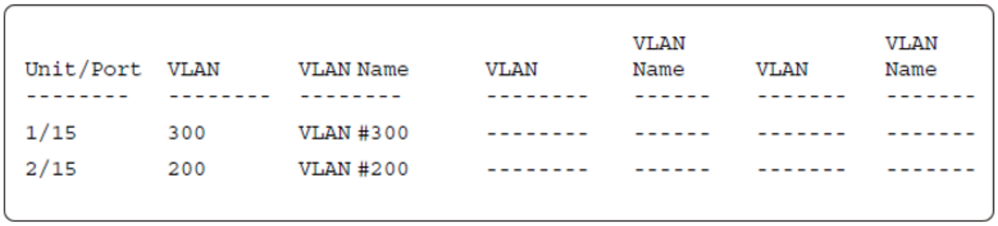
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
            Filter    Filter
            Untagged  Unregistered
Unit/Port   Frames    Frames         PVID      PRI       Tagging   Name
---------   --------  --------       --------  -------   -------   -------
1/15        No        Yes            300       2         UntagAll  Unit 1,
                                                                   Port 15

2/15        No        Yes            200       6         UntagAll  Unit 2,
                                                                   Port 15
```

13. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
                                                 VLAN               VLAN
Unit/Port   VLAN       VLAN Name     VLAN        Name      VLAN     Name
--------    --------   --------      --------    ------    -------  -------
1/15        300        VLAN #300     --------    ------    -------  -------
2/15        200        VLAN #200     --------    ------    -------  -------
```

Alternate configuration

The following operation applies to **SHSA authentication mode (Multihost MultiVLAN option disabled) without valid RADIUS attributes**, when the RADIUS server has no special attributes configured or the RADIUS server uses misconfigured attributes (not matching the device configuration).

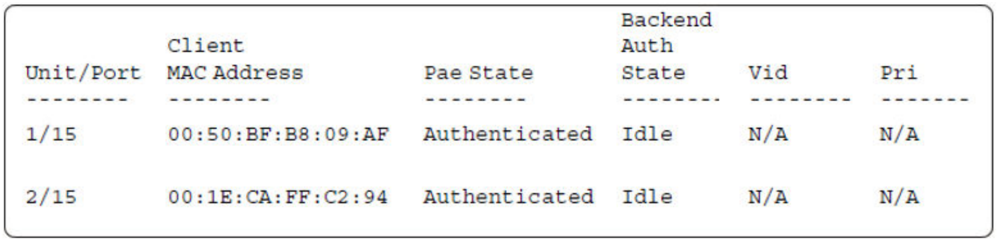
This configuration example modifies EAP and NEAP client attributes on the RADIUS server, replacing VLAN ID 200 with VLAN ID 123, and VLAN ID 300 with VLAN ID 124, which is not configured on the device.

1. Enable EAPOL MultiHost MultiVLAN.

```
Switch(config)#eapol disable
Switch(config)#no eapol multihost multivlan enable
Switch(config)#eapol enable
```

2. Confirm EAPOL MultiHost status.

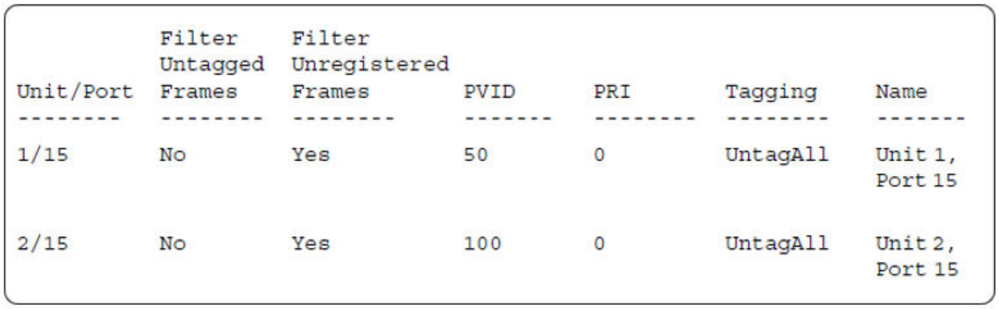
```
Switch(config)#show eapol multihost status
```



```
                                                  Backend
            Client                                Auth
Unit/Port   MAC Address         Pae State         State     Vid       Pri
--------    --------            --------          --------  --------  -------
1/15        00:50:BF:B8:09:AF   Authenticated     Idle      N/A       N/A

2/15        00:1E:CA:FF:C2:94   Authenticated     Idle      N/A       N/A
```

3. Confirm the VLAN interface settings.

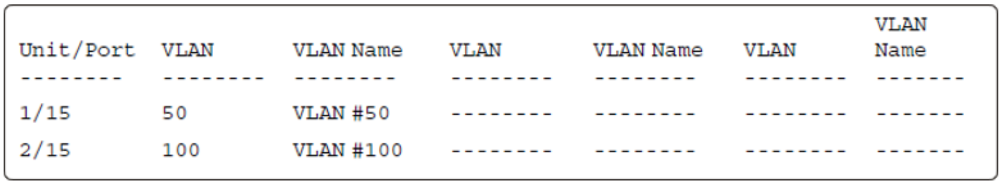
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
          Filter     Filter
          Untagged   Unregistered
Unit/Port Frames     Frames       PVID     PRI       Tagging    Name
--------- ---------  --------     -------  --------  --------   -------
1/15      No         Yes          50       0         UntagAll   Unit 1,
                                                                Port 15

2/15      No         Yes          100      0         UntagAll   Unit 2,
                                                                Port 15
```

4. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
                                                                VLAN
Unit/Port VLAN       VLAN Name    VLAN     VLAN Name  VLAN      Name
--------  ---------  --------     -------- --------   --------  -------
1/15      50         VLAN #50     -------- --------   --------  -------
2/15      100        VLAN #100    -------- --------   --------  -------
```

SHSA authentication mode (with Guest VLAN enabled) with or without RADIUS additional attributes, with or without Multihost MultiVLAN

The configuration example in this section applies to the following client port settings when:

- 801.x disabled on port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
- an unauthenticated client is on the port—the port is included in the Guest VLAN ID, and the port uses the Guest VLAN PVID
- an authenticated client is on the port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs but no RADIUS attribute is received, or an invalid RADIUS attribute is received, for the client
- an authenticated client is on the port—the port is included in the RADIUS VLAN ID and it uses the RADIUS VLAN PVID so that valid RADIUS attributes are received for the client

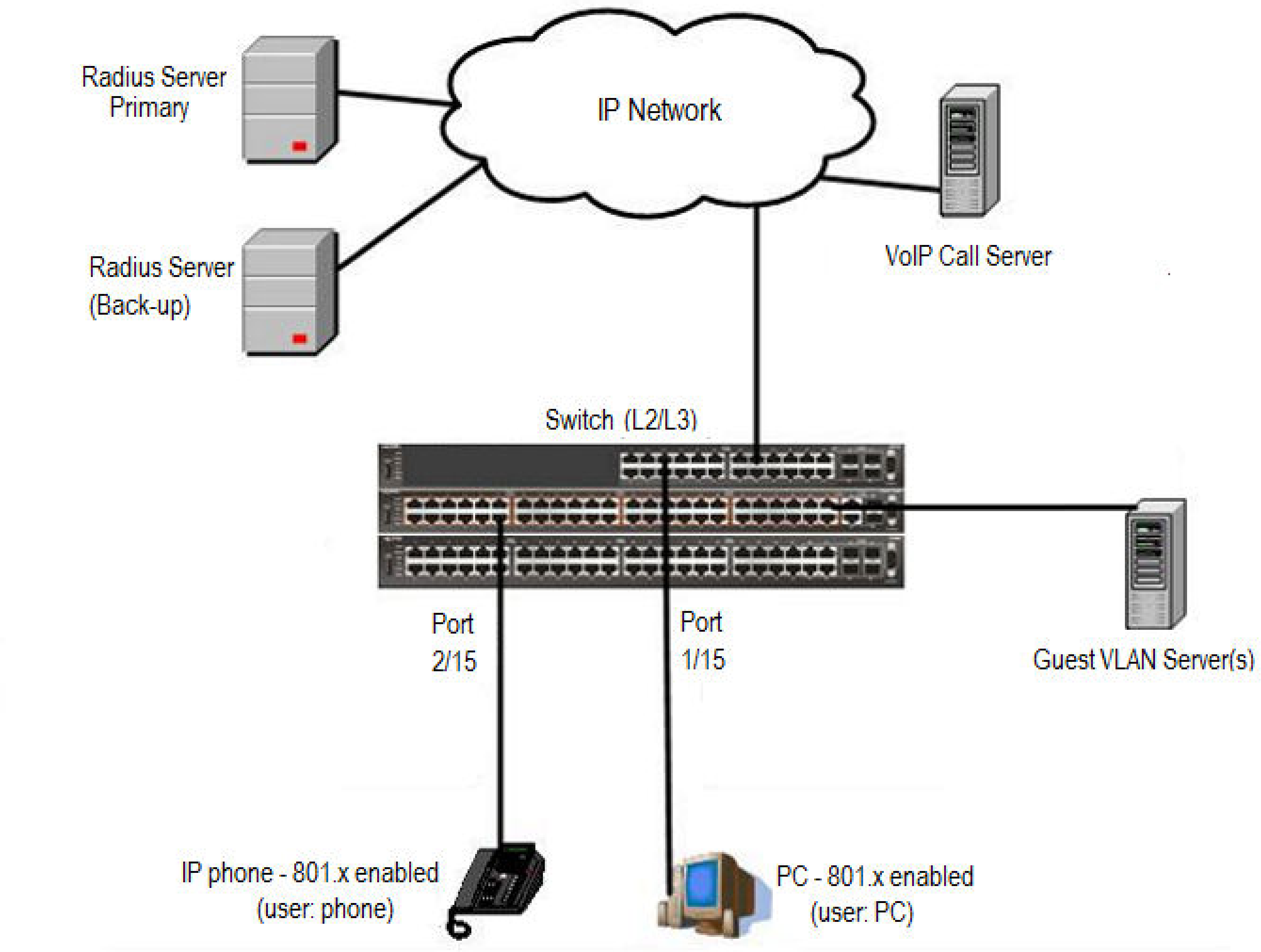


Figure 41: SHSA authentication mode (with Guest VLAN enabled) with or without RADIUS additional attributes, with or without Multihost MultiVLAN

Scenario

Assume the following settings:

1. RADIUS server configurations.
    - A primary server is mandatory. If a back-up server is used, the back-up server configuration must be the same as the primary server configuration.
2. Clients settings:
    - Port 2/15—801.x enabled IP phone connected - (user: phone)
        - Initial VLAN ID = 100
        - Guest VLAN ID = 20
        - RADIUS VLAN ID = 200

- Port 1/15—801.x enabled PC connected - (user: PC)
    - Initial VLAN ID = 50
    - Guest VLAN ID = 20
    - RADIUS VLAN ID = 300

3. Port settings:
    - VLAN ID/PVID port settings for 2/15:
        - 801.x disabled - VLAN ID/PVID = port 100/100
        - Unauthenticated client - VLAN ID/PVID = port 20/20
        - Authenticated (user: phone):
            - VLAN ID/PVID = 100/100 (No RADIUS attribute received or Invalid RADIUS attributes received)
            - VLAN ID/PVID = 200/200 (Valid RADIUS attributes received)
    - VLAN ID/PVID port settings for 1/15:
        - 801.x disabled - VLAN ID/PVID = port 50/50
        - Unauthenticated client - VLAN ID/PVID = port 20/20
        - Authenticated client on port (user: PC):
            - VLAN ID/PVID = 50/50 (No RADIUS attribute received or Invalid RADIUS attributes received)
            - VLAN ID/PVID = 300/300 (Valid RADIUS attributes received)

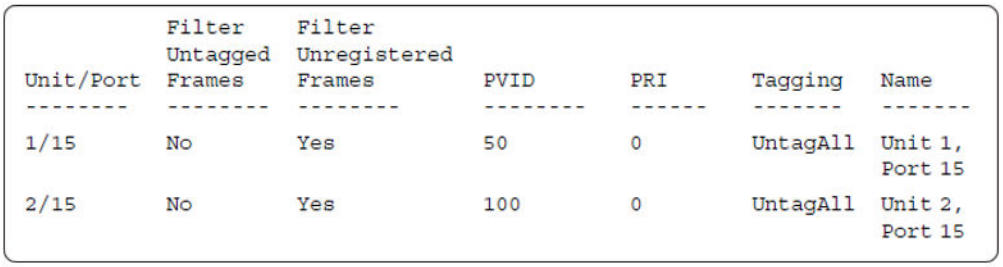
Configuration example

1. Configure the RADIUS servers and VLAN settings

```
Switch(config)# ip address 10.100.68.254 netmask 255.255.255.0 default-gateway 10.100.68.1
Switch(config)# radius-server host 10.100.68.2
Switch(config)# radius-server secondary-host 10.100.68.3
Switch(config)# radius-server key
Enter key: RadiusKey
Enter key: RadiusKey
Switch(config)# vlan configcontrol automatic
Switch(config)# vlan create 20 type port
Switch(config)# vlan create 50 type port
Switch(config)# vlan create 100 type port
Switch(config)# vlan create 200 type port
Switch(config)# vlan create 300 type port
Switch(config)# vlan members add 50 1/15
Switch(config)# vlan members add 100 2/15
```

2. Confirm the VLAN interface settings.

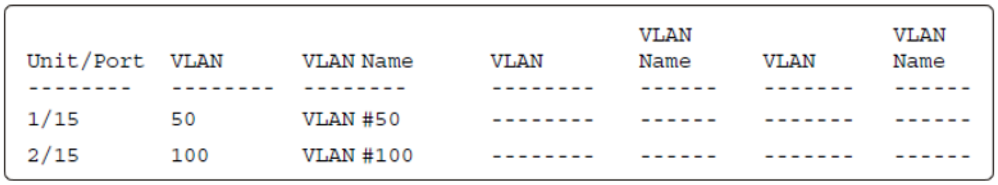
```
Switch(config)# sho vlan interface info 1/15,2/15
```



```
             Filter    Filter
             Untagged  Unregistered
Unit/Port    Frames    Frames         PVID      PRI     Tagging   Name
---------    --------  --------       --------  ------  -------   -------
1/15         No        Yes            50        0       UntagAll  Unit 1,
                                                                  Port 15
2/15         No        Yes            100       0       UntagAll  Unit 2,
                                                                  Port 15
```

3. Confirm the VLAN inteface VIDs.

```
Switch(config)# show vlan interface vids 1/15,2/15
```



```
                                                   VLAN               VLAN
Unit/Port   VLAN       VLAN Name    VLAN           Name     VLAN      Name
--------    --------   --------     --------       ------   -------   ------
1/15        50         VLAN #50     --------       ------   -------   ------
2/15        100        VLAN #100    --------       ------   -------   ------
```

4. Verify connectivity with the Primary RADIUS server and back-up RADIUS server (if back-up server is used). Firewalls may filter ICMP packets. In this case it is recommended to verify RADIUS server logs for authentication request sent by device.

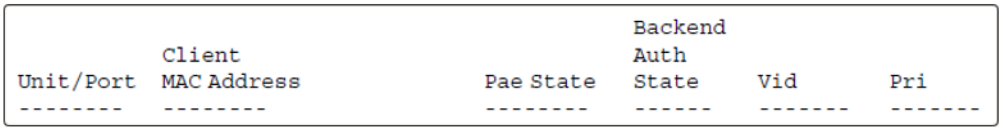
```
Switch(config)# ping 10.100.68.2
(Host is reachable)

Switch(config)# ping 10.100.68.3
(Host is reachable)
```

5. Set the EAPOL status.

```
Switch(config)# eapol guest-vlan vid 20
Switch(config)# eapol guest-vlan enable
Switch(config)# interface Ethernet 1/15,2/15
Switch(config-if)# eapol guest-vlan enable
Switch(config-if)# eapol status auto
Switch(config-if)# exit
Switch(config)# eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

6. Before EAP clients are authenticated, confirm the EAPOL MultiHost status.

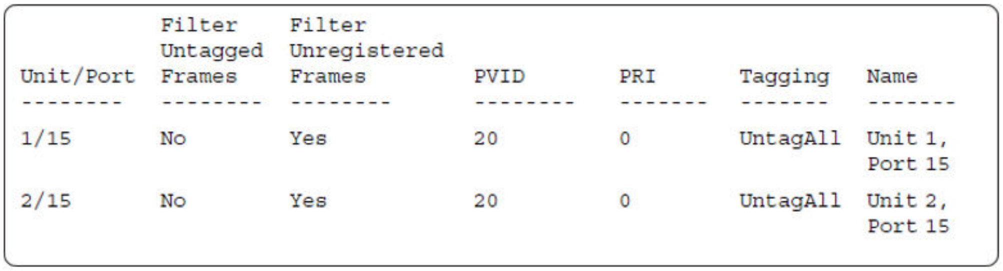
```
Switch(config)# show eapol multihost status
```



```
                                                Backend
            Client                              Auth
Unit/Port   MAC Address             Pae State   State    Vid       Pri
--------    --------                --------    ------   -------   -------
```

7. Confirm the VLAN interface settings.

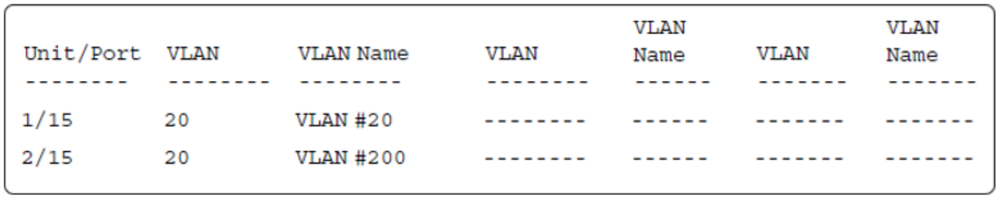
```
Switch(config)# show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames         PVID      PRI      Tagging   Name
---------  --------  --------       --------  -------  -------   -------
1/15       No        Yes            20        0        UntagAll  Unit 1,
                                                                 Port 15
2/15       No        Yes            20        0        UntagAll  Unit 2,
                                                                 Port 15
```

8. Confirm the VLAN interface VIDs.

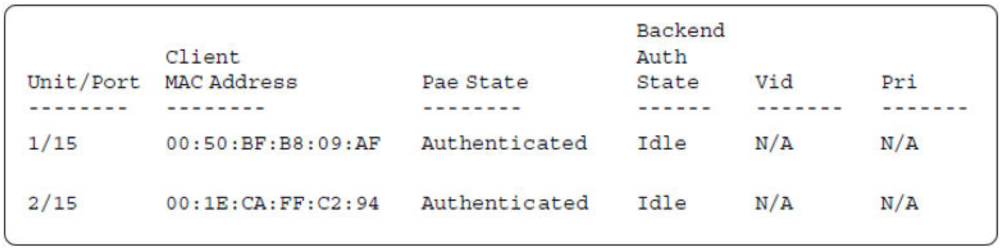
```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
                                                    VLAN              VLAN
Unit/Port  VLAN      VLAN Name      VLAN            Name     VLAN     Name
--------   --------  --------       --------        ------   -------  -------
1/15       20        VLAN #20       --------        ------   -------  -------
2/15       20        VLAN #200      --------        ------   -------  -------
```

9. After EAP clients are authenticated, confirm the EAPOL MultiHost status.

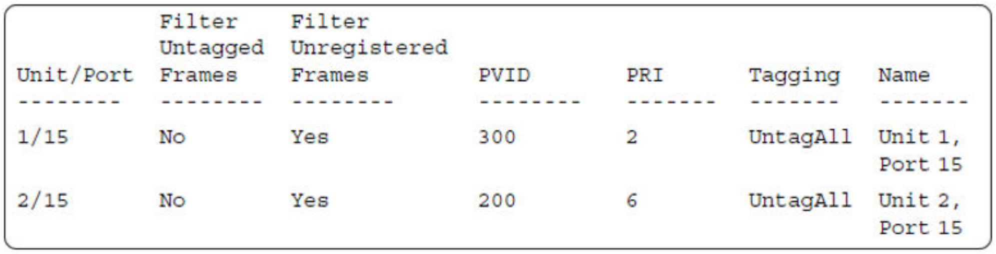
```
Switch(config)# show eapol multihost status
```



```
                                                 Backend
           Client                                Auth
Unit/Port  MAC Address         Pae State         State    Vid      Pri
--------   --------            --------          ------   -------  -------
1/15       00:50:BF:B8:09:AF   Authenticated     Idle     N/A      N/A

2/15       00:1E:CA:FF:C2:94   Authenticated     Idle     N/A      N/A
```

10. Confirm the VLAN interface settings.

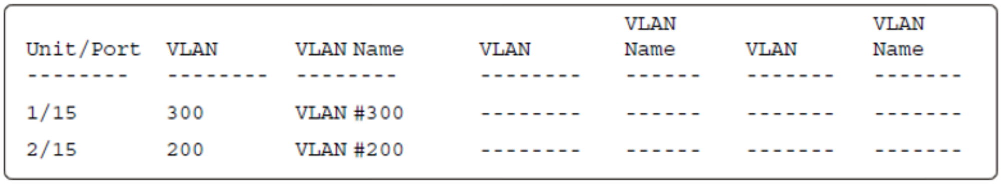
```
Switch(config)# show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames         PVID      PRI      Tagging   Name
--------   --------  --------       --------  -------  -------   -------
1/15       No        Yes            300       2        UntagAll  Unit 1,
                                                                 Port 15
2/15       No        Yes            200       6        UntagAll  Unit 2,
                                                                 Port 15
```

11. Confirm the VLAN interface VIDs.

```
Switch(config)# show vlan interface vids 1/15,2/15
```



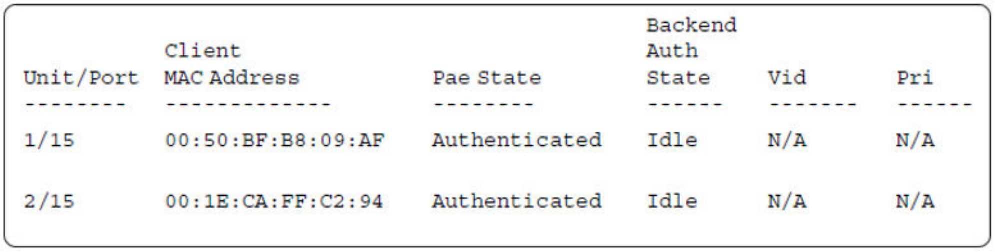
```
                                                   VLAN               VLAN
Unit/Port  VLAN      VLAN Name    VLAN      Name     VLAN     Name
--------   --------  --------     --------  ------   -------  -------
1/15       300       VLAN #300    --------  ------   -------  -------
2/15       200       VLAN #200    --------  ------   -------  -------
```

12. Enable EAPOL MultiHost MultiVLAN.

```
Switch(config)# eapol disable
Switch(config)# eapol multihost multivlan enable
Switch(config)# eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

13. Confirm EAPOL MultiHost status.

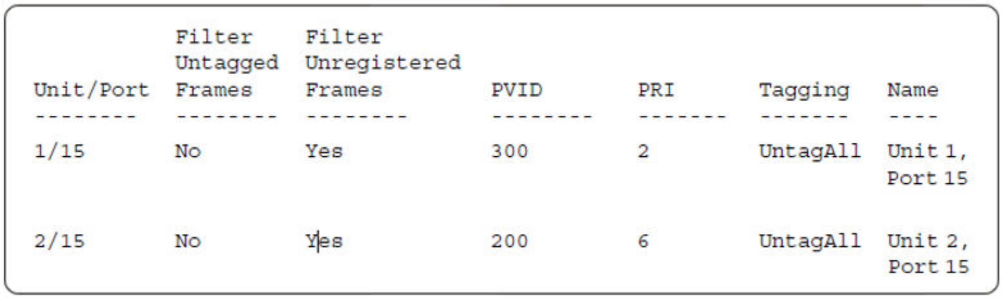
```
Switch(config)# show eapol multihost status
```



```
                                                  Backend
           Client                                 Auth
Unit/Port  MAC Address         Pae State          State    Vid      Pri
--------   -------------       ---------          ------   -------  ------
1/15       00:50:BF:B8:09:AF   Authenticated      Idle     N/A      N/A

2/15       00:1E:CA:FF:C2:94   Authenticated      Idle     N/A      N/A
```

14. Confirm the VLAN interface settings.

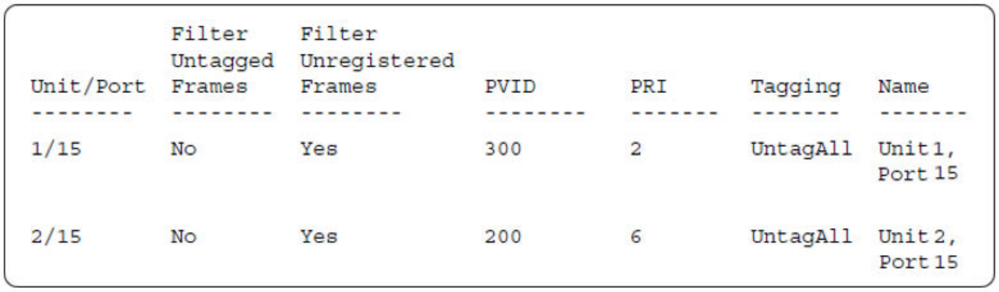
```
Switch(config)# show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames         PVID      PRI      Tagging   Name
--------   --------  --------       --------  -------  -------   ----
1/15       No        Yes            300       2        UntagAll  Unit 1,
                                                                 Port 15

2/15       No        Yes            200       6        UntagAll  Unit 2,
                                                                 Port 15
```

15. Confirm the VLAN interface settings.

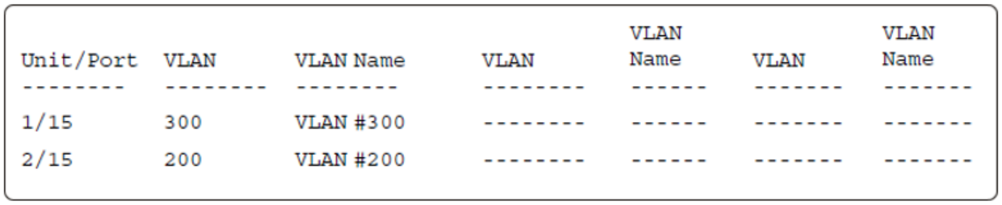
```
Switch(config)# show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI      Tagging   Name
---------  --------- ---------     --------- -------  -------   -------
1/15       No        Yes           300       2        UntagAll  Unit1,
                                                                Port15

2/15       No        Yes           200       6        UntagAll  Unit2,
                                                                Port15
```

16. Confirm the VLAN interface VIDs.

```
Switch(config)# show vlan interface vids 1/15,2/15
```



```
                                                  VLAN               VLAN
Unit/Port  VLAN       VLAN Name     VLAN          Name    VLAN       Name
---------  ---------  ---------     --------      ------  -------    -------
1/15       300        VLAN #300     --------      ------  -------    -------
2/15       200        VLAN #200     --------      ------  -------    -------
```

Alternate configuration

The following operation applies to **SHSA authentication mode with Guest VLAN (Multihost MultiVLAN option disabled) without valid RADIUS attributes**, when the RADIUS server has no special attributes configured or the RADIUS server uses misconfigured attributes (not matching the device configuration).

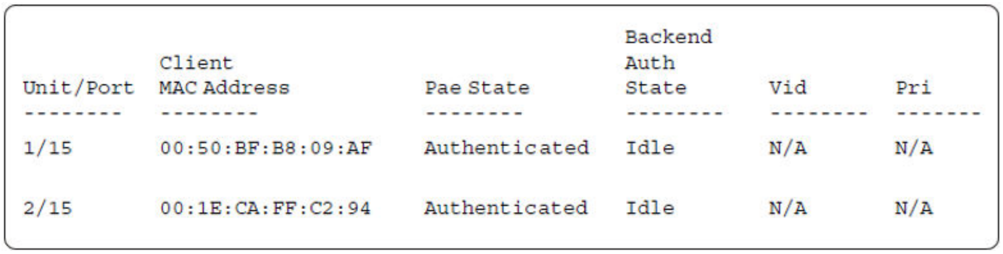
This configuration example modifies EAP and NEAP client attributes on the RADIUS server, replacing VLAN ID 200 with VLAN ID 123, and VLAN ID 300 with VLAN ID 124, which is not configured on the device.

1. Enable EAPOL MultiHost MultiVLAN.

```
Switch(config)# eapol disable
Switch(config)# no eapol multihost multivlan enable
Switch(config)# eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

2. Confirm EAPOL MultiHost status.

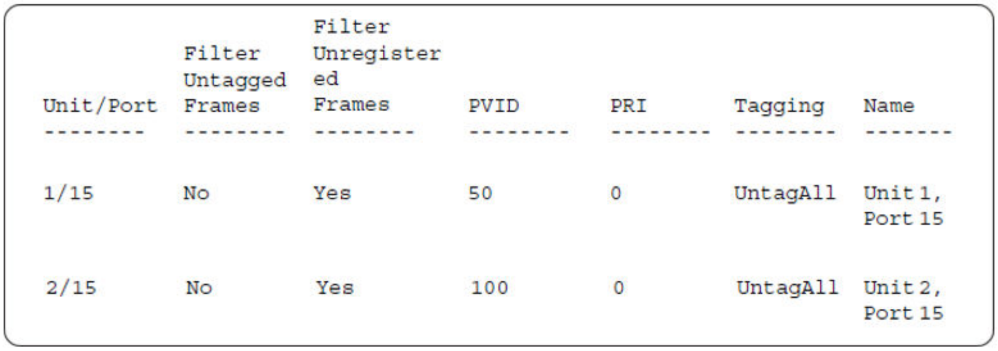
```
Switch(config)# show eapol multihost status
```



```
                                                Backend
           Client                               Auth
Unit/Port  MAC Address          Pae State       State     Vid       Pri
---------  ---------            ---------       --------  --------  -------
1/15       00:50:BF:B8:09:AF    Authenticated   Idle      N/A       N/A

2/15       00:1E:CA:FF:C2:94    Authenticated   Idle      N/A       N/A
```

3. Confirm the VLAN interface settings.

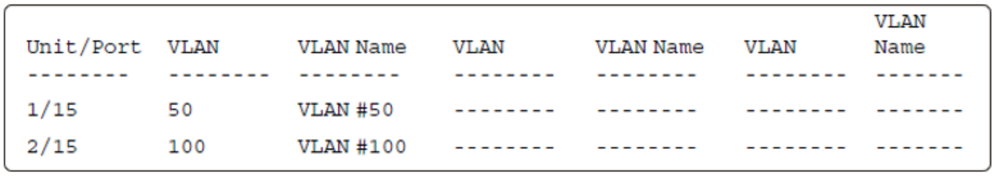
```
Switch(config)# show vlan interface info 1/15,2/15
```



```
                     Filter
           Filter    Unregister
           Untagged  ed
Unit/Port  Frames    Frames      PVID      PRI       Tagging   Name
---------  --------  --------    --------  --------  --------  -------

1/15       No        Yes         50        0         UntagAll  Unit 1,
                                                               Port 15


2/15       No        Yes         100       0         UntagAll  Unit 2,
                                                               Port 15
```

4. Confirm the VLAN interface VIDs.

```
Switch(config)# show vlan interface vids 1/15,2/15
```



```
                                                                 VLAN
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      Name
---------  --------  ---------  --------  ---------  --------  -------
1/15       50        VLAN #50   --------  ---------  --------  -------
2/15       100       VLAN #100  --------  ---------  --------  -------
```

SHSA authentication mode (with Guest VLAN and Fail Open VLAN enabled) with or without RADIUS additional attributes with or without Multihost MultiVLAN

The configuration example in this section applies to the following client port settings when:

- 801.x disabled on port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
- an unauthenticated client is on the port—the port is included in the Guest VLAN ID, and the port uses the Guest VLAN PVID
- an authenticated client is on the port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs but no RADIUS attribute is received, or an invalid RADIUS attribute is received, for the client
- an authenticated client is on the port—the port is included in the RADIUS VLAN ID and it uses the RADIUS VLAN PVID so that valid RADIUS attributes are received for the client
- RADIUS Server Unreachable (801.x enabled)—the port is included in the Fail Open VLAN, and the port uses the Fail Open VLAN PVID

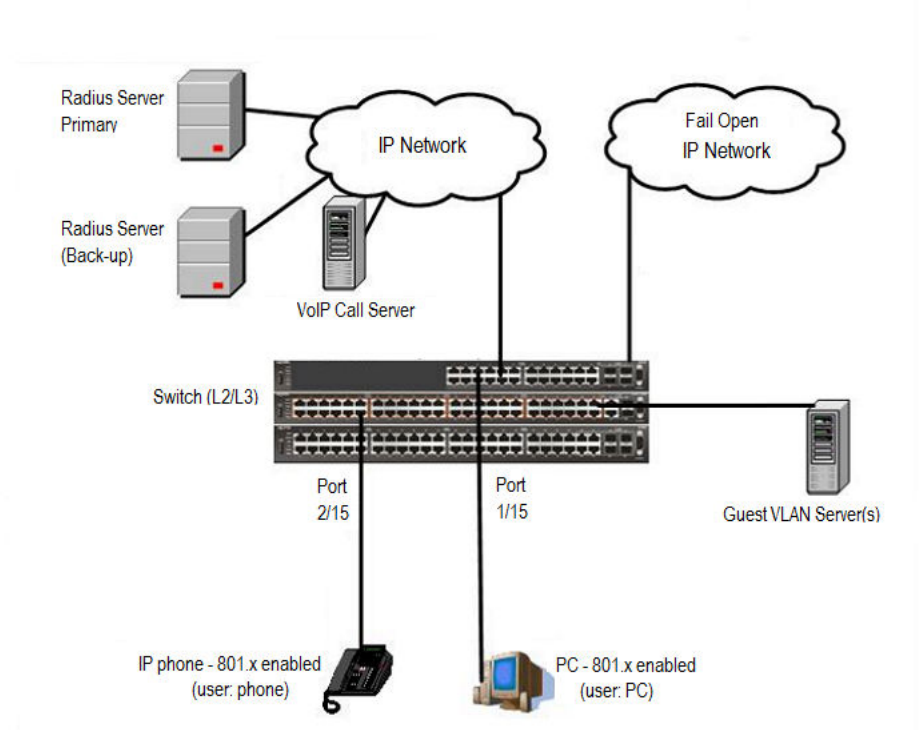


Figure 42: SHSA authentication mode (with Guest VLAN and Fail Open VLAN enabled) with or without RADIUS additional attributes with or without Multihost MultiVLAN

Scenario

Assume the following settings:

1. RADIUS server configurations.
   - Primary server is mandatory. If a back-up server is also used then the back-up server configurations must be the same as for primary server.
2. Clients settings:
   - Port 2/15—801.x enabled IP phone connected - (user: phone)
     - Initial VLAN ID = 100
     - Guest VLAN ID = 20
     - Fail Open VLAN ID = 30
     - RADIUS VLAN ID = 200
   - Port 1/15—801.x enabled PC connected - (user: PC)
     - Initial VLAN ID = 50
     - Guest VLAN ID = 20
     - Fail Open VLAN ID = 30
     - RADIUS VLAN ID = 300

3. Port settings:
   - VLAN ID/PVID port settings for 2/15:
     - 801.x disabled on port - VLAN ID/PVID = 100/100
     - Unauthenticated client on port - VLAN ID/PVID = 20/20
     - Authenticated (user: phone):
       - VLAN ID/PVID = 100/100 (No RADIUS attribute received or Invalid RADIUS attributes received)
       - VLAN ID/PVID = 200/200 (Valid RADIUS attributes received)
     - Radius Server Unreachable (801.x enabled) - VLAN ID/PVID = 30/30
   - VLAN ID/PVID port settings for 1/15:
     - 801.x disabled on port - VLAN ID/PVID = 50/50
     - Unauthenticated client on port - VLAN ID/PVID = 20/20
     - Authenticated client on port (user: PC):
       - VLAN ID/PVID = 50/50 (No RADIUS attribute received or Invalid RADIUS attributes received)
       - VLAN ID/PVID = 300/300 (Valid RADIUS attributes received)
     - Radius Server Unreachable (801.x enabled) – VLAN ID/PVID = 30/30

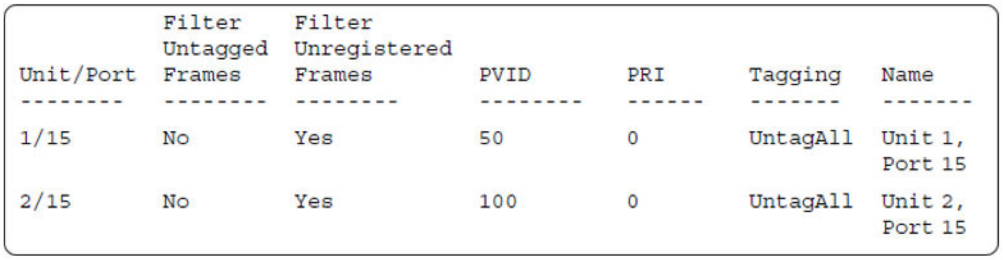
Configuration example

1. Configure the RADIUS servers and VLAN settings.

```
Switch(config)# ip address 10.100.68.254 netmask 255.255.255.0 default-gateway 10.100.68.1
Switch(config)# radius-server host 10.100.68.2
Switch(config)# radius-server secondary-host 10.100.68.3
Switch(config)# radius-server key
Enter key: RadiusKey
Enter key: RadiusKey
Switch(config)# vlan configcontrol automatic
Switch(config)# vlan create 20 type port
Switch(config)# vlan create 30 type port
Switch(config)# vlan create 50 type port
Switch(config)# vlan create 100 type port
Switch(config)# vlan create 200 type port
Switch(config)# vlan create 300 type port
Switch(config)# vlan members add 50 1/15
Switch(config)# vlan members add 100 2/15
```

2. Confirm the VLAN interface settings.

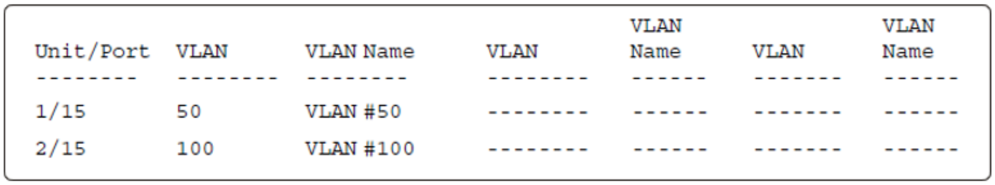
```
Switch(config)# sho vlan interface info 1/15,2/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames        PVID      PRI      Tagging  Name
--------  --------  --------      --------  ------   -------  -------
1/15      No        Yes           50        0        UntagAll Unit 1,
                                                              Port 15
2/15      No        Yes           100       0        UntagAll Unit 2,
                                                              Port 15
```

3. Confirm the VLAN inteface VIDs.

```
Switch(config)# show vlan interface vids 1/15,2/15
```



```
                                               VLAN                VLAN
Unit/Port  VLAN      VLAN Name     VLAN        Name      VLAN      Name
--------   --------  --------      --------    ------    -------   ------
1/15       50        VLAN #50      --------    ------    -------   ------
2/15       100       VLAN #100     --------    ------    -------   ------
```

4. Verify connectivity with the Primary RADIUS server and back-up RADIUS server (if back-up server is used). Firewalls may filter ICMP packets. In this case it is recommended to verify RADIUS server logs for authentication request sent by device.

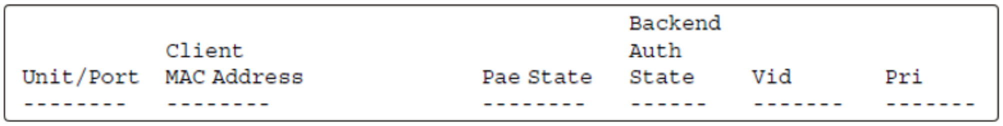
```
Switch(config)# ping 10.100.68.2
(Host is reachable)

Switch(config)# ping 10.100.68.3
(Host is reachable)
```

5. Set the EAPOL status.

```
Switch(config)# eapol guest-vlan vid 20
Switch(config)# eapol guest-vlan enable
Switch(config)# eapol multihost fail-open-vlan vid 30
Switch(config)# eapol multihost fail-open-vlan enable
Switch(config)# interface Ethernet 1/15,2/15
Switch(config-if)# eapol guest-vlan enable
Switch(config-if)# eapol status auto
Switch(config-if)# exit
Switch(config)# eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

6. Before EAP clients are authenticated, confirm the EAPOL MultiHost status.

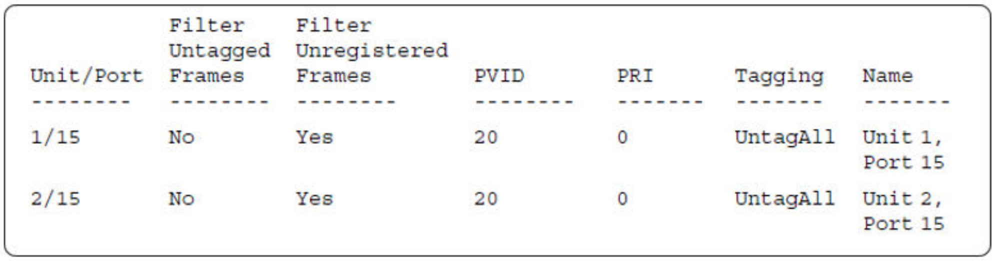
```
Switch(config)# show eapol multihost status
```



```
                                                Backend
           Client                               Auth
Unit/Port  MAC Address               Pae State  State     Vid       Pri
--------   --------                  --------   ------    -------   -------
```

7. Confirm the VLAN interface settings.

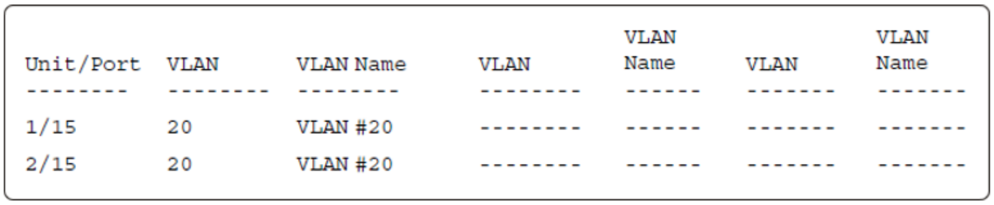
```
Switch(config)# show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI      Tagging   Name
--------   --------  --------      --------  -------  -------   -------
1/15       No        Yes           20        0        UntagAll  Unit 1,
                                                                Port 15
2/15       No        Yes           20        0        UntagAll  Unit 2,
                                                                Port 15
```

8. Confirm the VLAN interface VIDs.

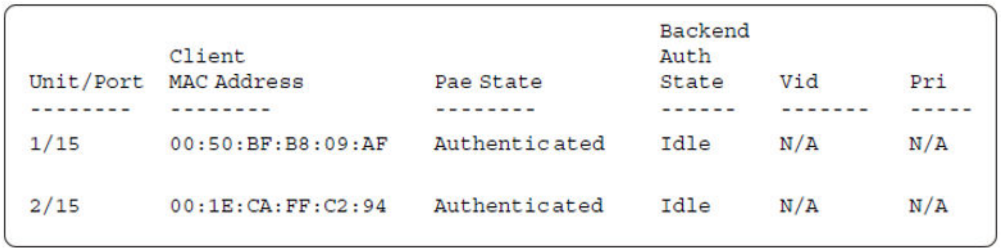
```
Switch(config)# show vlan interface vids 1/15,2/15
```



```
                                                  VLAN                VLAN
Unit/Port   VLAN      VLAN Name     VLAN          Name      VLAN      Name
--------    --------  --------      --------      ------    -------   -------
1/15        20        VLAN #20      --------      ------    -------   -------
2/15        20        VLAN #20      --------      ------    -------   -------
```

9. After EAP clients are authenticated, confirm the EAPOL MultiHost status.

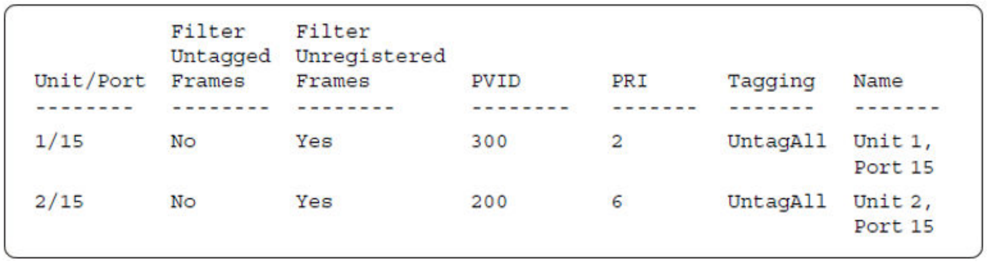
```
Switch(config)# show eapol multihost status
```



```
                                                    Backend
            Client                                  Auth
Unit/Port   MAC Address         Pae State           State     Vid        Pri
--------    --------            --------            ------    -------    -----
1/15        00:50:BF:B8:09:AF   Authenticated       Idle      N/A        N/A

2/15        00:1E:CA:FF:C2:94   Authenticated       Idle      N/A        N/A
```

10. Confirm the VLAN interface settings.

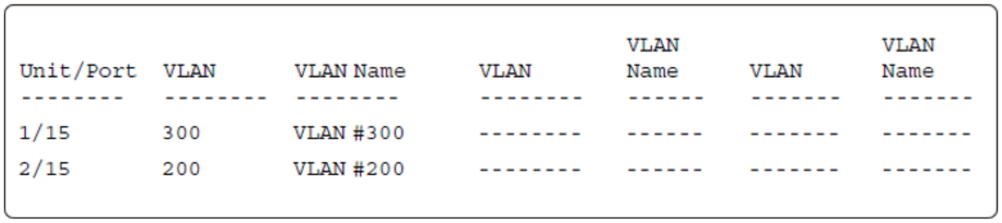
```
Switch(config)# show vlan interface info 1/15,2/15
```



```
            Filter     Filter
            Untagged   Unregistered
Unit/Port   Frames     Frames         PVID        PRI       Tagging    Name
--------    --------   --------       --------    -------   -------    -------
1/15        No         Yes            300         2         UntagAll   Unit 1,
                                                                       Port 15
2/15        No         Yes            200         6         UntagAll   Unit 2,
                                                                       Port 15
```

11. Confirm the VLAN interface VIDs.

```
Switch(config)# show vlan interface vids 1/15,2/15
```



```
                                                  VLAN                VLAN
Unit/Port   VLAN      VLAN Name     VLAN          Name      VLAN      Name
--------    --------  --------      --------      ------    -------   -------
1/15        300       VLAN #300     --------      ------    -------   -------
2/15        200       VLAN #200     --------      ------    -------   -------
```

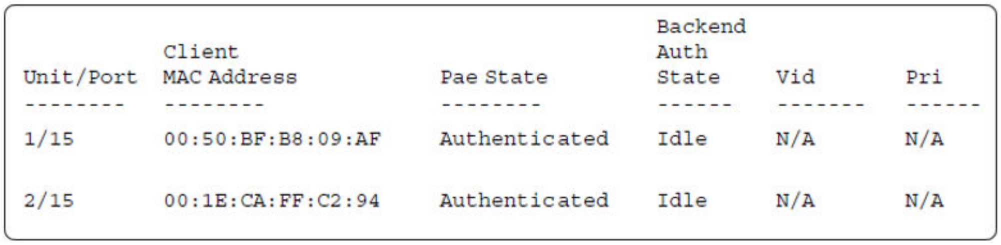
12. Disconnect both primary and back-up RADIUS servers from the network (unplug cables from server side).

13. Attempt to reach the primary and back-up RADIUS servers.

```
Switch(config)# ping 10.100.68.2
(Host is not reachable)
Switch(config)# ping 10.100.68.3
(Host is not reachable)
```

14. After approximately 3 minutes, confirm the EAPOL MultiHost status again.

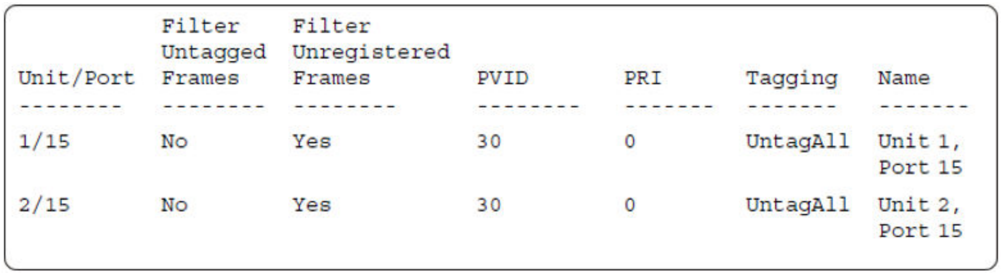
```
Switch(config)# show eapol multihost status
```



```
                                                   Backend
           Client                                  Auth
Unit/Port  MAC Address          Pae State          State    Vid       Pri
--------   --------             --------           ------   -------   ------
1/15       00:50:BF:B8:09:AF    Authenticated      Idle     N/A       N/A

2/15       00:1E:CA:FF:C2:94    Authenticated      Idle     N/A       N/A
```

15. Confirm the VLAN interface settings.

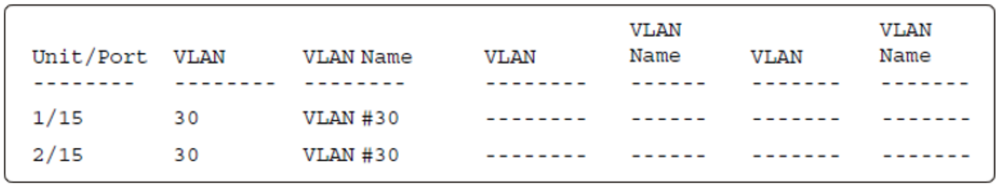
```
Switch(config)# show vlan interface info 1/15,2/15
```



```
           Filter     Filter
           Untagged   Unregistered
Unit/Port  Frames     Frames         PVID       PRI       Tagging    Name
--------   --------   --------       --------   -------   -------    -------
1/15       No         Yes            30         0         UntagAll   Unit 1,
                                                                     Port 15

2/15       No         Yes            30         0         UntagAll   Unit 2,
                                                                     Port 15
```

16. Confirm the VLAN interface VIDs.

```
Switch(config)# show vlan interface vids 1/15,2/15
```



```
                                                VLAN                VLAN
Unit/Port  VLAN       VLAN Name     VLAN        Name     VLAN       Name
--------   --------   --------      --------    ------   -------    -------
1/15       30         VLAN #30      --------    ------   -------    -------
2/15       30         VLAN #30      --------    ------   -------    -------
```

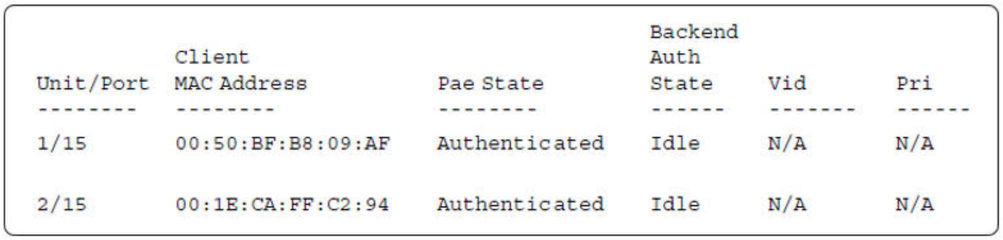
17. Connect primary or back-up RADIUS server to network (plug in cables from server side). For this example, the primary RADIUS server is connected.

18. After approximately 1 minute, attempt to reach the primary RADIUS server.

```
Switch(config)# ping 10.100.68.2
(Host is reachable)
```

19. Confirm the EAPOL MultiHost status again.

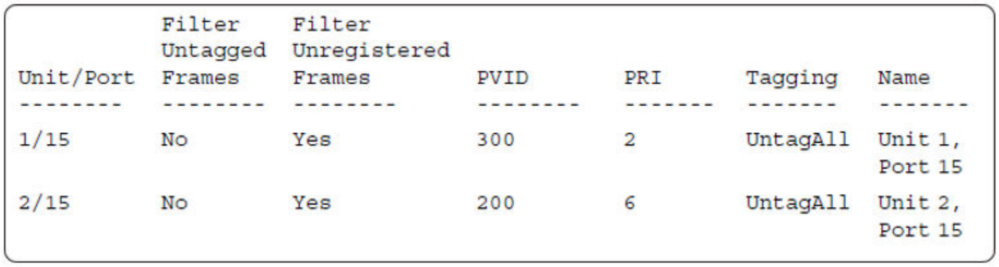
```
Switch(config)# show eapol multihost status
```



```
                                                     Backend
                Client                               Auth
Unit/Port       MAC Address         Pae State        State     Vid        Pri
--------        --------            --------         ------    -------    ------
1/15            00:50:BF:B8:09:AF   Authenticated    Idle      N/A        N/A

2/15            00:1E:CA:FF:C2:94   Authenticated    Idle      N/A        N/A
```

20. Confirm the VLAN interface settings.

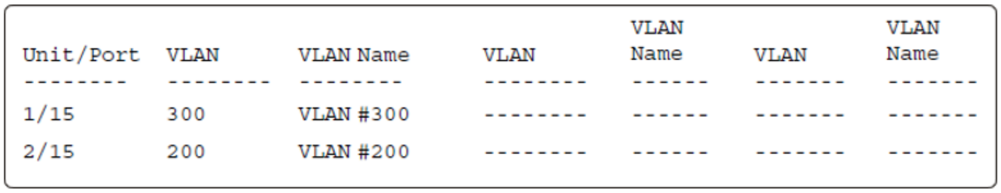
```
Switch(config)# show vlan interface info 1/15,2/15
```



```
           Filter     Filter
           Untagged   Unregistered
Unit/Port  Frames     Frames         PVID       PRI       Tagging    Name
--------   --------   --------       --------   -------   -------    -------
1/15       No         Yes            300        2         UntagAll   Unit 1,
                                                                     Port 15
2/15       No         Yes            200        6         UntagAll   Unit 2,
                                                                     Port 15
```

21. Confirm the VLAN interface VIDs.

```
Switch(config)# show vlan interface vids 1/15,2/15
```



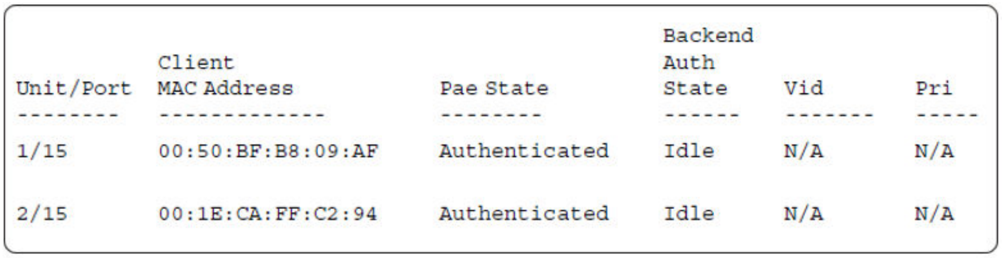
```
                                                   VLAN                VLAN
Unit/Port   VLAN        VLAN Name    VLAN          Name     VLAN       Name
--------    --------    --------     --------      ------   -------    -------
1/15        300         VLAN #300    --------      ------   -------    -------
2/15        200         VLAN #200    --------      ------   -------    -------
```

22. Enable EAPOL MultiHost MultiVLAN.

```
Switch(config)# eapol disable
Switch(config)# eapol multihost multivlan enable
Switch(config)# eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

23. After EAP clients are authenticated, confirm EAPOL MultiHost status.

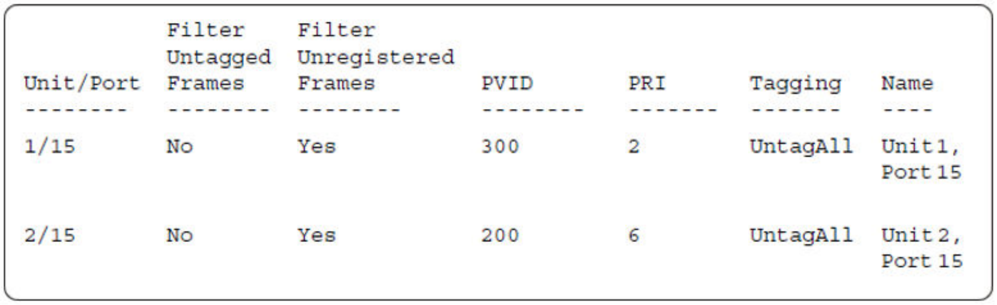
```
Switch(config)# show eapol multihost status
```



```
                                                        Backend
            Client                                      Auth
Unit/Port   MAC Address           Pae State             State     Vid        Pri
--------    -------------         --------              ------    -------    -----
1/15        00:50:BF:B8:09:AF     Authenticated         Idle      N/A        N/A

2/15        00:1E:CA:FF:C2:94     Authenticated         Idle      N/A        N/A
```

24. Confirm the VLAN interface settings.

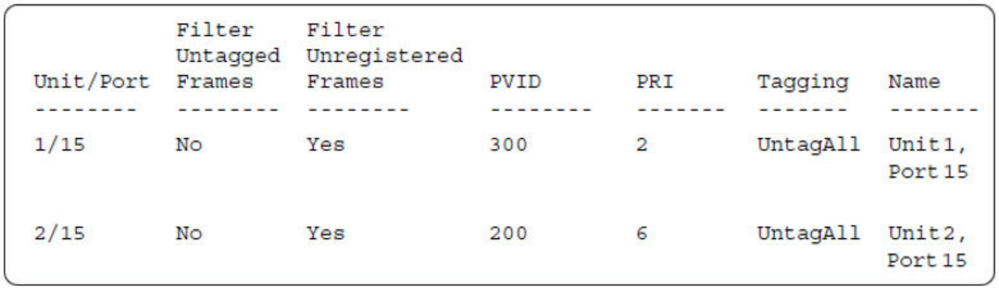
```
Switch(config)# show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI      Tagging   Name
---------  --------  --------      --------  -------  -------   ----
1/15       No        Yes           300       2        UntagAll  Unit1,
                                                                Port15

2/15       No        Yes           200       6        UntagAll  Unit2,
                                                                Port15
```

25. Confirm the VLAN interface settings.

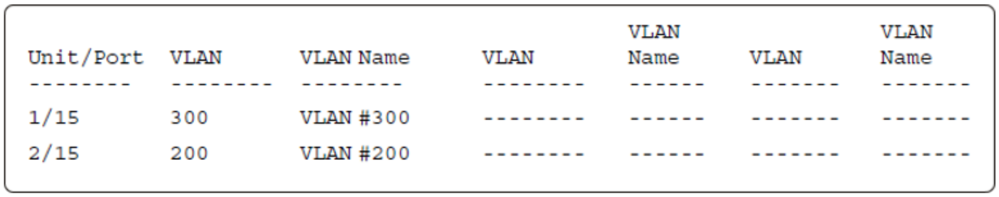
```
Switch(config)# show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI      Tagging   Name
---------  --------  --------      --------  -------  -------   -------
1/15       No        Yes           300       2        UntagAll  Unit1,
                                                                Port15

2/15       No        Yes           200       6        UntagAll  Unit2,
                                                                Port15
```

26. Confirm the VLAN interface VIDs.

```
Switch(config)# show vlan interface vids 1/15,2/15
```



```
                                                  VLAN              VLAN
Unit/Port  VLAN      VLAN Name     VLAN      Name      VLAN     Name
---------  --------  --------      --------  ------    -------  -------
1/15       300       VLAN #300     --------  ------    -------  -------
2/15       200       VLAN #200     --------  ------    -------  -------
```

Alternate configuration

The following operation applies to **SHSA authentication mode with Guest VLAN, Fail Open VLAN (Multihost MultiVLAN option enabled) without valid RADIUS attributes**, when the RADIUS server has no special attributes configured or the RADIUS server uses misconfigured attributes (not matching the device configuration).

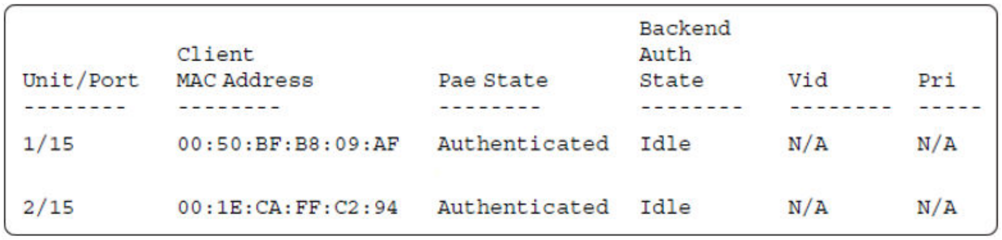
This configuration example modifies EAP and NEAP client attributes on the RADIUS server, replacing VLAN ID 300 with VLAN ID 124, which is not configured on the device.

1. Enable EAPOL.

```
Switch(config)# eapol disable
Switch(config)# eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

2. After EAP clients are authenticated, confirm EAPOL MultiHost status.

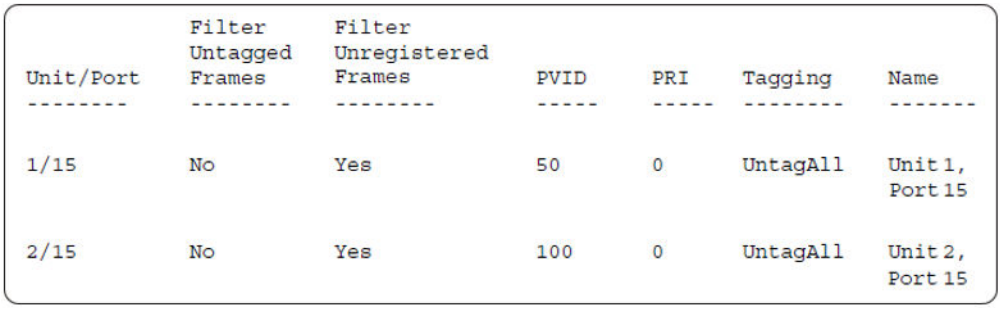
```
Switch(config)# show eapol multihost status
```



```
                                                   Backend
          Client                                   Auth
Unit/Port MAC Address          Pae State           State       Vid       Pri
--------  --------             --------            --------    --------  -----
1/15      00:50:BF:B8:09:AF    Authenticated       Idle        N/A       N/A

2/15      00:1E:CA:FF:C2:94    Authenticated       Idle        N/A       N/A
```

3. Confirm the VLAN interface settings.

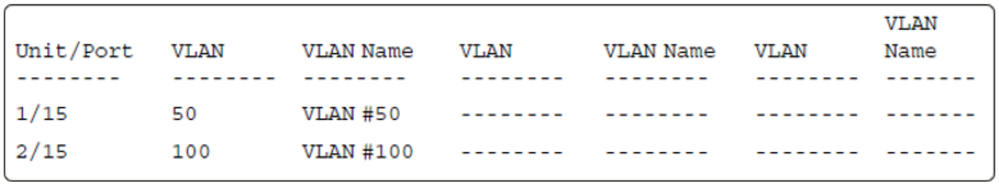
```
Switch(config)# show vlan interface info 1/15,2/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames        PVID   PRI    Tagging    Name
--------  --------  --------      -----  -----  --------   -------

1/15      No        Yes           50     0      UntagAll   Unit 1,
                                                           Port 15

2/15      No        Yes           100    0      UntagAll   Unit 2,
                                                           Port 15
```

4. Confirm the VLAN interface VIDs.

```
Switch(config)# show vlan interface vids 1/15,2/15
```



```
                                                                VLAN
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      Name
--------   --------  --------   --------  --------   --------  -------
1/15       50        VLAN #50   --------  --------   --------  -------
2/15       100       VLAN #100  --------  --------   --------  -------
```

MHSA authentication mode (with or without RADIUS VLAN and with or without Multihost MultiVLAN enabled)

The configuration example in this section applies to the following client port settings when:

- 802.1X is disabled on the port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
- an unauthenticated client is on the port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
- an authenticated client is on the port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs but no RADIUS attribute is received, or an invalid RADIUS attribute is received, for the client

- an authenticated client is on the port—the port is included in the RADIUS VLAN ID and it uses the RADIUS VLAN PVID so that valid RADIUS attributes are received for the client

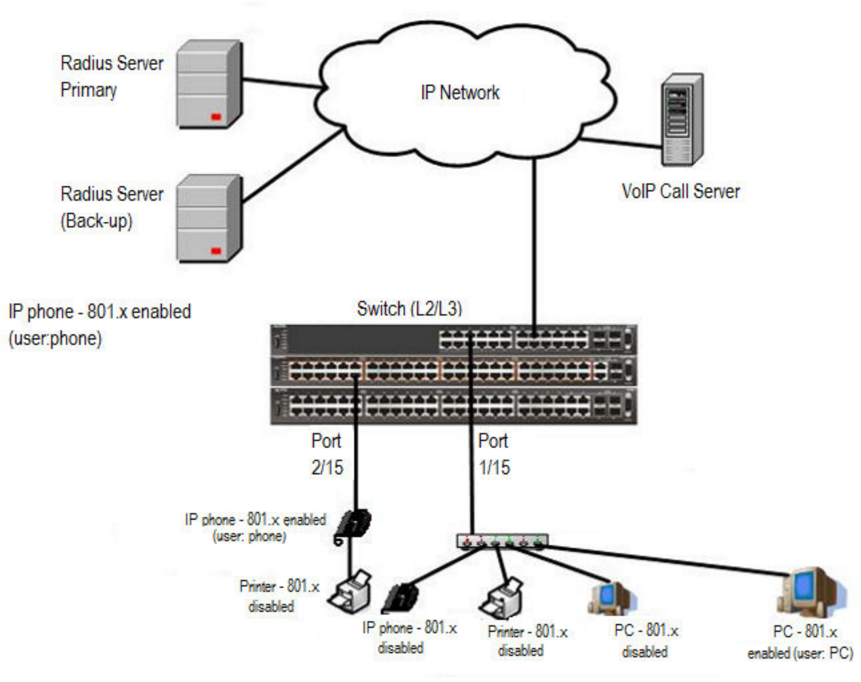


Figure 43: MHSA authentication mode (with or without RADIUS VLAN and with or without Multihost MultiVLAN enabled)

Scenario

Assume the following settings:

- Primary RADIUS server configured with two users:
  - user: phone with attribute VLAN ID: 200, Port priority: 6
  - user: PC with attribute VLAN ID: 300, Port priority: 2
- Backup RADIUS server configured with the same two users:
  - user: phone with attribute VLAN ID: 200, Port priority: 6
  - user: PC with attribute VLAN ID: 300, Port priority: 2
- Port 2/15—801.x enabled IP phone connected - (user: phone)
  - Initial VLAN ID = 100
  - RADIUS VLAN ID = 200
- Port 1/15—801.x enabled PC connected - (user: PC)
  - Initial VLAN ID = 50
  - RADIUS VLAN ID = 300

- 802.1x phone client VLAN ID/PVID port 2/15 settings:
  - 801.x disabled on port 100/100
  - Unauthenticated client on port 100/100
  - Authenticated (user: phone):
    - 100/100 (No RADIUS attribute received or Invalid RADIUS attributes received)
    - 200/200 (Valid RADIUS attributes received)
- 802.1x PC client VLAN ID/PVID port 1/15 settings:
  - 801.x disabled on port 50/50
  - Unauthenticated client on port 50/50
  - Authenticated client on port (user: PC):
    - 50/50 (No RADIUS attribute received or Invalid RADIUS attributes received)
    - 300/300 (Valid RADIUS attributes received)

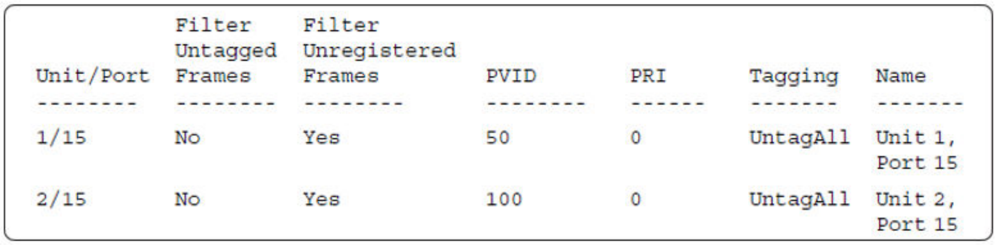
Configuration example

1. Configure the RADIUS servers and VLAN settings

```
Switch(config)# ip address 10.100.68.254 netmask 255.255.255.0 default-gateway 10.100.68.1
Switch(config)# radius-server host 10.100.68.2
Switch(config)# radius-server secondary-host 10.100.68.3
Switch(config)# radius-server key
Enter key: RadiusKey
Enter key: RadiusKey
Switch(config)# vlan configcontrol automatic
Switch(config)# vlan create 50 type port
Switch(config)# vlan create 100 type port
Switch(config)# vlan create 200 type port
Switch(config)# vlan create 300 type port
Switch(config)# vlan members add 50 1/15
Switch(config)# vlan members add 100 2/15
```

2. Confirm the VLAN interface settings

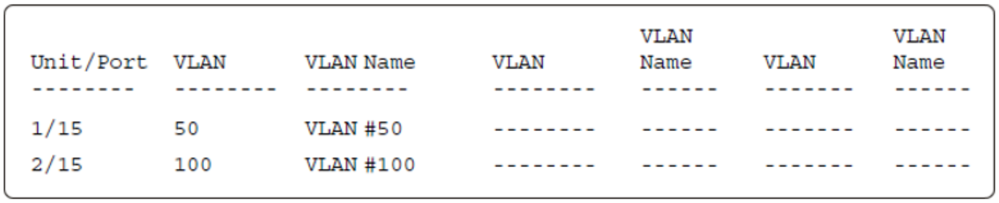
```
Switch(config)# sho vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI     Tagging   Name
---------  --------  --------      --------  ------  -------   -------
1/15       No        Yes           50        0       UntagAll  Unit 1,
                                                               Port 15

2/15       No        Yes           100       0       UntagAll  Unit 2,
                                                               Port 15
```

3. Confirm the VLAN interface VIDs

```
Switch(config)#sho vlan interface info 1/15,2/15
```



```
                                                 VLAN                VLAN
Unit/Port   VLAN       VLAN Name      VLAN       Name     VLAN       Name
--------    --------   --------       --------   ------   -------    ------
1/15        50         VLAN #50       --------   ------   -------    ------
2/15        100        VLAN #100      --------   ------   -------    ------
```

4. Confirm that you can reach the RADIUS server

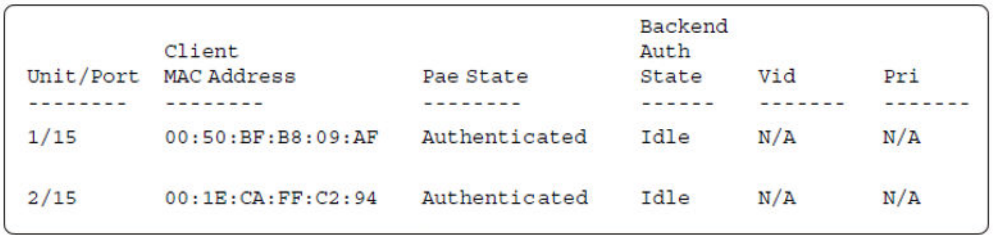
```
Switch(convig)#ping 10.100.68.2
(Host is reachable)
```

5. Set the EAPOL status

```
Switch(config)#interface Ethernet 1/15,2/15
Switch(config-if)#eapol multihost auto-non-eap-mhsa-enable
Switch(config-if)#eapol multihost non-eap-mac-max 4
Switch(config-if)#eapol multihost enable
Switch(config-if)#eapol status auto
Switch(config-if)#exit
Switch(config)#eapol multihost auto-non-eap-mhsa-enable
Switch(config)#eapol enable
```

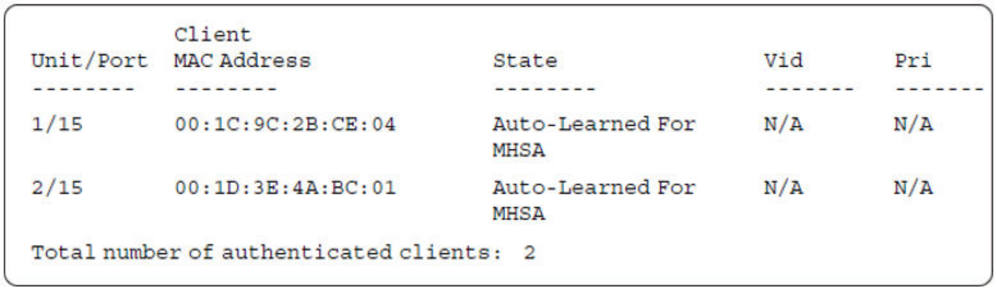
6. Confirm the EAPOL MultiHost status

```
Switch(config)#show eapol multihost status
```



```
                                                  Backend
            Client                                Auth
Unit/Port   MAC Address         Pae State         State    Vid       Pri
--------    --------            --------          ------   -------   -------
1/15        00:50:BF:B8:09:AF   Authenticated     Idle     N/A       N/A

2/15        00:1E:CA:FF:C2:94   Authenticated     Idle     N/A       N/A
```

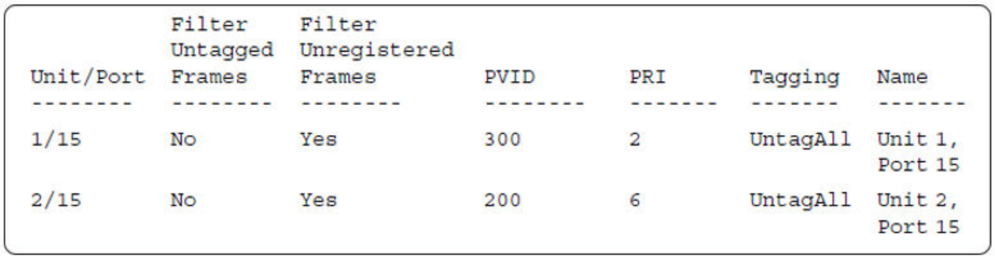
```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
            Client
Unit/Port   MAC Address          State              Vid       Pri
--------    --------             --------           -------   -------
1/15        00:1C:9C:2B:CE:04    Auto-Learned For   N/A       N/A
                                 MHSA
2/15        00:1D:3E:4A:BC:01    Auto-Learned For   N/A       N/A
                                 MHSA
Total number of authenticated clients:  2
```

7. Confirm the VLAN interface settings

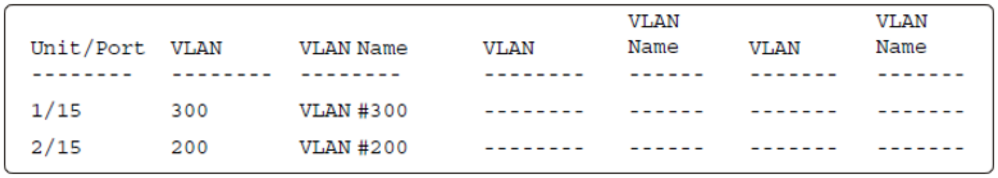
```
Switch(config)# show vlan interface info 1/15,2/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames        PVID      PRI      Tagging   Name
--------  --------  --------      --------  -------  -------   -------
1/15      No        Yes           300       2        UntagAll  Unit 1,
                                                               Port 15
2/15      No        Yes           200       6        UntagAll  Unit 2,
                                                               Port 15
```

8. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



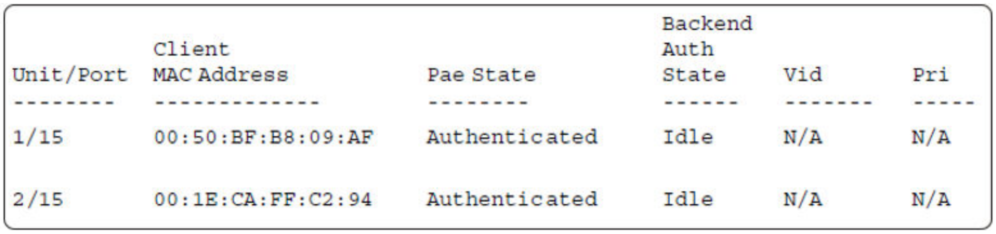
```
                                                VLAN              VLAN
Unit/Port  VLAN      VLAN Name     VLAN         Name     VLAN     Name
--------   --------  --------      --------     ------   -------  -------
1/15       300       VLAN #300     --------     ------   -------  -------
2/15       200       VLAN #200     --------     ------   -------  -------
```

9. Enable EAPOL MultiHost MultiVLAN.

```
Switch(config)#eapol disable
Switch(config)#eapol multihost multivlan enable
Switch(config)#eapol enable
```

10. Confirm EAPOL MultiHost status.

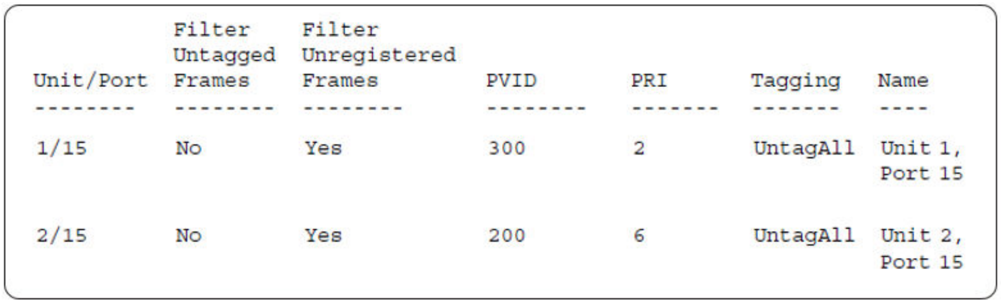
```
Switch(config)#show eapol multihost status
```



```
                                                Backend
           Client                               Auth
Unit/Port  MAC Address          Pae State       State    Vid      Pri
--------   -------------        --------        ------   -------  -----
1/15       00:50:BF:B8:09:AF    Authenticated   Idle     N/A      N/A

2/15       00:1E:CA:FF:C2:94    Authenticated   Idle     N/A      N/A
```

11. Confirm the VLAN interface settings.

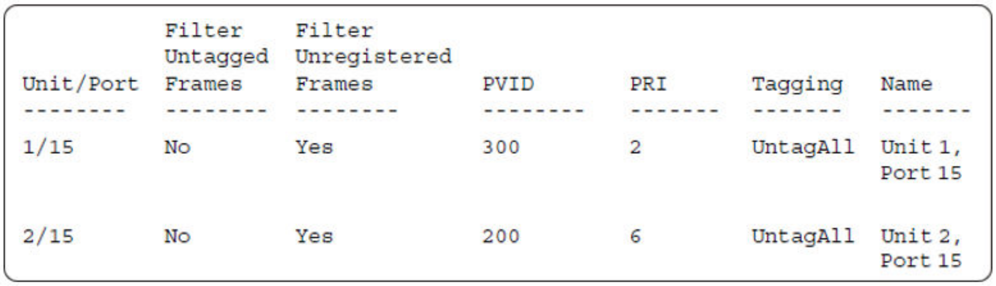
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames        PVID      PRI      Tagging   Name
--------  --------  --------      --------  -------  -------   ----
 1/15     No        Yes           300       2        UntagAll  Unit 1,
                                                               Port 15


 2/15     No        Yes           200       6        UntagAll  Unit 2,
                                                               Port 15
```

12. Confirm the VLAN interface settings.

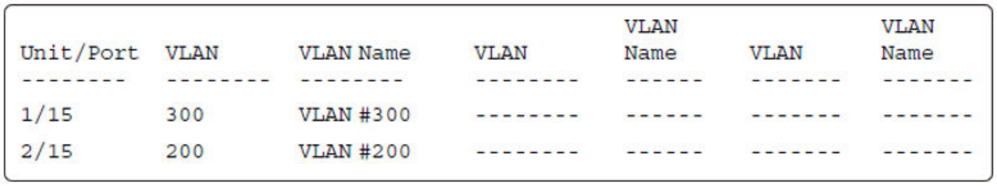
```
Switch(config)#show vlan interfce info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI      Tagging   Name
--------   --------  --------      --------  -------  -------   -------
1/15       No        Yes           300       2        UntagAll  Unit 1,
                                                                Port 15

2/15       No        Yes           200       6        UntagAll  Unit 2,
                                                                Port 15
```

13. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/14,2/15
```



```
                                             VLAN               VLAN
Unit/Port  VLAN      VLAN Name   VLAN      Name     VLAN      Name
--------   --------  --------    --------  ------   -------   -------
1/15       300       VLAN #300   --------  ------   -------   -------
2/15       200       VLAN #200   --------  ------   -------   -------
```

Alternate configuration

The following operation applies to **MHSA authentication mode (Multihost MultiVLAN enabled) without valid RADIUS attributes**, when the RADIUS server has no special attributes configured or the RADIUS server uses misconfigured attributes (not matching the device configuration).

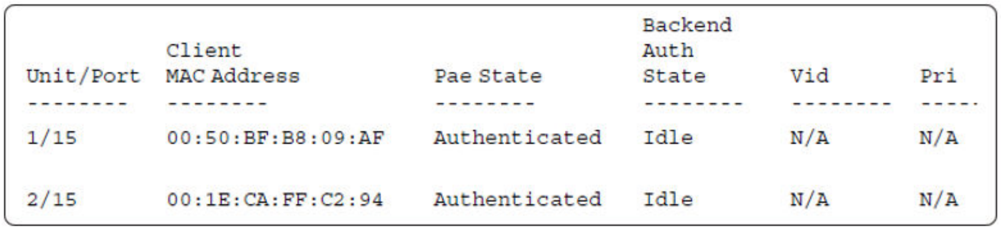
This configuration example modifies EAP and NEAP client attributes on the RADIUS server, replacing VLAN ID 200 with VLAN ID 123, and VLAN ID 300 with VLAN ID 124, which is not configured on the device.

1. Enable EAPOL MultiHost MultiVLAN

```
Switch(config)#eapol disable
Switch(config)#eapol multihost multivlan enable
Switch(config)#eapol enable
```

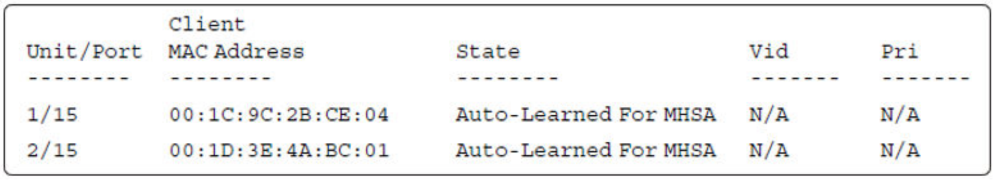
2. Confirm EAPOL MultiHost status.

```
Switch(config)#show eapol multihost status
```



```
                                                Backend
           Client                               Auth
Unit/Port  MAC Address        Pae State        State     Vid       Pri
--------   --------           --------         --------  --------  -----
1/15       00:50:BF:B8:09:AF  Authenticated    Idle      N/A       N/A

2/15       00:1E:CA:FF:C2:94  Authenticated    Idle      N/A       N/A
```

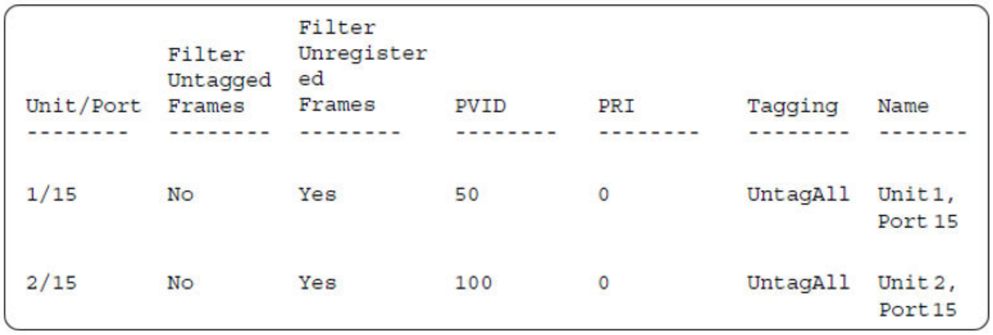
```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
            Client
Unit/Port   MAC Address           State                  Vid        Pri
---------   ---------             ---------              --------   --------
1/15        00:1C:9C:2B:CE:04     Auto-Learned For MHSA  N/A        N/A
2/15        00:1D:3E:4A:BC:01     Auto-Learned For MHSA  N/A        N/A
```

3. Confirm the VLAN interface settings.

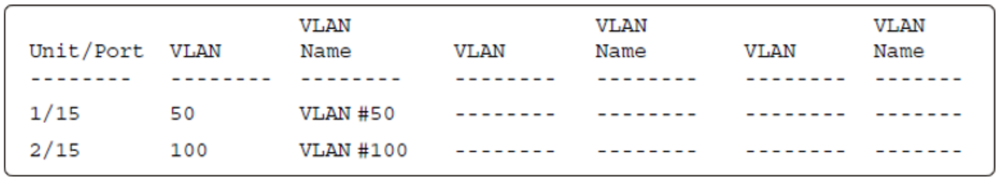
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
                       Filter
            Filter     Unregister
            Untagged   ed
Unit/Port   Frames     Frames     PVID       PRI        Tagging    Name
---------   --------   --------   --------   --------   --------   -------

1/15        No         Yes        50         0          UntagAll   Unit1,
                                                                   Port 15

2/15        No         Yes        100        0          UntagAll   Unit 2,
                                                                   Port15
```

4. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
                      VLAN                   VLAN                  VLAN
Unit/Port   VLAN      Name        VLAN       Name        VLAN      Name
---------   --------  --------    --------   --------    --------  -------
1/15        50        VLAN #50    --------   --------    --------  -------
2/15        100       VLAN #100   --------   --------    --------  -------
```

MHSA authentication mode (Guest VLAN option enabled) with or without RADIUS additional attributes with or without Multihost MultiVLAN

The configuration example in this section applies to the following client port settings when:

- 801.x disabled on port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
- an unauthenticated client is on the port—the port is included in the Guest VLAN ID, and the port uses the Guest VLAN PVID
- an authenticated client is on the port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs but no RADIUS attribute is received, or an invalid RADIUS attribute is received for the client
- an authenticated client is on the port—the port is included in the RADIUS VLAN ID and it uses the RADIUS VLAN PVID so that valid RADIUS attributes are received for the client

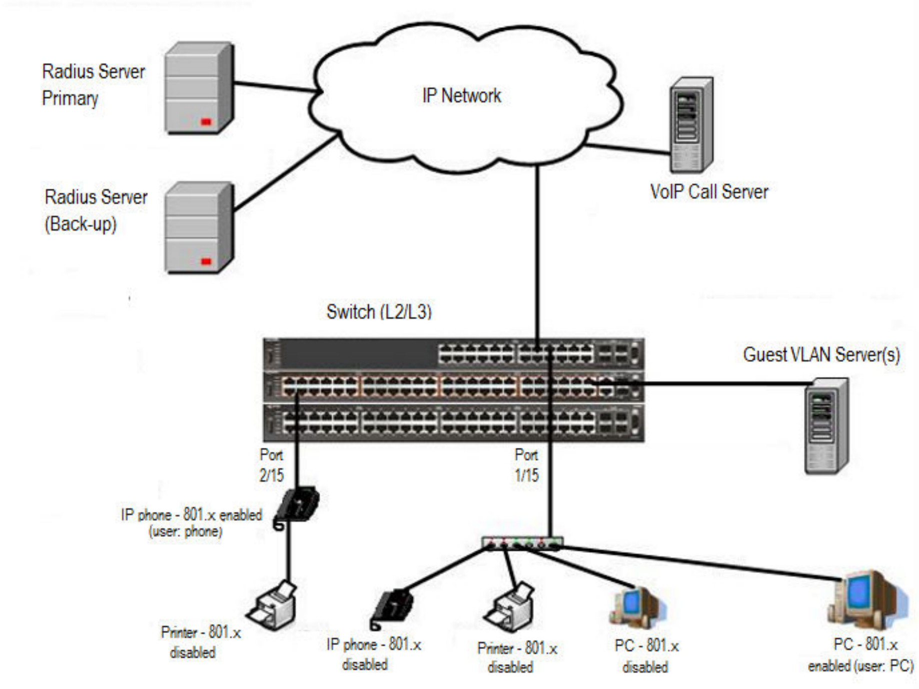


Figure 44: MHSA authentication mode (Guest VLAN option enabled) with or without RADIUS additional attributes with or without Multihost MultiVLAN

Scenario

Assume the following settings:

- Primary RADIUS server configured with two users:
  - user: phone with attribute VLAN ID: 200, Port priority: 6
  - user: PC with attribute VLAN ID: 300, Port priority: 2
- Backup RADIUS server configured with the same two users:
  - user: phone with attribute VLAN ID: 200, Port priority: 6
  - user: PC with attribute VLAN ID: 300, Port priority: 2
- Port 2/15—801.x enabled IP phone connected - (user: phone)
  - Initial VLAN ID = 100
  - Guest VLAN ID = 20
  - RADIUS VLAN ID = 200
- Port 1/15—801.x enabled PC connected - (user: PC)
  - Initial VLAN ID = 50
  - Guest VLAN ID = 20
  - RADIUS VLAN ID = 300

- 802.1x phone client VLAN ID/PVID port 2/15 settings:
  - 801.x disabled on port 100/100
  - Unauthenticated client on port 20/20
  - Authenticated (user: phone):
    - 100/100 (No RADIUS attribute received or Invalid RADIUS attributes received)
    - 200/200 (Valid RADIUS attributes received)
- 802.1x PC client VLAN ID/PVID port 1/15 settings:
  - 801.x disabled on port 50/50
  - Unauthenticated client on port 20/20
  - Authenticated client on port (user: PC):
    - 50/50 (No RADIUS attribute received or Invalid RADIUS attributes received)
    - 300/300 (Valid RADIUS attributes received)

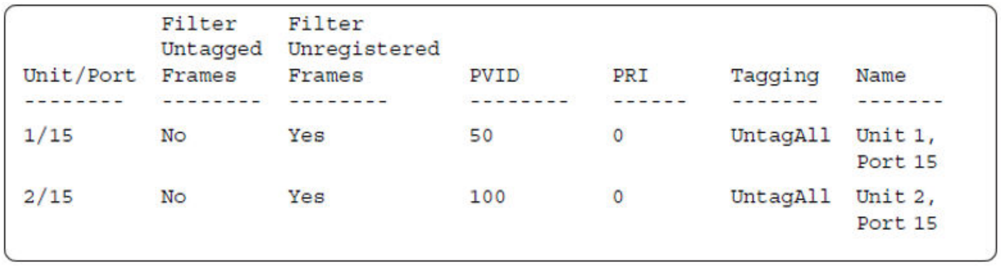
Configuration example

1. Configure the RADIUS servers and VLAN settings

```
Switch(config)#ip address10.100.68.254 netmask 255.255.255.0 default-gateway 10.100.68.1
Switch(config)#radius-serverhost 10.100.68.2
Switch(config)#radius-server secondary-host 10.100.68.3
Switch(config)#radius-server key
Enter key: RadiusKey
Enter key: RadiusKey
Switch(config)#vlan configcontrol automatic
Switch(config)#vlan create 20 type port
Switch(config)#vlan create 50 type port
Switch(config)#vlan create 100 type port
Switch(config)#vlan create 200 type port
Switch(config)#vlan create 300 type port
Switch(config)#vlan members add 50 1/15
Switch(config)#vlan members add 100 2/15
```

2. Confirm the VLAN interface settings.

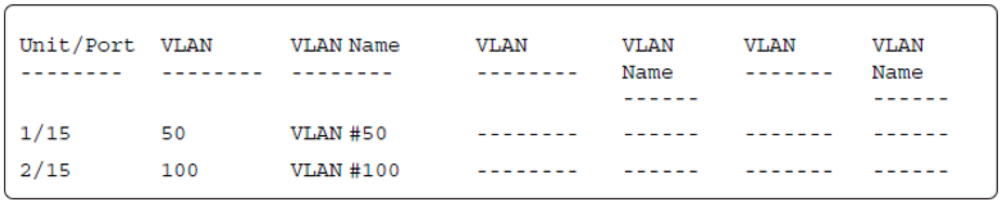
```
Switch(config)#sho vlan interfaceinfo 1/15,2/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames        PVID      PRI     Tagging   Name
--------  --------  --------      --------  ------  -------   -------
1/15      No        Yes           50        0       UntagAll  Unit 1,
                                                              Port 15
2/15      No        Yes           100       0       UntagAll  Unit 2,
                                                              Port 15
```

3. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
Unit/Port  VLAN      VLAN Name     VLAN      VLAN    VLAN     VLAN
--------   --------  --------      --------  Name    -------  Name
                                             ------           ------

1/15       50        VLAN #50      --------  ------  -------  ------
2/15       100       VLAN #100     --------  ------  -------  ------
```

4. Confirm that you can reach the RADIUS server.

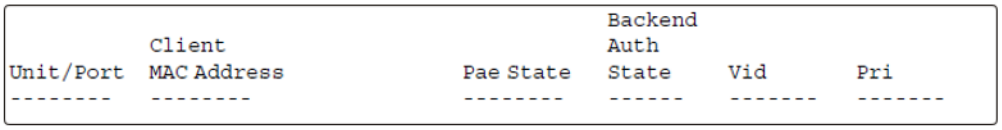
```
Switch(config)#ping 10.100.68.2
(Host is reachable)
```

5. Set the EAPOL status.

```
Switch(config)#eapol guest-vlanvid 20
Switch(config)#eapol guest-vlan enable
Switch(config)#interface Ethernet 1/15,2/15
Switch(config-if)#eapol multihost auto-non-eap-mhsa-enable
Switch(config-if)#eapolmultihost non-eap-mac-max 4
Switch(config-if)#eapol multihost enable
Switch(config-if)#eapol status auto
Switch(config-if)#exit
Switch(config)#eapol multihost auto-non-eap-mhsa-enable
Switch(config)#eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

6. Before EAP clients are authenticated, confirm the EAPOL MultiHost status

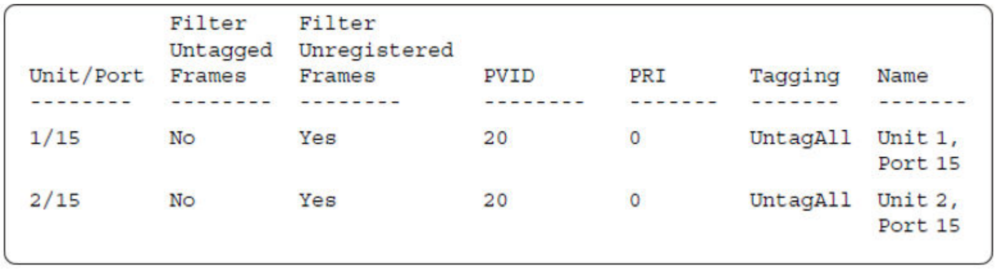
```
Switch(config)#show eapol multihost status
```



```
                                                       Backend
           Client                                      Auth
Unit/Port  MAC Address                      Pae State  State   Vid      Pri
--------   --------                         --------   ------  -------  -------
```

7. Confirm the VLAN interface settings.

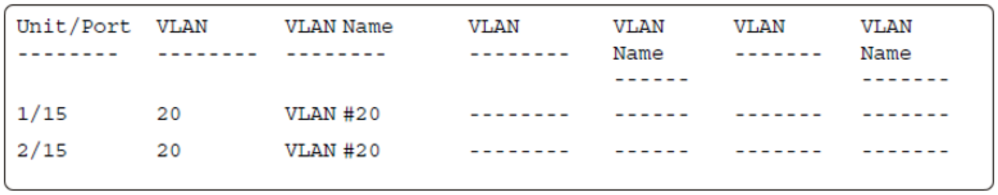
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI      Tagging   Name
--------   --------  --------      --------  -------  -------   -------

1/15       No        Yes           20        0        UntagAll  Unit 1,
                                                                Port 15

2/15       No        Yes           20        0        UntagAll  Unit 2,
                                                                Port 15
```

8. Confirm the VLAN interface VIDs.

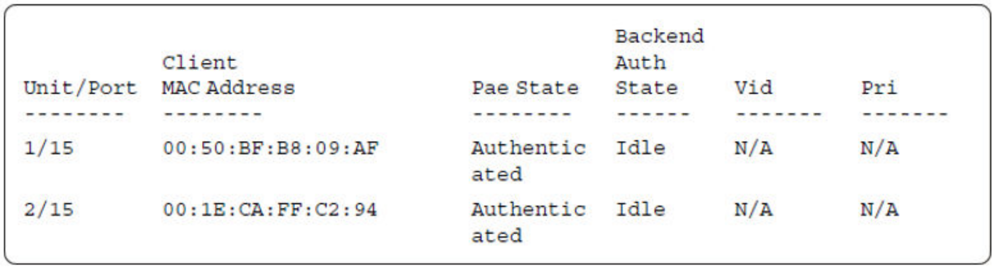
```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
Unit/Port  VLAN      VLAN Name    VLAN      VLAN    VLAN     VLAN
--------   --------  --------     --------  Name    -------  Name
                                            ------           -------
1/15       20        VLAN #20     --------  ------  -------  -------
2/15       20        VLAN #20     --------  ------  -------  -------
```

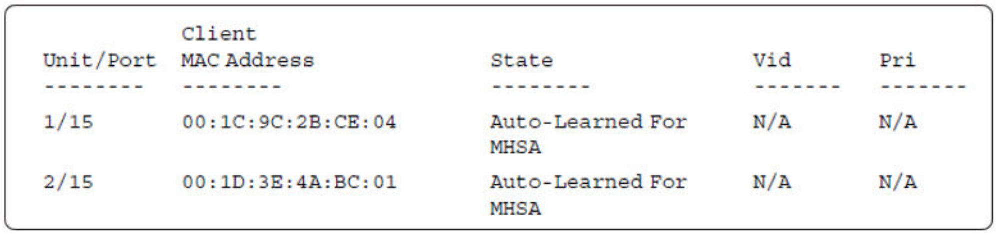
9. After EAP clients are authenticated, confirm the EAPOL MultiHost status.

```
Switch(config)#show eapol multihost status
```



```
                                                    Backend
            Client                                  Auth
Unit/Port   MAC Address                 Pae State   State    Vid      Pri
--------    --------                    --------    ------   -------  -------
1/15        00:50:BF:B8:09:AF           Authentic   Idle     N/A      N/A
                                        ated
2/15        00:1E:CA:FF:C2:94           Authentic   Idle     N/A      N/A
                                        ated
```

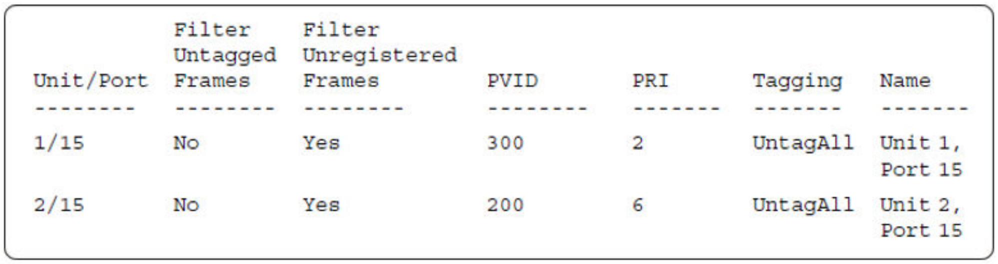
```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
            Client
Unit/Port   MAC Address                State               Vid      Pri
--------    --------                   --------            -------  -------
1/15        00:1C:9C:2B:CE:04          Auto-Learned For    N/A      N/A
                                       MHSA
2/15        00:1D:3E:4A:BC:01          Auto-Learned For    N/A      N/A
                                       MHSA
```

10. Confirm the VLAN interface settings.

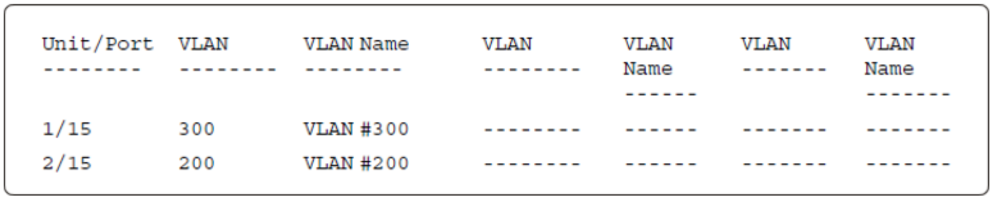
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
            Filter    Filter
            Untagged  Unregistered
Unit/Port   Frames    Frames         PVID      PRI      Tagging   Name
--------    --------  --------       --------  -------  -------   -------
1/15        No        Yes            300       2        UntagAll  Unit 1,
                                                                  Port 15
2/15        No        Yes            200       6        UntagAll  Unit 2,
                                                                  Port 15
```

11. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



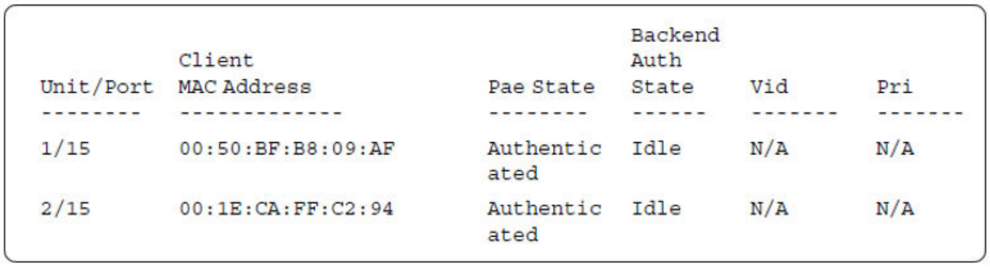
```
Unit/Port  VLAN      VLAN Name      VLAN      VLAN     VLAN      VLAN
--------   --------  --------       --------  Name     -------   Name
                                              ------             -------

1/15       300       VLAN #300      --------  ------   -------   -------
2/15       200       VLAN #200      --------  ------   -------   -------
```

12. Enable EAPOL MultiHost MultiVLAN.

```
Switch(config)#eapol disable
Switch(config)#eapol multihost multivlan enable
Switch(config)#eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

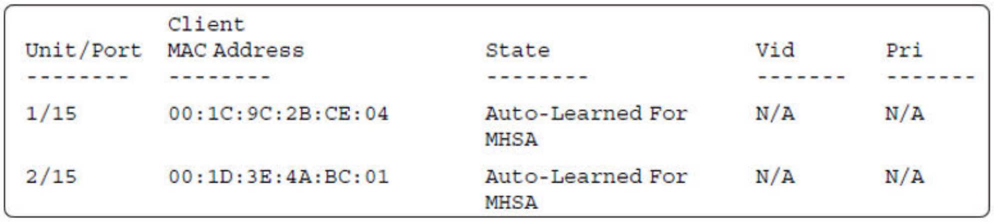
13. Confirm EAPOL MultiHost status.

```
Switch(config)#show eapol multihost status
```



```
                                                 Backend
           Client                                Auth
Unit/Port  MAC Address             Pae State     State    Vid      Pri
--------   -------------           --------      ------   -------  -------
1/15       00:50:BF:B8:09:AF       Authentic     Idle     N/A      N/A
                                   ated
2/15       00:1E:CA:FF:C2:94       Authentic     Idle     N/A      N/A
                                   ated
```

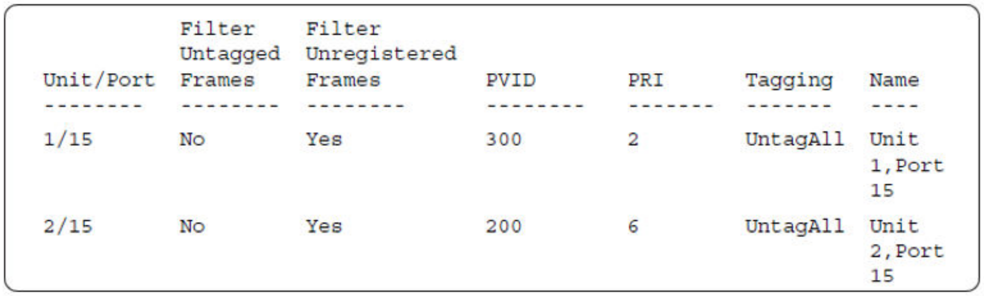
```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
           Client
Unit/Port  MAC Address             State                Vid       Pri
--------   --------                --------             -------   -------
1/15       00:1C:9C:2B:CE:04       Auto-Learned For     N/A       N/A
                                   MHSA
2/15       00:1D:3E:4A:BC:01       Auto-Learned For     N/A       N/A
                                   MHSA
```

14. Confirm the VLAN interface settings.

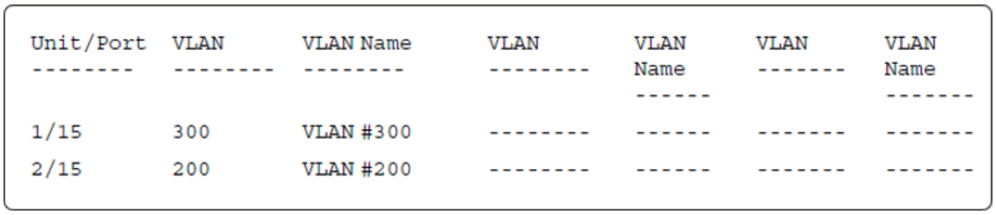
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames         PVID      PRI      Tagging   Name
--------   --------  --------       --------  -------  -------   ----
1/15       No        Yes            300       2        UntagAll  Unit
                                                                 1,Port
                                                                 15

2/15       No        Yes            200       6        UntagAll  Unit
                                                                 2,Port
                                                                 15
```

15. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
Unit/Port  VLAN      VLAN Name     VLAN      VLAN    VLAN     VLAN
--------   --------  --------      --------  Name    -------  Name
                                             ------           -------

1/15       300       VLAN #300     --------  ------  -------  -------
2/15       200       VLAN #200     --------  ------  -------  -------
```

Alternate configuration

The following operation applies to **MHSA authentication mode with Guest VLAN (Multihost MultiVLAN enabled) without valid RADIUS attributes**, when the RADIUS server has no special attributes configured or the RADIUS server uses misconfigured attributes (not matching the device configuration).

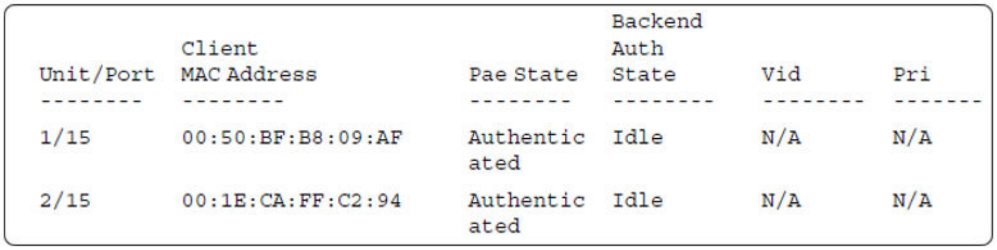
This configuration example modifies EAP and NEAP client attributes on the RADIUS server, replacing VLAN ID 200 with VLAN ID 123, and VLAN ID 300 with VLAN ID 124, which is not configured on the device.

1. Enable EAPOL MultiHost MultiVLAN.

```
Switch(config)#eapol disable
Switch(config)#eapol multihost multivlan enable
Switch(config)#eapol enable
% Depending on your stack configuation it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

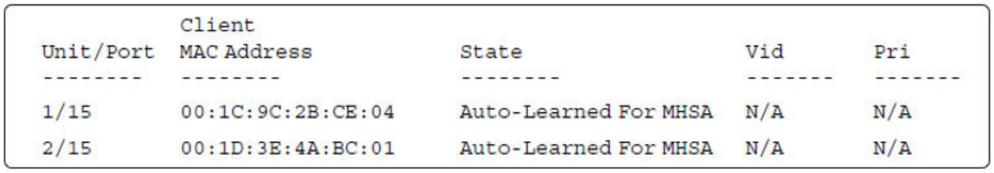
2. Confirm EAPOL MultiHost status.

```
Switch(config)#show eapol multihost status
```



```
                                                     Backend
           Client                                    Auth
Unit/Port  MAC Address                   Pae State   State     Vid       Pri
--------   --------                      --------    --------  --------  -------
1/15       00:50:BF:B8:09:AF             Authentic   Idle      N/A       N/A
                                         ated
2/15       00:1E:CA:FF:C2:94             Authentic   Idle      N/A       N/A
                                         ated
```

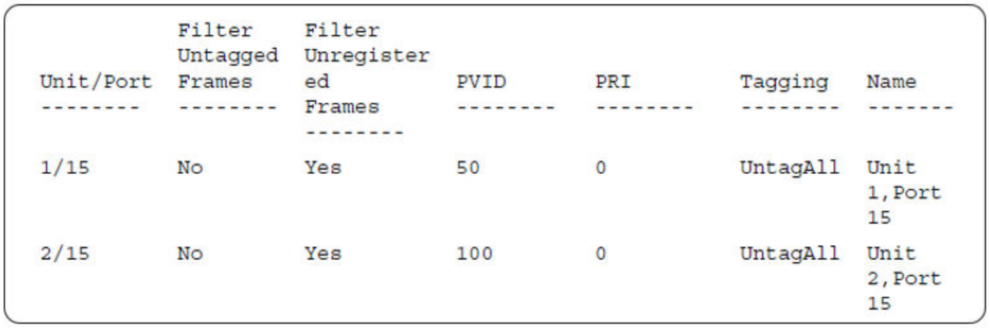
```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
           Client
Unit/Port  MAC Address         State                 Vid      Pri
--------   --------            --------              -------  -------
1/15       00:1C:9C:2B:CE:04   Auto-Learned For MHSA N/A      N/A
2/15       00:1D:3E:4A:BC:01   Auto-Learned For MHSA N/A      N/A
```

3. Confirm the VLAN interface settings.

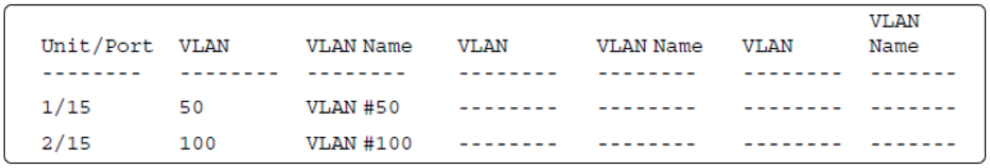
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregister
Unit/Port  Frames    ed          PVID      PRI       Tagging   Name
--------   --------  Frames      --------  --------  --------  -------
                     --------

1/15       No        Yes         50        0         UntagAll  Unit
                                                               1,Port
                                                               15

2/15       No        Yes         100       0         UntagAll  Unit
                                                               2,Port
                                                               15
```

4. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
                                                               VLAN
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      Name
--------   --------  --------   --------  --------   --------  -------
1/15       50        VLAN #50   --------  --------   --------  -------
2/15       100       VLAN #100  --------  --------   --------  -------
```

MHSA authentication mode (Guest VLAN and Fail Open VLAN options enabled) with or without RADIUS additional attributes and with or without Multihost MultiVLAN option

The configuration example in this section applies to the following client port settings when:

- 801.x disabled on port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
- an unauthenticated client is on the port—the port is included in the Guest VLAN ID, and the port uses the Guest VLAN PVID
- an authenticated client is on the port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs but no RADIUS attribute is received, or an invalid RADIUS attribute is received, for the client
- an authenticated client is on the port—the port is included in the RADIUS VLAN ID and it uses the RADIUS VLAN PVID so that valid RADIUS attributes are received for the client
- RADIUS Server Unreachable (801.x enabled)—the port is included in the Fail Open VLAN, and the port uses the Fail Open VLAN PVID

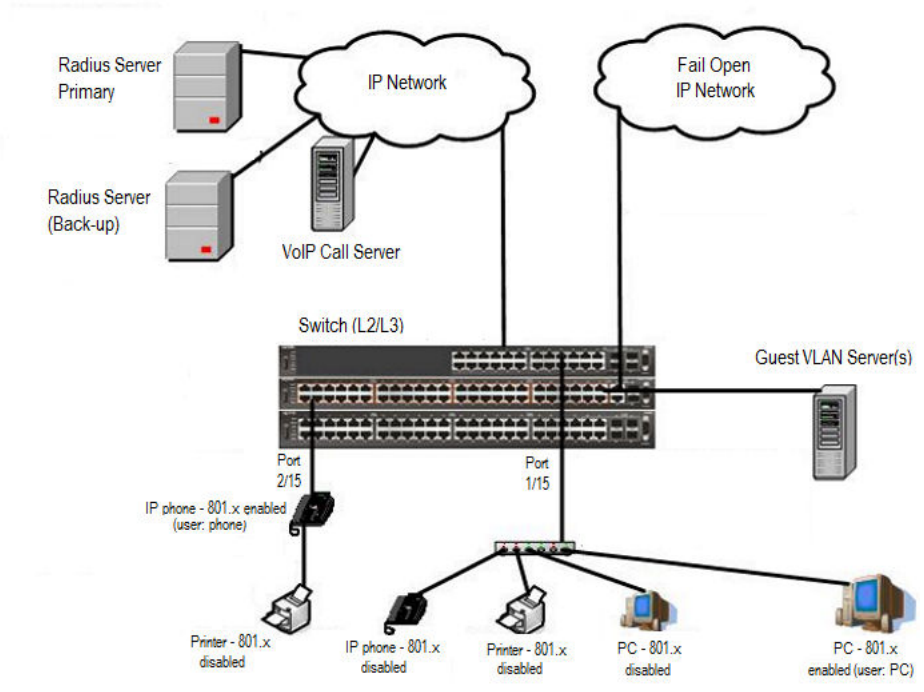


Figure 45: MHSA authentication mode (Guest VLAN and Fail Open VLAN options enabled) with or without RADIUS additional attributes and with or without Multihost MultiVLAN option

Scenario

Assume the following settings:

- Primary RADIUS server configured with two users:
  - user: phone with attribute VLAN ID: 200, Port priority: 6
  - user: PC with attribute VLAN ID: 300, Port priority: 2
- Backup RADIUS server configured with the same two users:
  - user: phone with attribute VLAN ID: 200, Port priority: 6
  - user: PC with attribute VLAN ID: 300, Port priority: 2
- Port 2/15—801.x enabled IP phone connected - (user: phone)
  - Initial VLAN ID = 100
  - Guest VLAN ID = 20
  - Fail Open VLAN ID = 30
  - RADIUS VLAN ID = 200
- Port 1/15—801.x enabled PC connected - (user: PC)
  - Initial VLAN ID = 50
  - Guest VLAN ID = 20

  - Fail Open VLAN ID = 30
  - RADIUS VLAN ID = 300
- 802.1x phone client VLAN ID/PVID port 2/15 settings:
  - 801.x disabled on port 100/100
  - Unauthenticated client on port 20/20
  - Authenticated (user: phone):
    - 100/100 (No RADIUS attribute received or Invalid RADIUS attributes received)
    - 200/200 (Valid RADIUS attributes received)
  - Radius Server Unreachable (801.x enabled) – 30/30
- 802.1x PC client VLAN ID/PVID port 1/15 settings:
  - 801.x disabled on port 50/50
  - Unauthenticated client on port 20/20
  - Authenticated client on port (user: PC):
    - 50/50 (No RADIUS attribute received or Invalid RADIUS attributes received)
    - 300/300 (Valid RADIUS attributes received)
  - Radius Server Unreachable (801.x enabled) – 30/30

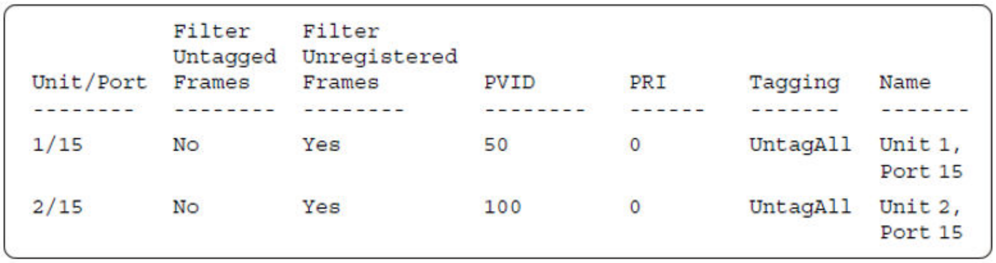
Configuration example

1. Configure the RADIUS servers and VLAN settings

```
Switch(config)#ip address 10.100.68.254 netmask 255.255.255.0 default-gateway 10.100.68.1
Switch(config)#radius-server host 10.100.68.2
Switch(config)#radius-server secondary-host 10.100.68.3
Switch(config)#radius-server key
Enter key: RadiusKey
Enter key: RadiusKey
Switch(config)#vlan configcontrol automatic
Switch(config)#vlan create 20 type port
Switch(config)#vlan create 30 type port
Switch(config)#vlan create 50 type port
Switch(config)#vlan create 100 type port
Switch(config)#vlan create 200 type port
Switch(config)#vlan create 300 type port
Switch(config)#vlan members add 50 1/15
Switch(config)#vlan members add 100 2/15
```

2. Confirm the VLAN interface settings.

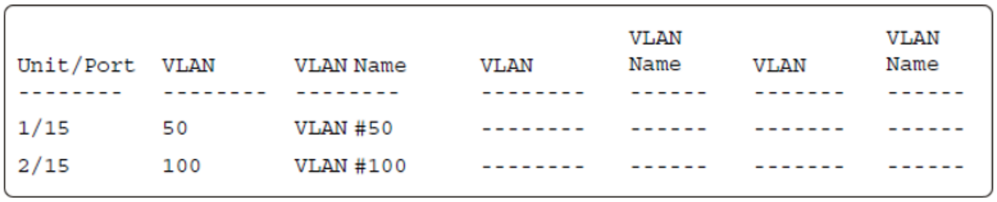
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
          Filter   Filter
          Untagged Unregistered
Unit/Port Frames   Frames       PVID     PRI    Tagging  Name
--------- -------- --------     -------- ------ -------  -------
1/15      No       Yes          50       0      UntagAll Unit 1,
                                                         Port 15
2/15      No       Yes          100      0      UntagAll Unit 2,
                                                         Port 15
```

3. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
                                                VLAN              VLAN
Unit/Port  VLAN      VLAN Name      VLAN        Name    VLAN      Name
--------   --------  --------       --------    ------  -------   ------
1/15       50        VLAN #50       --------    ------  -------   ------
2/15       100       VLAN #100      --------    ------  -------   ------
```

4. Confirm that you can reach the RADIUS server.

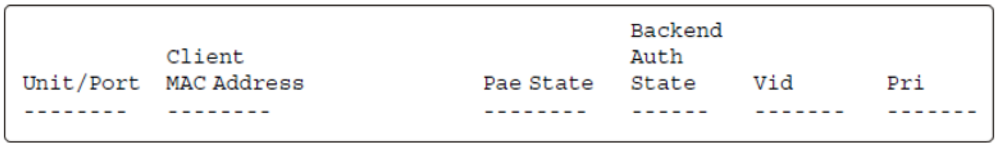
```
Switch(config)#ping 10.100.68.2
(Host is reachable)
```

5. Set the EAPOL status.

```
Switch(config)#eapol guest-vlan vid 20
Switch(config)#eapol guest-vlan enable
Switch(config)#eapol multihost fail-open-vlan vid 30
Switch(config)#eapol multihost fail-open-vlan enable
Switch(config)#interface Ethernet 1/15,2/15
Switch(config-if)#eapol multihost auto-non-eap-mhsa-enable
Switch(config-if)#eapol multihost non-eap-mac-max 4
Switch(config-if)#eapol multihost enable
Switch(config-if)#eapol status auto
Switch(config-if)#exit
Switch(config)#eapol multihost auto-non-eap-mhsa-enable
Switch(config)#eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

6. Before EAP clients are authenticated, confirm the EAPOL MultiHost status.

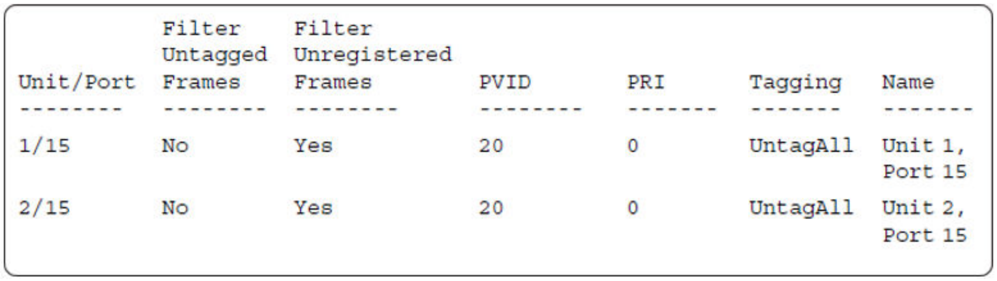
```
Switch(config)#show eapol multihost status
```



```
                                                 Backend
           Client                                Auth
Unit/Port  MAC Address               Pae State   State   Vid       Pri
--------   --------                  --------    ------  -------   -------
```

7. Confirm the VLAN interface settings.

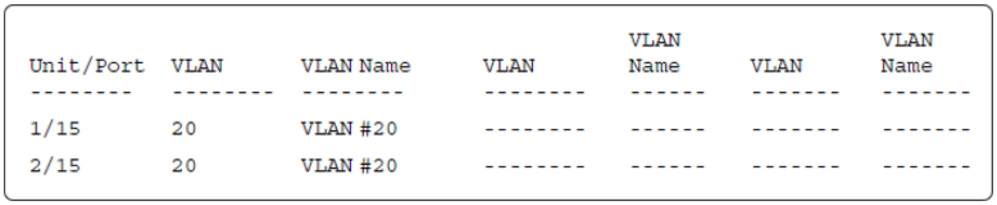
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames         PVID      PRI      Tagging   Name
--------   --------  --------       --------  -------  -------   -------
1/15       No        Yes            20        0        UntagAll  Unit 1,
                                                                 Port 15
2/15       No        Yes            20        0        UntagAll  Unit 2,
                                                                 Port 15
```

8. Confirm the VLAN interface VIDs.

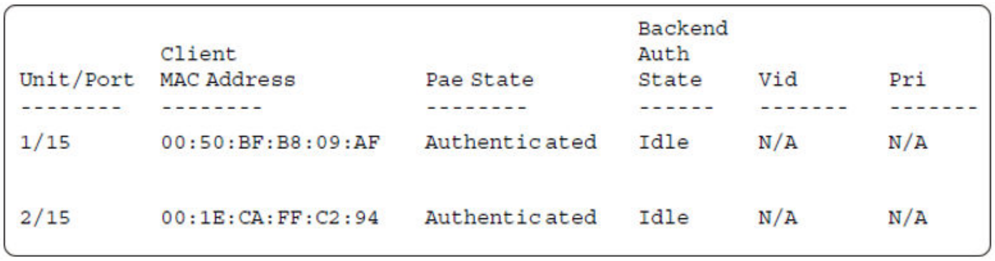
```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
                                                VLAN              VLAN
Unit/Port  VLAN      VLAN Name    VLAN          Name     VLAN     Name
--------   --------  --------     --------      ------   -------  -------
1/15       20        VLAN #20     --------      ------   -------  -------
2/15       20        VLAN #20     --------      ------   -------  -------
```

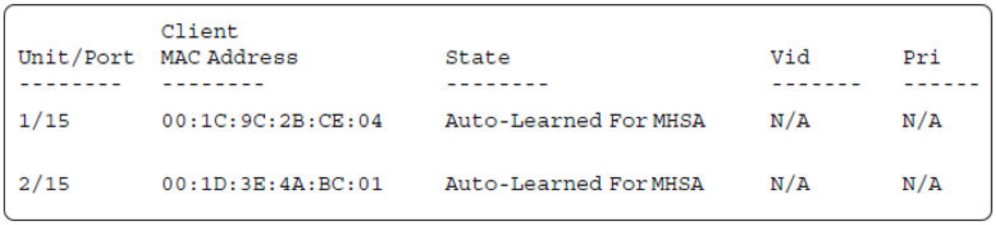
9. After EAP clients are authenticated, confirm the EAPOL MultiHost status.

```
Switch(config)#show eapol multihost status
```



```
                                                  Backend
           Client                                 Auth
Unit/Port  MAC Address        Pae State           State    Vid      Pri
--------   --------           --------            ------   -------  -------
1/15       00:50:BF:B8:09:AF  Authenticated       Idle     N/A      N/A


2/15       00:1E:CA:FF:C2:94  Authenticated       Idle     N/A      N/A
```

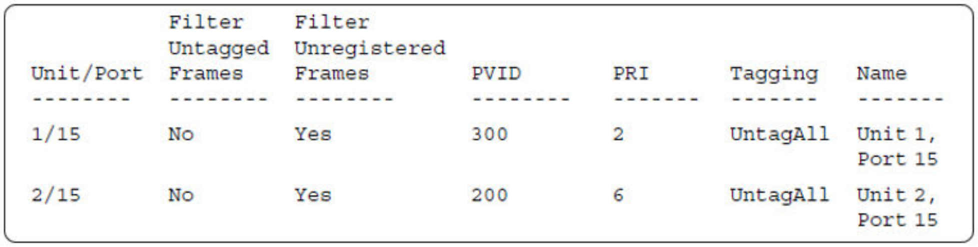
```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
           Client
Unit/Port  MAC Address        State                     Vid      Pri
--------   --------           --------                  -------  ------
1/15       00:1C:9C:2B:CE:04  Auto-Learned For MHSA     N/A      N/A

2/15       00:1D:3E:4A:BC:01  Auto-Learned For MHSA     N/A      N/A
```

10. Confirm the VLAN interface settings.

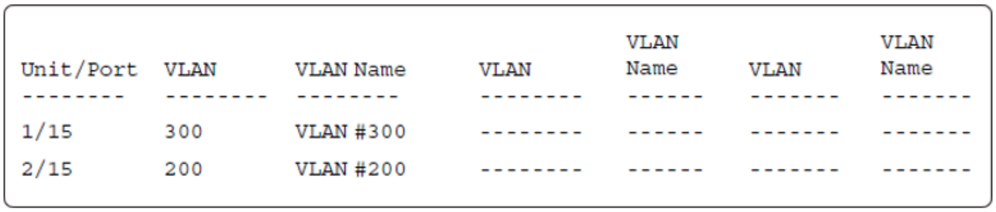
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI      Tagging   Name
--------   --------  --------      --------  -------  -------   -------
1/15       No        Yes           300       2        UntagAll  Unit 1,
                                                                Port 15
2/15       No        Yes           200       6        UntagAll  Unit 2,
                                                                Port 15
```

11. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
                                                    VLAN                VLAN
Unit/Port  VLAN      VLAN Name   VLAN      Name    VLAN     Name
--------   --------  --------    --------  ------  -------  -------
1/15       300       VLAN #300   --------  ------  -------  -------
2/15       200       VLAN #200   --------  ------  -------  -------
```

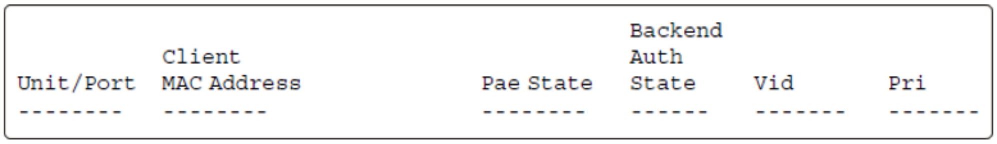
12. Disconnect both primary and back-up RADIUS servers from the network (unplug cables from server side).

13. Attempt to reach the primary and back-up RADIUS servers.

```
Switch(config)#ping 10.100.68.2
(Host is not reachable)
Switch(config)#ping 10.100.68.3
(Host is not reachable)
```

14. After approximately 3 minutes, confirm the EAPOL MultiHost status again.

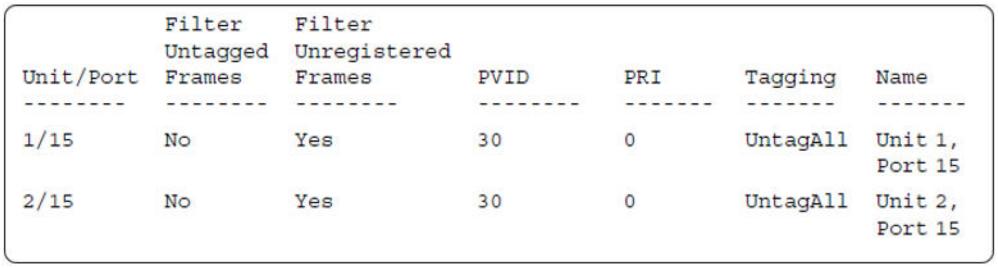
```
Switch(config)#show eapol multihost status
```



```
                                              Backend
           Client                             Auth
Unit/Port  MAC Address            Pae State   State   Vid      Pri
--------   --------               --------    ------  -------  -------
```

15. Confirm the VLAN interface settings.

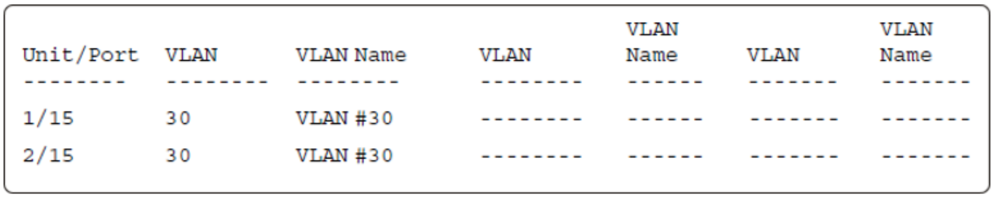
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI      Tagging   Name
--------   --------  --------      --------  -------  -------   -------
1/15       No        Yes           30        0        UntagAll  Unit 1,
                                                                Port 15
2/15       No        Yes           30        0        UntagAll  Unit 2,
                                                                Port 15
```

16. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
                                                    VLAN                VLAN
Unit/Port  VLAN      VLAN Name   VLAN      Name    VLAN     Name
--------   --------  --------    --------  ------  -------  -------
1/15       30        VLAN #30    --------  ------  -------  -------
2/15       30        VLAN #30    --------  ------  -------  -------
```

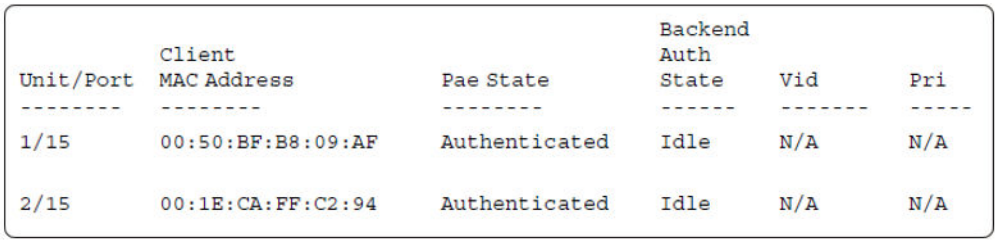
17. Connect primary or back-up RADIUS server to network (plug in cables from server side). For this example, the primary RADIUS server is connected.

18. After approximately 1 minute, attempt to reach the primary RADIUS server.

```
Switch(config)#ping 10.100.68.2
(Host is reachable)
```

19. Confirm the EAPOL MultiHost status again.

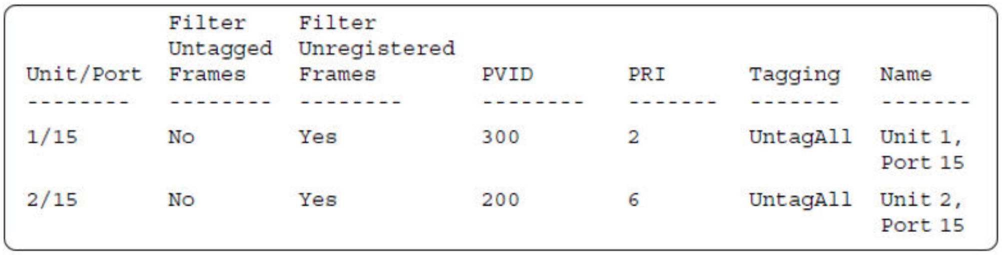
```
Switch(config)#show eapol multihost status
```



```
                                               Backend
            Client                             Auth
Unit/Port   MAC Address          Pae State     State    Vid       Pri
--------    --------             --------      ------   -------   -----
1/15        00:50:BF:B8:09:AF    Authenticated Idle     N/A       N/A

2/15        00:1E:CA:FF:C2:94    Authenticated Idle     N/A       N/A
```

20. Confirm the VLAN interface settings.

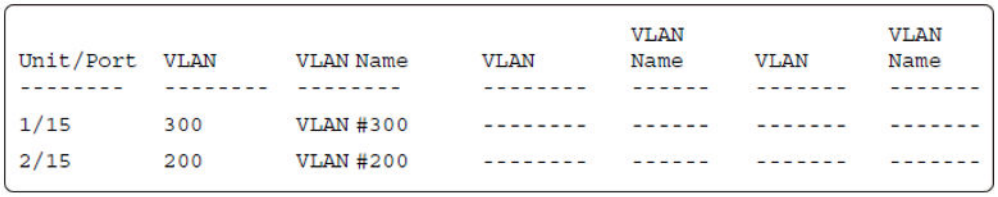
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
            Filter      Filter
            Untagged    Unregistered
Unit/Port   Frames      Frames         PVID       PRI       Tagging    Name
--------    --------    --------       --------   -------   -------    -------
1/15        No          Yes            300        2         UntagAll   Unit 1,
                                                                       Port 15
2/15        No          Yes            200        6         UntagAll   Unit 2,
                                                                       Port 15
```

21. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



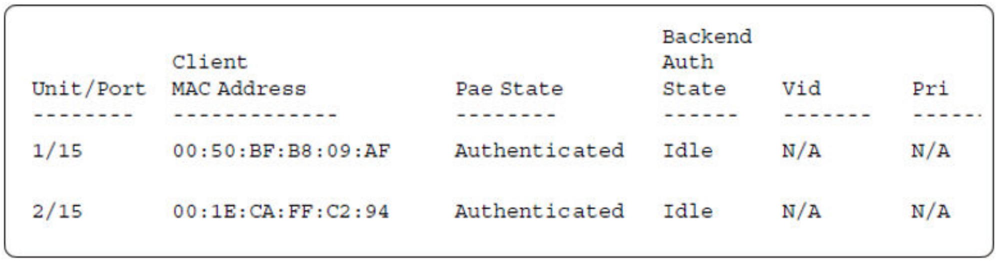
```
                                                  VLAN                VLAN
Unit/Port   VLAN        VLAN Name     VLAN        Name     VLAN       Name
--------    --------    --------      --------    ------   -------    -------
1/15        300         VLAN #300     --------    ------   -------    -------
2/15        200         VLAN #200     --------    ------   -------    -------
```

22. Enable EAPOL MultiHost MultiVLAN.

```
Switch(config)#eapol disable
Switch(config)#eapol multihost multivlan enable
Switch(config)#eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

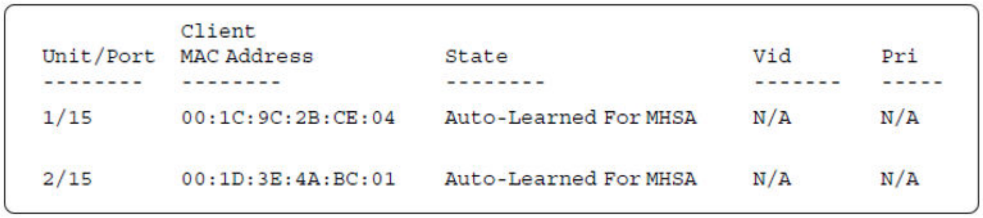
23. After EAP clients are authenticated, confirm EAPOL MultiHost status.

```
Switch(config)#show eapol multihost status
```



```
                                                   Backend
              Client                               Auth
Unit/Port     MAC Address         Pae State        State     Vid       Pri
--------      -------------       --------         ------    -------   ------
1/15          00:50:BF:B8:09:AF   Authenticated    Idle      N/A       N/A

2/15          00:1E:CA:FF:C2:94   Authenticated    Idle      N/A       N/A
```

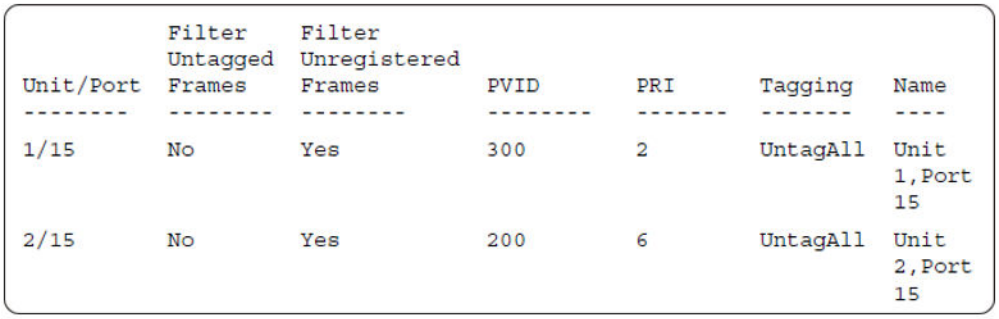
```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
              Client
Unit/Port     MAC Address          State                  Vid       Pri
--------      --------             --------               -------   -----
1/15          00:1C:9C:2B:CE:04    Auto-Learned For MHSA  N/A       N/A

2/15          00:1D:3E:4A:BC:01    Auto-Learned For MHSA  N/A       N/A
```

24. Confirm the VLAN interface settings.

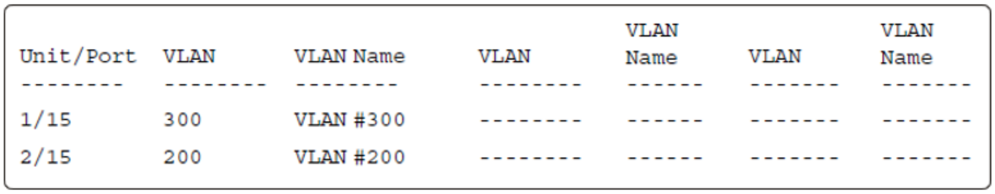
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
             Filter      Filter
             Untagged    Unregistered
Unit/Port    Frames      Frames          PVID        PRI        Tagging     Name
--------     --------    --------        --------    -------    -------     ----
1/15         No          Yes             300         2          UntagAll    Unit
                                                                            1,Port
                                                                            15
2/15         No          Yes             200         6          UntagAll    Unit
                                                                            2,Port
                                                                            15
```

25. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
                                                    VLAN                  VLAN
Unit/Port    VLAN        VLAN Name      VLAN        Name      VLAN        Name
--------     --------    --------       --------    ------    -------     -------
1/15         300         VLAN #300      --------    ------    -------     -------
2/15         200         VLAN #200      --------    ------    -------     -------
```

Alternate configuration

The following operation applies to **MHSA authentication mode with Guest VLAN and Fail Open VLAN options enabled (Multihost MultiVLAN option enabled) without valid RADIUS additional attributes**, when the RADIUS server has no special attributes configured or the RADIUS server uses misconfigured attributes (not matching the device configuration).

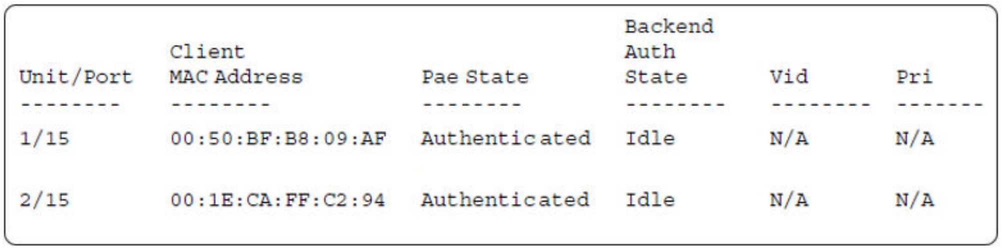
This configuration example modifies EAP and NEAP client attributes on the RADIUS server, replacing VLAN ID 200 with VLAN ID 123, and VLAN ID 300 with VLAN ID 124, which is not configured on the device.

1. Enable EAPOL MultiHost MultiVLAN.

```
Switch(config)#eapol disable
Switch(config)#eapol multihost multivlan enable
Switch(config)#eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

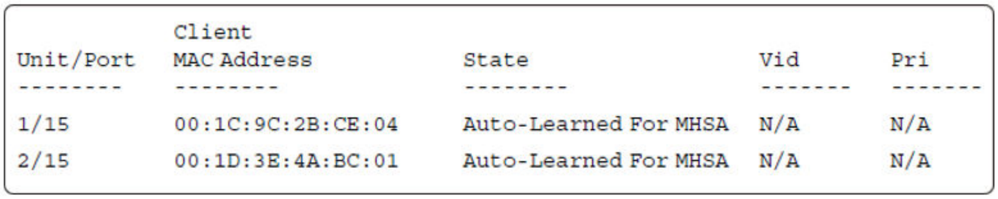
2. After EAP clients are authenticated, confirm EAPOL MultiHost status.

```
Switch(config)#show eapol multihost status
```



```
                                                     Backend
            Client                                   Auth
Unit/Port   MAC Address          Pae State           State      Vid        Pri
--------    --------             --------            --------   --------   -------
1/15        00:50:BF:B8:09:AF    Authenticated       Idle       N/A        N/A

2/15        00:1E:CA:FF:C2:94    Authenticated       Idle       N/A        N/A
```

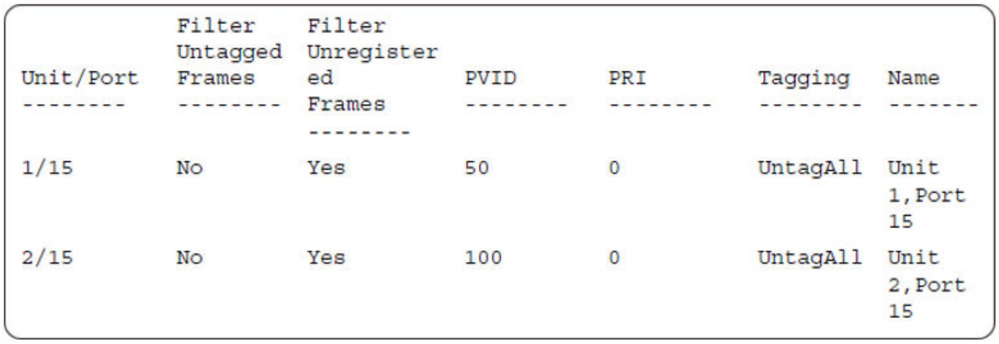
```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
            Client
Unit/Port   MAC Address            State                  Vid        Pri
--------    --------               --------               -------    -------
1/15        00:1C:9C:2B:CE:04      Auto-Learned For MHSA  N/A        N/A
2/15        00:1D:3E:4A:BC:01      Auto-Learned For MHSA  N/A        N/A
```

3. Confirm the VLAN interface settings.

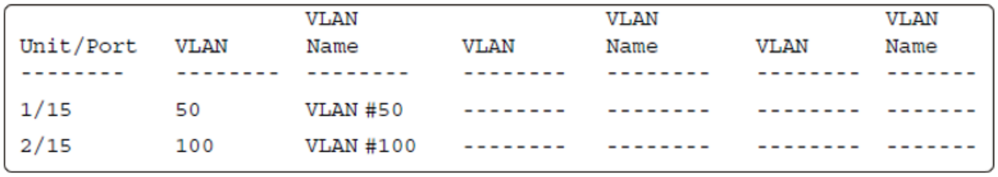
```
Switch(config)#show vlan interface info 1/15,2/15
```



```
            Filter     Filter
            Untagged   Unregister
Unit/Port   Frames     ed          PVID       PRI        Tagging    Name
--------    --------   Frames      --------   --------   --------   -------
                       --------

1/15        No         Yes         50         0          UntagAll   Unit
                                                                    1,Port
                                                                    15

2/15        No         Yes         100        0          UntagAll   Unit
                                                                    2,Port
                                                                    15
```

4. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 1/15,2/15
```



```
                    VLAN                  VLAN                  VLAN
Unit/Port  VLAN     Name       VLAN       Name       VLAN       Name
--------   -------- --------   --------   --------   --------   -------
1/15       50       VLAN #50   --------   --------   --------   -------
2/15       100      VLAN #100  --------   --------   --------   -------
```

MHMA authentication mode (Multihost MultiVLAN option disabled) with or without additional RADIUS attributes

For this EAP operational mode the port and client will have the following settings:

- when 802.1X is disabled on the port—the port is included in the initial VLAN – one or multiple initial VLANs are supported, and the port uses one of the initial VLAN PVIDs specified by the user.
- when 802.1X is enabled on the port:
  - an unauthenticated client is on the port with Guest VLAN enabled—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
  - an 802.1X authenticated client is on the port
    - the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs. In this case no RADIUS attribute is received or an invalid RADIUS attribute is received for the client.
    - the port is included in RADIUS VLAN Id and the port uses a RADIUS VLAN PVID (Valid RADIUS attributes received)
  - an 802.1X authenticated client is on the port
    - the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs. In this case no RADIUS attribute is received, or an invalid RADIUS attribute is received for the client.
    - the port is included in RADIUS VLAN Id and the port uses a RADIUS VLAN PVID (Valid RADIUS attributes received)
  - a non-802.1X authenticated static MAC client—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
  - a non-802.1X authenticated client is on the port using a DHCP signature—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs

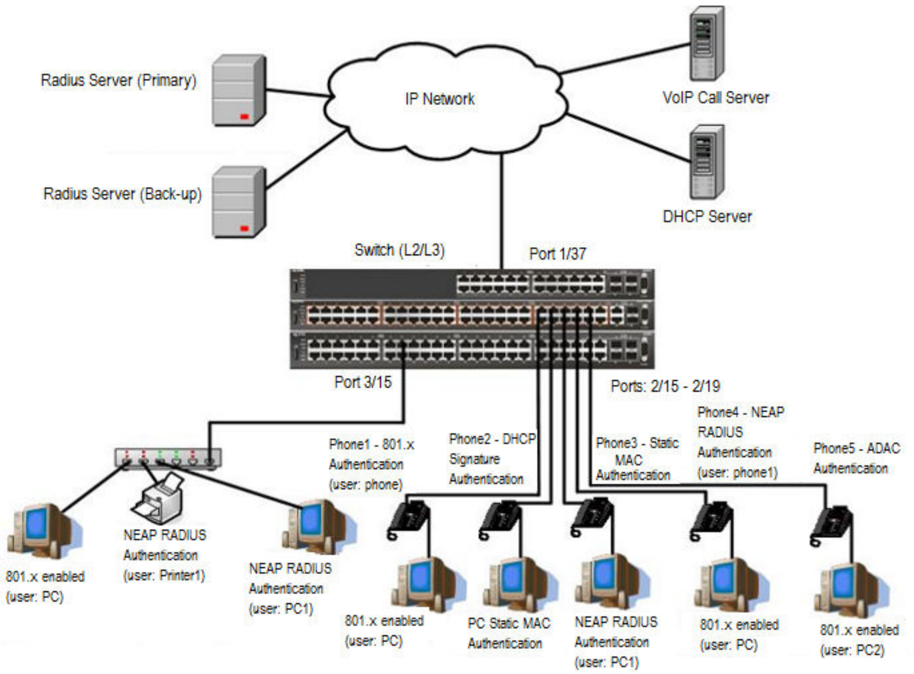

Radius Server (Primary)
IP Network
VoIP Call Server
Radius Server (Back-up)
DHCP Server
Switch (L2/L3)
Port 1/37
Port 3/15
Ports: 2/15 - 2/19
Phone1 - 801.x Authentication (user: phone)
Phone2 - DHCP Signature Authentication
Phone3 - Static MAC Authentication
Phone4 - NEAP RADIUS Authentication (user: phone1)
Phone5 - ADAC Authentication
801.x enabled (user: PC)
NEAP RADIUS Authentication (user: Printer1)
NEAP RADIUS Authentication (user: PC1)
801.x enabled (user: PC)
PC Static MAC Authentication
NEAP RADIUS Authentication (user: PC1)
801.x enabled (user: PC)
801.x enabled (user: PC2)

Figure 46: MHMA authentication mode (Multihost MultiVLAN option disabled) with or without additional RADIUS attributes

Scenario

Assume the following settings:

1. RADIUS servers configuration.
    - A primary server is mandatory. If a back-up server is used, the back-up server configuration must be the same as for primary server configuration.
2. Configure all IP Phones to send tag traffic with proper VoIP VLAN ID.
3. Clients settings:
    - Port 2/15:
        - 801.x authenticated user Phone1connected
        - 801.x enabled user PC connected
        - Initial VLAN ID = 50, 200
        - PC RADIUS VLAN ID = 300
    - Port 2/16:
        - DHCP signature authenticated user Phone2 connected
        - Static MAC authenticated user PC connected
        - Initial VLAN ID = 50, 200
        - Phone EAP VOIP VLAN ID = 200

- Port 2/17:
    - Static MAC authenticated user Phone3 connected
    - NEAP RADIUS authenticated user PC1 connected
    - Initial VLAN ID = 50, 200
    - PC RADIUS VLAN ID = 300
- Port 2/18:
    - NEAP RADIUS authenticated user Phone1 connected
    - 801.x enabled user PC connected
    - Initial VLAN ID = 50, 200
    - PC RADIUS VLAN ID = 300
    - Phone RADIUS VLAN ID = none
- Port 2/19:
    - ADAC authenticated user Phone5 connected
    - 801.x enabled user PC2 connected
    - Initial VLAN ID = 50, 300
    - PC RADIUS VLAN ID = none
    - Phone ADAC VLAN ID = 201
- Port 3/15:
    - 801.x enabled user PC connected
    - NEAP RADIUS authenticated user Printer1 connected
    - NEAP RADIUS authenticated user PC1 connected
    - Initial VLAN ID = 50
    - RADIUS VLAN ID = 300

4. Port settings:
    - VLAN ID/PVID port settings for 2/15:
        - 801.x disabled - VLAN ID/PVID = 50,200/50
        - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 50,200/50
        - Authenticated (user phone authenticated, user PC unauthenticated):
            - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
        - Authenticated (user phone authenticated, user PC authenticated):
            - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)

    - VLAN ID/PVID = 50, 200, 300/ 300 (Valid RADIUS attributes received)

- VLAN ID/PVID port settings for 2/16:
  - 801.x disabled - VLAN ID/PVID = 50,300/300
  - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 50,300/300
  - Authenticated (Phone DHCP signature OK, EAP VOIP VLAN ID 200 assigned):
    - VLAN ID/PVID = 50,200,300/300
  - Authenticated (PC MAC defined in static list, PC MAC learned in MAC address table, Phone DHCP signature OK):
    - VLAN ID/PVID = 50,200,300/300
- VLAN ID/PVID port settings for 2/17:
  - 801.x disabled - VLAN ID/PVID = 50,200/50
  - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 50,200/50
  - Authenticated (Phone MAC defined in static list, Phone MAC learned in MAC address table):
    - VLAN ID/PVID = 50, 200/ 50
  - Authenticated (user PC1 authenticated; Phone MAC defined in static list, Phone MAC learned in MAC address table):
    - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes) received)
    - VLAN ID/PVID = 50, 200, 300/ 300 (Valid RADIUS attributes received)

VLAN ID/PVID port settings for 2/18:

- 801.x disabled - VLAN ID/PVID = 50,200/50
- Unauthenticated client with 801.x enabled - VLAN ID/PVID = 50,200/50
- Authenticated (user phone1 authenticated, user PC unauthenticated):
  - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
- Authenticated (user PC authenticated, user phone1 authenticated):
  - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
  - VLAN ID/PVID = 50, 200, 300/ 300 (Valid RADIUS attributes received)

VLAN ID/PVID port settings for 2/19:

- 801.x disabled - VLAN ID/PVID = 50,300/300
- Unauthenticated client with 801.x enabled - VLAN ID/PVID = 50,300/300

- Authenticated (phone is ADAC authenticated, user PC unauthenticated):
    - VLAN ID/PVID = 50, 300, 201/ 300 (No RADIUS attribute received/Invalid RADIUS attributes received)
- Authenticated (user PC2 authenticated, phone is ADAC authenticated):
    - VLAN ID/PVID = 50, 300, 201/ 300 (No RADIUS attribute received/Invalid RADIUS attributes received)

VLAN ID/PVID port settings for 3/15:

- 801.x disabled - VLAN ID/PVID = 50/50
- Unauthenticated client with 801.x enabled - VLAN ID/PVID = 50/50
- Authenticated (at least one user authenticated from : PC, PC1, Printer1):
    - VLAN ID/PVID = 50/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
    - VLAN ID/PVID = 300/ 300 (Valid RADIUS attributes received)

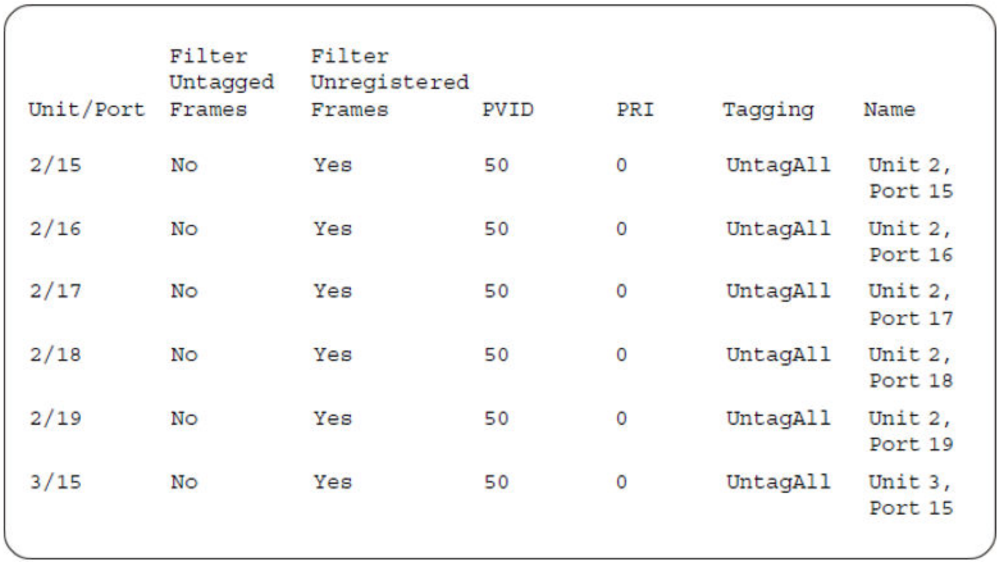
Configuration example

1. Configure the RADIUS servers and VLAN settings

```
Switch(config)#ip address 10.100.68.254 netmask 255.255.255.0 default-gateway 10.100.68.1
Switch(config)#radius-server host 10.100.68.2
Switch(config)#radius-server secondary-host 10.100.68.3
Switch(config)#radius-server key
Enter key: RadiusKey
Enter key: RadiusKey
Switch(config)#vlan configcontrol automatic
Switch(config)#vlan create 50 type port
Switch(config)#vlan create 200 type port
Switch(config)#vlan create 300 type port
Switch(config)#vlan members add 50 2/15-19,3/15
Switch(config)#vlan members add 100 2/15
Switch(config)#vlan create 201 voice-vlan
```

2. Confirm the VLAN interface settings.

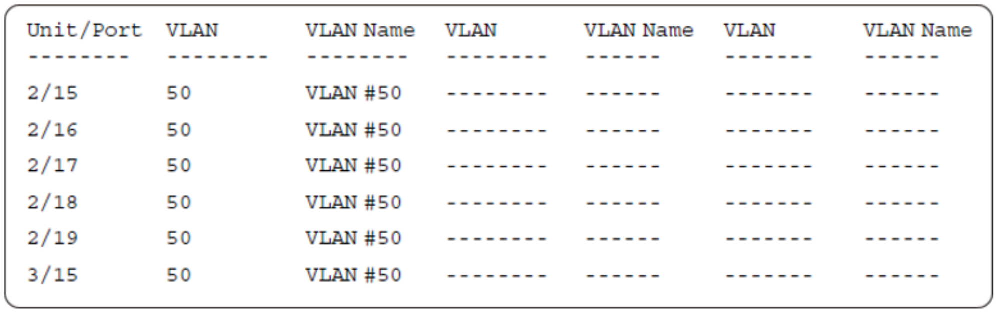
```
Switch(config)#sho vlan interface info 2/15-19,3/15
```



```
           Filter     Filter
           Untagged   Unregistered
Unit/Port  Frames     Frames        PVID     PRI     Tagging     Name

2/15       No         Yes           50       0       UntagAll    Unit 2,
                                                                 Port 15
2/16       No         Yes           50       0       UntagAll    Unit 2,
                                                                 Port 16
2/17       No         Yes           50       0       UntagAll    Unit 2,
                                                                 Port 17
2/18       No         Yes           50       0       UntagAll    Unit 2,
                                                                 Port 18
2/19       No         Yes           50       0       UntagAll    Unit 2,
                                                                 Port 19
3/15       No         Yes           50       0       UntagAll    Unit 3,
                                                                 Port 15
```

3. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15-19,3/15
```



```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN     VLAN Name
--------   --------  --------   --------  ------     -------  ------
2/15       50        VLAN #50   --------  ------     -------  ------
2/16       50        VLAN #50   --------  ------     -------  ------
2/17       50        VLAN #50   --------  ------     -------  ------
2/18       50        VLAN #50   --------  ------     -------  ------
2/19       50        VLAN #50   --------  ------     -------  ------
3/15       50        VLAN #50   --------  ------     -------  ------
```

4. Change VLAN config control mode to flexible mode in order to add same port in multiple initial VLANs.

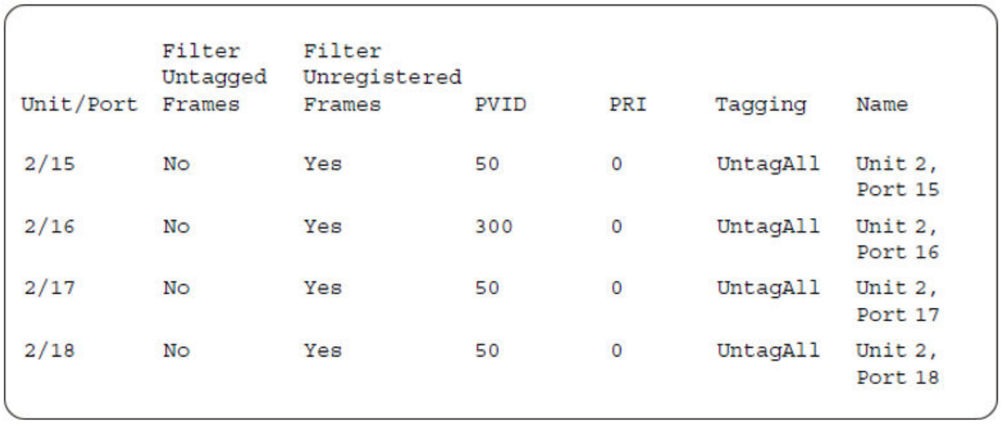
```
Switch(config)#vlan configcontrol flexible
```

5. Add IP phone ports to the voice vlan, VLAN ID 200.

```
Switch(config)#vlan members add 200 2/15,2/17,2/18
Switch(config)#vlan members add 300 2/16
Switch(config)#vlan members add 300 2/19
Switch(config)#vlan port 2/16 pvid 300
Switch(config)#vlan port 2/19 pvid 300
```

6. Confirm the VLAN interface settings.

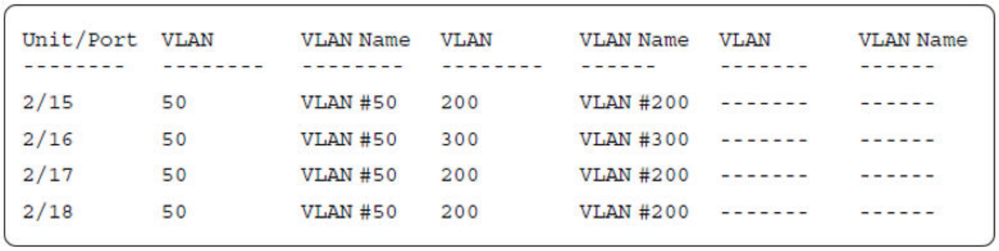
```
Switch(config)#sho vlan interface info 2/15,2/16,2/17,2/18
```



```
            Filter    Filter
            Untagged  Unregistered
Unit/Port   Frames    Frames        PVID     PRI     Tagging    Name

2/15        No        Yes           50       0       UntagAll   Unit 2,
                                                                Port 15
2/16        No        Yes           300      0       UntagAll   Unit 2,
                                                                Port 16
2/17        No        Yes           50       0       UntagAll   Unit 2,
                                                                Port 17
2/18        No        Yes           50       0       UntagAll   Unit 2,
                                                                Port 18
```

7. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15,2/16,2/17,2/18
```



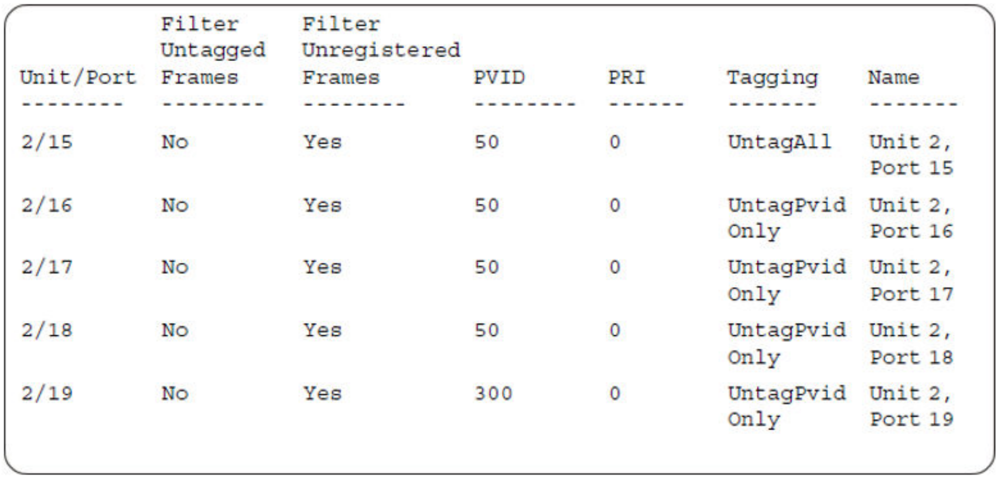
```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
--------   --------  --------   --------  ------     -------   ------
2/15       50        VLAN #50   200       VLAN #200  -------   ------
2/16       50        VLAN #50   300       VLAN #300  -------   ------
2/17       50        VLAN #50   200       VLAN #200  -------   ------
2/18       50        VLAN #50   200       VLAN #200  -------   ------
```

8. Since all IP Phones will be sending tagged traffic and only the PC will need to receive untagged traffic, set the port to untagpvidOnly.

```
Switch(config)#vlan ports 2/15,2/16,2/17,2/18,2/19 tagging untagpvidOnly
```

9. Confirm the VLAN interface settings.

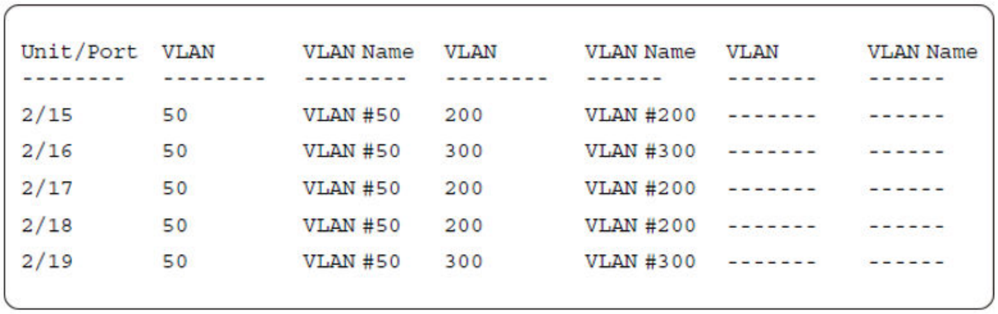
```
Switch(config)#sho vlan interface info 2/15,2/16,2/17,2/18
```



```
            Filter    Filter
            Untagged  Unregistered
Unit/Port   Frames    Frames        PVID      PRI     Tagging    Name
--------    --------  --------      --------  ------  -------    -------
2/15        No        Yes           50        0       UntagAll   Unit 2,
                                                                 Port 15
2/16        No        Yes           50        0       UntagPvid  Unit 2,
                                                      Only       Port 16
2/17        No        Yes           50        0       UntagPvid  Unit 2,
                                                      Only       Port 17
2/18        No        Yes           50        0       UntagPvid  Unit 2,
                                                      Only       Port 18
2/19        No        Yes           300       0       UntagPvid  Unit 2,
                                                      Only       Port 19
```

10. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15,2/16,2/17,2/18
```



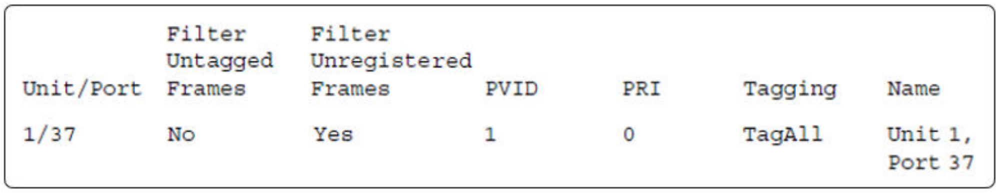
```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN     VLAN Name
--------   --------  --------   --------  ------     -------  ------
2/15       50        VLAN #50   200       VLAN #200  -------  ------
2/16       50        VLAN #50   300       VLAN #300  -------  ------
2/17       50        VLAN #50   200       VLAN #200  -------  ------
2/18       50        VLAN #50   200       VLAN #200  -------  ------
2/19       50        VLAN #50   300       VLAN #300  -------  ------
```

11. Configure the uplink port 1/37 to transport traffic from all VLANs (1,50,200,300).

```
Switch(config)#vlan members add 50,200,300 1/37
Switch(config)#vlan ports 1/37 tagging tagall
```

12. Confirm the VLAN interface settings for uplink port 1/37.

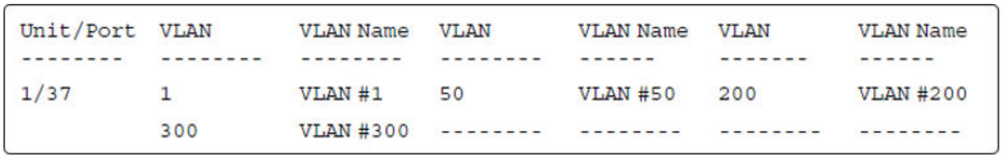
```
Switch(config)#sho vlan interface info 1/37
```



```
           Filter     Filter
           Untagged   Unregistered
Unit/Port  Frames     Frames        PVID     PRI      Tagging   Name

1/37       No         Yes           1        0        TagAll    Unit 1,
                                                                Port 37
```

13. Confirm the VLAN inteface VIDs for uplink port 1/37.

```
Switch(config)#show vlan interface vids 1/37
```



```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
--------   --------  --------   --------  ------     -------   ------
1/37       1         VLAN #1    50        VLAN #50   200       VLAN #200
           300       VLAN #300  --------  --------   --------  --------
```

14. Configure ADAC. Use Voice VLAN 201.

```
Switch(config)#interface Ethernet 2/19
Switch(config-if)#adac detection mac lldp
Switch(config-if)#adac enable
Switch(config-if)#exit
Switch(config)#adac uplink-port 1/37
Switch(config)#adac voice-vlan 201
```

Important:

Select only the ADAC mode that allows multiple MACs (clients) on a port. ADAC modes untagged-frames-basic and untagged-frames-advanced, support only one MAC per port (the IP phone MAC).

```
Switch(config)#adac op-mode tagged-frames
```

15. Add the MAC address of the IP phone connected on port 2/19 if the IP phone does not support the LLDP protocol.

```
Switch(config)#adac mac-range-table low-end 00-1C-9C-4A-BC-01 high-end 00-1C-9C-4A-BC-02
```

16. Verify connectivity with the Primary RADIUS server and back-up RADIUS server (if back-up server is used). Firewalls may filter ICMP packets. In this case it is recommended to verify RADIUS server logs for authentication request sent by device.

```
Switch(config)#ping 10.100.68.2
(Host is reachable)
Switch(config)#ping 10.100.68.3
(Host is reachable)
```

17. Set the EAPOL status for port 2/15.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/15 enable
Switch(config-if)#eapol port 2/15 status auto
Switch(config-if)#eapol multihost port 2/15 eap-mac-max 2
Switch(config-if)#eapol multihost port 2/15 use-radius-assigned-vlan
Switch(config-if)#exit
```

18. Set the EAPOL status for port 2/16.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/16 enable
Switch(config-if)#eapol port 2/16 status auto
Switch(config-if)#eapol multihost port 2/16 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 2/16 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/16 non-eap-phone-enable
Switch(config-if)#eapol multihost non-eap-mac port 2/16 00-19-E1-A2-4D-36
Switch(config-if)#exit
```

19. Set the EAPOL status for port 2/17.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/17 enable
Switch(config-if)#eapol port 2/17 status auto
Switch(config-if)#eapol multihost port 2/17 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 2/17 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/17 radius-non-eap-enable
Switch(config-if)#eapol multihost port 2/17 non-eap-use-radius-assigned- vlan
Switch(config-if)#eapol multihost non-eap-mac port 2/17 00-19-E1-E5-52-4A
Switch(config-if)#exit
```

20. Set the EAPOL status for port 2/18.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/18 enable
Switch(config-if)#eapol port 2/18 status auto
Switch(config-if)#eapol multihost port 2/18 eap-mac-max 1
Switch(config-if)#eapol multihost port 2/18 non-eap-mac-max 1
Switch(config-if)#eapol multihost port 2/18 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/18 radius-non-eap-enable
Switch(config-if)#eapol multihost port 2/18 use-radius-assigned-vlan
Switch(config-if)#exit
```

21. Set the EAPOL status for port 2/19.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/19 enable
Switch(config-if)#eapol port 2/19 status auto
Switch(config-if)#eapol multihost port 2/19 eap-mac-max 1
Switch(config-if)#eapol multihost port 2/19 non-eap-mac-max 1
Switch(config-if)#eapol multihost port 2/19 allow-non-eap-enable
```

22. To confirm that VLAN modifications are not performed by EAP on ADAC enabled ports, disable the VLAN assignment on port 2/19 for EAP and NON-EAP clients.

```
Switch(config-if)#no eapol multihost port 2/19 use-radius-assigned-vlan
Switch(config-if)#no eapol multihost port 2/19 non-eap-use-radius-assigned-vlan
Switch(config-if)#exit
```

23. Set the EAPOL status for port 3/15.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 3/15 enable
Switch(config-if)#eapol port 3/15 status auto
Switch(config-if)#eapol multihost port 3/15 eap-mac-max 1
Switch(config-if)#eapol multihost port 3/15 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 3/15 allow-non-eap-enable
Switch(config-if)#eapol multihost port 3/15 use-radius-assigned-vlan
Switch(config-if)#eapol multihost port 3/15 radius-non-eap-enable
Switch(config-if)#eapol multihost port 3/15 non-eap-use-radius-assigned- vlan
Switch(config-if)#exit
```

24. Set the EAPOL MultiHost status.

```
Switch(config)#eapol multihost voip-vlan 1 vid 200
Switch(config)#eapol multihost voip-vlan 1 enable
Switch(config)#eapol multihost allow-non-eap-enable
Switch(config)#eapol multihost non-eap-phone-enable
Switch(config)#eapol multihost non-eap-use-radius-assigned-vlan
Switch(config)#eapol multihost use-radius-assigned-vlan
Switch(config)#eapol multihost radius-non-eap-enable
Switch(config)#eapol enable
```

25. Enable ADAC.

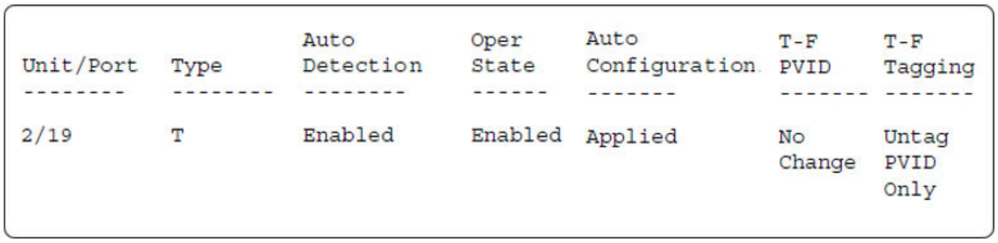
```
Switch(config)#adac enable
```

Note:

After ADAC is enabled (for tagged-frames and untagged-frames-advanced modes), uplink port, and telephony ports (detected IP phones) are added to the ADAC voice VLAN.

26. Confirm the ADAC interface status for port 2/19.

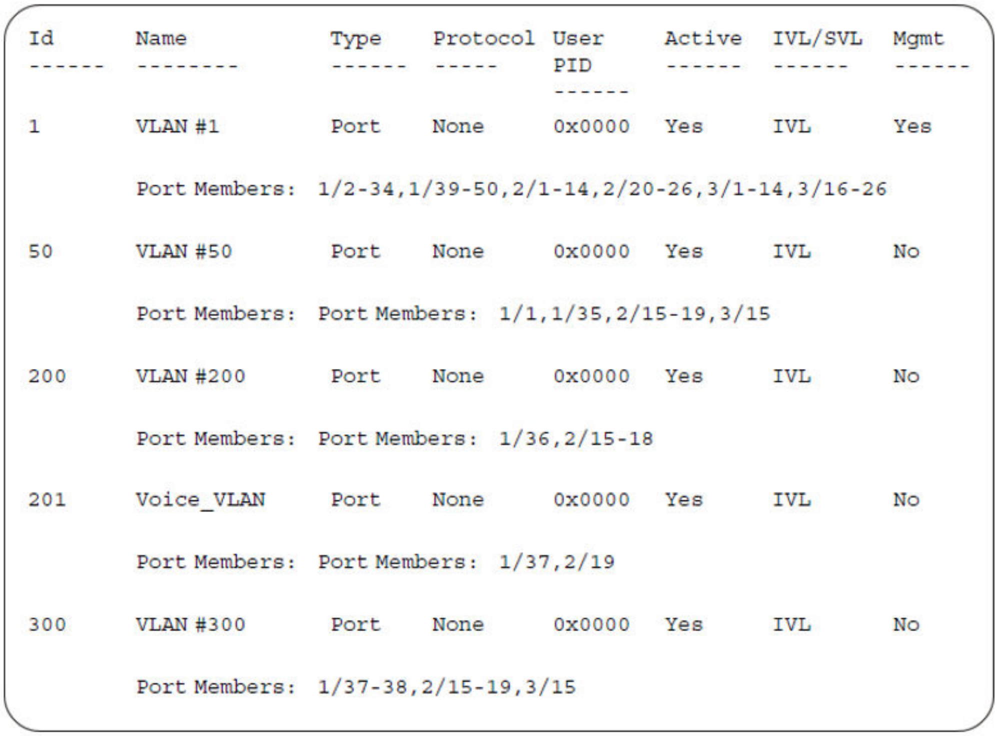
```
Switch(config)#show adac interface 2/19
```



```
                     Auto        Oper     Auto           T-F      T-F
Unit/Port   Type     Detection   State    Configuration  PVID     Tagging
--------  -------- --------    ------   -------        -------  -------

2/19        T        Enabled     Enabled  Applied        No       Untag
                                                         Change   PVID
                                                                  Only
```

27. Confirm the VLAN status.

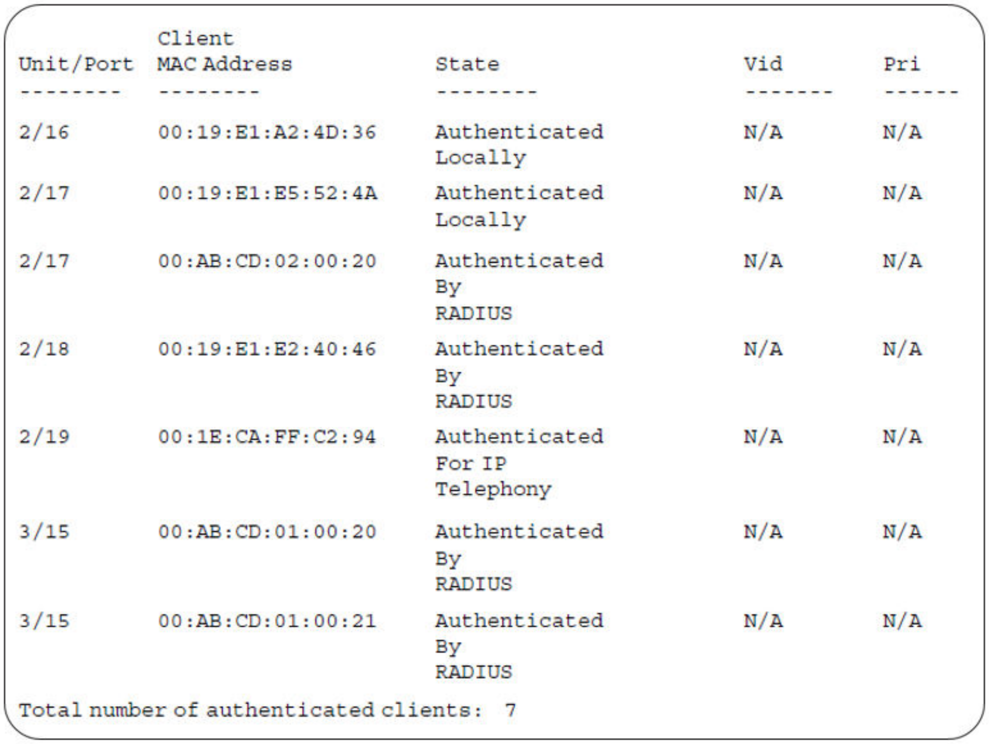
```
Switch(config)#show vlan
```



```
Id      Name            Type     Protocol User     Active   IVL/SVL  Mgmt
------  --------        ------   -----    PID      ------   ------   ------
                                          ------

1       VLAN #1         Port     None     0x0000   Yes      IVL      Yes

        Port Members:  1/2-34,1/39-50,2/1-14,2/20-26,3/1-14,3/16-26

50      VLAN #50        Port     None     0x0000   Yes      IVL      No

        Port Members:  Port Members:  1/1,1/35,2/15-19,3/15

200     VLAN #200       Port     None     0x0000   Yes      IVL      No

        Port Members:  Port Members:  1/36,2/15-18

201     Voice_VLAN      Port     None     0x0000   Yes      IVL      No

        Port Members:  Port Members:  1/37,2/19

300     VLAN #300       Port     None     0x0000   Yes      IVL      No

        Port Members:  1/37-38,2/15-19,3/15
```

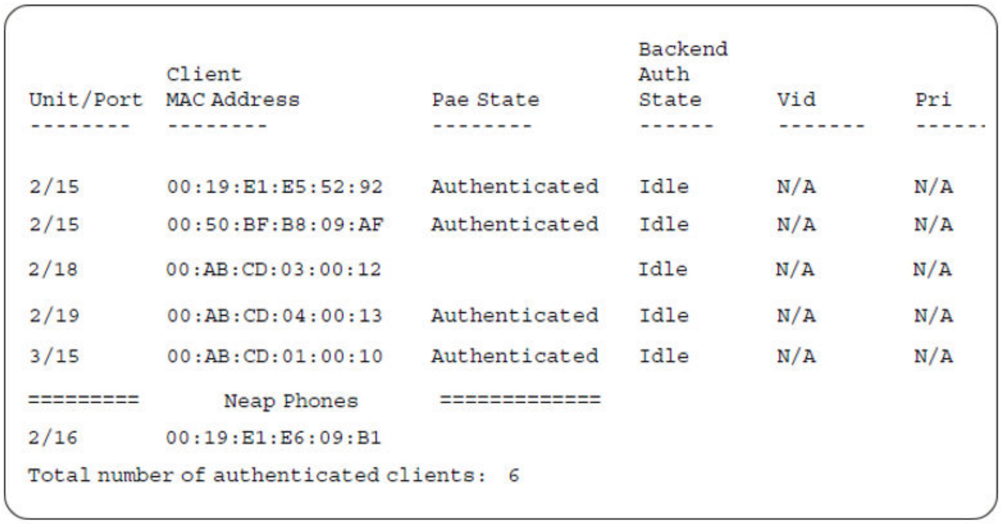
28. Confirm the EAPOL MultiHost status.

```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
           Client
Unit/Port  MAC Address          State                   Vid       Pri
--------   --------             --------                -------   ------
2/16       00:19:E1:A2:4D:36    Authenticated           N/A       N/A
                                Locally
2/17       00:19:E1:E5:52:4A    Authenticated           N/A       N/A
                                Locally
2/17       00:AB:CD:02:00:20    Authenticated           N/A       N/A
                                By
                                RADIUS
2/18       00:19:E1:E2:40:46    Authenticated           N/A       N/A
                                By
                                RADIUS
2/19       00:1E:CA:FF:C2:94    Authenticated           N/A       N/A
                                For IP
                                Telephony
3/15       00:AB:CD:01:00:20    Authenticated           N/A       N/A
                                By
                                RADIUS
3/15       00:AB:CD:01:00:21    Authenticated           N/A       N/A
                                By
                                RADIUS
Total number of authenticated clients:  7
```

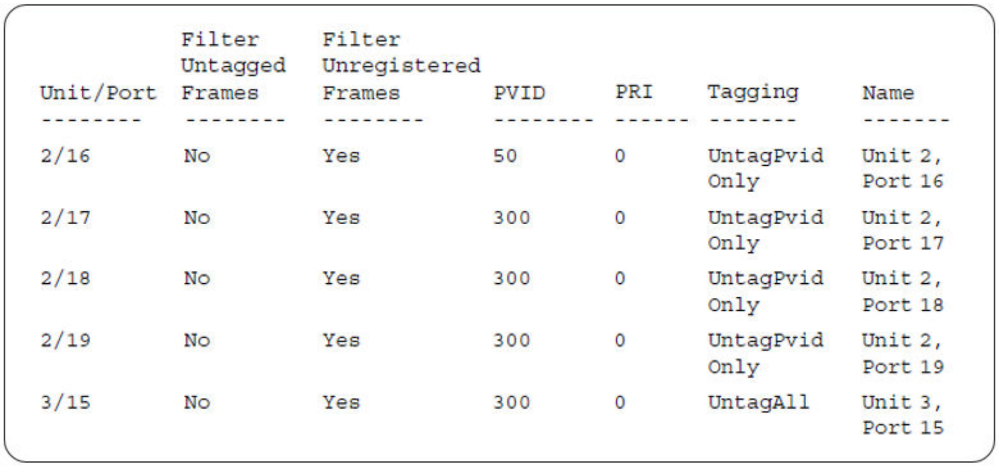
```
Switch(config)#show eapol multihost status
```



```
                                                   Backend
          Client                                   Auth
Unit/Port MAC Address          Pae State           State    Vid      Pri
--------  --------             --------            ------   -------  ------

2/15      00:19:E1:E5:52:92    Authenticated       Idle     N/A      N/A
2/15      00:50:BF:B8:09:AF    Authenticated       Idle     N/A      N/A
2/18      00:AB:CD:03:00:12                        Idle     N/A      N/A
2/19      00:AB:CD:04:00:13    Authenticated       Idle     N/A      N/A
3/15      00:AB:CD:01:00:10    Authenticated       Idle     N/A      N/A
=========      Neap Phones     =============
2/16      00:19:E1:E6:09:B1
Total number of authenticated clients:  6
```

29. Confirm the VLAN interface settings.

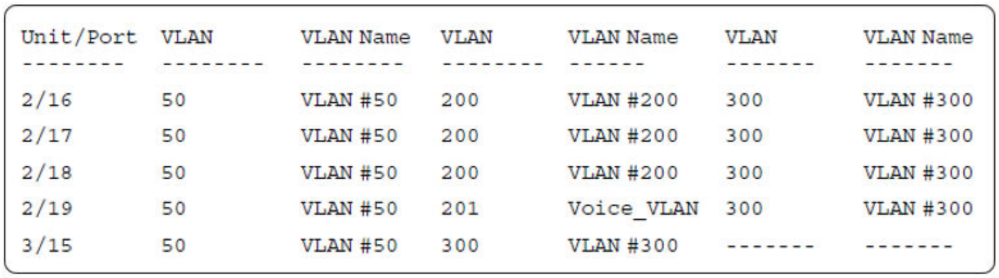
```
Switch(config)#show vlan interface info 2/16-19,3/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames        PVID      PRI     Tagging    Name
--------  --------  --------      --------  ------  -------    -------
2/16      No        Yes           50        0       UntagPvid  Unit 2,
                                                    Only       Port 16
2/17      No        Yes           300       0       UntagPvid  Unit 2,
                                                    Only       Port 17
2/18      No        Yes           300       0       UntagPvid  Unit 2,
                                                    Only       Port 18
2/19      No        Yes           300       0       UntagPvid  Unit 2,
                                                    Only       Port 19
3/15      No        Yes           300       0       UntagAll   Unit 3,
                                                               Port 15
```

30. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/16-19,3/15
```



```
Unit/Port VLAN      VLAN Name VLAN      VLAN Name  VLAN     VLAN Name
--------  --------  --------  --------  ------     -------  -------
2/16      50        VLAN #50  200       VLAN #200  300      VLAN #300
2/17      50        VLAN #50  200       VLAN #200  300      VLAN #300
2/18      50        VLAN #50  200       VLAN #200  300      VLAN #300
2/19      50        VLAN #50  201       Voice_VLAN 300      VLAN #300
3/15      50        VLAN #50  300       VLAN #300  -------  -------
```

Alternate configuration

The following operation applies to **MHMA authentication mode (Multihost MultiVLAN option disabled) without valid additional RADIUS attributes**, when the RADIUS server has no special attributes configured or the RADIUS server uses misconfigured attributes (not matching the device configuration).

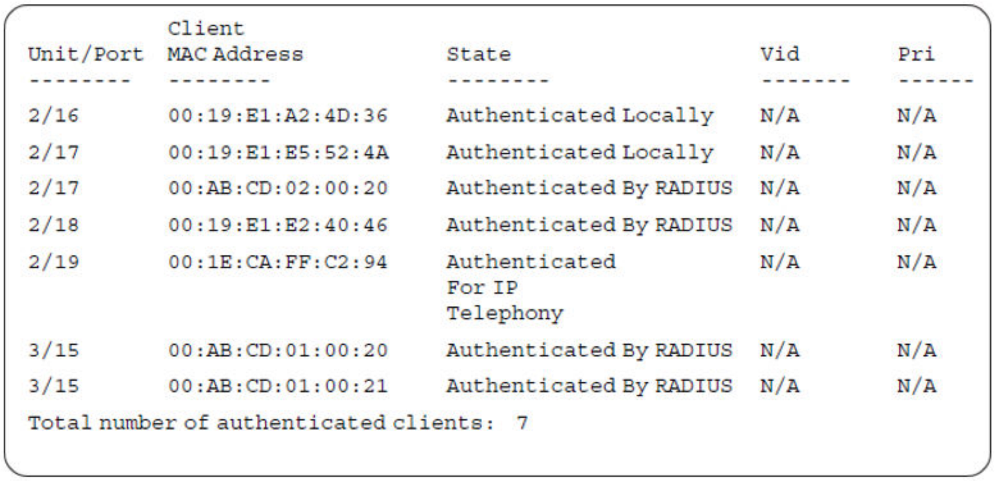
This configuration example modifies EAP and NEAP client attributes on the RADIUS server, replacing VLAN ID 300 with VLAN ID 124, which is not configured on the device.

1. Enable EAPOL.

```
Switch(config)#eapol disable
Switch(config)#eapol enable
```

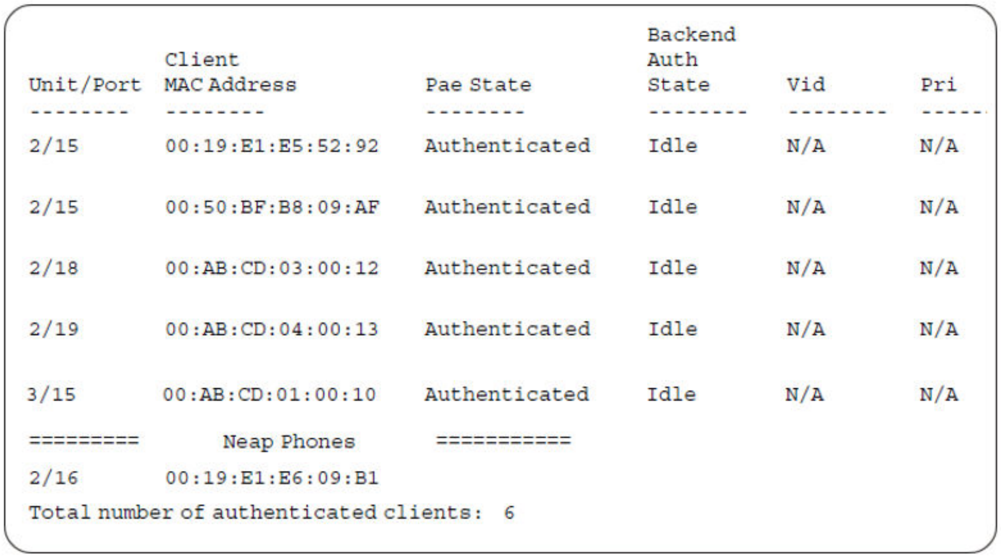
2. Confirm EAPOL MultiHost status.

```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
          Client
Unit/Port MAC Address         State                   Vid       Pri
--------  --------            --------                -------   ------
2/16      00:19:E1:A2:4D:36   Authenticated Locally   N/A       N/A
2/17      00:19:E1:E5:52:4A   Authenticated Locally   N/A       N/A
2/17      00:AB:CD:02:00:20   Authenticated By RADIUS N/A       N/A
2/18      00:19:E1:E2:40:46   Authenticated By RADIUS N/A       N/A
2/19      00:1E:CA:FF:C2:94   Authenticated           N/A       N/A
                              For IP
                              Telephony
3/15      00:AB:CD:01:00:20   Authenticated By RADIUS N/A       N/A
3/15      00:AB:CD:01:00:21   Authenticated By RADIUS N/A       N/A
Total number of authenticated clients:  7
```

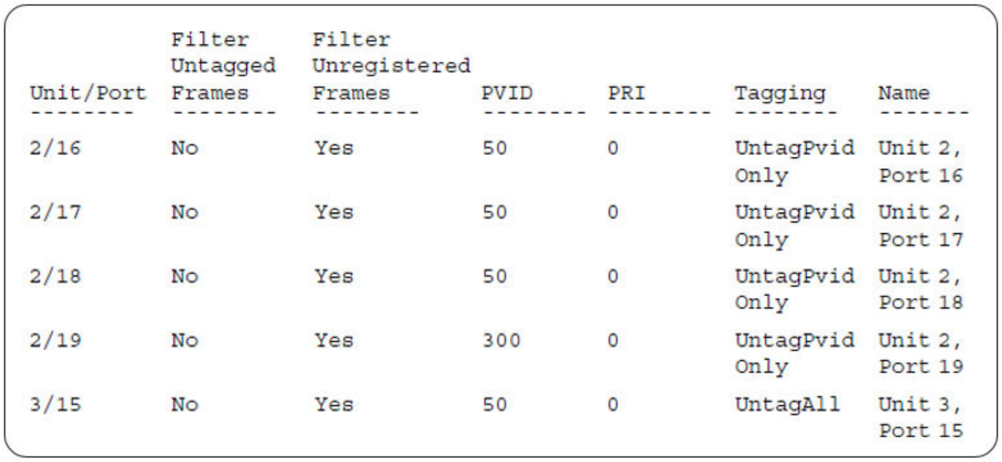
```
Switch(config)#show eapol multihost status
```



```
                                                Backend
          Client                                Auth
Unit/Port MAC Address          Pae State        State     Vid       Pri
--------  --------             --------         --------  --------  -----
2/15      00:19:E1:E5:52:92    Authenticated    Idle      N/A       N/A

2/15      00:50:BF:B8:09:AF    Authenticated    Idle      N/A       N/A

2/18      00:AB:CD:03:00:12    Authenticated    Idle      N/A       N/A

2/19      00:AB:CD:04:00:13    Authenticated    Idle      N/A       N/A

3/15      00:AB:CD:01:00:10    Authenticated    Idle      N/A       N/A

=========        Neap Phones        ===========
2/16      00:19:E1:E6:09:B1
Total number of authenticated clients:  6
```

3. Confirm the VLAN interface settings.

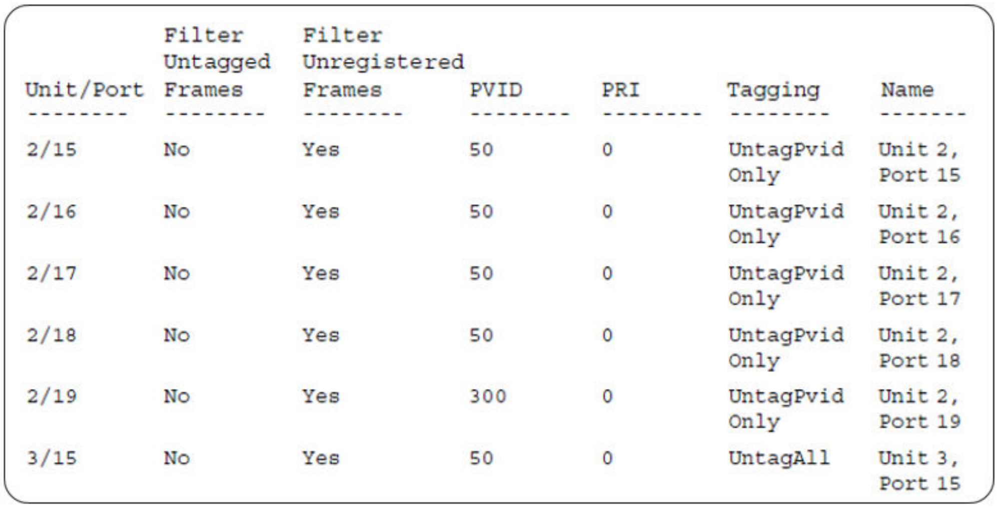
```
Switch(config)#show vlan interface info 2/16-19,3/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI       Tagging    Name
--------   --------  --------      --------  --------  --------   -------
2/16       No        Yes           50        0         UntagPvid  Unit 2,
                                                       Only       Port 16

2/17       No        Yes           50        0         UntagPvid  Unit 2,
                                                       Only       Port 17

2/18       No        Yes           50        0         UntagPvid  Unit 2,
                                                       Only       Port 18

2/19       No        Yes           300       0         UntagPvid  Unit 2,
                                                       Only       Port 19

3/15       No        Yes           50        0         UntagAll   Unit 3,
                                                                  Port 15
```

4. Confirm the VLAN interface settings.

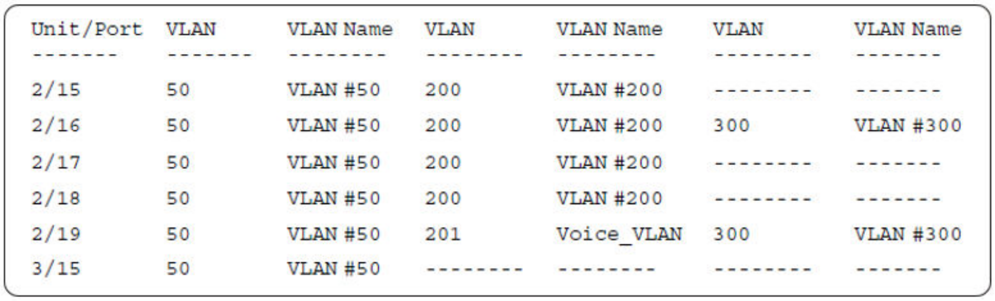
```
Switch(config)#show vlan interface info 2/15-19,3/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI       Tagging    Name
--------   --------  --------      --------  --------  --------   -------
2/15       No        Yes           50        0         UntagPvid  Unit 2,
                                                       Only       Port 15

2/16       No        Yes           50        0         UntagPvid  Unit 2,
                                                       Only       Port 16

2/17       No        Yes           50        0         UntagPvid  Unit 2,
                                                       Only       Port 17

2/18       No        Yes           50        0         UntagPvid  Unit 2,
                                                       Only       Port 18

2/19       No        Yes           300       0         UntagPvid  Unit 2,
                                                       Only       Port 19

3/15       No        Yes           50        0         UntagAll   Unit 3,
                                                                  Port 15
```

5. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-19,3/15
```



```
Unit/Port  VLAN     VLAN Name  VLAN      VLAN Name   VLAN      VLAN Name
-------    -------  --------   --------  --------    --------  -------
2/15       50       VLAN #50   200       VLAN #200   --------  -------
2/16       50       VLAN #50   200       VLAN #200   300       VLAN #300
2/17       50       VLAN #50   200       VLAN #200   --------  -------
2/18       50       VLAN #50   200       VLAN #200   --------  -------
2/19       50       VLAN #50   201       Voice_VLAN  300       VLAN #300
3/15       50       VLAN #50   --------  --------    --------  -------
```

MHMA authentication mode (Multihost MultiVLAN option enabled) with or without additional RADIUS attributes

When you operate in MHMA mode with MHMV support activated each client can have its own VLAN ID and PVID. MAC type VLANs are used to achieve this new functionality.

For this EAP operational mode, the port and client will have the following settings:

- when 802.1X is disabled on the port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
- when 802.1X is enabled on the port:
  - an unauthenticated client is on the port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
  - an 801.x authenticated client is on the port
    - the port is added to an initial VLAN and the port PVID is the initial VLAN PVID - the client uses the initial VLAN PVIDs (client traffic can be sent in multiple initial VLANs). In this case no RADIUS attribute is received, or an invalid RADIUS attribute is received for the 801.x client.
    - the port is added to RADIUS VLAN and the port PVID is the initial VLAN PVID - the client PVID is set to RADIUS VLAN PVID (Valid RADIUS attributes received for 801.x client)
  - an authenticated non-801.x radius client is on the port with Guest VLAN enabled
    - the port is added to an initial VLAN, and the port PVID is the initial VLAN PVID - the client uses the initial VLAN PVIDs (client traffic can be sent in multiple INITIAL VLANs). In this case no RADIUS attribute is received, or an invalid RADIUS attribute is received for the non-801.x radius client.
    - the port is added to the RADIUS VLAN and the port PVID is the initial VLAN PVID - the client PVID is set to RADIUS VLAN PVID (Valid RADIUS attributes received for non-801.x radius client)
  - an authenticated non-801.x static MAC client is on the port (client MAC was learned in the MAC address table). In this case the port is added to an initial VLAN, and the port PVID is the initial VLAN PVID - the client uses the initial VLAN PVIDs (client traffic can be sent in multiple initial VLANs)
  - an authenticated non-801.x DHCP client is on the port and using a DHCP signature—the port remains in the initial VLAN, and the port uses the initial VLAN PVID - the DHCP client uses tagged traffic, with the VOIP VLANs (DHCP client traffic can be sent desired VOIP VLAN is tagged traffic is used for the IP phone)

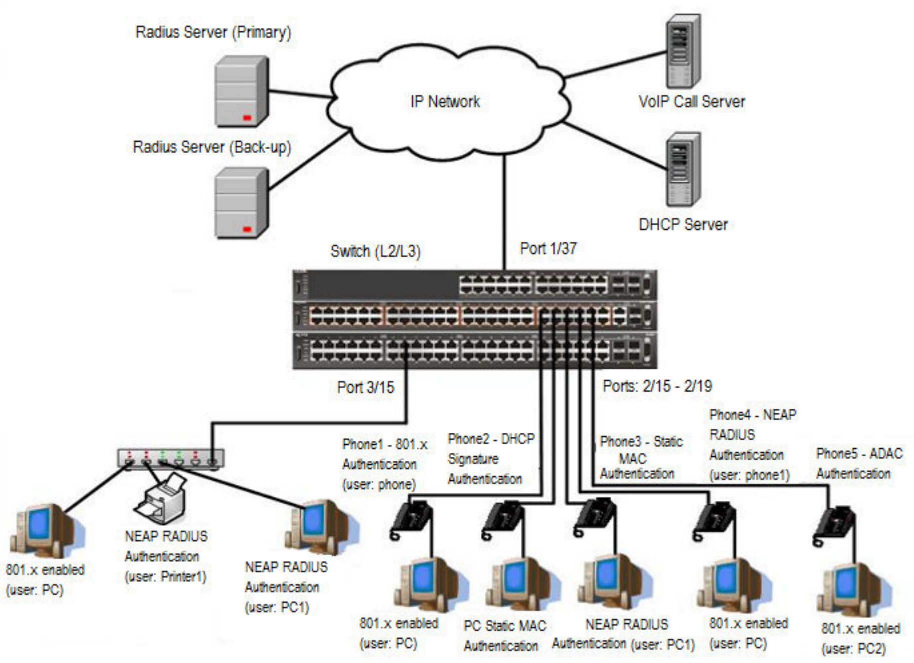

Radius Server (Primary)
IP Network
VoIP Call Server
Radius Server (Back-up)
DHCP Server
Switch (L2/L3)
Port 1/37
Port 3/15
Ports: 2/15 - 2/19
Phone1 - 801.x Authentication (user: phone)
Phone2 - DHCP Signature Authentication
Phone3 - Static MAC Authentication
Phone4 - NEAP RADIUS Authentication (user: phone1)
Phone5 - ADAC Authentication
801.x enabled (user: PC)
NEAP RADIUS Authentication (user: Printer1)
NEAP RADIUS Authentication (user: PC1)
801.x enabled (user: PC)
PC Static MAC Authentication
NEAP RADIUS Authentication (user: PC1)
801.x enabled (user: PC)
801.x enabled (user: PC2)

Figure 47: MHMA authentication mode (Multihost MultiVLAN option enabled) with or without additional RADIUS attributes

Scenario

Assume the following settings:

1. RADIUS server configuration.
    - A primary server is mandatory. If a back-up server is used, the back-up server configuration must be the same as for primary server configuration.
2. Configure all IP Phones to send tag traffic with proper VoIP VLAN ID.
3. Clients settings:
    - Port 2/15:
        - 801.x authenticated user Phone1connected
        - 801.x enabled user PC connected
        - Initial VLAN ID = 50, 200
        - PC RADIUS VLAN ID = 300
        - Phone RADIUS VLAN ID = none
    - Port 2/16:
        - DHCP signature authenticated user Phone2 connected
        - Static MAC authenticated user PC connected
        - Initial VLAN ID = 50, 300
        - Phone EAP VOIP VLAN ID = 200

- Port 2/17:
    - Static MAC authenticated user Phone3 connected
    - NEAP RADIUS authenticated user PC1 connected
    - Initial VLAN ID = 50, 200
    - PC RADIUS VLAN ID = 300
- Port 2/18:
    - NEAP RADIUS authenticated user Phone1 connected
    - 801.x enabled user PC connected
    - Initial VLAN ID = 50, 200
    - PC RADIUS VLAN ID = 300
    - Phone RADIUS VLAN ID = none
- Port 2/19:
    - ADAC authenticated user Phone5 connected
    - 801.x enabled user PC2 connected
    - Initial VLAN ID = 50, 300
    - PC RADIUS VLAN ID = none
    - Phone ADAC VLAN ID = 201
- Port 3/15:
    - 801.x enabled user PC connected
    - NEAP RADIUS authenticated user Printer1 connected
    - NEAP RADIUS authenticated user PC1 connected
    - Initial VLAN ID = 50
    - RADIUS VLAN ID = 300

4. Port settings:

- VLAN ID/PVID port settings for 2/15:
    - 801.x disabled - VLAN ID/PVID = 50,200/50
    - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 50,200/50
    - Authenticated (user phone authenticated, user PC unauthenticated):
        - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
        - EAP port vid for phone client: 50

  - Authenticated (user phone authenticated, user PC authenticated):
    - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
    - VLAN ID/PVID = 50, 200, 300/ 50 (Valid RADIUS attributes received)
    - EAP port vid for PC client: 300
    - EAP port vid for phone client: 50
- VLAN ID/PVID port settings for 2/16:
  - 801.x disabled - VLAN ID/PVID = 50,300/300
  - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 50,300/300
  - Authenticated (Phone DHCP signature OK, EAP VOIP VLAN ID 200 assigned):
    - VLAN ID/PVID = 50,200,300/300
  - Authenticated (PC MAC defined in static list, PC MAC learned in MAC address table, Phone DHCP signature OK):
    - VLAN ID/PVID = 50,200,300/300
    - EAP port vid for PC client: 300
    - EAP port vid for phone client: 200
- VLAN ID/PVID port settings for 2/17:
  - 801.x disabled - VLAN ID/PVID = 50,200/50
  - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 50,200/50
  - Authenticated (Phone MAC defined in static list, Phone MAC learned in MAC address table):
    - VLAN ID/PVID = 50, 200/ 50
    - EAP port vid for phone client: 50
  - Authenticated (user PC1 authenticated; Phone MAC defined in static list, Phone MAC learned in MAC address table):
    - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
    - VLAN ID/PVID = 50, 200, 300/ 300 (Valid RADIUS attributes received)
    - EAP port vid for PC client: 300
    - EAP port vid for phone client: 50

VLAN ID/PVID port settings for 2/18:

  - 801.x disabled - VLAN ID/PVID = 50,200/50
  - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 50,200/50

- Authenticated (user phone1 authenticated, user PC unauthenticated):
    - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
    - EAP port vid for phone client: 50
- Authenticated (user PC authenticated, user phone1 authenticated):
    - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
    - VLAN ID/PVID = 50, 200, 300/ 300 (Valid RADIUS attributes received)
    - EAP port vid for PC client: 300
    - EAP port vid for phone client: 50

VLAN ID/PVID port settings for 2/19:

- 801.x disabled - VLAN ID/PVID = 50,300/300
- Unauthenticated client with 801.x enabled - VLAN ID/PVID = 50,300/300
- Authenticated (phone is ADAC authenticated, user PC unauthenticated):
    - VLAN ID/PVID = 50, 300, 201/ 300 (No RADIUS attribute received/Invalid RADIUS attributes received)
    - EAP port vid for phone client: NA
- Authenticated (user PC2 authenticated, phone is ADAC authenticated):
    - VLAN ID/PVID = 50, 300, 201/ 300 (No RADIUS attribute received/Invalid RADIUS attributes received)
    - EAP port vid for PC client: 300
    - EAP port vid for phone client: NA

VLAN ID/PVID port settings for 3/15:

- 801.x disabled - VLAN ID/PVID = 50/50
- Unauthenticated client with 801.x enabled - VLAN ID/PVID = 50/50
- Authenticated (at least one user authenticated from : PC, PC1, Printer1):
    - VLAN ID/PVID = 50/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
    - VLAN ID/PVID = 300/ 300 (Valid RADIUS attributes received)
    - EAP port vid for PC client: 300
    - EAP port vid for printer NEAP client: 300
    - EAP port vid for NEAP PC client: 300

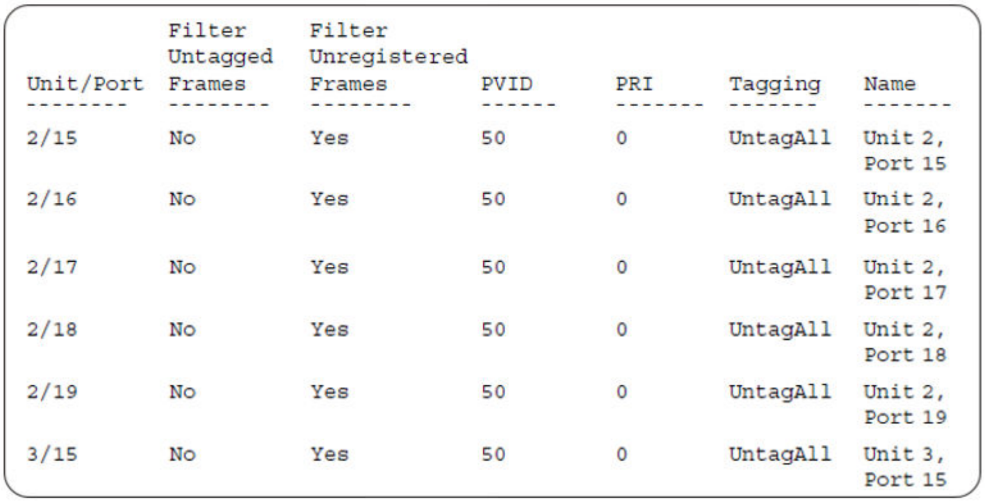
Configuration example

1. Configure the RADIUS servers and VLAN settings

```
Switch(config)#ip address 10.100.68.254 netmask 255.255.255.0 default-gateway 10.100.68.1
Switch(config)#radius-server host 10.100.68.2
Switch(config)#radius-server secondary-host 10.100.68.3
Switch(config)#radius-server key
Enter key: RadiusKey
Enter key: RadiusKey
Switch(config)#vlan configcontrol automatic
Switch(config)#vlan create 50 type port
Switch(config)#vlan create 200 type port
Switch(config)#vlan create 300 type port
Switch(config)#vlan members add 50 2/15-19,3/15
```

2. Confirm the VLAN interface settings.

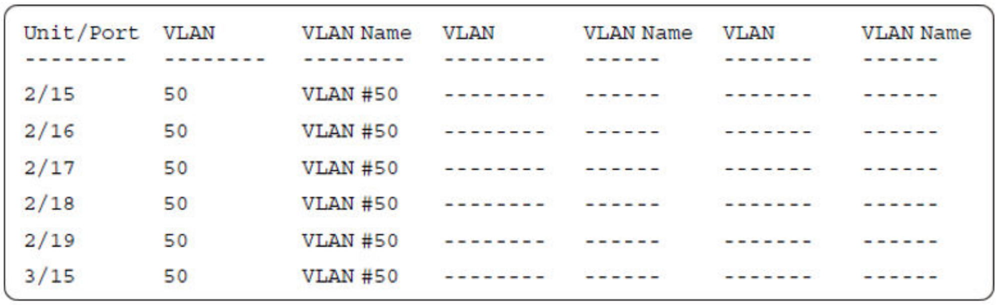
```
Switch(config)#show vlan interface info 2/15-19,3/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID    PRI      Tagging   Name
---------  --------  --------      ------  -------  -------   -------
2/15       No        Yes           50      0        UntagAll  Unit 2,
                                                              Port 15

2/16       No        Yes           50      0        UntagAll  Unit 2,
                                                              Port 16

2/17       No        Yes           50      0        UntagAll  Unit 2,
                                                              Port 17

2/18       No        Yes           50      0        UntagAll  Unit 2,
                                                              Port 18

2/19       No        Yes           50      0        UntagAll  Unit 2,
                                                              Port 19

3/15       No        Yes           50      0        UntagAll  Unit 3,
                                                              Port 15
```

3. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15-19,3/15
```



```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
--------   --------  --------   --------  ------     -------   ------
2/15       50        VLAN #50   --------  ------     -------   ------
2/16       50        VLAN #50   --------  ------     -------   ------
2/17       50        VLAN #50   --------  ------     -------   ------
2/18       50        VLAN #50   --------  ------     -------   ------
2/19       50        VLAN #50   --------  ------     -------   ------
3/15       50        VLAN #50   --------  ------     -------   ------
```

4. Change VLAN config control mode to flexible mode in order to add same port in multiple initial VLANs.

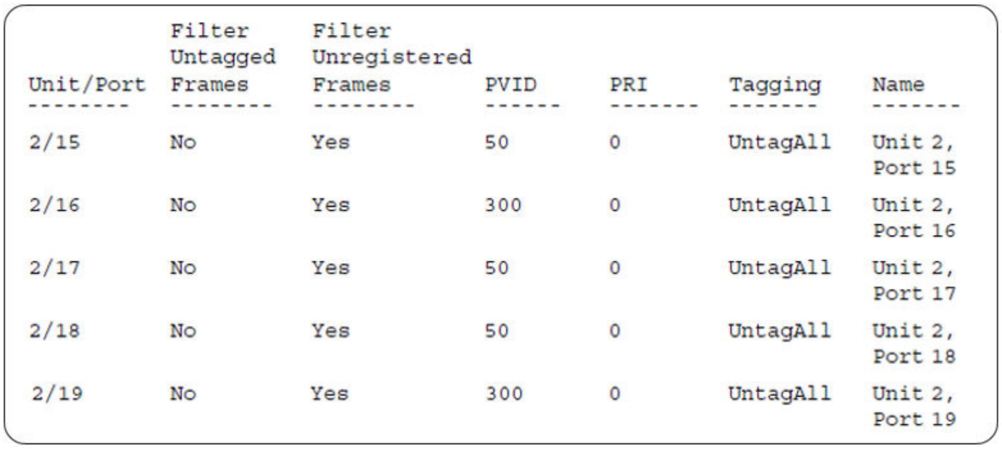
```
Switch(config)#vlan configcontrol flexible
```

5. Add IP phone ports to the voice vlan, VLAN ID 200.

```
Switch(config)#vlan members add 200 2/15,2/17,2/18
Switch(config)#vlan members add 300 2/16
Switch(config)#vlan members add 300 2/19
Switch(config)#vlan port 2/16 pvid 300
Switch(config)#vlan port 2/19 pvid 300
```

6. Confirm the VLAN interface settings.

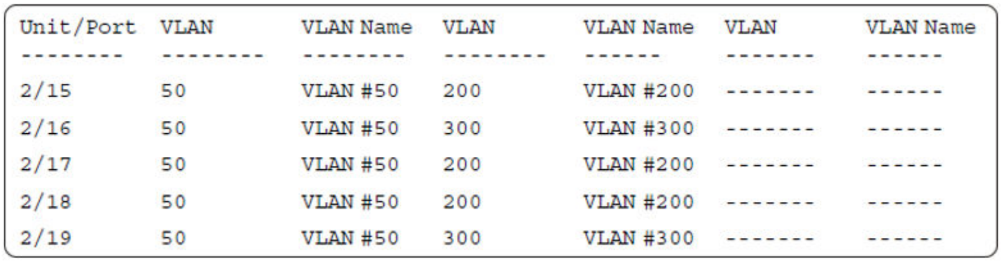
```
Switch(config)#sho vlan interface info 2/15-19
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID    PRI      Tagging   Name
--------   --------  --------      ------  -------  -------   -------
2/15       No        Yes           50      0        UntagAll  Unit 2,
                                                              Port 15
2/16       No        Yes           300     0        UntagAll  Unit 2,
                                                              Port 16
2/17       No        Yes           50      0        UntagAll  Unit 2,
                                                              Port 17
2/18       No        Yes           50      0        UntagAll  Unit 2,
                                                              Port 18
2/19       No        Yes           300     0        UntagAll  Unit 2,
                                                              Port 19
```

7. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vid 2/15-19
```



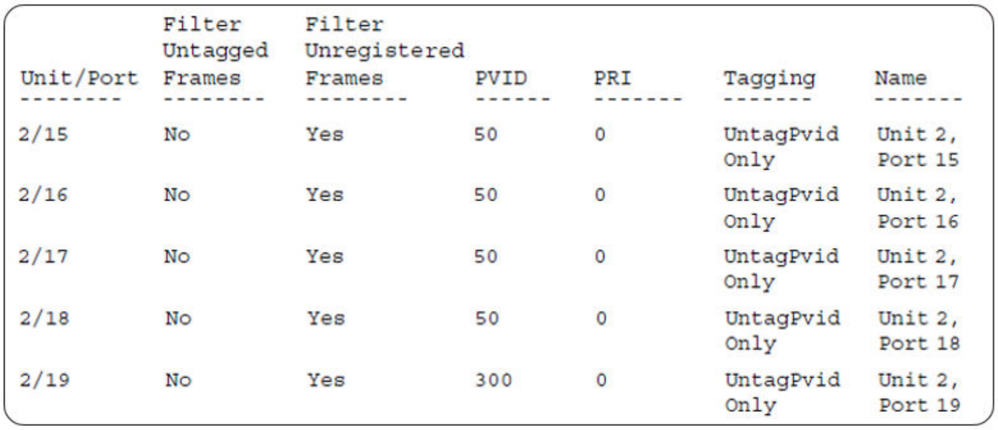
```
Unit/Port  VLAN       VLAN Name  VLAN       VLAN Name  VLAN      VLAN Name
--------   --------   --------   --------   ------     -------   ------
2/15       50         VLAN #50   200        VLAN #200  -------   ------
2/16       50         VLAN #50   300        VLAN #300  -------   ------
2/17       50         VLAN #50   200        VLAN #200  -------   ------
2/18       50         VLAN #50   200        VLAN #200  -------   ------
2/19       50         VLAN #50   300        VLAN #300  -------   ------
```

8. Since all IP Phones will be sending tagged traffic and only the PC will need to receive untagged traffic, set the port to untagpvidOnly.

```
Switch(config)#vlan ports 2/15,2/16,2/17,2/18,2/19 tagging untagpvidOnly
```

9. Confirm the VLAN interface settings.

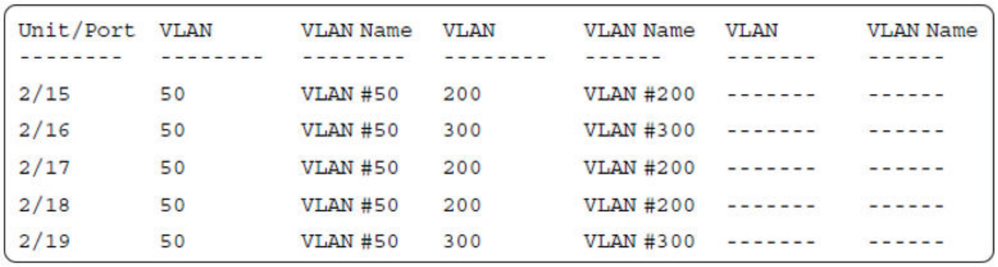
```
Switch(config)#sho vlan interface info 2/15,2/16,2/17,2/18,2/19
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames       PVID   PRI     Tagging   Name
--------  --------  --------     ------ ------- -------   -------
2/15      No        Yes          50     0       UntagPvid Unit 2,
                                                Only      Port 15
2/16      No        Yes          50     0       UntagPvid Unit 2,
                                                Only      Port 16
2/17      No        Yes          50     0       UntagPvid Unit 2,
                                                Only      Port 17
2/18      No        Yes          50     0       UntagPvid Unit 2,
                                                Only      Port 18
2/19      No        Yes          300    0       UntagPvid Unit 2,
                                                Only      Port 19
```

10. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15,2/16,2/17,2/18,2/19
```



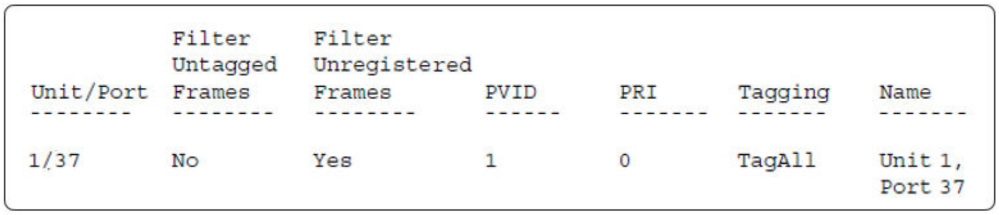
```
Unit/Port VLAN      VLAN Name VLAN      VLAN Name VLAN      VLAN Name
--------  --------  --------  --------  ------    -------   ------
2/15      50        VLAN #50  200       VLAN #200 -------   ------
2/16      50        VLAN #50  300       VLAN #300 -------   ------
2/17      50        VLAN #50  200       VLAN #200 -------   ------
2/18      50        VLAN #50  200       VLAN #200 -------   ------
2/19      50        VLAN #50  300       VLAN #300 -------   ------
```

11. Configure the uplink port 1/37 to transport traffic from all VLANs (1,50,200,300). VLAN 201 is automatically added by ADAC.

```
Switch(config)#vlan members add 50,200,300 1/37
Switch(config)#vlan ports 1/37 tagging tagall
```

12. Confirm the VLAN interface settings for uplink port 1/37.

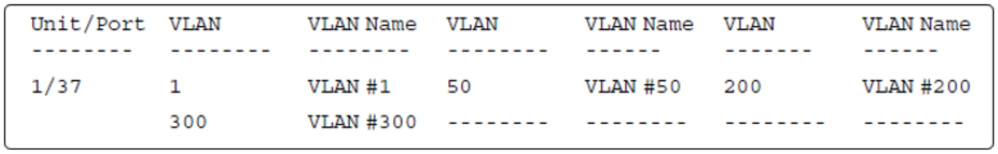
```
Switch(config)#sho vlan interface info 1/37
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames       PVID   PRI     Tagging   Name
--------  --------  --------     ------ ------- -------   -------

1/37      No        Yes          1      0       TagAll    Unit 1,
                                                          Port 37
```

13. Confirm the VLAN inteface VIDs for uplink port 1/37.

```
Switch(config)#show vlan interface vid 1/37
```



```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
--------   --------  --------   --------  ------     -------   ------
1/37       1         VLAN #1    50        VLAN #50   200       VLAN #200
           300       VLAN #300  --------  --------   --------  --------
```

14. Configure ADAC.

```
Switch(config)#interface Ethernet 2/19
Switch(config-if)#adac detection mac lldp
Switch(config-if)#adac enable
Switch(config-if)#exit
Switch(config)#adac uplink-port 1/37
Switch(config)#adac voice-vlan 201
```

Important:

Select only the ADAC mode that allows multiple MACs (clients) on a port. ADAC modes untagged-frames-basic and untagged-frames-advanced, support only one MAC per port (the IP phone MAC).

```
Switch(config)#adac op-mode tagged-frames
```

15. Add the MAC address of the IP phone connected on port 2/19 if the IP phone does not support the LLDP protocol.

```
Switch(config)#adac mac-range-table low-end 00-1C-9C-4A-BC-01 high-end 00-1C-9C-4A-BC-02
```

16. Verify connectivity with the Primary RADIUS server and back-up RADIUS server (if back-up server is used). Firewalls may filter ICMP packets. In this case it is recommended to verify RADIUS server logs for authentication request sent by device.

```
Switch(config)#ping 10.100.68.2
(Host is reachable)

Switch(config)#ping 10.100.68.3
 (Host is reachable)
```

17. Set the EAPOL status for port 2/15.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/15 enable
Switch(config-if)#eapol port 2/15 status auto
Switch(config-if)#eapol multihost port 2/15 eap-mac-max 2
Switch(config-if)#eapol multihost port 2/15 use-radius-assigned-vlan
Switch(config-if)#exit
```

18. Set the EAPOL status for port 2/16.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/16 enable
Switch(config-if)#eapol port 2/16 status auto
Switch(config-if)#eapol multihost port 2/16 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 2/16 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/16 non-eap-phone-enable
Switch(config-if)#eapol multihost non-eap-mac port 2/16 00-19-E1-A2-4D-36
Switch(config-if)#exit
```

19. Set the EAPOL status for port 2/17.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/17 enable
Switch(config-if)#eapol port 2/17 status auto
Switch(config-if)#eapol multihost port 2/17 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 2/17 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/17 radius-non-eap-enable
Switch(config-if)#eapol multihost port 2/17 non-eap-use-radius-assigned- vlan
Switch(config-if)#eapol multihost non-eap-mac port 2/17 00-19-E1-E5-52-4A
Switch(config-if)#exit
```

20. Set the EAPOL status for port 2/18.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/18 enable
Switch(config-if)#eapol port 2/18 status auto
Switch(config-if)#eapol multihost port 2/18 eap-mac-max 1
Switch(config-if)#eapol multihost port 2/18 non-eap-mac-max 1
Switch(config-if)#eapol multihost port 2/18 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/18 radius-non-eap-enable
Switch(config-if)#eapol multihost port 2/18 use-radius-assigned-vlan
Switch(config-if)#exit
```

21. Set the EAPOL status for port 2/19.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/19 enable
Switch(config-if)#eapol port 2/19 status auto
Switch(config-if)#eapol multihost port 2/19 eap-mac-max 1
Switch(config-if)#eapol multihost port 2/19 non-eap-mac-max 1
Switch(config-if)#eapol multihost port 2/19 allow-non-eap-enable
```

22. To confirm that VLAN modifications are not performed by EAP on ADAC enabled ports, disable the VLAN assignment on port 2/19 for EAP and NON-EAP clients.

```
Switch(config-if)#no eapol multihost port 2/19 use-radius-assigned-vlan
Switch(config-if)#no eapol multihost port 2/19 non-eap-use-radius-assigned-vlan
Switch(config-if)#exit
```

23. Set the EAPOL status for port 3/15.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 3/15 enable
Switch(config-if)#eapol port 3/15 status auto
Switch(config-if)#eapol multihost port 3/15 eap-mac-max 1
Switch(config-if)#eapol multihost port 3/15 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 3/15 allow-non-eap-enable
Switch(config-if)#eapol multihost port 3/15 use-radius-assigned-vlan
Switch(config-if)#eapol multihost port 3/15 radius-non-eap-enable
Switch(config-if)#eapol multihost port 3/15 non-eap-use-radius-assigned- vlan
Switch(config-if)#exit
```

24. Set the EAPOL MultiHost status.

```
Switch(config)#eapol multihost voip-vlan 1 vid 200
Switch(config)#eapol multihost voip-vlan 1 enable
Switch(config)#eapol multihost allow-non-eap-enable
Switch(config)#eapol multihost non-eap-phone-enable
Switch(config)#eapol multihost non-eap-use-radius-assigned-vlan
Switch(config)#eapol multihost use-radius-assigned-vlan
Switch(config)#eapol multihost radius-non-eap-enable
```

Important:

You can enable the MutiVlan option only when EAPOL is globally disabled and Fail Open VLAN is not used. The use-most-recent-radius-vlan option is mutually exclusive with the MutiVlan option because the MultiVlan option provides multiple VLAN support on one EAPOL enabled port.

```
Switch(config)#eapol multihost multivlan enable
Switch(config)#eapol enable
```

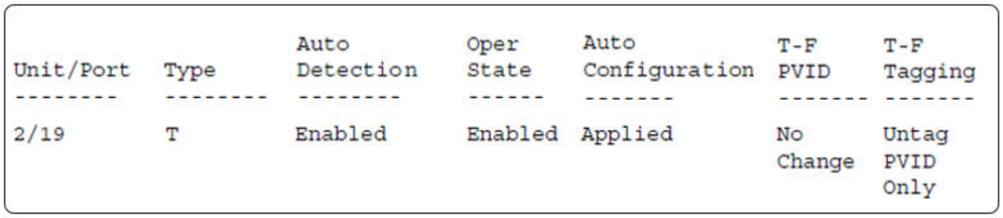
25. Enable ADAC.

```
Switch(config)#adac enable
```

After ADAC is enabled (for tagged-frames and untagged-frames-advanced modes), the ADAC voice VLAN is automatically created and the uplink port, and telephony ports (detected IP phones) are added to the ADAC voice VLAN.

26. Confirm the ADAC interface status for port 2/19.

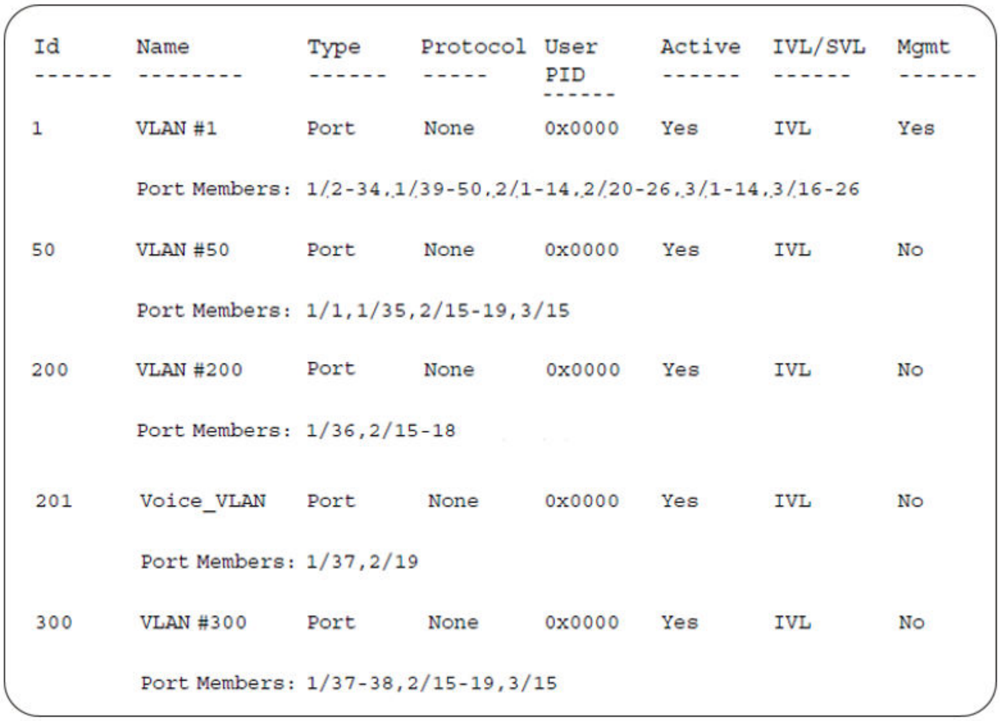
```
Switch(config)#show adac interface 2/19
```



```
                      Auto         Oper     Auto           T-F      T-F
Unit/Port  Type       Detection    State    Configuration  PVID     Tagging
---------  ---------  ---------    ------   -------        -------  -------

2/19       T          Enabled      Enabled  Applied        No       Untag
                                                           Change   PVID
                                                                    Only
```

27. Confirm the VLAN status.

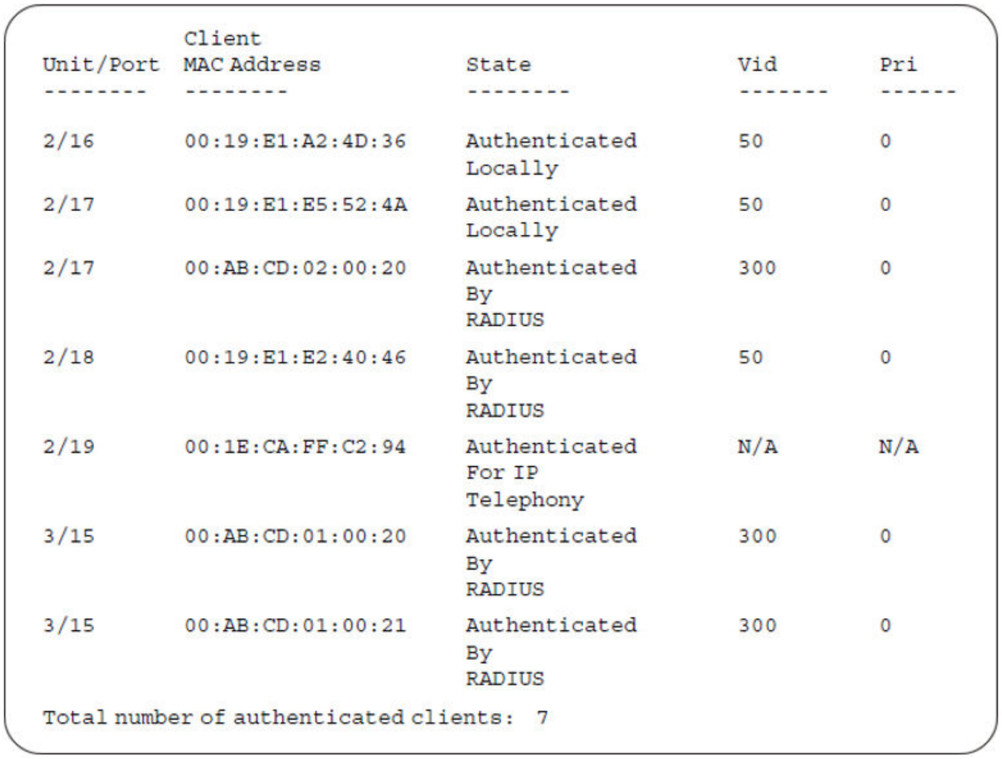
```
Switch(config)#show vlan
```



```
Id      Name          Type     Protocol  User     Active   IVL/SVL   Mgmt
------  --------      ------   -----     PID      ------   ------    ------
                                         ------

1       VLAN #1       Port     None      0x0000   Yes      IVL       Yes

        Port Members: 1/2-34,1/39-50,2/1-14,2/20-26,3/1-14,3/16-26

50      VLAN #50      Port     None      0x0000   Yes      IVL       No

        Port Members: 1/1,1/35,2/15-19,3/15

200     VLAN #200     Port     None      0x0000   Yes      IVL       No

        Port Members: 1/36,2/15-18

201     Voice_VLAN    Port     None      0x0000   Yes      IVL       No

        Port Members: 1/37,2/19

300     VLAN #300     Port     None      0x0000   Yes      IVL       No

        Port Members: 1/37-38,2/15-19,3/15
```

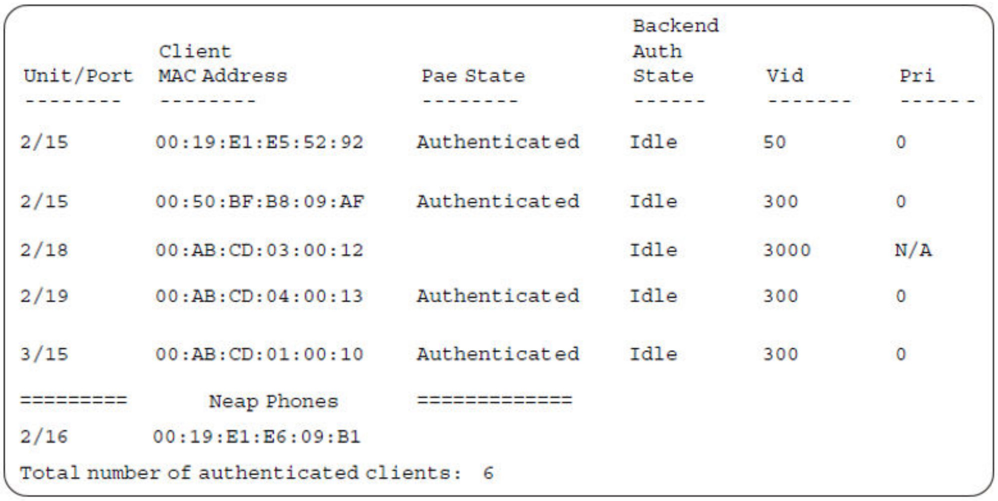
28. Confirm the EAPOL MultiHost status.

```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
           Client
Unit/Port  MAC Address          State              Vid        Pri
--------   --------             --------           -------    ------

2/16       00:19:E1:A2:4D:36    Authenticated      50         0
                                Locally
2/17       00:19:E1:E5:52:4A    Authenticated      50         0
                                Locally
2/17       00:AB:CD:02:00:20    Authenticated      300        0
                                By
                                RADIUS
2/18       00:19:E1:E2:40:46    Authenticated      50         0
                                By
                                RADIUS
2/19       00:1E:CA:FF:C2:94    Authenticated      N/A        N/A
                                For IP
                                Telephony
3/15       00:AB:CD:01:00:20    Authenticated      300        0
                                By
                                RADIUS
3/15       00:AB:CD:01:00:21    Authenticated      300        0
                                By
                                RADIUS

Total number of authenticated clients:  7
```

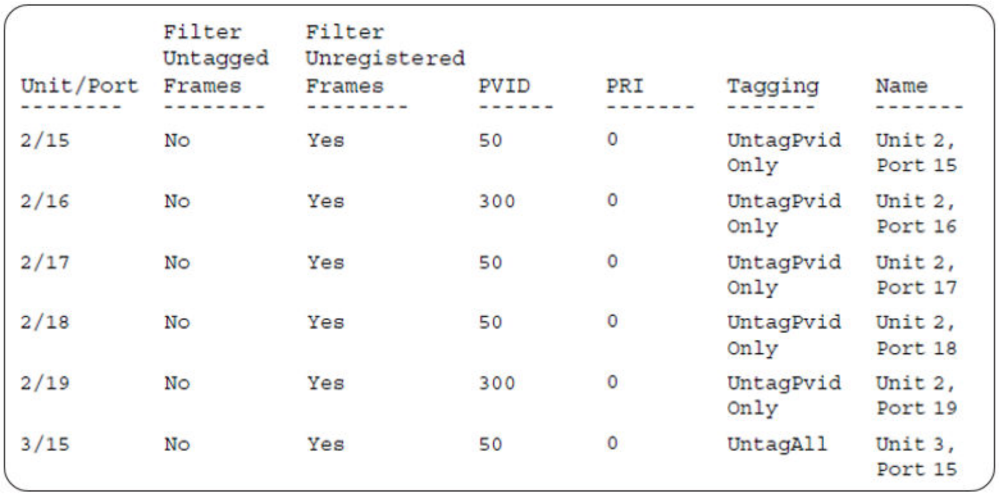
```
Switch(config)#show eapol multihost status
```



```
                                                  Backend
          Client                                  Auth
Unit/Port MAC Address         Pae State           State     Vid       Pri
--------  --------            --------            ------    -------   ------

2/15      00:19:E1:E5:52:92   Authenticated       Idle      50        0

2/15      00:50:BF:B8:09:AF   Authenticated       Idle      300       0

2/18      00:AB:CD:03:00:12                       Idle      3000      N/A

2/19      00:AB:CD:04:00:13   Authenticated       Idle      300       0

3/15      00:AB:CD:01:00:10   Authenticated       Idle      300       0

=========       Neap Phones    =============
2/16      00:19:E1:E6:09:B1
Total number of authenticated clients:  6
```

29. Confirm the VLAN interface settings.

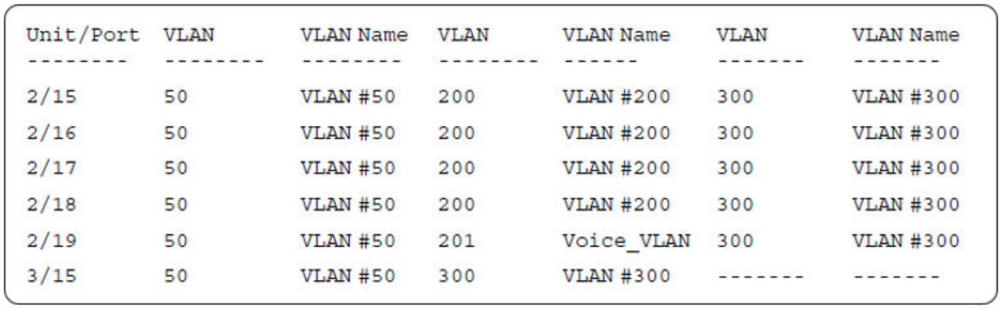
```
Switch(config)#show vlan interface info 2/15-19,3/15
```



```
              Filter     Filter
              Untagged   Unregistered
Unit/Port     Frames     Frames         PVID     PRI       Tagging     Name
--------      --------   --------       ------   -------   -------     -------
2/15          No         Yes            50       0         UntagPvid   Unit 2,
                                                           Only        Port 15

2/16          No         Yes            300      0         UntagPvid   Unit 2,
                                                           Only        Port 16

2/17          No         Yes            50       0         UntagPvid   Unit 2,
                                                           Only        Port 17

2/18          No         Yes            50       0         UntagPvid   Unit 2,
                                                           Only        Port 18

2/19          No         Yes            300      0         UntagPvid   Unit 2,
                                                           Only        Port 19

3/15          No         Yes            50       0         UntagAll    Unit 3,
                                                                       Port 15
```

30. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-19,3/15
```



```
Unit/Port   VLAN       VLAN Name   VLAN       VLAN Name    VLAN      VLAN Name
--------    --------   --------    --------   ------       -------   -------
2/15        50         VLAN #50    200        VLAN #200    300       VLAN #300
2/16        50         VLAN #50    200        VLAN #200    300       VLAN #300
2/17        50         VLAN #50    200        VLAN #200    300       VLAN #300
2/18        50         VLAN #50    200        VLAN #200    300       VLAN #300
2/19        50         VLAN #50    201        Voice_VLAN   300       VLAN #300
3/15        50         VLAN #50    300        VLAN #300    -------   -------
```

Alternate configuration

The following operation applies to **MHMA authentication mode (Multihost MultiVLAN option enabled) without valid additional RADIUS attributes**, when the RADIUS server has no special attributes configured or the RADIUS server uses misconfigured attributes (not matching the device configuration).

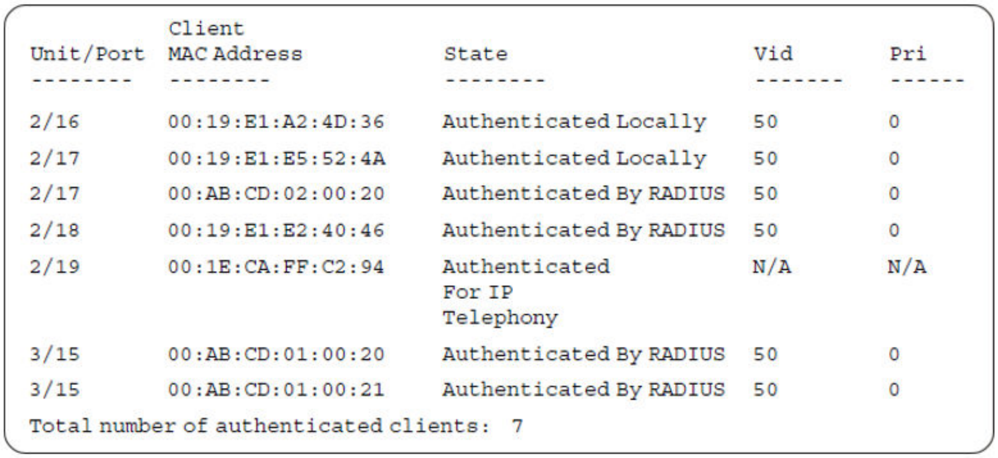
This configuration example modifies EAP and NEAP client attributes on the RADIUS server, replacing VLAN ID 300 with VLAN ID 124, which is not configured on the device.

1. Enable EAPOL.

```
Switch(config)#eapol disable
Switch(config)#eapol enable
```

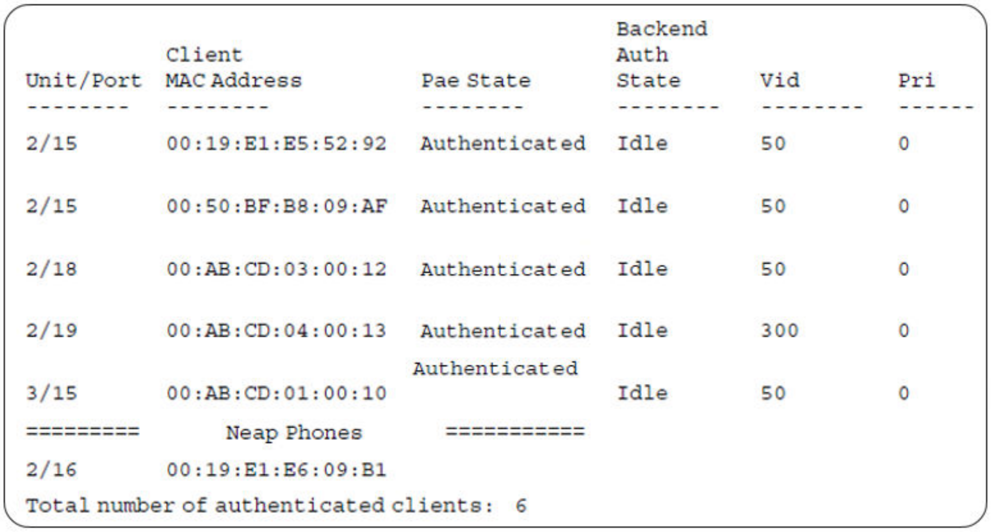
2. Confirm EAPOL MultiHost status.

```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
          Client
Unit/Port MAC Address          State                   Vid      Pri
--------  --------             --------                -------  ------

2/16      00:19:E1:A2:4D:36    Authenticated Locally   50       0
2/17      00:19:E1:E5:52:4A    Authenticated Locally   50       0
2/17      00:AB:CD:02:00:20    Authenticated By RADIUS 50       0
2/18      00:19:E1:E2:40:46    Authenticated By RADIUS 50       0
2/19      00:1E:CA:FF:C2:94    Authenticated           N/A      N/A
                               For IP
                               Telephony
3/15      00:AB:CD:01:00:20    Authenticated By RADIUS 50       0
3/15      00:AB:CD:01:00:21    Authenticated By RADIUS 50       0
Total number of authenticated clients:  7
```

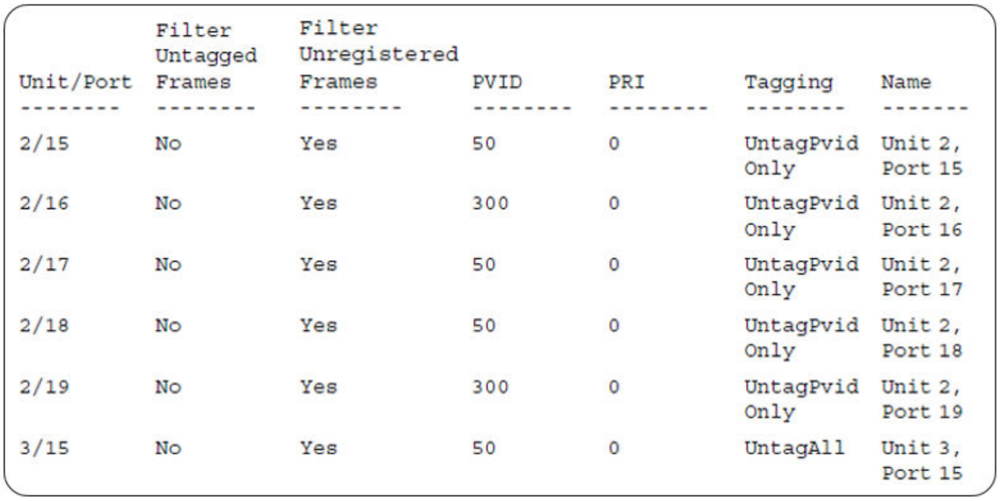
```
Switch(config)#show eapol multihost status
```



```
                                           Backend
          Client                           Auth
Unit/Port MAC Address        Pae State     State     Vid       Pri
--------  --------           --------      --------  --------  ------
2/15      00:19:E1:E5:52:92  Authenticated Idle      50        0

2/15      00:50:BF:B8:09:AF  Authenticated Idle      50        0

2/18      00:AB:CD:03:00:12  Authenticated Idle      50        0

2/19      00:AB:CD:04:00:13  Authenticated Idle      300       0
                            Authenticated
3/15      00:AB:CD:01:00:10                Idle      50        0
=========        Neap Phones      ===========
2/16      00:19:E1:E6:09:B1
Total number of authenticated clients:  6
```

3. Confirm the VLAN interface settings.

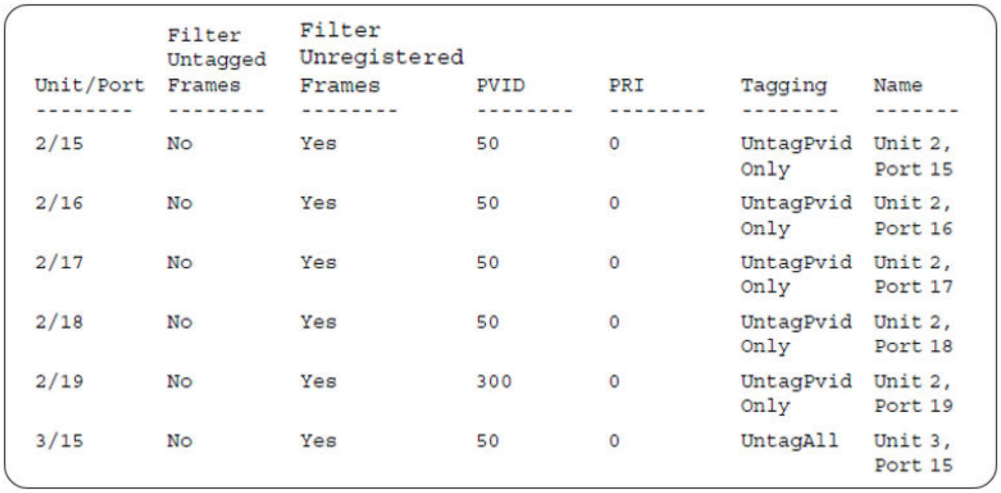
```
Switch(config)#show vlan interface info 2/15-19,3/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames        PVID      PRI       Tagging   Name
--------  --------  --------      --------  --------  --------  -------
2/15      No        Yes           50        0         UntagPvid Unit 2,
                                                      Only      Port 15
2/16      No        Yes           300       0         UntagPvid Unit 2,
                                                      Only      Port 16
2/17      No        Yes           50        0         UntagPvid Unit 2,
                                                      Only      Port 17
2/18      No        Yes           50        0         UntagPvid Unit 2,
                                                      Only      Port 18
2/19      No        Yes           300       0         UntagPvid Unit 2,
                                                      Only      Port 19
3/15      No        Yes           50        0         UntagAll  Unit 3,
                                                                Port 15
```

4. Confirm the VLAN interface settings.

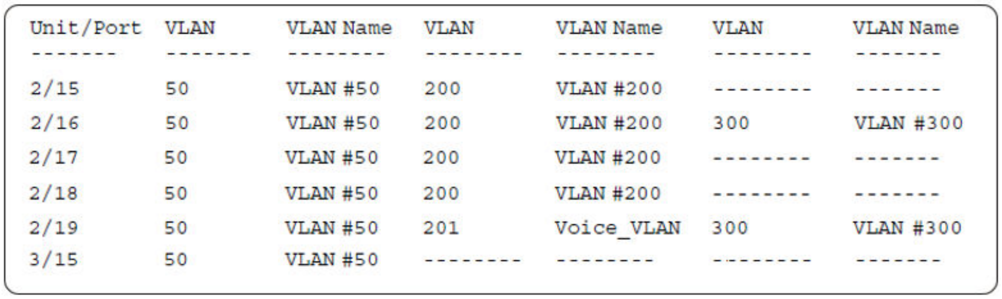
```
Switch(config)#show vlan interface info 2/15-19,3/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames        PVID      PRI       Tagging   Name
--------  --------  --------      --------  --------  --------  -------
2/15      No        Yes           50        0         UntagPvid Unit 2,
                                                      Only      Port 15
2/16      No        Yes           50        0         UntagPvid Unit 2,
                                                      Only      Port 16
2/17      No        Yes           50        0         UntagPvid Unit 2,
                                                      Only      Port 17
2/18      No        Yes           50        0         UntagPvid Unit 2,
                                                      Only      Port 18
2/19      No        Yes           300       0         UntagPvid Unit 2,
                                                      Only      Port 19
3/15      No        Yes           50        0         UntagAll  Unit 3,
                                                                Port 15
```

5. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-19,3/15
```



```
Unit/Port VLAN     VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
-------   -------  --------   --------  --------   --------  -------
2/15      50       VLAN #50   200       VLAN #200  --------  -------
2/16      50       VLAN #50   200       VLAN #200  300       VLAN #300
2/17      50       VLAN #50   200       VLAN #200  --------  -------
2/18      50       VLAN #50   200       VLAN #200  --------  -------
2/19      50       VLAN #50   201       Voice_VLAN 300       VLAN #300
3/15      50       VLAN #50   --------  --------   --------  -------
```

MHMA authentication mode with Guest VLAN (Multihost MultiVLAN option disabled) with or without additional RADIUS attributes

The configuration example in this section applies to the following client port settings when:

- when 802.1X is disabled on the port—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
- when 802.1X is enabled on the port:
    - an unauthenticated client is on the port with Guest VLAN enabled—the port is included in the Guest VLAN ID, and the port uses one of the Guest VLAN PVIDs
    - an authenticated client is on the port with Guest VLAN enabled
        - the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs but no RADIUS attribute is received, or an invalid RADIUS attribute is received, for the client
        - the port is included in RADIUS VLAN Id and the port uses a RADIUS VLAN PVID (Valid RADIUS attributes received)
    - an authenticated client is on the port with Guest VLAN enabled
        - the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs but no RADIUS attribute is received, or an invalid RADIUS attribute is received, and Static MAC is defined for the client
        - the port is included in RADIUS VLAN Id and the port uses a RADIUS VLAN PVID (Valid RADIUS attributes received)
    - an authenticated client is on the port with Guest VLAN enabled and a static defined MAC—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs
    - an authenticated client is on the port with Guest VLAN enabled and using a DHCP signature—the port is included in the initial VLAN ID, and the port uses one of the initial VLAN PVIDs

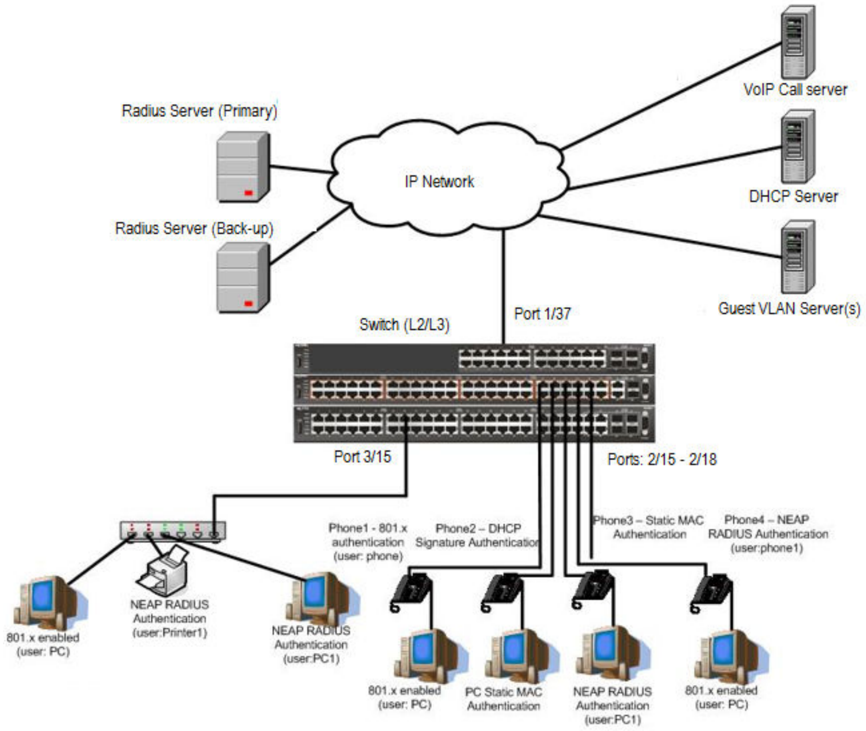

VoIP Call server
Radius Server (Primary)
IP Network
DHCP Server
Radius Server (Back-up)
Guest VLAN Server(s)
Port 1/37
Switch (L2/L3)
Port 3/15
Ports: 2/15 - 2/18
Phone1 - 801.x authentication (user: phone)
Phone2 – DHCP Signature Authentication
Phone3 – Static MAC Authentication
Phone4 – NEAP RADIUS Authentication (user:phone1)
801.x enabled (user: PC)
NEAP RADIUS Authentication (user:Printer1)
NEAP RADIUS Authentication (user:PC1)
801.x enabled (user: PC)
PC Static MAC Authentication
NEAP RADIUS Authentication (user:PC1)
801.x enabled (user: PC)

Figure 48: MHMA authentication mode with Guest VLAN (Multihost MultiVLAN option disabled) with or without additional RADIUS attributes

Scenario

Assume the following settings:

- Primary RADIUS server configured with six users:
  - EAP user: phone with no VLAN ID radius attribute
  - EAP user: PC with attribute VLAN ID: 300
  - EAP user: PC2 with no VLAN ID radius attribute
  - RADIUS user for phone1 with no VLAN ID radius attribute
  - RADIUS user for PC1 with attribute VLAN ID: 300
  - RADIUS user for Printer1 with attribute VLAN ID: 300
- Backup RADIUS server configured with the same six users:
  - EAP user: phone with no VLAN ID radius attribute
  - EAP user: PC with attribute VLAN ID: 300
  - EAP user: PC2 with no VLAN ID radius attribute
  - RADIUS user for phone1 with no VLAN ID radius attribute
  - RADIUS user for PC1 with attribute VLAN ID: 300
  - RADIUS user for Printer1 with attribute VLAN ID: 300

All IP Phones are configured to send tag traffic with a VoIP VLAN ID.

- Port 2/15:
  - 801.x authenticated user Phone1connected
  - 801.x enabled user PC connected
  - Guest VLAN ID = 20
  - Initial VLAN ID = 50, 200
  - PC RADIUS VLAN ID = 300
  - Phone RADIUS VLAN ID = none
- Port 2/16:
  - DHCP signature authenticated user Phone2 connected
  - Static MAC authenticated user PC connected
  - Guest VLAN ID = 20
  - Initial VLAN ID = 50, 300
  - Phone EAP VOIP VLAN ID = 200
- Port 2/17:
  - Static MAC authenticated user Phone3 connected
  - NEAP RADIUS authenticated user PC1 connected
  - Guest VLAN ID = 20
  - Initial VLAN ID = 50, 200
  - PC RADIUS VLAN ID = 300
- Port 2/18:
  - Phone4 – NEAP RADIUS Authentication (user:phone1)
  - 801.x enabled user PC connected
  - Guest VLAN ID = 20
  - Initial VLAN ID = 50, 200
  - PC RADIUS VLAN ID = 300
  - Phone RADIUS VLAN ID = none
- Port 3/15:
  - 801.x enabled user PC connected
  - NEAP RADIUS authenticated user Printer1 connected
  - NEAP RADIUS authenticated user PC1 connected
  - Guest VLAN ID = 20
  - Initial VLAN ID = 50

  - RADIUS VLAN ID = 300
- 802.1x phone client VLAN ID/PVID port 2/15 settings:
  - 801.x disabled on 50,200/50
  - Unauthenticated client with 801.x enabled on 20/20
  - Authenticated (user phone authenticated, user PC unauthenticated):
    - 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
  - Authenticated (user phone authenticated, user PC authenticated):
    - 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
    - 50, 200, 300/ 300 (Valid RADIUS attributes received)
- 802.1x PC client VLAN ID/PVID port 2/16 settings:
  - 801.x disabled on 50,300/300
  - Unauthenticated client with 801.x enabled on 20/20
  - Authenticated (Phone DHCP signature OK, EAP VOIP VLAN ID 200 assigned):
    - 50,200,300/300
  - Authenticated (PC MAC defined in static list, PC MAC learned in MAC address table, Phone DHCP signature OK):
    - 50,200,300/300
- 802.1x PC client VLAN ID/PVID port 2/17 settings:
  - 801.x disabled on 50,200/50
  - Unauthenticated client with 801.x enabled on 20/20
  - Authenticated (Phone MAC defined in static list, Phone MAC learned in MAC address table):
    - 50, 200/ 50
  - Authenticated (user PC1 authenticated; Phone MAC defined in static list, Phone MAC learned in MAC address table):
    - 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes) received)
    - 50, 200, 300/ 300 (Valid RADIUS attributes received)

802.1x PC client VLAN ID/PVID port 2/18 settings:

  - 801.x disabled on 50,200/50
  - Unauthenticated client with 801.x enabled on 20/20
  - Authenticated (user phone1 authenticated, user PC unauthenticated):
    - 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
  - Authenticated (user PC authenticated, user phone1 authenticated):
    - 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)

- 50, 200, 300/ 300 (Valid RADIUS attributes received)

802.1x PC client VLAN ID/PVID port 3/15 settings:

- 801.x disabled on 50/50
- Unauthenticated client with 801.x enabled on 20/20
- Authenticated (at least one user authenticated from : PC, PC1, Printer1):
  - 50/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
  - 300/ 300 (Valid RADIUS attributes received)

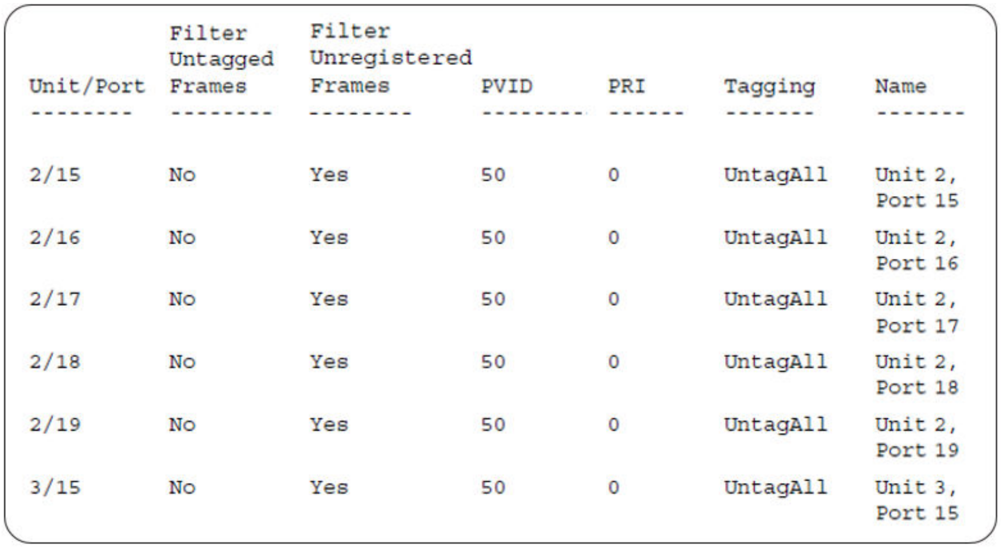
Configuration example

1. Configure the RADIUS servers and VLAN settings

```
Switch(config)#ip address 10.100.68.254 netmask 255.255.255.0 default-gateway 10.100.68.1
Switch(config)#radius-server host 10.100.68.2
Switch(config)#radius-server secondary-host 10.100.68.3
Switch(config)#radius-server key
Enter key: RadiusKey
Enter key: RadiusKey
Switch(config)#vlan configcontrol automatic
Switch(config)#vlan create 20 type port
Switch(config)#vlan create 50 type port
Switch(config)#vlan create 200 type port
Switch(config)#vlan create 300 type port
Switch(config)#vlan members add 50 2/15-19,3/15
```

2. Confirm the VLAN interface settings.

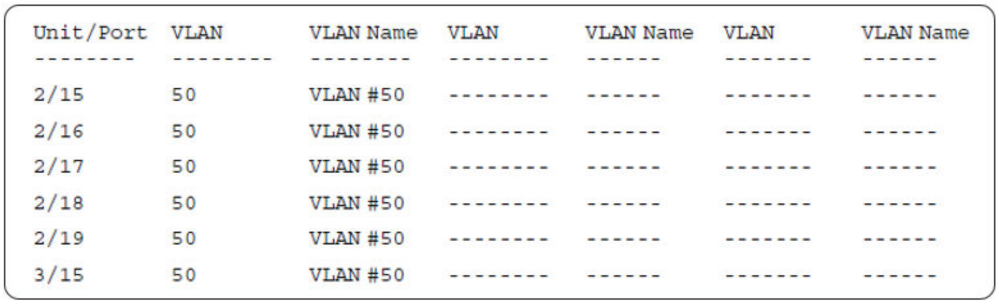
```
Switch(config)#sho vlan interface info 2/15-19,3/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames       PVID     PRI    Tagging   Name
--------  --------  --------     -------- ------ -------   -------

2/15      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 15
2/16      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 16
2/17      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 17
2/18      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 18
2/19      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 19
3/15      No        Yes          50       0      UntagAll  Unit 3,
                                                           Port 15
```

3. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15-19,3/15
```



```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN     VLAN Name
--------   --------  --------   --------  ------     -------  ------
2/15       50        VLAN #50   --------  ------     -------  ------
2/16       50        VLAN #50   --------  ------     -------  ------
2/17       50        VLAN #50   --------  ------     -------  ------
2/18       50        VLAN #50   --------  ------     -------  ------
2/19       50        VLAN #50   --------  ------     -------  ------
3/15       50        VLAN #50   --------  ------     -------  ------
```

4. Change VLAN config control mode to flexible mode in order to add same port in multiple initial VLANs.

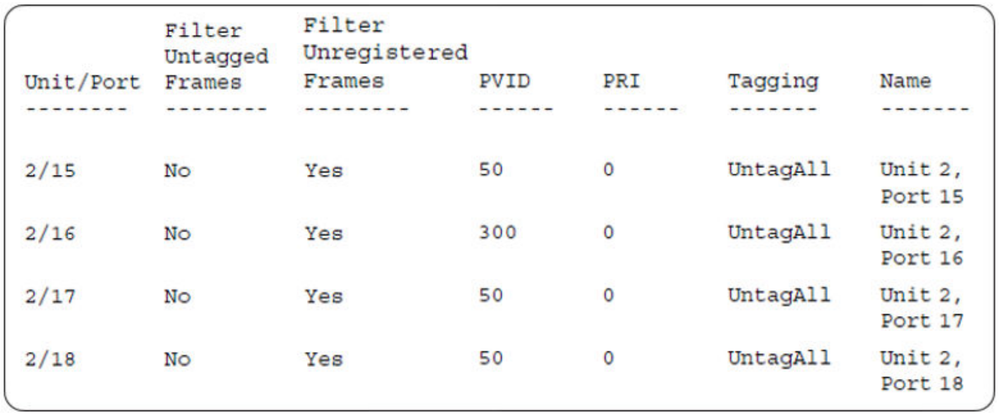
```
Switch(config)#vlan configcontrol flexible
```

5. Add IP phone ports to the voice vlan, VLAN ID 200.

```
Switch(config)#vlan members add 200 2/15,2/17,2/18
Switch(config)#vlan members add 300 2/16
Switch(config)#vlan port 2/16 pvid 300
```

6. Confirm the VLAN interface settings.

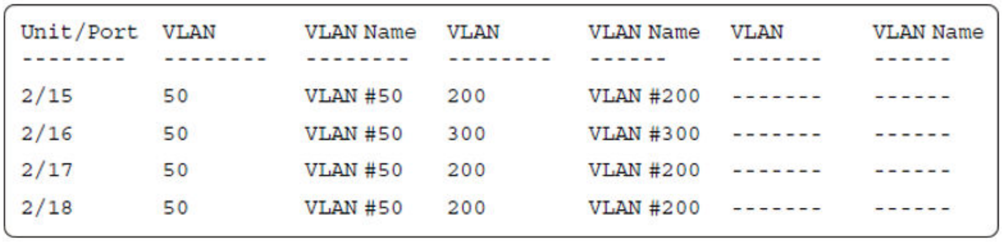
```
Switch(config)#sho vlan interface info 2/15,2/16,2/17,2/18
```



```
                     Filter
           Filter    Unregistered
           Untagged
Unit/Port  Frames    Frames       PVID    PRI     Tagging   Name
--------   --------  --------     ------  ------  -------   -------

2/15       No        Yes          50      0       UntagAll  Unit 2,
                                                            Port 15
2/16       No        Yes          300     0       UntagAll  Unit 2,
                                                            Port 16
2/17       No        Yes          50      0       UntagAll  Unit 2,
                                                            Port 17
2/18       No        Yes          50      0       UntagAll  Unit 2,
                                                            Port 18
```

7. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15,2/16,2/17,2/18
```



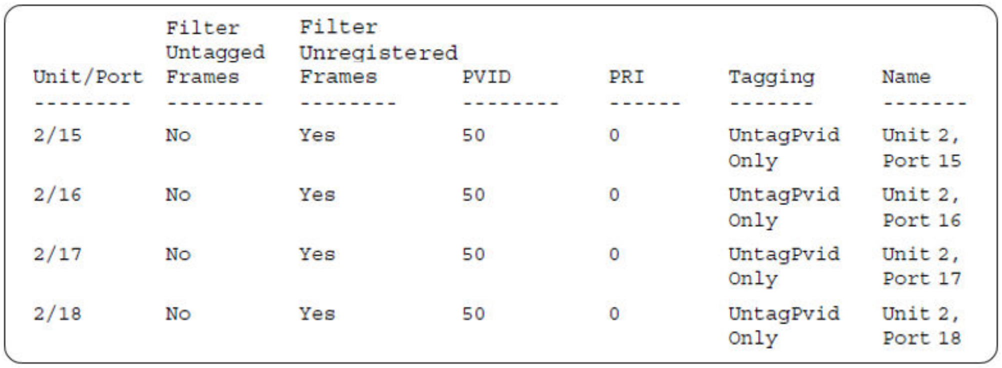
```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN     VLAN Name
--------   --------  --------   --------  ------     -------  ------
2/15       50        VLAN #50   200       VLAN #200  -------  ------
2/16       50        VLAN #50   300       VLAN #300  -------  ------
2/17       50        VLAN #50   200       VLAN #200  -------  ------
2/18       50        VLAN #50   200       VLAN #200  -------  ------
```

8. Since all IP Phones will be sending tagged traffic and only the PC will need to receive untagged traffic, set the port to untagpvidOnly.

```
Switch(config)#vlan ports 2/15,2/16,2/17,2/18 tagging untagpvidOnly
```

9. Confirm the VLAN interface settings.

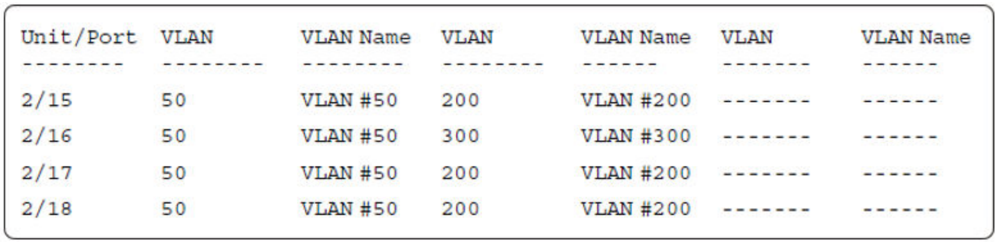
```
Switch(config)#sho vlan interface info 2/15,2/16,2/17,2/18
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames       PVID      PRI     Tagging    Name
--------  --------  --------     --------  ------  -------    -------
2/15      No        Yes          50        0       UntagPvid  Unit 2,
                                                   Only       Port 15
2/16      No        Yes          50        0       UntagPvid  Unit 2,
                                                   Only       Port 16
2/17      No        Yes          50        0       UntagPvid  Unit 2,
                                                   Only       Port 17
2/18      No        Yes          50        0       UntagPvid  Unit 2,
                                                   Only       Port 18
```

10. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15,2/16,2/17,2/18
```



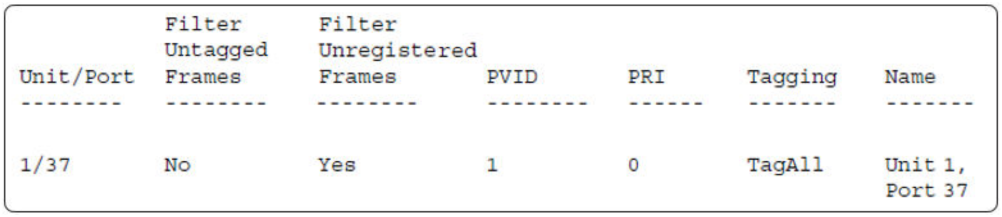
```
Unit/Port VLAN      VLAN Name VLAN      VLAN Name VLAN      VLAN Name
--------  --------  --------  --------  ------    -------   ------
2/15      50        VLAN #50  200       VLAN #200 -------   ------
2/16      50        VLAN #50  300       VLAN #300 -------   ------
2/17      50        VLAN #50  200       VLAN #200 -------   ------
2/18      50        VLAN #50  200       VLAN #200 -------   ------
```

11. Configure the uplink port 1/37 to transport traffic from all VLANs (1,50,200,300).

```
Switch(config)#vlan members add 50,200,300 1/37
Switch(config)#vlan ports 1/37 tagging tagall
```

12. Confirm the VLAN interface settings for uplink port 1/37.

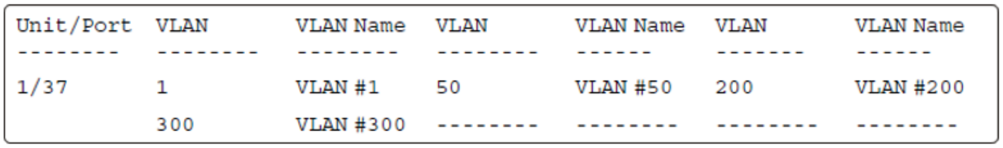
```
Switch(config)#sho vlan interface info 1/37
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames       PVID      PRI     Tagging    Name
--------  --------  --------     --------  ------  -------    -------

1/37      No        Yes          1         0       TagAll     Unit 1,
                                                              Port 37
```

13. Confirm the VLAN inteface VIDs for uplink port 1/37.

```
Switch(config)#show vlan interface vids 1/37
```



```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
---------  --------  --------   --------  ------     -------   ------
1/37       1         VLAN #1    50        VLAN #50   200       VLAN #200
           300       VLAN #300  --------  --------   --------  --------
```

14. Verify connectivity with the Primary RADIUS server and back-up RADIUS server (if back-up server is used). Firewalls may filter ICMP packets. In this case it is recommended to verify RADIUS server logs for authentication request sent by device.

```
Switch(config)#ping 10.100.68.2
(Host is reachable)

 Switch(config)#ping 10.100.68.3
 (Host is reachable)
```

15. Set the EAPOL status for port 2/15.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/15 enable
Switch(config-if)#eapol port 2/15 status auto
Switch(config-if)#eapol multihost port 2/15 eap-mac-max 2
Switch(config-if)#eapol multihost port 2/15 use-radius-assigned-vlan
Switch(config-if)#eapol guest-vlan port 2/15 enable
Switch(config-if)#exit
```

16. Set the EAPOL status for port 2/16.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/16 enable
Switch(config-if)#eapol port 2/16 status auto
Switch(config-if)#eapol multihost port 2/16 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 2/16 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/16 non-eap-phone-enable
Switch(config-if)#eapol multihost non-eap-mac port 2/16 00-19-E1-A2-4D-36
Switch(config-if)#eapol guest-vlan port 2/16 enable
Switch(config-if)#exit
```

17. Set the EAPOL status for port 2/17.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/17 enable
Switch(config-if)#eapol port 2/17 status auto
Switch(config-if)#eapol multihost port 2/17 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 2/17 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/17 radius-non-eap-enable
Switch(config-if)#eapol multihost port 2/17 non-eap-use-radius-assigned- vlan
Switch(config-if)#eapol multihost non-eap-mac port 2/17 00-19-E1-E5-52-4A
Switch(config-if)#eapol guest-vlan port 2/17 enable
Switch(config-if)#exit
```

18. Set the EAPOL status for port 2/18.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/18 enable
Switch(config-if)#eapol port 2/18 status auto
Switch(config-if)#eapol multihost port 2/18 eap-mac-max 1
Switch(config-if)#eapol multihost port 2/18 non-eap-mac-max 1
Switch(config-if)#eapol multihost port 2/18 radius-non-eap-enable
Switch(config-if)#eapol multihost port 2/18 use-radius-assigned-vlan
Switch(config-if)#eapol guest-vlan port 2/18 enable
Switch(config-if)#exit
```

19. Set the EAPOL status for port 3/15.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 3/15 enable
Switch(config-if)#eapol port 3/15 status auto
Switch(config-if)#eapol multihost port 3/15 eap-mac-max 1
Switch(config-if)#eapol multihost port 3/15 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 3/15 use-radius-assigned-vlan
Switch(config-if)#eapol multihost port 3/15 radius-non-eap-enable
Switch(config-if)#eapol multihost port 3/15 non-eap-use-radius-assigned- vlan
Switch(config-if)#eapol guest-vlan port 3/15 enable
Switch(config-if)#exit
```

20. Set the Guest VLAN

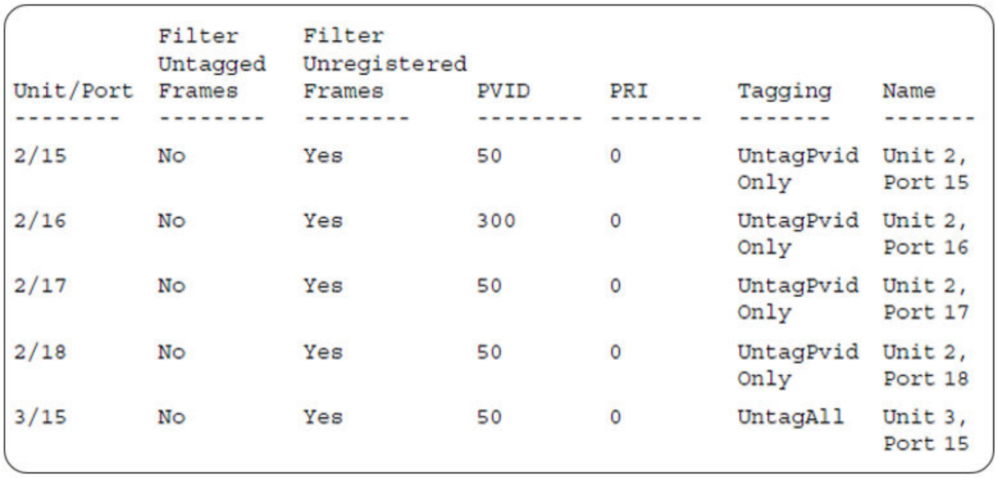
```
Switch(config)#eapol guest-vlan vid 20
Switch(config)#eapol guest-vlan enable
```

21. Set the EAPOL MultiHost status.

```
Switch(config)#eapol multihost voip-vlan 1 vid 200
Switch(config)#eapol multihost voip-vlan 1 enable
Switch(config)#eapol multihost allow-non-eap-enable
Switch(config)#eapol multihost non-eap-phone-enable
Switch(config)#eapol multihost non-eap-use-radius-assigned-vlan
Switch(config)#eapol multihost use-radius-assigned-vlan
Switch(config)#eapol multihost radius-non-eap-enable
```

22. Confirm the VLAN interface settings.

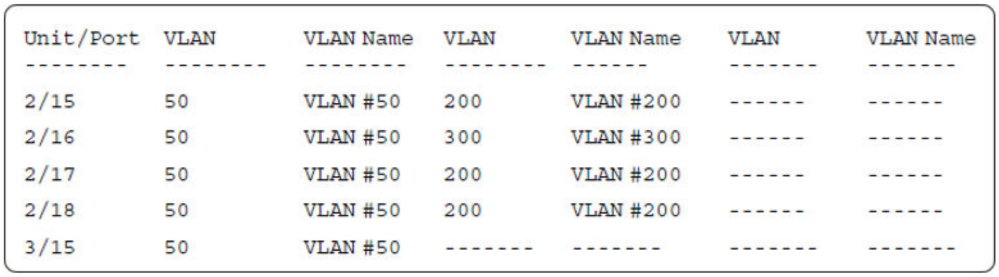
```
Switch(config)#show vlan interface info 2/15-18,3/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames       PVID     PRI     Tagging   Name
--------  --------  --------     -------- ------- -------   -------
2/15      No        Yes          50       0       UntagPvid Unit 2,
                                                  Only      Port 15

2/16      No        Yes          300      0       UntagPvid Unit 2,
                                                  Only      Port 16

2/17      No        Yes          50       0       UntagPvid Unit 2,
                                                  Only      Port 17

2/18      No        Yes          50       0       UntagPvid Unit 2,
                                                  Only      Port 18

3/15      No        Yes          50       0       UntagAll  Unit 3,
                                                            Port 15
```

23. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```



```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN     VLAN Name
--------   --------  --------   --------  ------     -------  -------
2/15       50        VLAN #50   200       VLAN #200  ------   ------
2/16       50        VLAN #50   300       VLAN #300  ------   ------
2/17       50        VLAN #50   200       VLAN #200  ------   ------
2/18       50        VLAN #50   200       VLAN #200  ------   ------
3/15       50        VLAN #50   -------   -------    -------  -------
```

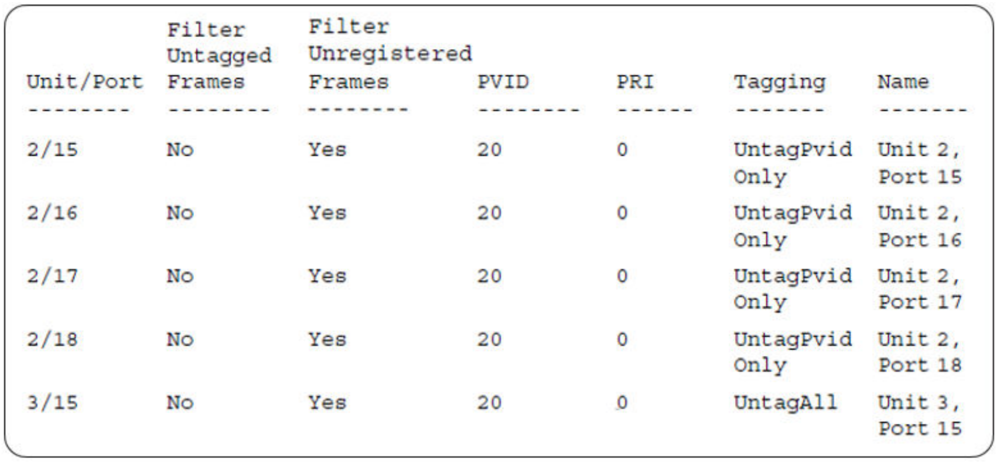
24. Enable EAPOL globally.

```
Switch(config)#eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

Before any clients authenticate on ports:

25. Confirm the VLAN interface settings.

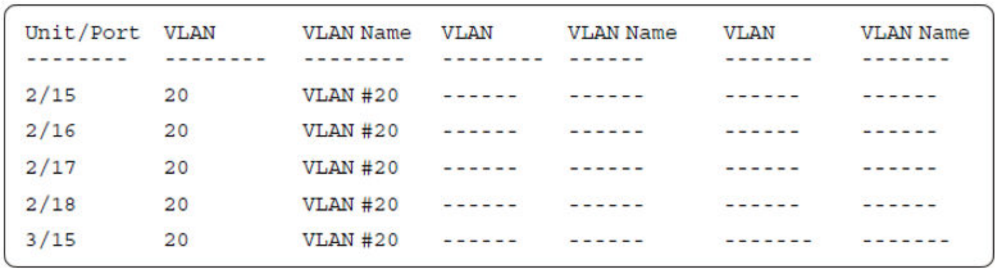
```
Switch(config)#sho vlan interface info 2/15-18,3/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames      PVID      PRI     Tagging   Name
--------   --------  --------    --------  ------  -------   -------
2/15       No        Yes         20        0       UntagPvid Unit 2,
                                                   Only      Port 15
2/16       No        Yes         20        0       UntagPvid Unit 2,
                                                   Only      Port 16
2/17       No        Yes         20        0       UntagPvid Unit 2,
                                                   Only      Port 17
2/18       No        Yes         20        0       UntagPvid Unit 2,
                                                   Only      Port 18
3/15       No        Yes         20        0       UntagAll  Unit 3,
                                                             Port 15
```

26. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```

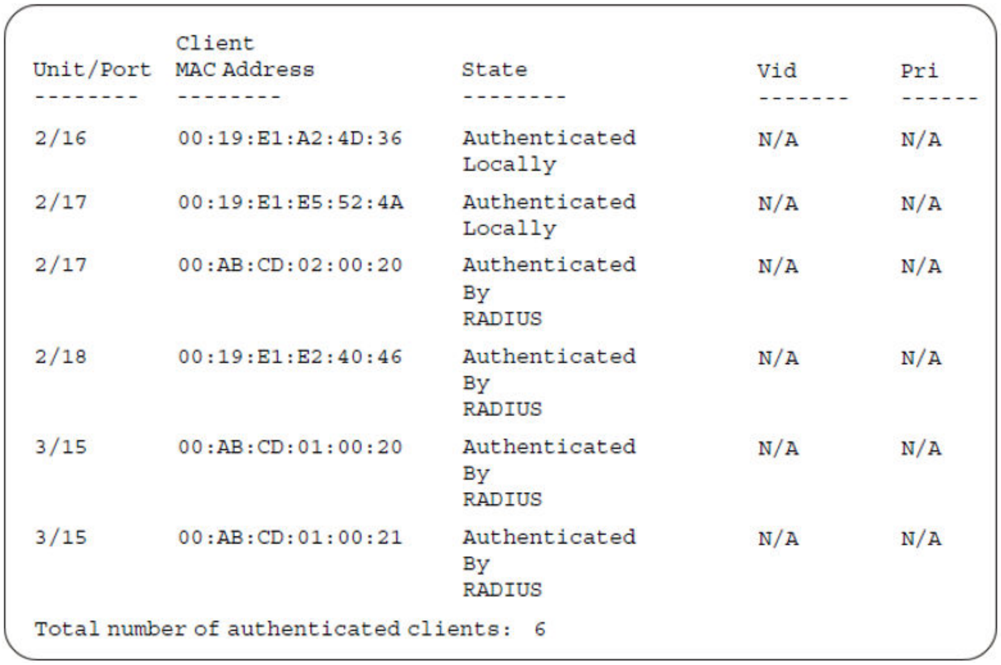


```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN     VLAN Name
--------   --------  --------   --------  ------     -------  -------
2/15       20        VLAN #20   ------    ------     ------   ------
2/16       20        VLAN #20   ------    ------     ------   ------
2/17       20        VLAN #20   ------    ------     ------   ------
2/18       20        VLAN #20   ------    ------     ------   ------
3/15       20        VLAN #20   ------    ------     -------  -------
```

After all clients authenticate on ports:

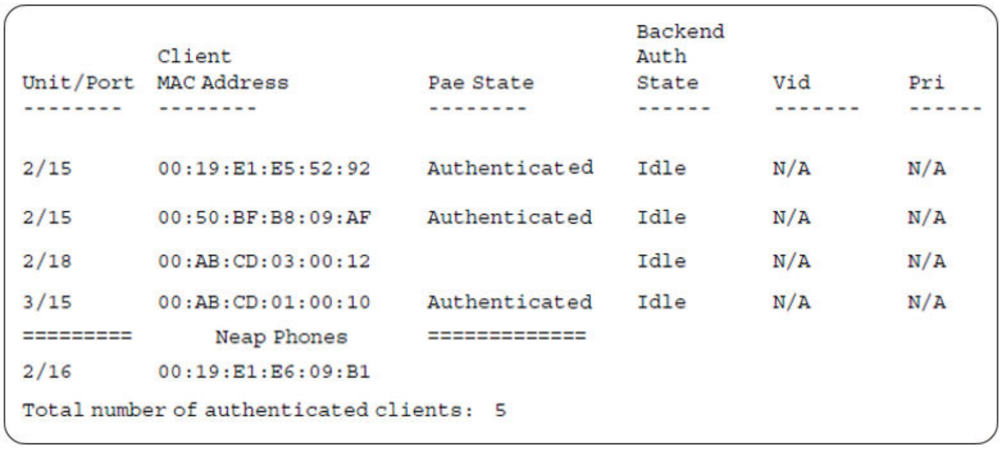
27. Confirm the EAPOL MultiHost status.

```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
           Client
Unit/Port  MAC Address           State                 Vid       Pri
--------   --------              --------              -------   ------
2/16       00:19:E1:A2:4D:36     Authenticated         N/A       N/A
                                 Locally
2/17       00:19:E1:E5:52:4A     Authenticated         N/A       N/A
                                 Locally
2/17       00:AB:CD:02:00:20     Authenticated         N/A       N/A
                                 By
                                 RADIUS
2/18       00:19:E1:E2:40:46     Authenticated         N/A       N/A
                                 By
                                 RADIUS
3/15       00:AB:CD:01:00:20     Authenticated         N/A       N/A
                                 By
                                 RADIUS
3/15       00:AB:CD:01:00:21     Authenticated         N/A       N/A
                                 By
                                 RADIUS
Total number of authenticated clients:  6
```

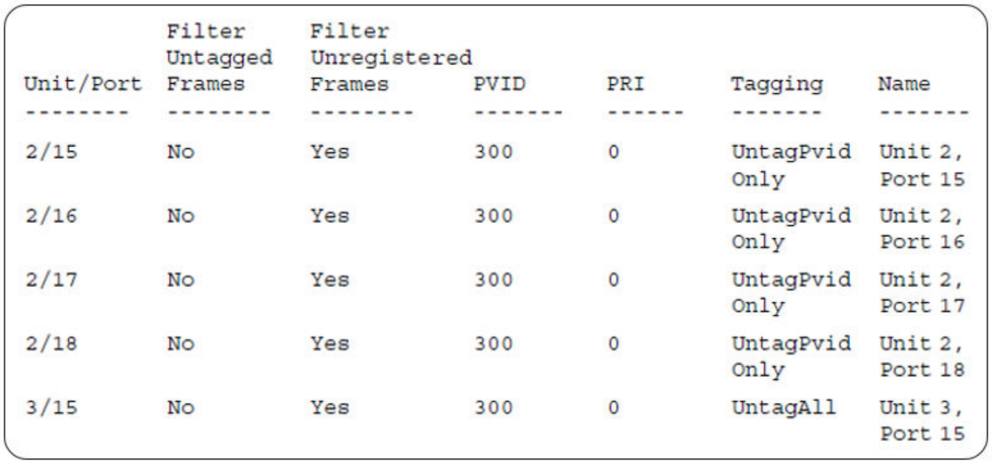
```
Switch(config)#show eapol multihost status
```



```
                                              Backend
           Client                             Auth
Unit/Port  MAC Address          Pae State     State     Vid       Pri
--------   --------             --------      ------    -------   ------

2/15       00:19:E1:E5:52:92    Authenticated Idle      N/A       N/A

2/15       00:50:BF:B8:09:AF    Authenticated Idle      N/A       N/A

2/18       00:AB:CD:03:00:12                  Idle      N/A       N/A

3/15       00:AB:CD:01:00:10    Authenticated Idle      N/A       N/A
=========      Neap Phones      =============
2/16       00:19:E1:E6:09:B1
Total number of authenticated clients:  5
```

28. Confirm the VLAN interface settings.

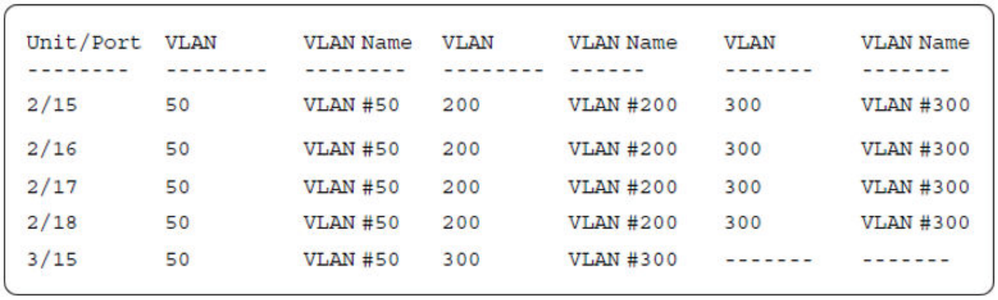
```
Switch(config)#sho vlan interface info 2/15-18,3/15
```



```
             Filter     Filter
             Untagged   Unregistered
Unit/Port    Frames     Frames        PVID      PRI      Tagging     Name
--------     --------   --------      -------   ------   -------     -------
2/15         No         Yes           300       0        UntagPvid   Unit 2,
                                                         Only        Port 15
2/16         No         Yes           300       0        UntagPvid   Unit 2,
                                                         Only        Port 16
2/17         No         Yes           300       0        UntagPvid   Unit 2,
                                                         Only        Port 17
2/18         No         Yes           300       0        UntagPvid   Unit 2,
                                                         Only        Port 18
3/15         No         Yes           300       0        UntagAll    Unit 3,
                                                                     Port 15
```

29. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```



```
Unit/Port   VLAN       VLAN Name   VLAN       VLAN Name   VLAN      VLAN Name
--------    --------   --------    --------   ------      -------   -------
2/15        50         VLAN #50    200        VLAN #200   300       VLAN #300
2/16        50         VLAN #50    200        VLAN #200   300       VLAN #300
2/17        50         VLAN #50    200        VLAN #200   300       VLAN #300
2/18        50         VLAN #50    200        VLAN #200   300       VLAN #300
3/15        50         VLAN #50    300        VLAN #300   -------   -------
```

Alternate configuration

The following operation applies to **MHMA authentication mode with Guest VLAN (Multihost MultiVLAN option disabled) without valid additional RADIUS attributes** , when the RADIUS server has no special attributes configured or the RADIUS server uses misconfigured attributes (not matching the device configuration).

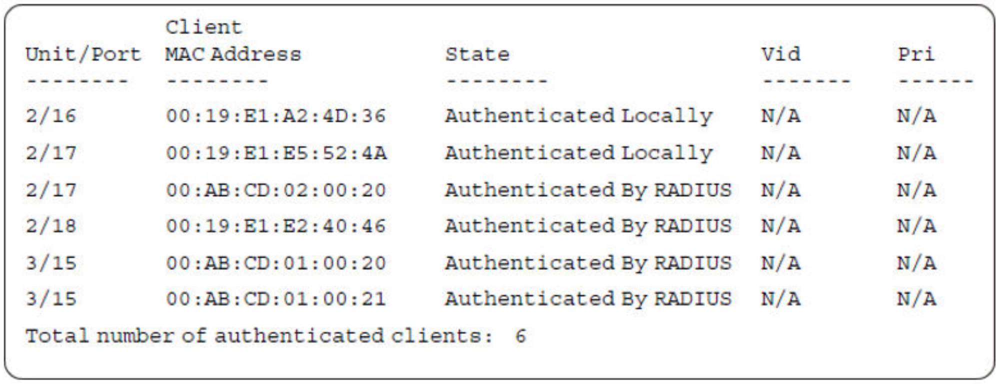
This configuration example modifies EAP and NEAP client attributes on the RADIUS server, replacing VLAN ID 300 with VLAN ID 124, which is not configured on the device.

1. Enable EAPOL.

```
Switch(config)#eapol disable
Switch(config)#eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

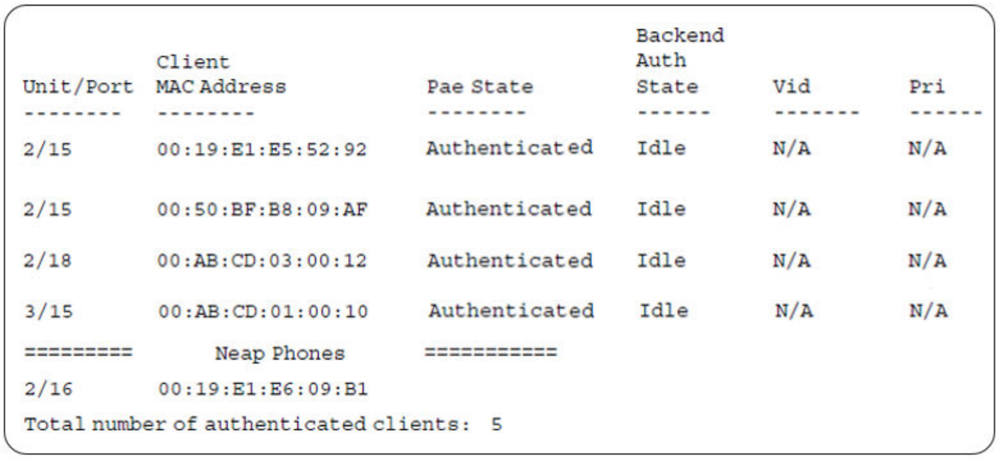
2. Confirm EAPOL MultiHost status.

```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
           Client
Unit/Port  MAC Address          State                    Vid       Pri
--------   --------             --------                 -------   ------
2/16       00:19:E1:A2:4D:36    Authenticated Locally    N/A       N/A
2/17       00:19:E1:E5:52:4A    Authenticated Locally    N/A       N/A
2/17       00:AB:CD:02:00:20    Authenticated By RADIUS  N/A       N/A
2/18       00:19:E1:E2:40:46    Authenticated By RADIUS  N/A       N/A
3/15       00:AB:CD:01:00:20    Authenticated By RADIUS  N/A       N/A
3/15       00:AB:CD:01:00:21    Authenticated By RADIUS  N/A       N/A
Total number of authenticated clients:  6
```

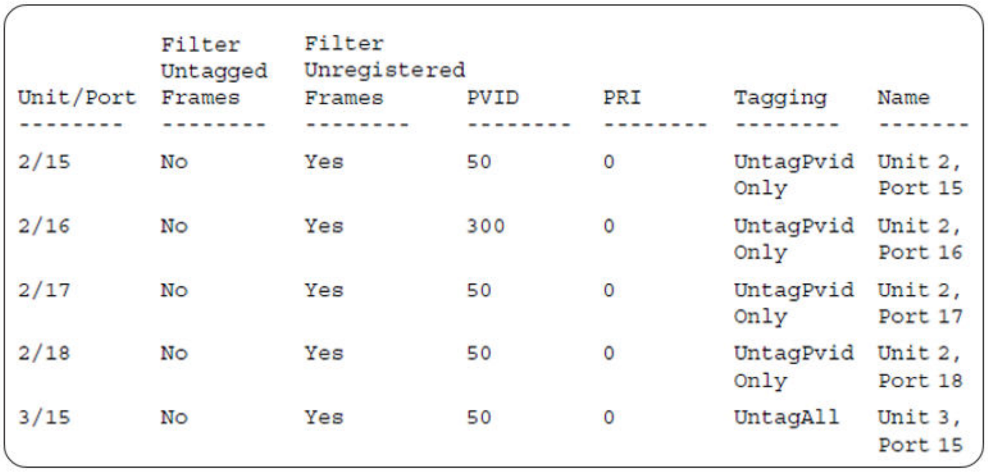
```
Switch(config)#show eapol multihost status
```



```
                                                  Backend
           Client                                 Auth
Unit/Port  MAC Address          Pae State         State     Vid       Pri
--------   --------             --------          ------    -------   ------

2/15       00:19:E1:E5:52:92    Authenticated     Idle      N/A       N/A

2/15       00:50:BF:B8:09:AF    Authenticated     Idle      N/A       N/A

2/18       00:AB:CD:03:00:12    Authenticated     Idle      N/A       N/A

3/15       00:AB:CD:01:00:10    Authenticated     Idle      N/A       N/A
=========        Neap Phones      ===========
2/16       00:19:E1:E6:09:B1
Total number of authenticated clients:  5
```

3. Confirm the VLAN interface settings.

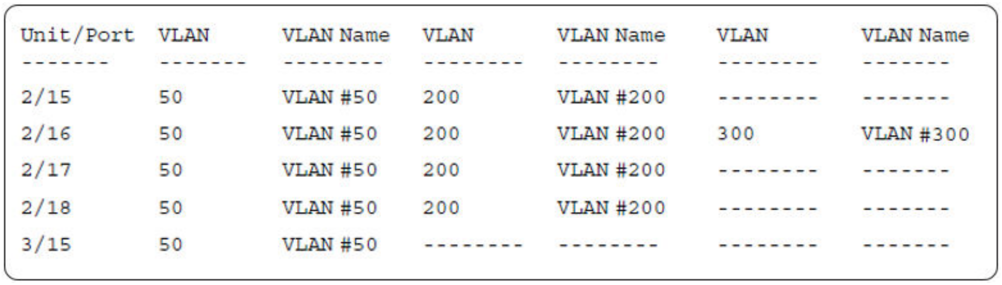
```
Switch(config)#show vlan interface info 2/15-18,3/15
```



```
           Filter     Filter
           Untagged   Unregistered
Unit/Port  Frames     Frames      PVID      PRI       Tagging    Name
--------   --------   --------    --------  --------  --------   -------
2/15       No         Yes         50        0         UntagPvid  Unit 2,
                                                      Only       Port 15
2/16       No         Yes         300       0         UntagPvid  Unit 2,
                                                      Only       Port 16
2/17       No         Yes         50        0         UntagPvid  Unit 2,
                                                      Only       Port 17
2/18       No         Yes         50        0         UntagPvid  Unit 2,
                                                      Only       Port 18
3/15       No         Yes         50        0         UntagAll   Unit 3,
                                                                 Port 15
```

4. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```



```
Unit/Port  VLAN     VLAN Name  VLAN     VLAN Name  VLAN     VLAN Name
-------    -------  --------   -------- --------   -------- -------
2/15       50       VLAN #50   200      VLAN #200  -------- -------
2/16       50       VLAN #50   200      VLAN #200  300      VLAN #300
2/17       50       VLAN #50   200      VLAN #200  -------- -------
2/18       50       VLAN #50   200      VLAN #200  -------- -------
3/15       50       VLAN #50   -------- --------   -------- -------
```

MHMA authentication mode with Guest VLAN (Multihost MultiVLAN option enabled) with or without additional RADIUS attributes

For this EAP operational mode the port and client will have the following settings:

- when 802.1X is disabled on the port—the port is included in an initial VLAN – one or multiple initial VLANs are supported, and the port uses one of the initial VLAN PVIDs specified by the user
- when 802.1X is enabled on the port:
  - an unauthenticated client is on the port with Guest VLAN enabled—the port is included only in the Guest VLAN ID, and the port uses the Guest VLAN PVID
  - an authenticated 801.x client is on the port with Guest VLAN enabled
    - the port is added to an initial VLAN and port PVID is the Guest VLAN PVID - the client uses the initial VLAN PVIDs (client traffic can be sent in multiple initial VLANs). In this case no RADIUS attribute is received, or an invalid RADIUS attribute is received, for the 801.x client.
    - the port is added to the RADIUS VLAN and the port PVID is the Guest VLAN PVID - the client PVID is set to the RADIUS VLAN PVID (Valid RADIUS attributes received for 801.x client)
  - an authenticated non-801.x client is on the port with Guest VLAN enabled
    - the port is added to an initial VLAN, and the port PVID is the Guest VLAN PVID - the client uses the initial VLAN PVIDs (client traffic can be sent in multiple initial VLANs). In this case no RADIUS attribute is received, or an invalid RADIUS attribute is received for the non-801.x radius client.
    - the port is added to the RADIUS VLAN and the port PVID is the Guest VLAN PVID - the client PVID is set to the RADIUS VLAN PVID (Valid RADIUS attributes received for non-801.x radius client)
  - an authenticated non-801.x static MAC client is on the port with Guest VLAN enabled (client MAC was learned in the MAC address table). In this case the port is added to an initial

VLAN, and the port PVID is the Guest VLAN PVID - the client uses the initial VLAN PVIDs (client traffic can be sent in multiple initial VLANs)

- an authenticated non-801.x client is on the port with Guest VLAN enabled and using a DHCP signature—the port remains in the Guest VLAN, and the port uses the Guest VLAN PVID - the DHCP client uses the first VOIP VLAN PVIDs (DHCP client traffic cannot be sent in multiple VOIP VLANs, only the fist VOIP VLAN defined is used)

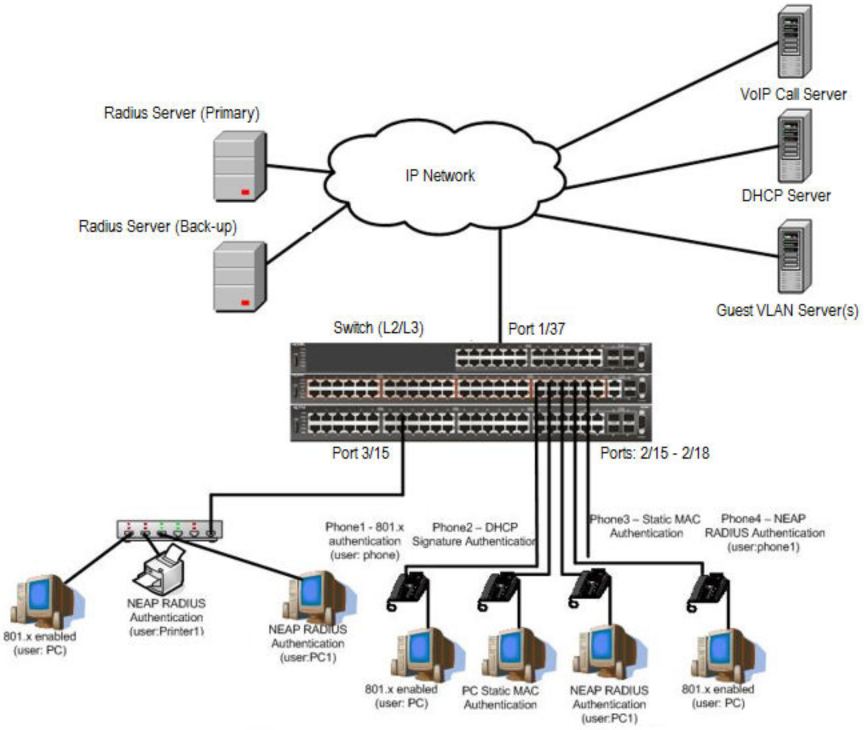

Radius Server (Primary)
Radius Server (Back-up)
IP Network
VoIP Call Server
DHCP Server
Guest VLAN Server(s)
Switch (L2/L3)
Port 1/37
Port 3/15
Ports: 2/15 - 2/18
Phone1 - 801.x authentication (user: phone)
Phone2 – DHCP Signature Authentication
Phone3 – Static MAC Authentication
Phone4 – NEAP RADIUS Authentication (user:phone1)
801.x enabled (user: PC)
NEAP RADIUS Authentication (user:Printer1)
NEAP RADIUS Authentication (user:PC1)
801.x enabled (user: PC)
PC Static MAC Authentication
NEAP RADIUS Authentication (user:PC1)
801.x enabled (user: PC)

Figure 49: MHMA authentication mode with Guest VLAN (Multihost MultiVLAN option enabled) with or without additional RADIUS attributes

Scenario

Assume the following settings:

1. RADIUS server(s) configurations.
    - A primary server is mandatory. If a back-up server is used, the back-up server configuration must be the same as for primary server configuration.
2. Configure all IP Phones to send tag traffic with proper VoIP VLAN ID.
3. Clients settings:
    - Port 2/15:
        - 801.x authenticated user Phone1connected
        - 801.x enabled user PC connected
        - Guest VLAN ID = 20
        - Initial VLAN ID = 50, 200

    - PC RADIUS VLAN ID = 300
    - Phone RADIUS VLAN ID = none
  - Port 2/16:
    - DHCP signature authenticated user Phone2 connected
    - Static MAC authenticated user PC connected
    - Guest VLAN ID = 20
    - Initial VLAN ID = 50, 300
    - Phone EAP VOIP VLAN ID = 200
  - Port 2/17:
    - Static MAC authenticated user Phone3 connected
    - NEAP RADIUS authenticated user PC1 connected
    - Guest VLAN ID = 20
    - Initial VLAN ID = 50, 200
    - PC RADIUS VLAN ID = 300
  - Port 2/18:
    - Phone4 – NEAP RADIUS Authentication (user:phone1)
    - 801.x enabled user PC connected
    - Guest VLAN ID = 20
    - Initial VLAN ID = 50, 200
    - PC RADIUS VLAN ID = 300
    - Phone RADIUS VLAN ID = none
  - Port 3/15:
    - 801.x enabled user PC connected
    - NEAP RADIUS authenticated user Printer1 connected
    - NEAP RADIUS authenticated user PC1 connected
    - Guest VLAN ID = 20
    - Initial VLAN ID = 50
    - RADIUS VLAN ID = 300
4. Port settings:
  - VLAN ID/PVID port settings for 2/15:
    - 801.x disabled - VLAN ID/PVID = 50,200/50
    - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 20/20

  - Authenticated (user phone authenticated, user PC unauthenticated):
    - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
  - Authenticated (user phone authenticated, user PC authenticated):
    - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
    - VLAN ID/PVID = 50, 200, 300/ 300 (Valid RADIUS attributes received)
- VLAN ID/PVID port settings for 2/16:
  - 801.x disabled - VLAN ID/PVID = 50,300/300
  - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 20/20
  - Authenticated (Phone DHCP signature OK, EAP VOIP VLAN ID 200 assigned):
    - VLAN ID/PVID = 50,200,300/300
  - Authenticated (PC MAC defined in static list, PC MAC learned in MAC address table, Phone DHCP signature OK):
    - VLAN ID/PVID = 50,200,300/300
- VLAN ID/PVID port settings for 2/17:
  - 801.x disabled - VLAN ID/PVID = 50,200/50
  - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 20/20
  - Authenticated (Phone MAC defined in static list, Phone MAC learned in MAC address table):
    - VLAN ID/PVID = 50, 200/ 50
  - Authenticated (user PC1 authenticated; Phone MAC defined in static list, Phone MAC learned in MAC address table):
    - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes) received)
    - VLAN ID/PVID = 50, 200, 300/ 300 (Valid RADIUS attributes received)

VLAN ID/PVID port settings for 2/18:

  - 801.x disabled - VLAN ID/PVID = 50,200/50
  - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 20/20
  - Authenticated (user phone1 authenticated, user PC unauthenticated):
    - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
  - Authenticated (user PC authenticated, user phone1 authenticated):
    - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)

- VLAN ID/PVID = 50, 200, 300/ 300 (Valid RADIUS attributes received)

VLAN ID/PVID port settings for 3/15:

- 801.x disabled - VLAN ID/PVID = 50/50
- Unauthenticated client with 801.x enabled - VLAN ID/PVID = 20/20
- Authenticated (at least one user authenticated from : PC, PC1, Printer1):
  - VLAN ID/PVID = 50/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
  - VLAN ID/PVID = 300/ 300 (Valid RADIUS attributes received)

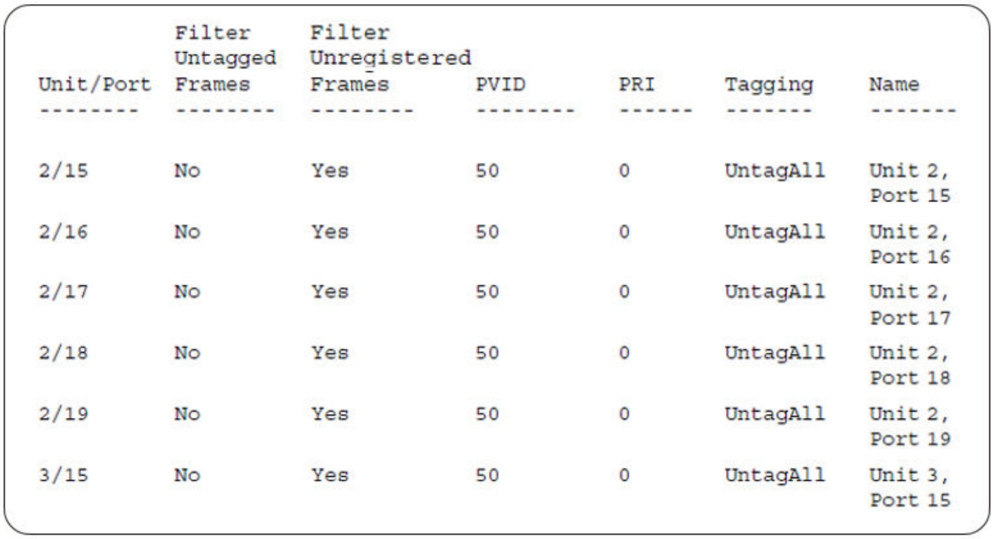
Configuration example

1. Configure the RADIUS servers and VLAN settings

```
Switch(config)#ip address 10.100.68.254 netmask 255.255.255.0 default-gateway 10.100.68.1
Switch(config)#radius-server host 10.100.68.2
Switch(config)#radius-server secondary-host 10.100.68.3
Switch(config)#radius-server key
Enter key: RadiusKey
Enter key: RadiusKey
Switch(config)#vlan configcontrol automatic
Switch(config)#vlan create 20 type port
Switch(config)#vlan create 50 type port
Switch(config)#vlan create 200 type port
Switch(config)#vlan create 300 type port
Switch(config)#vlan members add 50 2/15-19,3/15
```

2. Confirm the VLAN interface settings.

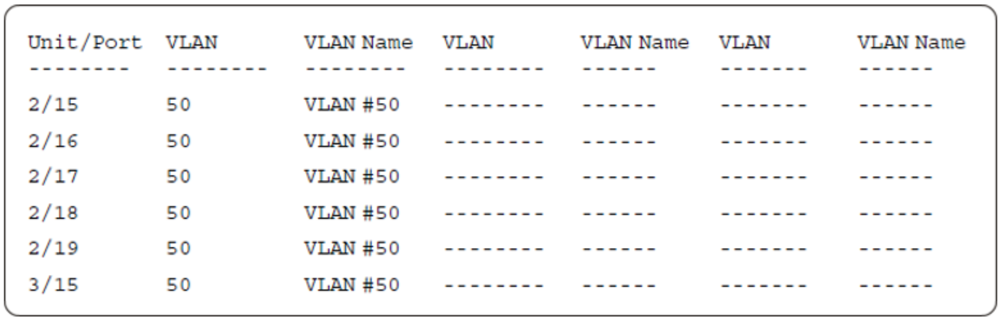
```
Switch(config)#sho vlan interface info 2/15-19,3/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames       PVID     PRI    Tagging   Name
--------  --------  --------     -------- ------ -------   -------

2/15      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 15
2/16      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 16
2/17      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 17
2/18      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 18
2/19      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 19
3/15      No        Yes          50       0      UntagAll  Unit 3,
                                                           Port 15
```

3. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15-19,3/15
```



```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
--------   --------  --------   --------  ------     -------   ------
2/15       50        VLAN #50   --------  ------     -------   ------
2/16       50        VLAN #50   --------  ------     -------   ------
2/17       50        VLAN #50   --------  ------     -------   ------
2/18       50        VLAN #50   --------  ------     -------   ------
2/19       50        VLAN #50   --------  ------     -------   ------
3/15       50        VLAN #50   --------  ------     -------   ------
```

4. Change VLAN config control mode to flexible mode in order to add same port in multiple initial VLANs.

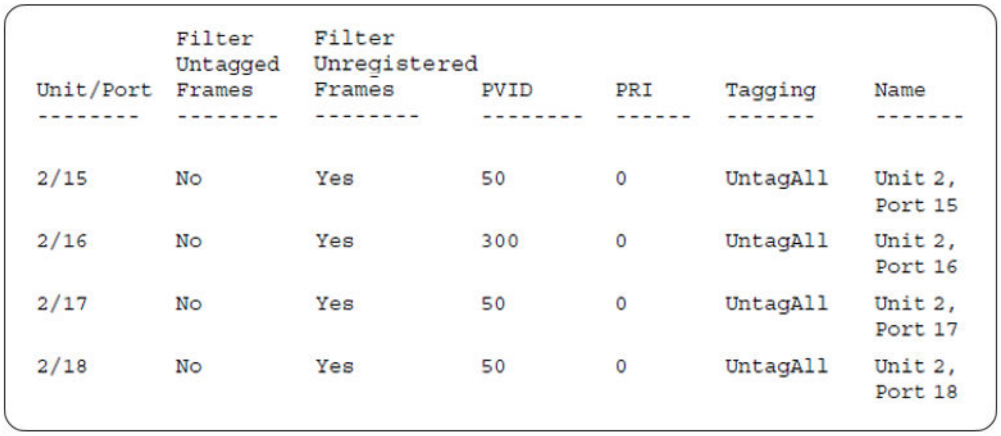
```
Switch(config)#vlan configcontrol flexible
```

5. Add IP phone ports to the voice vlan, VLAN ID 200.

```
Switch(config)#vlan members add 200 2/15,2/17,2/18
Switch(config)#vlan members add 300 2/16
Switch(config)#vlan port 2/16 pvid 300
```

6. Confirm the VLAN interface settings.

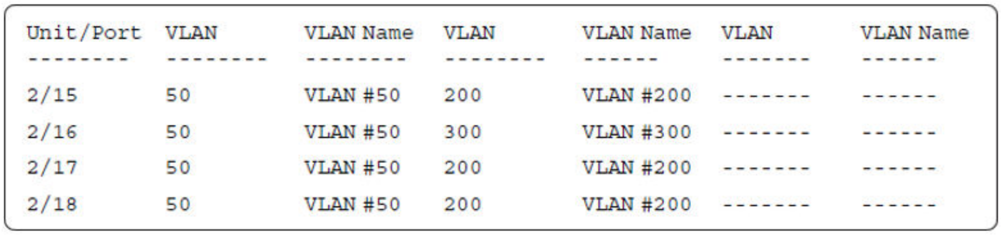
```
Switch(config)#sho vlan interface info 2/15,2/16,2/17,2/18
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames       PVID      PRI     Tagging   Name
--------   --------  --------     --------  ------  -------   -------

2/15       No        Yes          50        0       UntagAll  Unit 2,
                                                              Port 15
2/16       No        Yes          300       0       UntagAll  Unit 2,
                                                              Port 16
2/17       No        Yes          50        0       UntagAll  Unit 2,
                                                              Port 17
2/18       No        Yes          50        0       UntagAll  Unit 2,
                                                              Port 18
```

7. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15,2/16,2/17,2/18
```



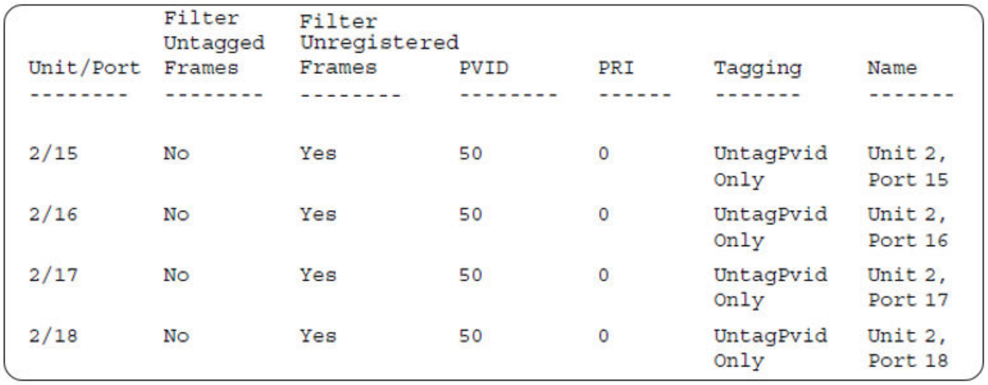
```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
--------   --------  --------   --------  ------     -------   ------
2/15       50        VLAN #50   200       VLAN #200  -------   ------
2/16       50        VLAN #50   300       VLAN #300  -------   ------
2/17       50        VLAN #50   200       VLAN #200  -------   ------
2/18       50        VLAN #50   200       VLAN #200  -------   ------
```

8. Since all IP Phones will be sending tagged traffic and only the PC will need to receive untagged traffic, set the port to untagpvidOnly.

```
Switch(config)#vlan ports 2/15,2/16,2/17,2/18 tagging untagpvidOnly
```

9. Confirm the VLAN interface settings.

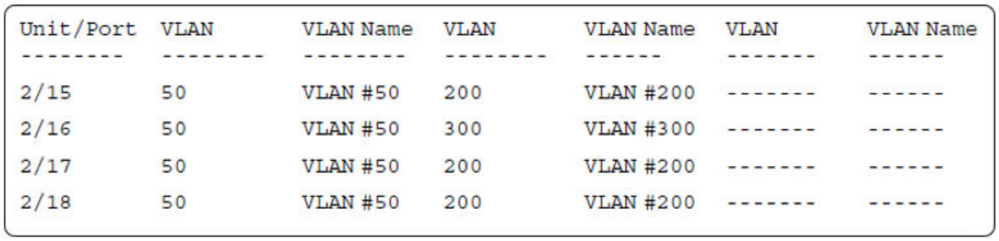
```
Switch(config)#sho vlan interface info 2/15,2/16,2/17,2/18
```



```
           Filter     Filter
           Untagged   Unregistered
Unit/Port  Frames     Frames        PVID      PRI     Tagging    Name
--------   --------   --------      --------  ------  -------    -------

2/15       No         Yes           50        0       UntagPvid  Unit 2,
                                                      Only       Port 15
2/16       No         Yes           50        0       UntagPvid  Unit 2,
                                                      Only       Port 16
2/17       No         Yes           50        0       UntagPvid  Unit 2,
                                                      Only       Port 17
2/18       No         Yes           50        0       UntagPvid  Unit 2,
                                                      Only       Port 18
```

10. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15,2/16,2/17,2/18
```



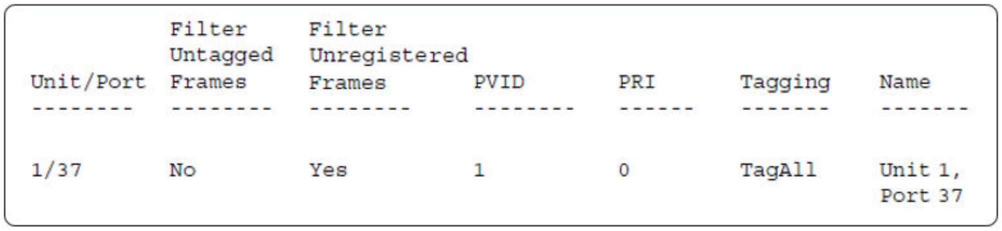
```
Unit/Port  VLAN       VLAN Name  VLAN       VLAN Name  VLAN      VLAN Name
--------   --------   --------   --------   ------     -------   ------
2/15       50         VLAN #50   200        VLAN #200  -------   ------
2/16       50         VLAN #50   300        VLAN #300  -------   ------
2/17       50         VLAN #50   200        VLAN #200  -------   ------
2/18       50         VLAN #50   200        VLAN #200  -------   ------
```

11. Configure the uplink port 1/37 to transport traffic from all VLANs (1,50,200,300).

```
Switch(config)#vlan members add 50,200,300 1/37
Switch(config)#vlan ports 1/37 tagging tagall
```

12. Confirm the VLAN interface settings for uplink port 1/37.

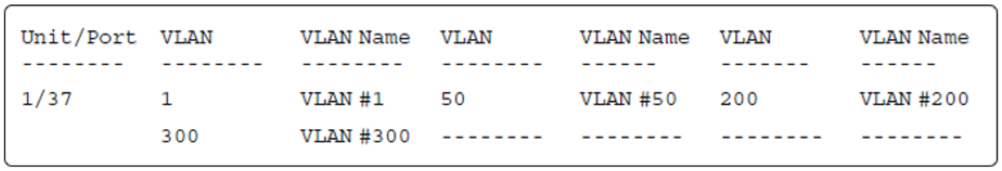
```
Switch(config)#sho vlan interface info 1/37
```



```
           Filter     Filter
           Untagged   Unregistered
Unit/Port  Frames     Frames        PVID      PRI     Tagging   Name
--------   --------   --------      --------  ------  -------   -------

1/37       No         Yes           1         0       TagAll    Unit 1,
                                                                Port 37
```

13. Confirm the VLAN inteface VIDs for uplink port 1/37.

```
Switch(config)#show vlan interface vids 1/37
```



```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
--------   --------  --------   --------  ------     -------   ------
1/37       1         VLAN #1    50        VLAN #50   200       VLAN #200
           300       VLAN #300  --------  --------   --------  --------
```

14. Verify connectivity with the Primary RADIUS server and back-up RADIUS server (if back-up server is used). Firewalls may filter ICMP packets. In this case it is recommended to verify RADIUS server logs for authentication request sent by device.

```
Switch(config)#ping 10.100.68.2
(Host is reachable)
Switch(config)#ping 10.100.68.3
(Host is reachable)
```

15. Set the EAPOL status for port 2/15.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/15 enable
Switch(config-if)#eapol port 2/15 status auto
Switch(config-if)#eapol multihost port 2/15 eap-mac-max 2
Switch(config-if)#eapol multihost port 2/15 use-radius-assigned-vlan
Switch(config-if)#eapol guest-vlan port 2/15 enable
Switch(config-if)#exit
```

16. Set the EAPOL status for port 2/16.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/16 enable
Switch(config-if)#eapol port 2/16 status auto
Switch(config-if)#eapol multihost port 2/16 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 2/16 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/16 non-eap-phone-enable
Switch(config-if)#eapol multihost non-eap-mac port 2/16 00-19-E1-A2-4D-36
Switch(config-if)#eapol guest-vlan port 2/16 enable
Switch(config-if)#exit
```

17. Set the EAPOL status for port 2/17.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/17 enable
Switch(config-if)#eapol port 2/17 status auto
Switch(config-if)#eapol multihost port 2/17 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 2/17 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/17 radius-non-eap-enable
Switch(config-if)#eapol multihost port 2/17 non-eap-use-radius-assigned- vlan
Switch(config-if)#eapol multihost non-eap-mac port 2/17 00-19-E1-E5-52-4A
Switch(config-if)#eapol guest-vlan port 2/17 enable
Switch(config-if)#exit
```

18. Set the EAPOL status for port 2/18.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/18 enable
Switch(config-if)#eapol port 2/18 status auto
Switch(config-if)#eapol multihost port 2/18 eap-mac-max 1
Switch(config-if)#eapol multihost port 2/18 non-eap-mac-max 1
Switch(config-if)#eapol multihost port 2/18 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/18 radius-non-eap-enable
Switch(config-if)#eapol multihost port 2/18 use-radius-assigned-vlan
Switch(config-if)#eapol guest-vlan port 2/18 enable
Switch(config-if)#exit
```

19. Set the EAPOL status for port 3/15.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 3/15 enable
Switch(config-if)#eapol port 3/15 status auto
Switch(config-if)#eapol multihost port 3/15 eap-mac-max 1
Switch(config-if)#eapol multihost port 3/15 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 3/15 allow-non-eap-enable
Switch(config-if)#eapol multihost port 3/15 use-radius-assigned-vlan
Switch(config-if)#eapol multihost port 3/15 radius-non-eap-enable
Switch(config-if)#eapol multihost port 3/15 non-eap-use-radius-assigned- vlan
Switch(config-if)#eapol guest-vlan port 3/15 enable
Switch(config-if)#exit
```

20. Set the Guest VLAN.

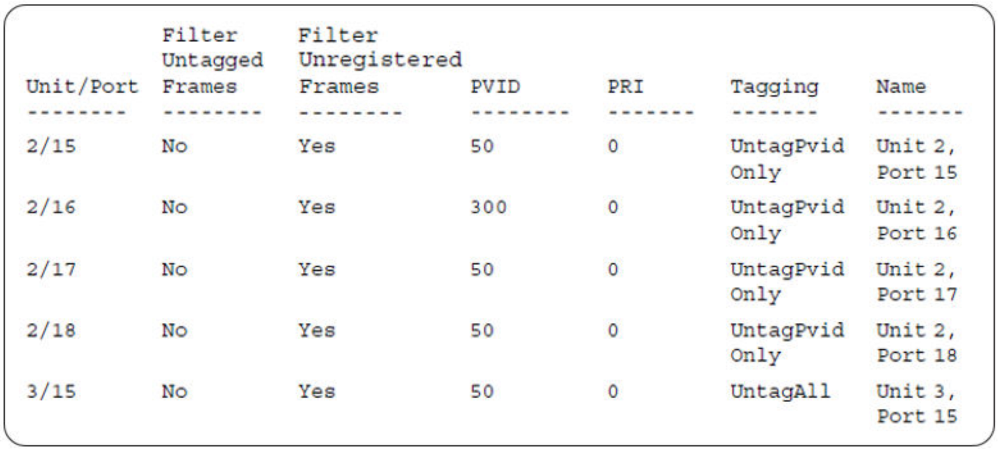
```
Switch(config)#eapol guest-vlan vid 20
Switch(config)#eapol guest-vlan enable
```

21. Set the EAPOL MultiHost status.

```
Switch(config)#eapol multihost multivlan enable
Switch(config)#eapol multihost voip-vlan 1 vid 200
Switch(config)#eapol multihost voip-vlan 1 enable
Switch(config)#eapol multihost allow-non-eap-enable
Switch(config)#eapol multihost non-eap-phone-enable
Switch(config)#eapol multihost non-eap-use-radius-assigned-vlan
Switch(config)#eapol multihost use-radius-assigned-vlan
Switch(config)#eapol multihost radius-non-eap-enable
```

22. Confirm the VLAN interface settings.

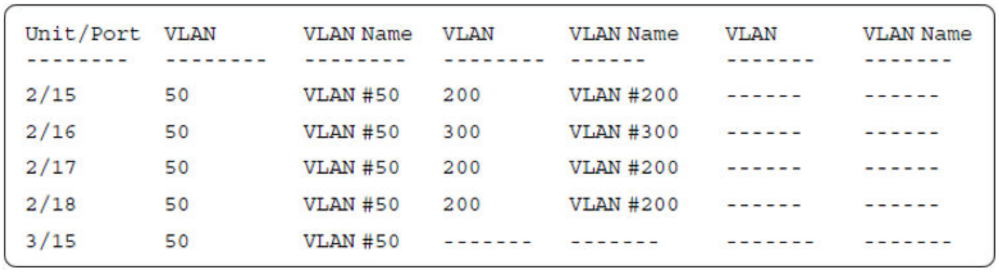
```
Switch(config)#show vlan interface info 2/15-18,3/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames       PVID     PRI     Tagging   Name
--------- --------  --------     -------- ------- -------   -------
2/15      No        Yes          50       0       UntagPvid Unit 2,
                                                  Only      Port 15
2/16      No        Yes          300      0       UntagPvid Unit 2,
                                                  Only      Port 16
2/17      No        Yes          50       0       UntagPvid Unit 2,
                                                  Only      Port 17
2/18      No        Yes          50       0       UntagPvid Unit 2,
                                                  Only      Port 18
3/15      No        Yes          50       0       UntagAll  Unit 3,
                                                            Port 15
```

23. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```



```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN     VLAN Name
---------  --------  --------   --------  ------     -------  -------
2/15       50        VLAN #50   200       VLAN #200  ------   ------
2/16       50        VLAN #50   300       VLAN #300  ------   ------
2/17       50        VLAN #50   200       VLAN #200  ------   ------
2/18       50        VLAN #50   200       VLAN #200  ------   ------
3/15       50        VLAN #50   -------   -------    -------  -------
```

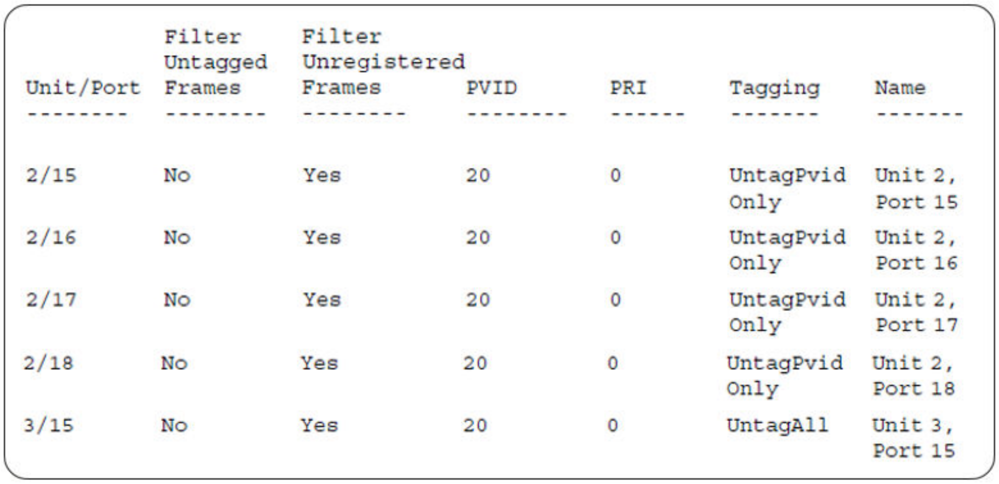
24. Enable EAPOL globally.

```
Switch(config)#eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

Before any clients authenticate on ports:

25. Confirm the VLAN interface settings.

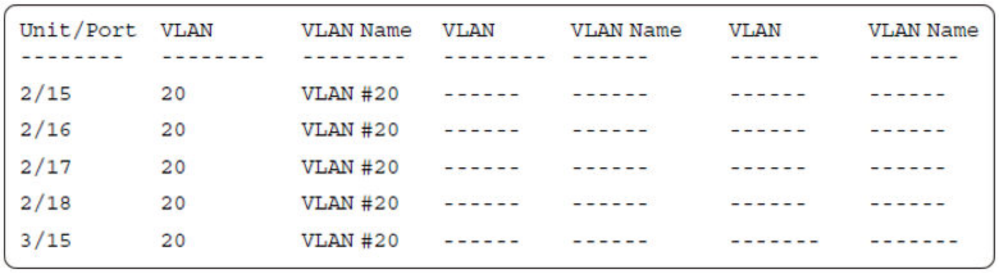
```
Switch(config)#sho vlan interface info 2/15-18,3/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames       PVID      PRI     Tagging    Name
--------   --------  --------     --------  ------  -------    -------

2/15       No        Yes          20        0       UntagPvid  Unit 2,
                                                    Only       Port 15
2/16       No        Yes          20        0       UntagPvid  Unit 2,
                                                    Only       Port 16
2/17       No        Yes          20        0       UntagPvid  Unit 2,
                                                    Only       Port 17
2/18       No        Yes          20        0       UntagPvid  Unit 2,
                                                    Only       Port 18
3/15       No        Yes          20        0       UntagAll   Unit 3,
                                                               Port 15
```

26. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```

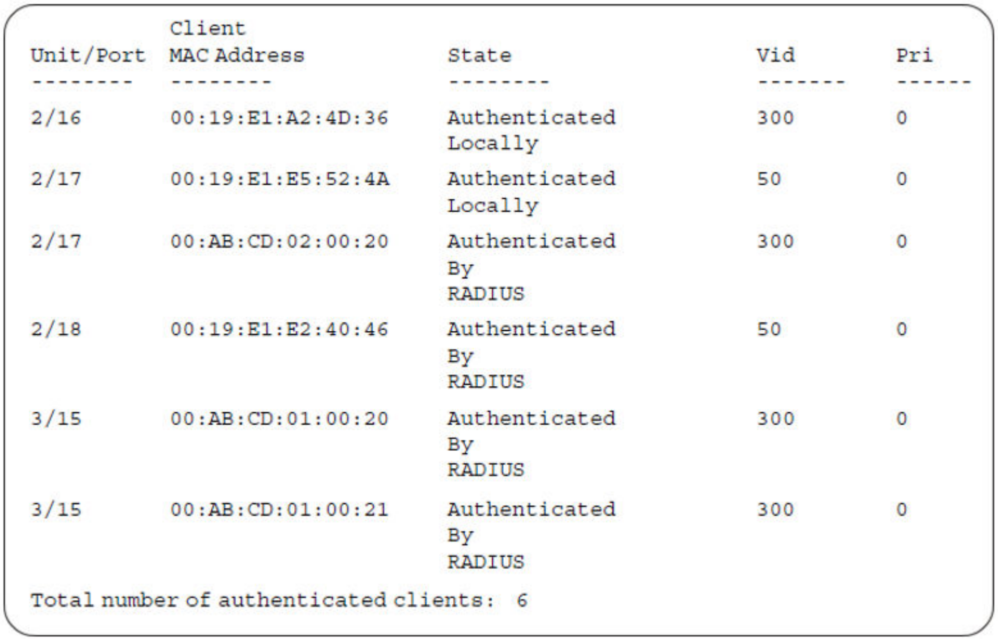


```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN     VLAN Name
--------   --------  --------   --------  ------     -------  -------
2/15       20        VLAN #20   ------    ------     ------   ------
2/16       20        VLAN #20   ------    ------     ------   ------
2/17       20        VLAN #20   ------    ------     ------   ------
2/18       20        VLAN #20   ------    ------     ------   ------
3/15       20        VLAN #20   ------    ------     -------  -------
```

After all clients authenticate on ports:

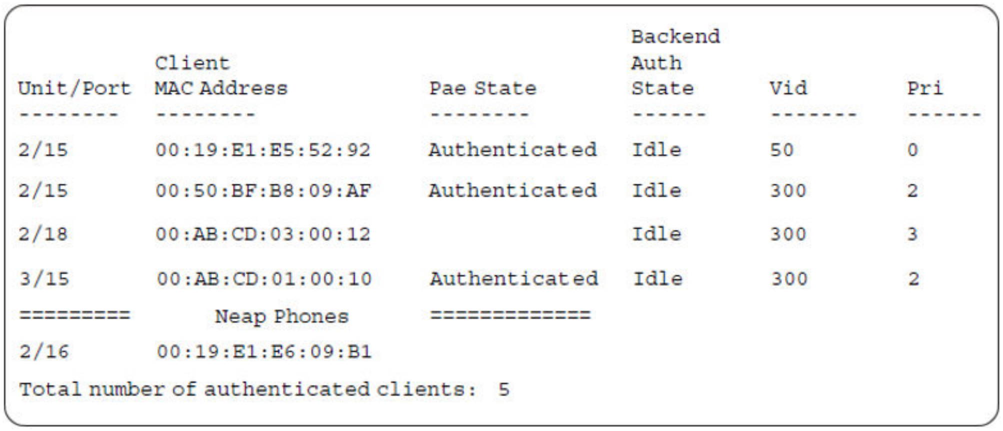
27. Confirm the EAPOL MultiHost status.

```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
          Client
Unit/Port MAC Address        State              Vid      Pri
--------  --------           --------           -------  ------
2/16      00:19:E1:A2:4D:36  Authenticated      300      0
                             Locally
2/17      00:19:E1:E5:52:4A  Authenticated      50       0
                             Locally
2/17      00:AB:CD:02:00:20  Authenticated      300      0
                             By
                             RADIUS
2/18      00:19:E1:E2:40:46  Authenticated      50       0
                             By
                             RADIUS
3/15      00:AB:CD:01:00:20  Authenticated      300      0
                             By
                             RADIUS
3/15      00:AB:CD:01:00:21  Authenticated      300      0
                             By
                             RADIUS
Total number of authenticated clients:  6
```

```
Switch(config)#show eapol multihost status
```

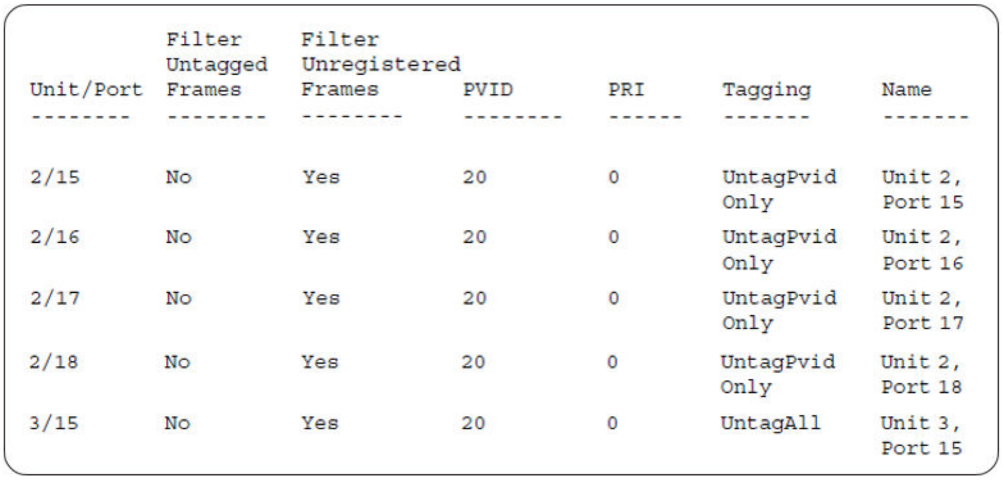


```
                                                Backend
          Client                                Auth
Unit/Port MAC Address        Pae State          State    Vid      Pri
--------  --------           --------           ------   -------  ------
2/15      00:19:E1:E5:52:92  Authenticated      Idle     50       0
2/15      00:50:BF:B8:09:AF  Authenticated      Idle     300      2
2/18      00:AB:CD:03:00:12                     Idle     300      3
3/15      00:AB:CD:01:00:10  Authenticated      Idle     300      2
=========       Neap Phones  =============
2/16      00:19:E1:E6:09:B1
Total number of authenticated clients:  5
```

All Guest VLAN enabled ports will service unauthenticated clients (new clients or old clients failing authentication) with Guest VLAN access even if authenticated clients are present on the same port. This behavior is different from MHMA mode with Guest VLAN having Multihost MultiVLAN option disabled, where Guest VLAN was available only until the first client is authenticated on the port.

28. Confirm the VLAN interface settings.

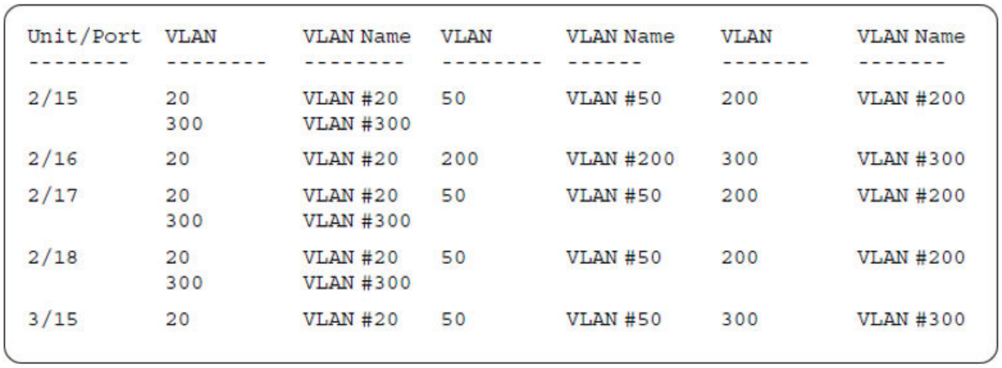
```
Switch(config)#sho vlan interface info 2/15-18,3/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI     Tagging    Name
--------   --------  --------      --------  ------  -------    -------

2/15       No        Yes           20        0       UntagPvid  Unit 2,
                                                     Only       Port 15
2/16       No        Yes           20        0       UntagPvid  Unit 2,
                                                     Only       Port 16
2/17       No        Yes           20        0       UntagPvid  Unit 2,
                                                     Only       Port 17
2/18       No        Yes           20        0       UntagPvid  Unit 2,
                                                     Only       Port 18
3/15       No        Yes           20        0       UntagAll   Unit 3,
                                                                Port 15
```

29. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```



```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
--------   --------  --------   --------  ------     -------   -------
2/15       20        VLAN #20   50        VLAN #50   200       VLAN #200
           300       VLAN #300
2/16       20        VLAN #20   200       VLAN #200  300       VLAN #300
2/17       20        VLAN #20   50        VLAN #50   200       VLAN #200
           300       VLAN #300
2/18       20        VLAN #20   50        VLAN #50   200       VLAN #200
           300       VLAN #300
3/15       20        VLAN #20   50        VLAN #50   300       VLAN #300
```

Alternate configuration

The following operation applies to the **MHMA authentication mode with Guest VLAN (Multihost MultiVLAN option enabled) without valid additional RADIUS attributes** configuration example, when the RADIUS server has no special attributes configured or the RADIUS server uses misconfigured attributes (not matching the device configuration).

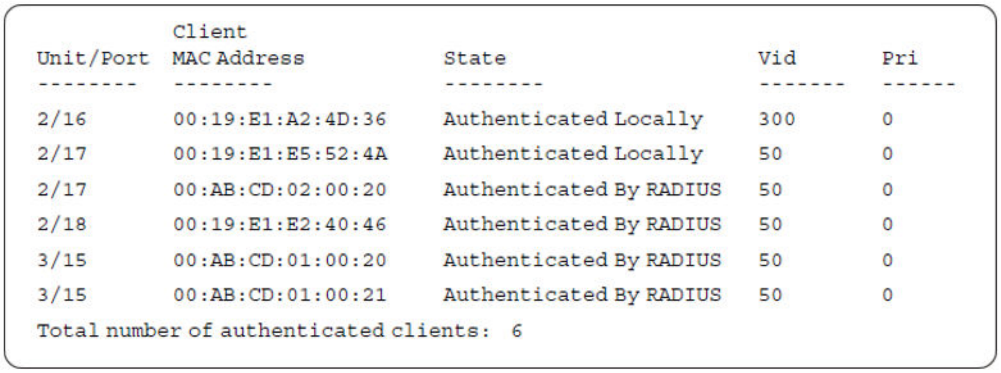
This configuration example modifies EAP and NEAP client attributes on the RADIUS server, replacing VLAN ID 300 with VLAN ID 124, which is not configured on the device.

1. Enable EAPOL.

```
Switch(config)#eapol disable
Switch(config)#eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

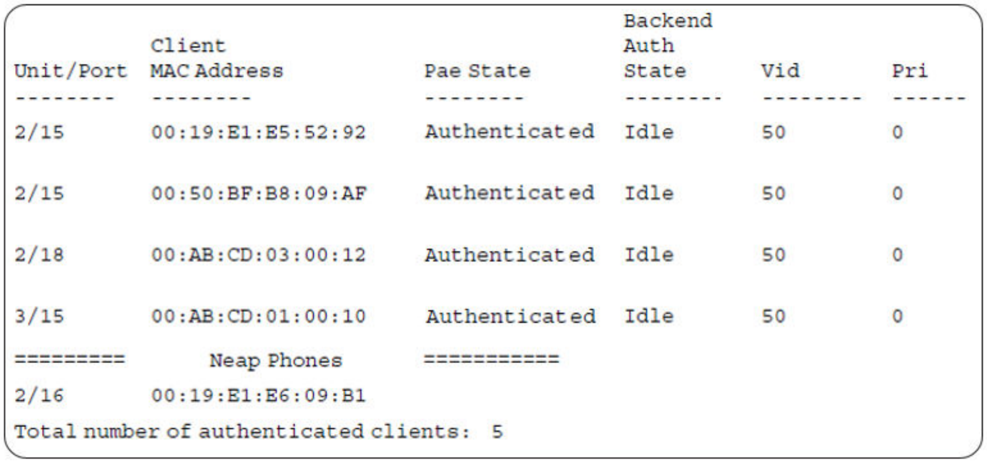
2. Confirm EAPOL MultiHost status.

```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
            Client
Unit/Port   MAC Address          State                     Vid       Pri
--------    --------             --------                  -------   ------
2/16        00:19:E1:A2:4D:36    Authenticated Locally     300       0
2/17        00:19:E1:E5:52:4A    Authenticated Locally     50        0
2/17        00:AB:CD:02:00:20    Authenticated By RADIUS   50        0
2/18        00:19:E1:E2:40:46    Authenticated By RADIUS   50        0
3/15        00:AB:CD:01:00:20    Authenticated By RADIUS   50        0
3/15        00:AB:CD:01:00:21    Authenticated By RADIUS   50        0
Total number of authenticated clients:  6
```

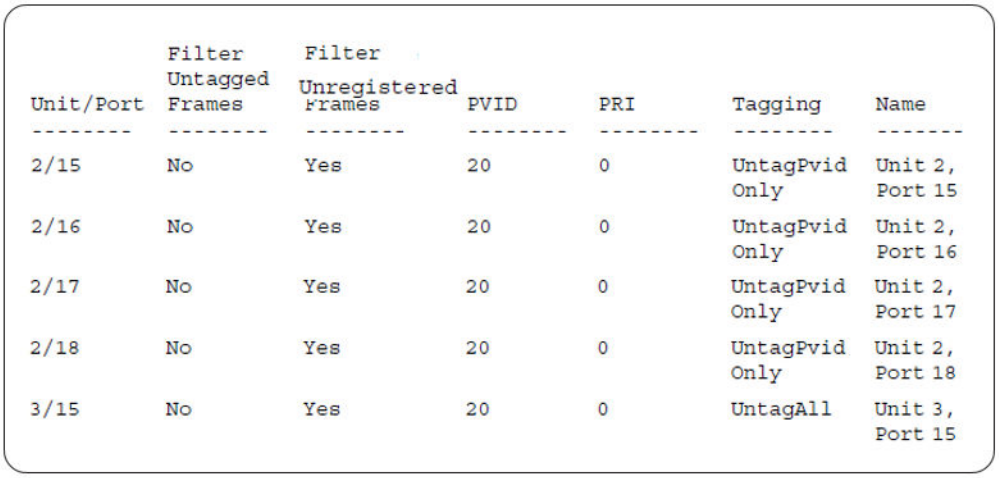
```
Switch(config)#show eapol multihost status
```



```
                                                  Backend
            Client                                Auth
Unit/Port   MAC Address          Pae State        State      Vid        Pri
--------    --------             --------         --------   --------   ------
2/15        00:19:E1:E5:52:92    Authenticated    Idle       50         0

2/15        00:50:BF:B8:09:AF    Authenticated    Idle       50         0

2/18        00:AB:CD:03:00:12    Authenticated    Idle       50         0

3/15        00:AB:CD:01:00:10    Authenticated    Idle       50         0
=========        Neap Phones      ===========
2/16        00:19:E1:E6:09:B1
Total number of authenticated clients:  5
```

3. Confirm the VLAN interface settings.

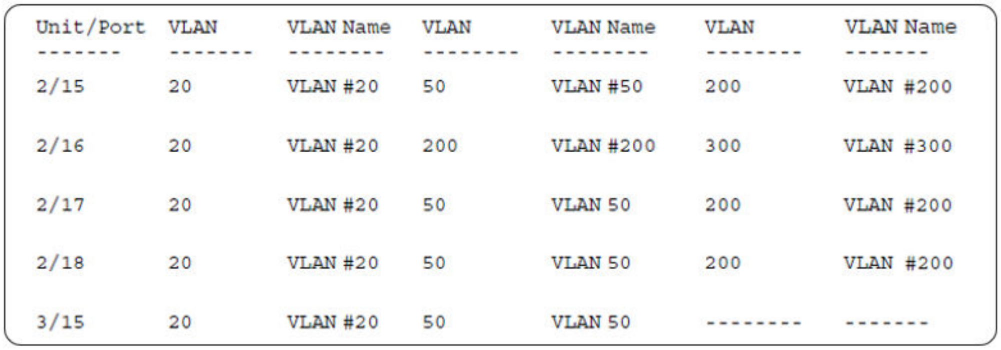
```
Switch(config)#show vlan interface info 2/15-18,3/15
```



```
            Filter      Filter
            Untagged    Unregistered
Unit/Port   Frames      Frames        PVID       PRI        Tagging    Name
--------    --------    --------      --------   --------   --------   -------
2/15        No          Yes           20         0          UntagPvid  Unit 2,
                                                            Only       Port 15
2/16        No          Yes           20         0          UntagPvid  Unit 2,
                                                            Only       Port 16
2/17        No          Yes           20         0          UntagPvid  Unit 2,
                                                            Only       Port 17
2/18        No          Yes           20         0          UntagPvid  Unit 2,
                                                            Only       Port 18
3/15        No          Yes           20         0          UntagAll   Unit 3,
                                                                       Port 15
```

4. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```



```
Unit/Port  VLAN     VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
-------    -------  --------   --------  --------   --------  -------
2/15       20       VLAN #20   50        VLAN #50   200       VLAN #200

2/16       20       VLAN #20   200       VLAN #200  300       VLAN #300

2/17       20       VLAN #20   50        VLAN 50    200       VLAN #200

2/18       20       VLAN #20   50        VLAN 50    200       VLAN #200

3/15       20       VLAN #20   50        VLAN 50    --------  -------
```

MHMA authentication mode with Guest VLAN and Fail Open VLAN (Multihost MultiVLAN option disabled) with or without additional RADIUS attributes

For this EAP operational mode the port and client will have the following settings:

- when 802.1X is disabled on the port—the port is included in an initial VLAN – one or multiple initial VLANs are supported and the port uses one of the initial VLAN PVIDs specified by the user
- when 802.1X is enabled on the port:
    - an unauthenticated client is on the port with Guest VLAN enabled—the port is included in the Guest VLAN ID and the port uses one of the Guest VLAN PVIDs
    - an authenticated 801.x client is on the port with Guest VLAN enabled
        - the port is added to an initial VLAN and uses one of the initial VLAN PVIDs (port is removed from Guest VLAN). In this case no RADIUS attribute is received, or an invalid RADIUS attribute is received, for the client.
        - the port is moved to the RADIUS VLAN (port is removed from Guest VLAN) and the port uses a RADIUS VLAN PVID (Valid RADIUS attributes received).

- a non-801.x authenticated client is on the port with Guest VLAN enabled
    - the port is added to an initial VLAN (port is removed from Guest VLAN), and the port uses one of the initial VLAN PVIDs. In this case no RADIUS attribute is received, or an invalid RADIUS attribute is received for the client.
    - the port is moved to the RADIUS VLAN and the port uses a RADIUS VLAN PVID (Valid RADIUS attributes received).
- an authenticated non-801.x client is on the port with Guest VLAN enabled and a non-801.x static MAC client defined MAC—the port is included in an initial VLAN (port is removed from Guest VLAN), and the port uses one of the initial VLAN PVIDs
- an authenticated non-801.x DHCP client is on the port with Guest VLAN enabled and using a DHCP signature—the port remains in the Guest VLAN and the port uses the Guest VLAN PVID. The port is member of any EAP VOIP VLANs that have been created.
- RADIUS Server Unreachable (801.x enabled)—the port is moved to the Fail Open VLAN (port is removed from Guest VLAN), and the port uses the Fail Open VLAN PVID.

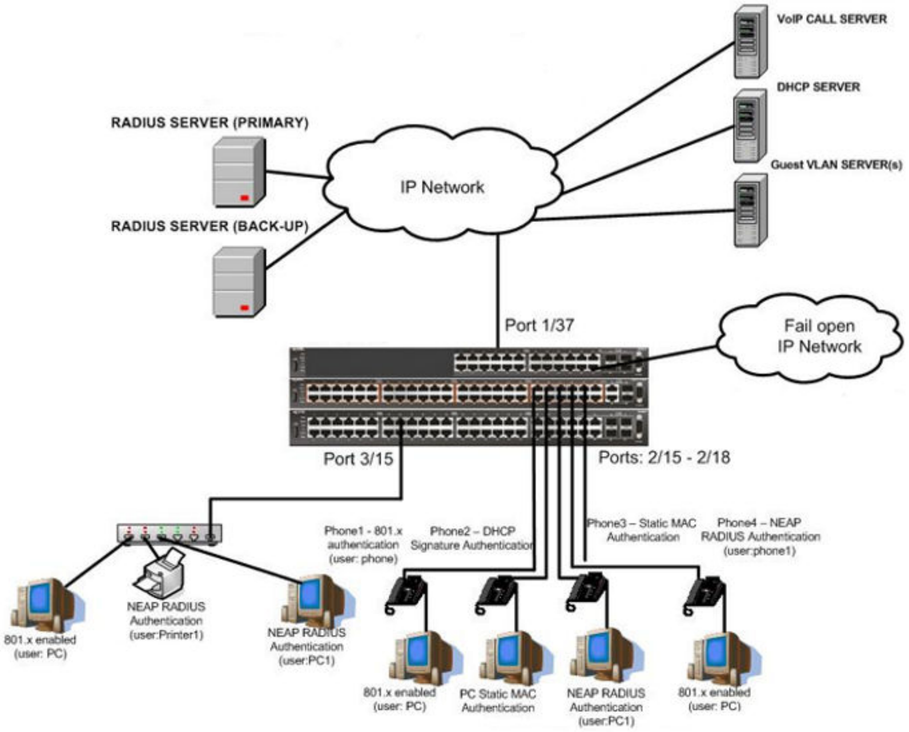

VoIP CALL SERVER
DHCP SERVER
Guest VLAN SERVER(s)
RADIUS SERVER (PRIMARY)
RADIUS SERVER (BACK-UP)
IP Network
Port 1/37
Fail open
IP Network
Port 3/15
Ports: 2/15 - 2/18
Phone1 - 801.x authentication (user: phone)
Phone2 – DHCP Signature Authentication
Phone3 – Static MAC Authentication
Phone4 – NEAP RADIUS Authentication (user:phone1)
801.x enabled (user: PC)
NEAP RADIUS Authentication (user:Printer1)
NEAP RADIUS Authentication (user:PC1)
801.x enabled (user: PC)
PC Static MAC Authentication
NEAP RADIUS Authentication (user:PC1)
801.x enabled (user: PC)

Figure 50: MHMA authentication mode with Guest VLAN and Fail Open VLAN (Multihost MultiVLAN option disabled) with or without additional RADIUS attributes

Scenario

Assume the following settings:

1. RADIUS server configuration.
    - A primary server is mandatory. If a back-up server is used, the back-up server configuration must be the same as for primary server configuration.

2. Configure all IP Phones to send tag traffic with proper VoIP VLAN ID.
3. Clients settings:
   - Port 2/15:
     - 801.x authenticated user Phone1connected
     - 801.x enabled user PC connected
     - Guest VLAN ID = 20
     - Fail Open VLAN ID = 30
     - Initial VLAN ID = 50, 200
     - PC RADIUS VLAN ID = 300
     - Phone RADIUS VLAN ID = none
   - Port 2/16:
     - DHCP signature authenticated user Phone2 connected
     - Static MAC authenticated user PC connected
     - Guest VLAN ID = 20
     - Fail Open VLAN ID = 30
     - Initial VLAN ID = 50, 300
     - Phone EAP VOIP VLAN ID = 200
   - Port 2/17:
     - Static MAC authenticated user Phone3 connected
     - NEAP RADIUS authenticated user PC1 connected
     - Guest VLAN ID = 20
     - Fail Open VLAN ID = 30
     - Initial VLAN ID = 50, 200
     - PC RADIUS VLAN ID = 300
   - Port 2/18:
     - Phone4 – NEAP RADIUS Authentication (user:phone1)
     - 801.x enabled user PC connected
     - Guest VLAN ID = 20
     - Fail Open VLAN ID = 30
     - Initial VLAN ID = 50, 200
     - PC RADIUS VLAN ID = 300
     - Phone RADIUS VLAN ID = none

- Port 3/15:
    - 801.x enabled user PC connected
    - NEAP RADIUS authenticated user Printer1 connected
    - NEAP RADIUS authenticated user PC1 connected
    - Guest VLAN ID = 20
    - Fail Open VLAN ID = 30
    - Initial VLAN ID = 50
    - RADIUS VLAN ID = 300

4. Port settings:
    - VLAN ID/PVID port settings for 2/15:
        - 801.x disabled - VLAN ID/PVID = 50,200/50
        - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 20/20
        - Authenticated (user phone authenticated, user PC unauthenticated):
            - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
        - Authenticated (user phone authenticated, user PC authenticated):
            - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
            - VLAN ID/PVID = 50, 200, 300/ 300 (Valid RADIUS attributes received)
        - RADIUS Server Unreachable (801.x enabled) - VLAN ID/PVID = 30/30
    - VLAN ID/PVID port settings for 2/16:
        - 801.x disabled - VLAN ID/PVID = 50,300/300
        - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 20/20
        - Authenticated (Phone DHCP signature OK, EAP VOIP VLAN ID 200 assigned):
            - VLAN ID/PVID = 50,200,300/300
        - Authenticated (PC MAC defined in static list, PC MAC learned in MAC address table, Phone DHCP signature OK):
            - VLAN ID/PVID = 50,200,300/300
        - RADIUS Server Unreachable (801.x enabled) - VLAN ID/PVID = 30/30
    - VLAN ID/PVID port settings for 2/17:
        - 801.x disabled - VLAN ID/PVID = 50,200/50
        - Unauthenticated client with 801.x enabled - VLAN ID/PVID = 20/20

- Authenticated (Phone MAC defined in static list, Phone MAC learned in MAC address table):
  - VLAN ID/PVID = 50, 200/ 50
- Authenticated (user PC1 authenticated; Phone MAC defined in static list, Phone MAC learned in MAC address table):
  - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes) received)
  - VLAN ID/PVID = 50, 200, 300/ 300 (Valid RADIUS attributes received)
- RADIUS Server Unreachable (801.x enabled) - VLAN ID/PVID = 30/30

VLAN ID/PVID port settings for 2/18:

- 801.x disabled - VLAN ID/PVID = 50,200/50
- Unauthenticated client with 801.x enabled - VLAN ID/PVID = 20/20
- Authenticated (user phone1 authenticated, user PC unauthenticated):
  - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
- Authenticated (user PC authenticated, user phone1 authenticated):
  - VLAN ID/PVID = 50, 200/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
  - VLAN ID/PVID = 50, 200, 300/ 300 (Valid RADIUS attributes received)
- RADIUS Server Unreachable (801.x enabled) - VLAN ID/PVID = 30/30

VLAN ID/PVID port settings for 3/15:

- 801.x disabled - VLAN ID/PVID = 50/50
- Unauthenticated client with 801.x enabled - VLAN ID/PVID = 20/20
- Authenticated (at least one user authenticated from : PC, PC1, Printer1):
  - VLAN ID/PVID = 50/ 50 (No RADIUS attribute received/Invalid RADIUS attributes received)
  - VLAN ID/PVID = 300/ 300 (Valid RADIUS attributes received)
- RADIUS Server Unreachable (801.x enabled) - VLAN ID/PVID = 30/30

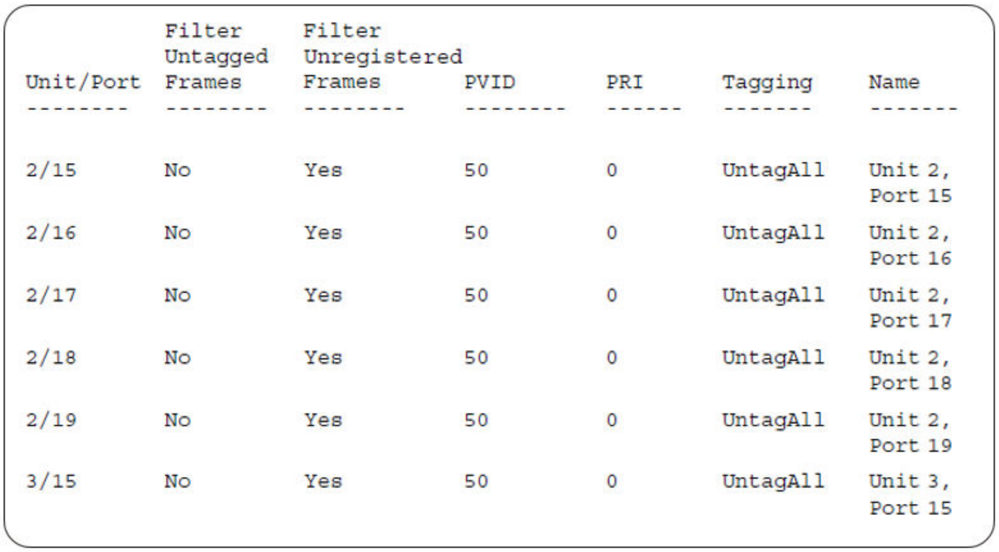
Configuration example

1. Configure the RADIUS servers and VLAN settings

```
Switch(config)#ip address 10.100.68.254 netmask 255.255.255.0 default-gateway 10.100.68.1
Switch(config)#radius-server host 10.100.68.2
Switch(config)#radius-server secondary-host 10.100.68.3
Switch(config)#radius-server key
Enter key: RadiusKey
Enter key: RadiusKey
Switch(config)#vlan configcontrol automatic
Switch(config)#vlan create 20 type port
Switch(config)#vlan create 30 type port
Switch(config)#vlan create 50 type port
Switch(config)#vlan create 200 type port
Switch(config)#vlan create 300 type port
Switch(config)#vlan members add 50 2/15-19,3/15
```

2. Confirm the VLAN interface settings.

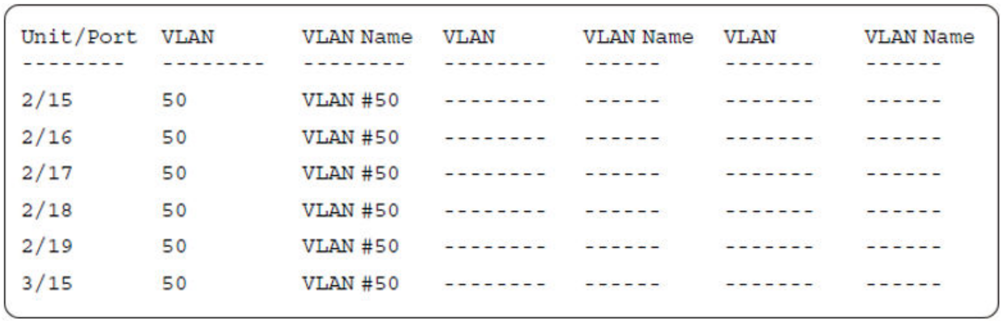
```
 Switch(config)#sho vlan interface info 2/15-19,3/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames       PVID     PRI    Tagging   Name
--------  --------  --------     -------- ------ -------   -------

2/15      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 15
2/16      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 16
2/17      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 17
2/18      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 18
2/19      No        Yes          50       0      UntagAll  Unit 2,
                                                           Port 19
3/15      No        Yes          50       0      UntagAll  Unit 3,
                                                           Port 15
```

3. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15-19,3/15
```



```
Unit/Port VLAN      VLAN Name VLAN      VLAN Name VLAN      VLAN Name
--------  --------  --------  --------  ------    -------   ------
2/15      50        VLAN #50  --------  ------    -------   ------
2/16      50        VLAN #50  --------  ------    -------   ------
2/17      50        VLAN #50  --------  ------    -------   ------
2/18      50        VLAN #50  --------  ------    -------   ------
2/19      50        VLAN #50  --------  ------    -------   ------
3/15      50        VLAN #50  --------  ------    -------   ------
```

4. Change VLAN config control mode to flexible mode to add same port in multiple initial VLANs.

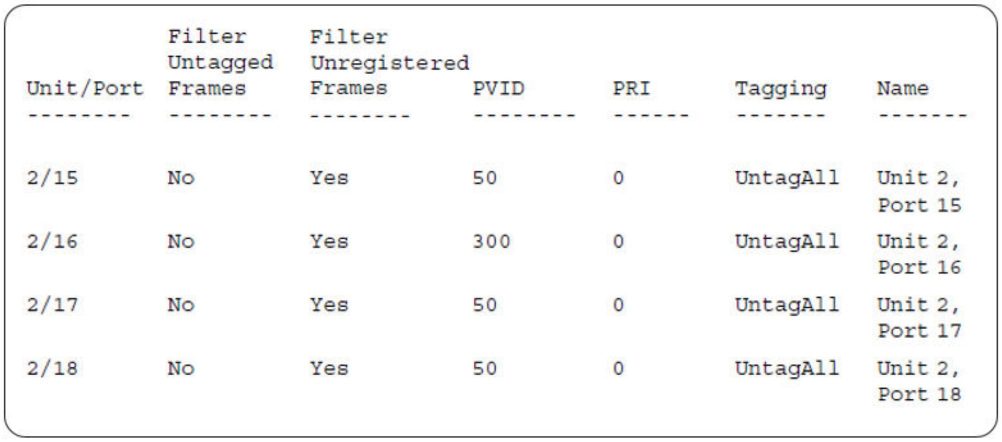
```
Switch(config)#vlan configcontrol flexible
```

5. Add IP phone ports to the voice vlan, VLAN ID 200.

```
Switch(config)#vlan members add 200 2/15,2/17,2/18
Switch(config)#vlan members add 300 2/16
Switch(config)#vlan port 2/16 pvid 300
```

6. Confirm the VLAN interface settings.

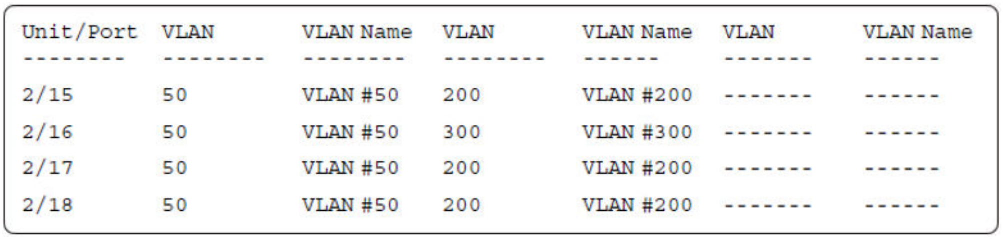
```
Switch(config)#sho vlan interface info 2/15,2/16,2/17,2/18
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames        PVID      PRI    Tagging  Name
--------  --------  --------      --------  ------ -------  -------

2/15      No        Yes           50        0      UntagAll Unit 2,
                                                            Port 15
2/16      No        Yes           300       0      UntagAll Unit 2,
                                                            Port 16
2/17      No        Yes           50        0      UntagAll Unit 2,
                                                            Port 17
2/18      No        Yes           50        0      UntagAll Unit 2,
                                                            Port 18
```

7. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15,2/16,2/17,2/18
```



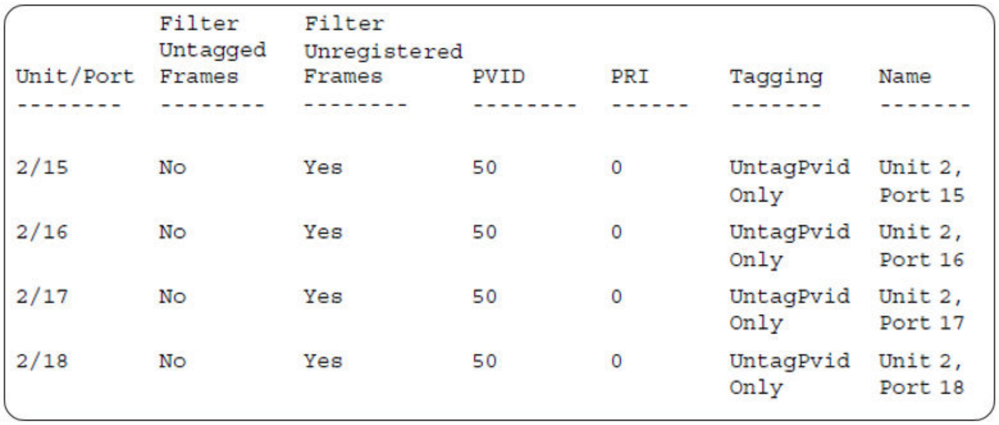
```
Unit/Port VLAN      VLAN Name VLAN      VLAN Name VLAN     VLAN Name
--------  --------  --------  --------  ------    -------  ------
2/15      50        VLAN #50  200       VLAN #200 -------  ------
2/16      50        VLAN #50  300       VLAN #300 -------  ------
2/17      50        VLAN #50  200       VLAN #200 -------  ------
2/18      50        VLAN #50  200       VLAN #200 -------  ------
```

8. Since all IP Phones will be sending tagged traffic and only the PC will need to receive untagged traffic, set the port to untagpvidOnly.

```
Switch(config)#vlan ports 2/15,2/16,2/17,2/18 tagging untagpvidOnly
```

9. Confirm the VLAN interface settings.

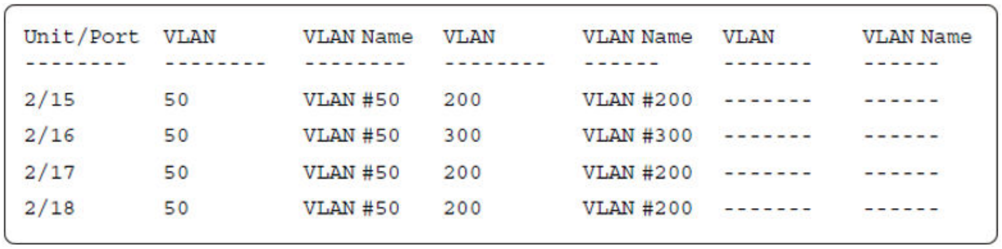
```
Switch(config)#sho vlan interface info 2/15,2/16,2/17,2/18
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames        PVID      PRI    Tagging   Name
--------  --------  --------      --------  ------ -------   -------

2/15      No        Yes           50        0      UntagPvid Unit 2,
                                                   Only      Port 15
2/16      No        Yes           50        0      UntagPvid Unit 2,
                                                   Only      Port 16
2/17      No        Yes           50        0      UntagPvid Unit 2,
                                                   Only      Port 17
2/18      No        Yes           50        0      UntagPvid Unit 2,
                                                   Only      Port 18
```

10. Confirm the VLAN inteface VIDs.

```
Switch(config)#show vlan interface vids 2/15,2/16,2/17,2/18
```



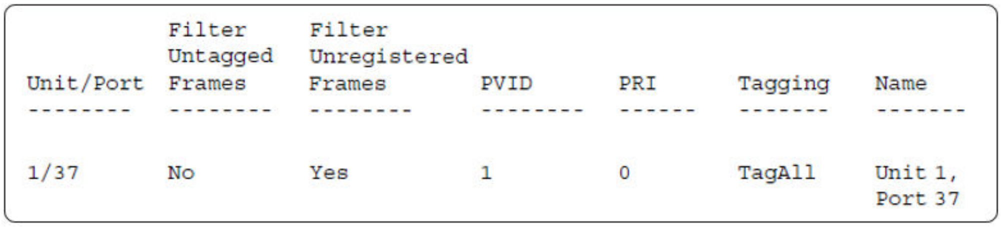
```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
--------   --------  --------   --------  ------     -------   ------

2/15       50        VLAN #50   200       VLAN #200  -------   ------
2/16       50        VLAN #50   300       VLAN #300  -------   ------
2/17       50        VLAN #50   200       VLAN #200  -------   ------
2/18       50        VLAN #50   200       VLAN #200  -------   ------
```

11. Configure the uplink port 1/37 to transport traffic from all VLANs (50,200,300).

```
Switch(config)#vlan members add 50,200,300 1/37
Switch(config)#vlan ports 1/37 tagging tagall
```

12. Confirm the VLAN interface settings for uplink port 1/37.

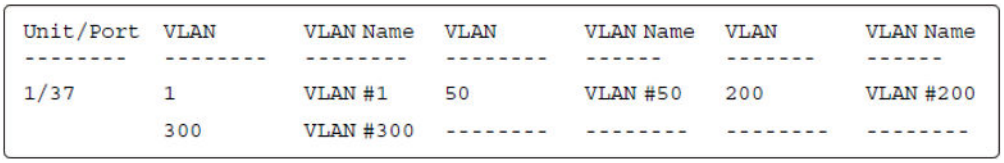
```
Switch(config)#sho vlan interface info 1/37
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI     Tagging   Name
--------   --------  --------      --------  ------  -------   -------

1/37       No        Yes           1         0       TagAll    Unit 1,
                                                               Port 37
```

13. Confirm the VLAN inteface VIDs for uplink port 1/37.

```
Switch(config)#show vlan interface vid 1/37
```



```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
--------   --------  --------   --------  ------     -------   ------
1/37       1         VLAN #1    50        VLAN #50   200       VLAN #200
           300       VLAN #300  --------  --------   --------  --------
```

14. Verify connectivity with the Primary RADIUS server and back-up RADIUS server (if back-up server is used). Firewalls may filter ICMP packets. In this case it is recommended to verify RADIUS server logs for authentication request sent by device.

```
Switch(config)#ping 10.100.68.2
(Host is reachable)

Switch(config)#ping 10.100.68.3
(Host is reachable)
```

15. Set the EAPOL status for port 2/15.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/15 enable
Switch(config-if)#eapol port 2/15 status auto
Switch(config-if)#eapol multihost port 2/15 eap-mac-max 2
Switch(config-if)#eapol multihost port 2/15 use-radius-assigned-vlan
Switch(config-if)#eapol guest-vlan port 2/15 enable
Switch(config-if)#exit
```

16. Set the EAPOL status for port 2/16.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/16 enable
Switch(config-if)#eapol port 2/16 status auto
Switch(config-if)#eapol multihost port 2/16 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 2/16 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/16 non-eap-phone-enable
Switch(config-if)#eapol multihost non-eap-mac port 2/16 00-19-E1-A2-4D-36
Switch(config-if)#eapol guest-vlan port 2/16 enable
Switch(config-if)#exit
```

17. Set the EAPOL status for port 2/17.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/17 enable
Switch(config-if)#eapol port 2/17 status auto
Switch(config-if)#eapol multihost port 2/17 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 2/17 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/17 radius-non-eap-enable
Switch(config-if)#eapol multihost port 2/17 non-eap-use-radius-assigned- vlan
Switch(config-if)#eapol multihost non-eap-mac port 2/17 00-19-E1-E5-52-4A
Switch(config-if)#eapol guest-vlan port 2/17 enable
Switch(config-if)#exit
```

18. Set the EAPOL status for port 2/18.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 2/18 enable
Switch(config-if)#eapol port 2/18 status auto
Switch(config-if)#eapol multihost port 2/18 eap-mac-max 1
Switch(config-if)#eapol multihost port 2/18 non-eap-mac-max 1
Switch(config-if)#eapol multihost port 2/18 allow-non-eap-enable
Switch(config-if)#eapol multihost port 2/18 radius-non-eap-enable
Switch(config-if)#eapol multihost port 2/18 use-radius-assigned-vlan
Switch(config-if)#eapol guest-vlan port 2/18 enable
Switch(config-if)#exit
```

19. Set the EAPOL status for port 3/15.

```
Switch(config)#interface Ethernet all
Switch(config-if)#eapol multihost port 3/15 enable
Switch(config-if)#eapol port 3/15 status auto
Switch(config-if)#eapol multihost port 3/15 eap-mac-max 1
Switch(config-if)#eapol multihost port 3/15 non-eap-mac-max 2
Switch(config-if)#eapol multihost port 3/15 allow-non-eap-enable
Switch(config-if)#eapol multihost port 3/15 use-radius-assigned-vlan
Switch(config-if)#eapol multihost port 3/15 radius-non-eap-enable
Switch(config-if)#eapol multihost port 3/15 non-eap-use-radius-assigned- vlan
Switch(config-if)#eapol guest-vlan port 3/15 enable
Switch(config-if)#exit
```

20. Set the Guest VLAN and Fail Open VLAN.

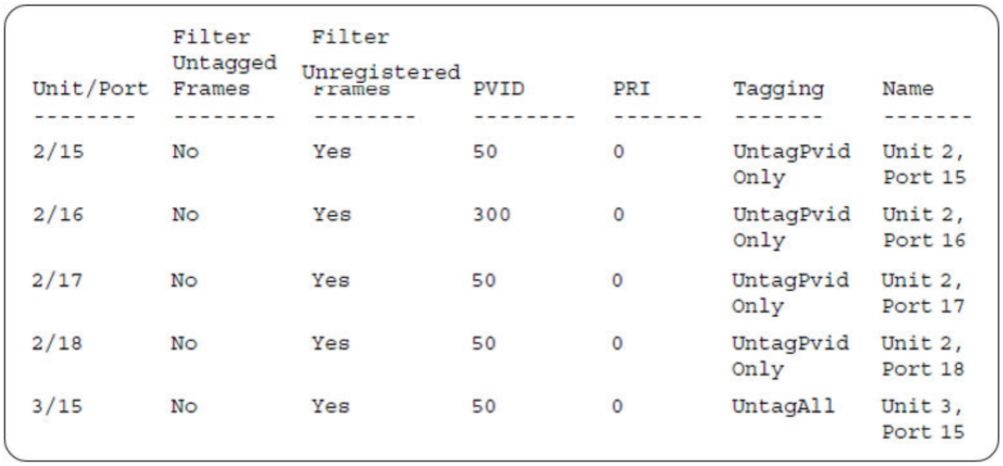
```
Switch(config)#eapol guest-vlan vid 20
Switch(config)#eapol guest-vlan enable
Switch(config)#eapol multihost fail-open-vlan vid 30
Switch(config)#eapol multihost fail-open-vlan enable
```

21. Set the EAPOL MultiHost status.

```
Switch(config)#eapol multihost voip-vlan 1 vid 200
Switch(config)#eapol multihost voip-vlan 1 enable
Switch(config)#eapol multihost allow-non-eap-enable
Switch(config)#eapol multihost non-eap-phone-enable
Switch(config)#eapol multihost non-eap-use-radius-assigned-vlan
Switch(config)#eapol multihost use-radius-assigned-vlan
Switch(config)#eapol multihost radius-non-eap-enable
```

22. Confirm the VLAN interface settings.

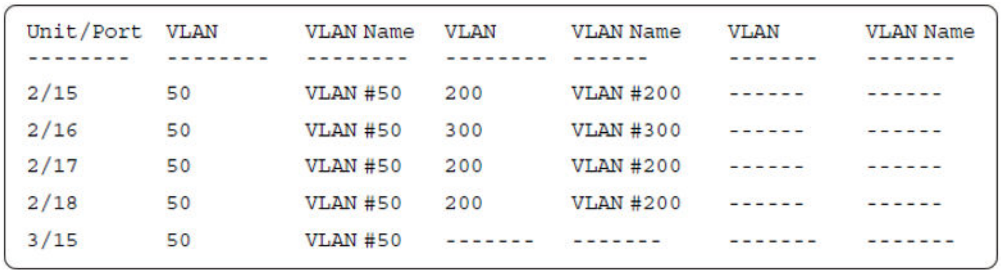
```
Switch(config)#show vlan interface info 2/15-18,3/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames        PVID      PRI      Tagging    Name
--------   --------  --------      --------  -------  -------    -------
2/15       No        Yes           50        0        UntagPvid  Unit 2,
                                                      Only       Port 15
2/16       No        Yes           300       0        UntagPvid  Unit 2,
                                                      Only       Port 16
2/17       No        Yes           50        0        UntagPvid  Unit 2,
                                                      Only       Port 17
2/18       No        Yes           50        0        UntagPvid  Unit 2,
                                                      Only       Port 18
3/15       No        Yes           50        0        UntagAll   Unit 3,
                                                                 Port 15
```

23. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```



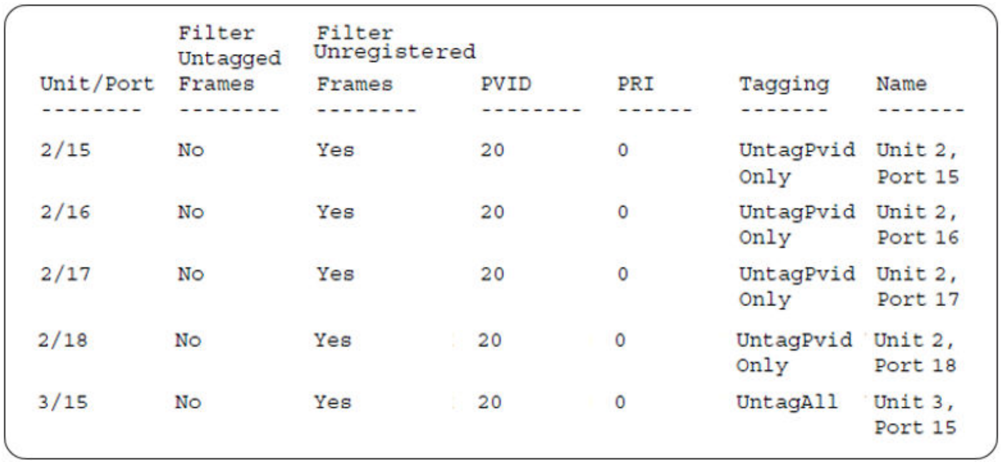
```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN     VLAN Name
--------   --------  --------   --------  ------     -------  -------
2/15       50        VLAN #50   200       VLAN #200  ------   ------
2/16       50        VLAN #50   300       VLAN #300  ------   ------
2/17       50        VLAN #50   200       VLAN #200  ------   ------
2/18       50        VLAN #50   200       VLAN #200  ------   ------
3/15       50        VLAN #50   -------   -------    -------  -------
```

24. Enable EAPOL globally.

```
Switch(config)#eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

25. Confirm the VLAN interface settings.

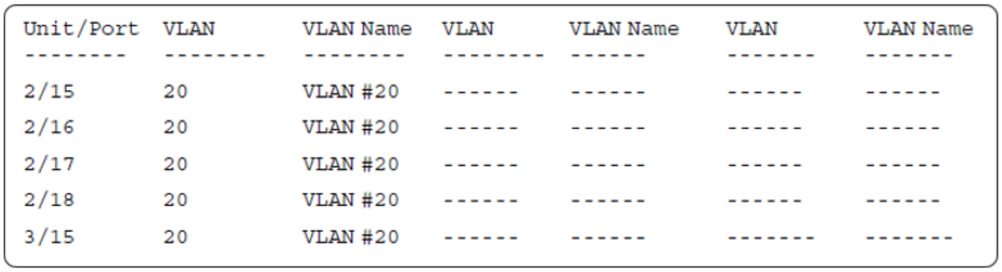
```
Switch(config)#sho vlan interface info 2/15-18,3/15
```



```
           Filter    Filter
           Untagged  Unregistered
Unit/Port  Frames    Frames      PVID      PRI      Tagging   Name
--------   --------  --------    --------  ------   -------   -------

2/15       No        Yes         20        0        UntagPvid Unit 2,
                                                    Only      Port 15

2/16       No        Yes         20        0        UntagPvid Unit 2,
                                                    Only      Port 16

2/17       No        Yes         20        0        UntagPvid Unit 2,
                                                    Only      Port 17

2/18       No        Yes         20        0        UntagPvid Unit 2,
                                                    Only      Port 18

3/15       No        Yes         20        0        UntagAll  Unit 3,
                                                              Port 15
```

26. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```

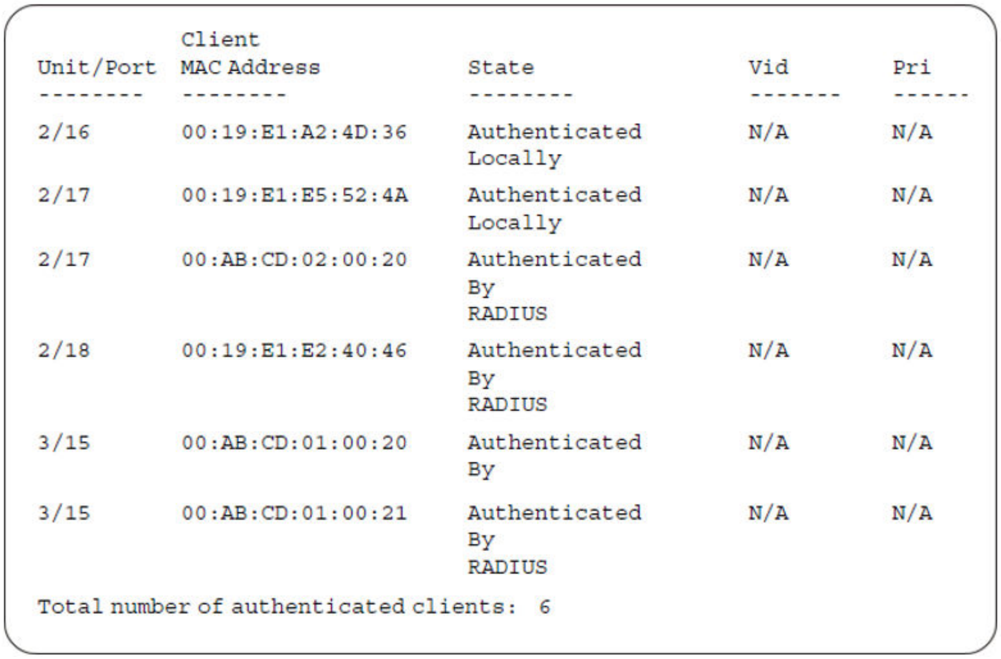


```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN     VLAN Name
--------   --------  --------   --------  ------     -------  -------
2/15       20        VLAN #20   ------    ------     ------   ------
2/16       20        VLAN #20   ------    ------     ------   ------
2/17       20        VLAN #20   ------    ------     ------   ------
2/18       20        VLAN #20   ------    ------     ------   ------
3/15       20        VLAN #20   ------    ------     -------  -------
```

After all clients authenticate on ports:

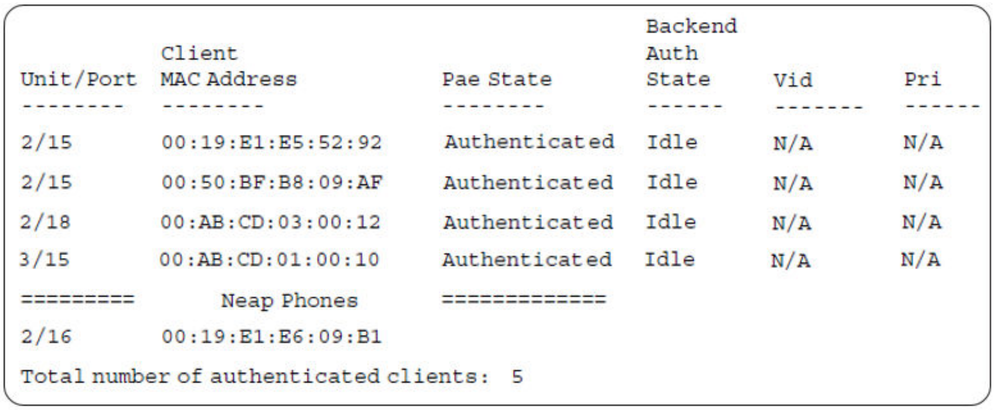
27. Confirm the EAPOL MultiHost status.

```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
          Client
Unit/Port MAC Address        State            Vid     Pri
--------  --------           --------         ------- ------
2/16      00:19:E1:A2:4D:36  Authenticated    N/A     N/A
                             Locally
2/17      00:19:E1:E5:52:4A  Authenticated    N/A     N/A
                             Locally
2/17      00:AB:CD:02:00:20  Authenticated    N/A     N/A
                             By
                             RADIUS
2/18      00:19:E1:E2:40:46  Authenticated    N/A     N/A
                             By
                             RADIUS
3/15      00:AB:CD:01:00:20  Authenticated    N/A     N/A
                             By
3/15      00:AB:CD:01:00:21  Authenticated    N/A     N/A
                             By
                             RADIUS
Total number of authenticated clients:  6
```

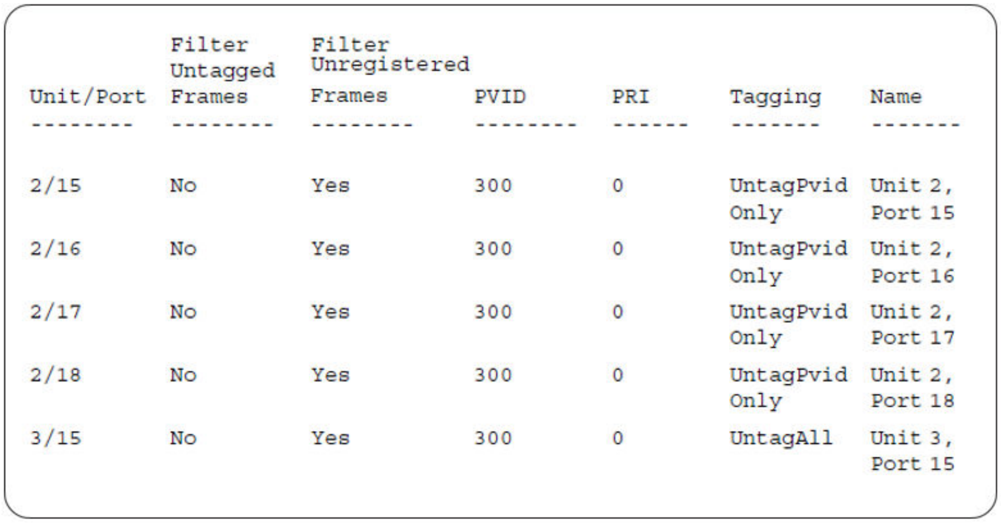
```
Switch(config)#show eapol multihost status
```



```
                                         Backend
          Client                         Auth
Unit/Port MAC Address       Pae State    State   Vid     Pri
--------  --------          --------     ------  ------- ------
2/15      00:19:E1:E5:52:92 Authenticated Idle   N/A     N/A
2/15      00:50:BF:B8:09:AF Authenticated Idle   N/A     N/A
2/18      00:AB:CD:03:00:12 Authenticated Idle   N/A     N/A
3/15      00:AB:CD:01:00:10 Authenticated Idle   N/A     N/A
=========     Neap Phones   =============
2/16      00:19:E1:E6:09:B1
Total number of authenticated clients:  5
```

28. Confirm the VLAN interface settings.

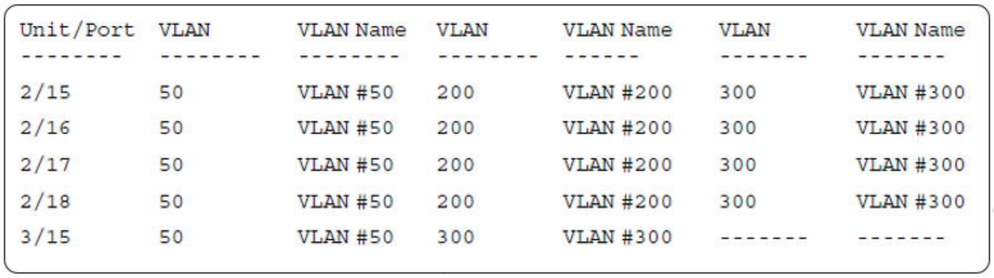
```
Switch(config)#sho vlan interface info 2/15-18,3/15
```



```
          Filter     Filter
          Untagged   Unregistered
Unit/Port Frames     Frames      PVID      PRI     Tagging   Name
--------  --------   --------    --------  ------  -------   -------

2/15      No         Yes         300       0       UntagPvid Unit 2,
                                                   Only      Port 15
2/16      No         Yes         300       0       UntagPvid Unit 2,
                                                   Only      Port 16
2/17      No         Yes         300       0       UntagPvid Unit 2,
                                                   Only      Port 17
2/18      No         Yes         300       0       UntagPvid Unit 2,
                                                   Only      Port 18
3/15      No         Yes         300       0       UntagAll  Unit 3,
                                                             Port 15
```

29. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```



```
Unit/Port  VLAN      VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
--------   --------  --------   --------  ------     -------   -------
2/15       50        VLAN #50   200       VLAN #200  300       VLAN #300
2/16       50        VLAN #50   200       VLAN #200  300       VLAN #300
2/17       50        VLAN #50   200       VLAN #200  300       VLAN #300
2/18       50        VLAN #50   200       VLAN #200  300       VLAN #300
3/15       50        VLAN #50   300       VLAN #300  -------   -------
```

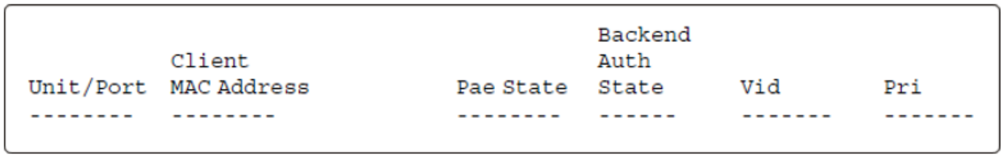
30. Disconnect both primary and back-up RADIUS servers from the network (unplug cables from server side).

31. Attempt to reach the primary and back-up RADIUS servers.

```
Switch(config)#ping 10.100.68.2
(Host is not reachable)

Switch(config)#ping 10.100.68.3
(Host is not reachable)
```

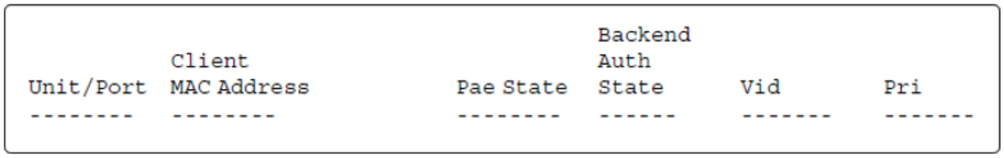
32. After approximately 3 minutes, confirm the EAPOL MultiHost status again.

```
Switch(config)#show eapol multihost status
```



```
                                                Backend
          Client                                Auth
Unit/Port MAC Address             Pae State     State    Vid       Pri
--------  --------                --------      ------   -------   -------
```

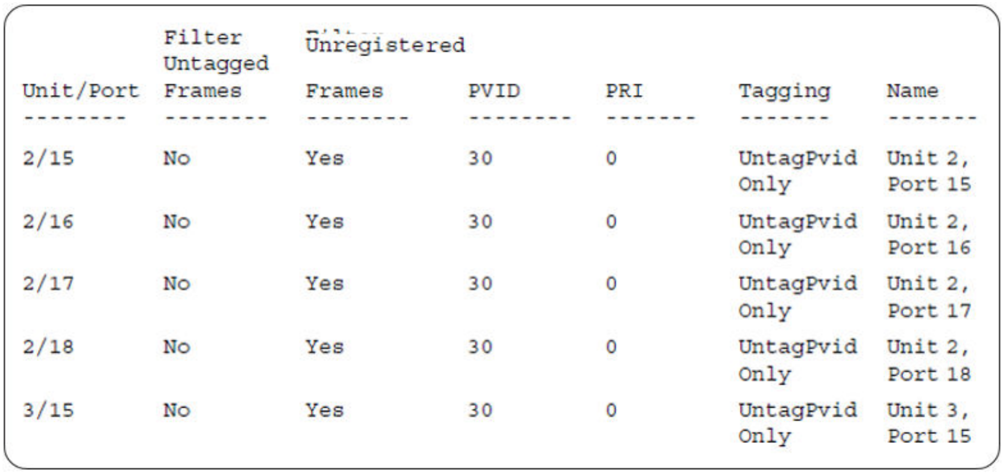
```
Switch(config)#show eapol multihost non-eap-mac status
```



```
                                                  Backend
          Client                                  Auth
Unit/Port MAC Address                   Pae State State      Vid       Pri
--------  --------                      --------  ------     -------   -------
```

33. Confirm the VLAN interface settings.

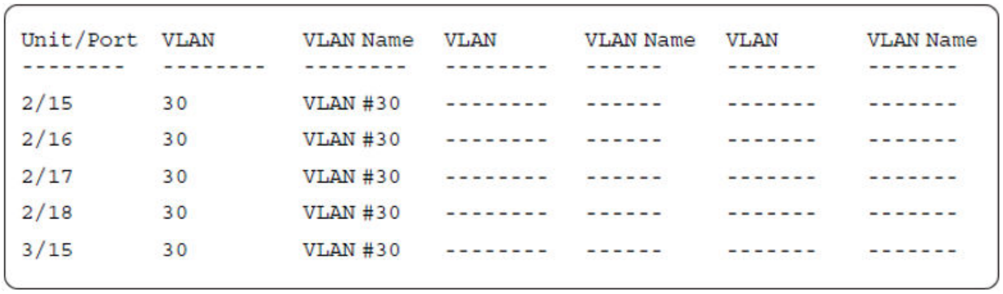
```
Switch(config)#show vlan interface info 2/15-18,3/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames     PVID      PRI       Tagging   Name
--------  --------  --------   --------  -------   -------   -------
2/15      No        Yes        30        0         UntagPvid Unit 2,
                                                   Only      Port 15
2/16      No        Yes        30        0         UntagPvid Unit 2,
                                                   Only      Port 16
2/17      No        Yes        30        0         UntagPvid Unit 2,
                                                   Only      Port 17
2/18      No        Yes        30        0         UntagPvid Unit 2,
                                                   Only      Port 18
3/15      No        Yes        30        0         UntagPvid Unit 3,
                                                   Only      Port 15
```

34. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```



```
Unit/Port VLAN      VLAN Name VLAN      VLAN Name VLAN      VLAN Name
--------  --------  --------  --------  ------    -------   -------
2/15      30        VLAN #30  --------  ------    -------   -------
2/16      30        VLAN #30  --------  ------    -------   -------
2/17      30        VLAN #30  --------  ------    -------   -------
2/18      30        VLAN #30  --------  ------    -------   -------
3/15      30        VLAN #30  --------  ------    -------   -------
```

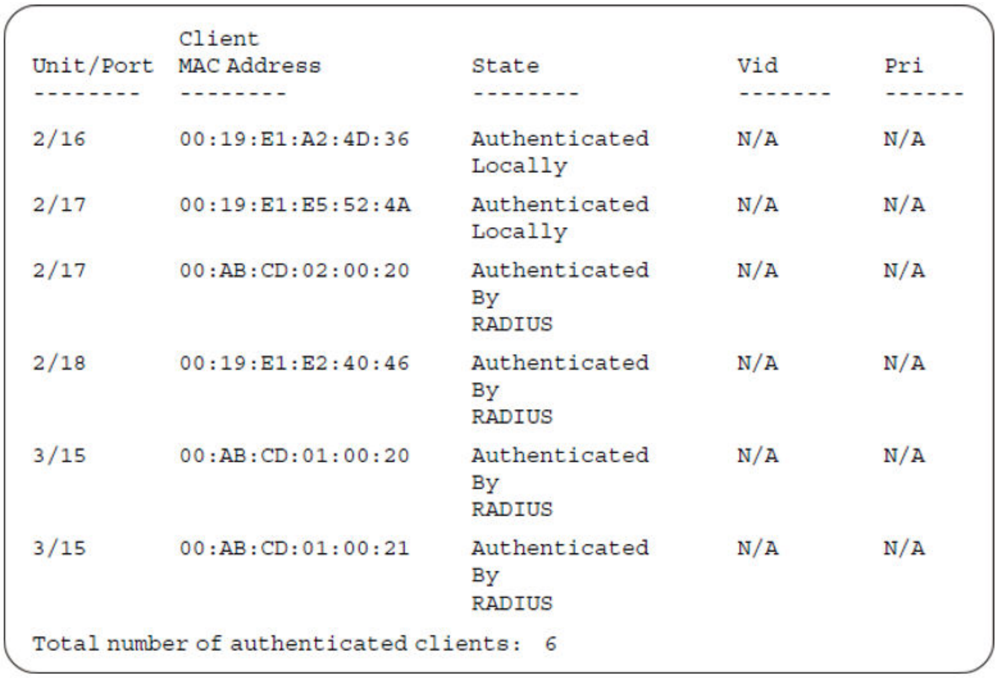
35. Connect primary or back-up RADIUS server to network (plug in cables from server side). For this example, the primary RADIUS server is connected.

36. After approximately 1 minute, attempt to reach the primary RADIUS server.

```
Switch(config)#ping 10.100.68.2
 (Host is reachable)
```

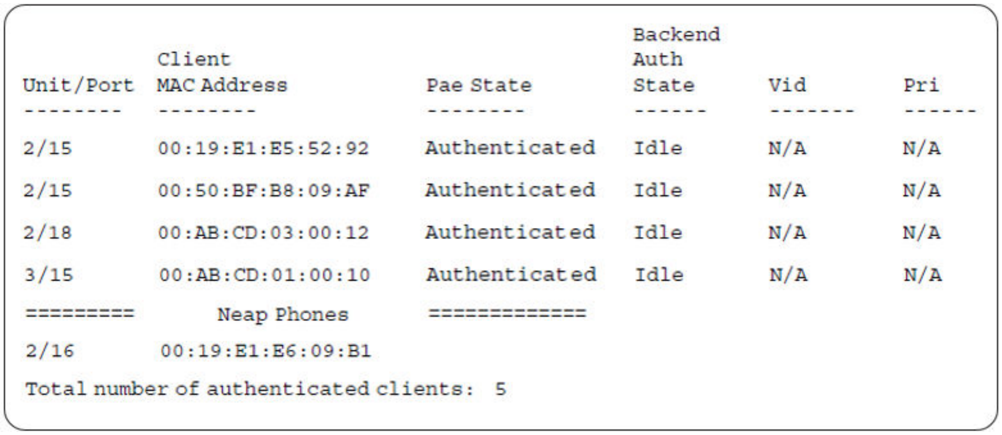
37. Confirm the EAPOL MultiHost status.

```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
           Client
Unit/Port  MAC Address          State          Vid        Pri
--------   --------             --------       -------    ------

2/16       00:19:E1:A2:4D:36    Authenticated  N/A        N/A
                                Locally
2/17       00:19:E1:E5:52:4A    Authenticated  N/A        N/A
                                Locally
2/17       00:AB:CD:02:00:20    Authenticated  N/A        N/A
                                By
                                RADIUS
2/18       00:19:E1:E2:40:46    Authenticated  N/A        N/A
                                By
                                RADIUS
3/15       00:AB:CD:01:00:20    Authenticated  N/A        N/A
                                By
                                RADIUS
3/15       00:AB:CD:01:00:21    Authenticated  N/A        N/A
                                By
                                RADIUS
Total number of authenticated clients:  6
```

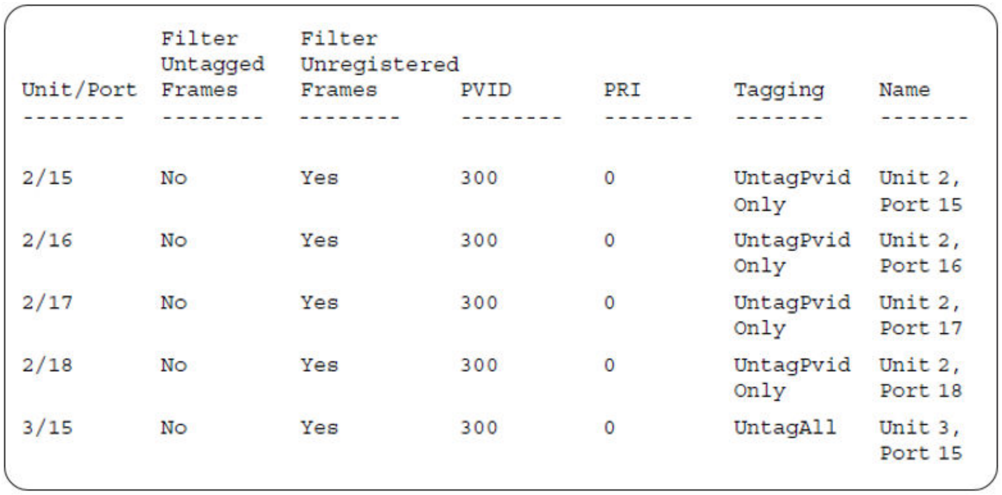
```
Switch(config)#show eapol multihost status
```



```
                                             Backend
           Client                            Auth
Unit/Port  MAC Address         Pae State     State     Vid       Pri
--------   --------            --------      ------    -------   ------

2/15       00:19:E1:E5:52:92   Authenticated Idle      N/A       N/A

2/15       00:50:BF:B8:09:AF   Authenticated Idle      N/A       N/A

2/18       00:AB:CD:03:00:12   Authenticated Idle      N/A       N/A

3/15       00:AB:CD:01:00:10   Authenticated Idle      N/A       N/A
=========      Neap Phones     =============
2/16       00:19:E1:E6:09:B1
Total number of authenticated clients:  5
```

38. Confirm the VLAN interface settings.

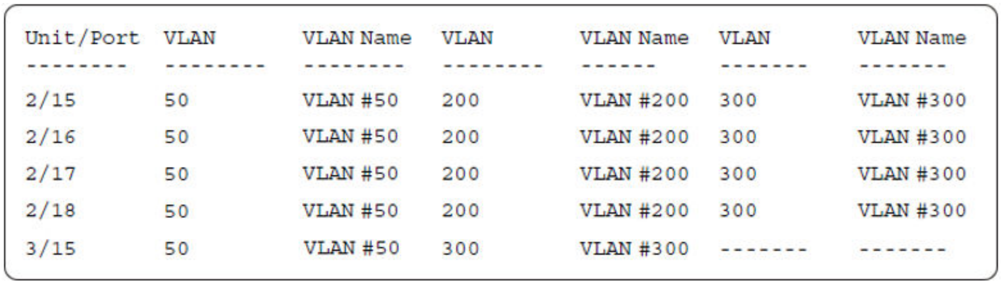
```
Switch(config)#show vlan interface info 2/15-18,3/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames      PVID     PRI     Tagging   Name
--------  --------  --------    -------- ------- -------   -------

2/15      No        Yes         300      0       UntagPvid Unit 2,
                                                 Only      Port 15
2/16      No        Yes         300      0       UntagPvid Unit 2,
                                                 Only      Port 16
2/17      No        Yes         300      0       UntagPvid Unit 2,
                                                 Only      Port 17
2/18      No        Yes         300      0       UntagPvid Unit 2,
                                                 Only      Port 18
3/15      No        Yes         300      0       UntagAll  Unit 3,
                                                           Port 15
```

39. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```



```
Unit/Port VLAN      VLAN Name VLAN      VLAN Name VLAN      VLAN Name
--------  --------  --------  --------  ------    -------   -------
2/15      50        VLAN #50  200       VLAN #200 300       VLAN #300
2/16      50        VLAN #50  200       VLAN #200 300       VLAN #300
2/17      50        VLAN #50  200       VLAN #200 300       VLAN #300
2/18      50        VLAN #50  200       VLAN #200 300       VLAN #300
3/15      50        VLAN #50  300       VLAN #300 -------   -------
```

Alternate configuration

The following operation applies to the **MHMA authentication mode with Guest VLAN and Fail Open VLAN (Multihost MultiVLAN option disabled) without valid additional RADIUS attributes** configuration example, when the RADIUS server has no special attributes configured or the RADIUS server uses misconfigured attributes (not matching the device configuration).

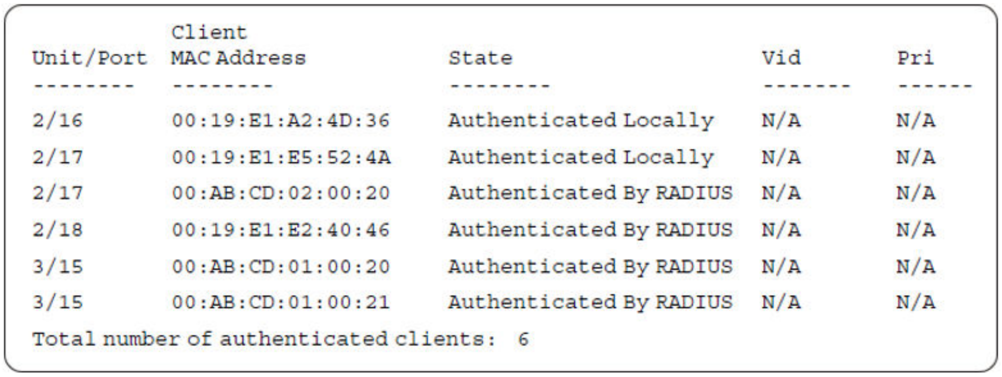
This configuration example modifies EAP and NEAP client attributes on the RADIUS server, replacing VLAN ID 300 with VLAN ID 124, which is not configured on the device.

1. Enable EAPOL.

```
Switch(config)#eapol disable
Switch(config)#eapol enable
% Depending on your stack configuration it may take up to 4 minutes for
% port vlan membership and vid to take effect on all guest-vlan enabled ports.
```

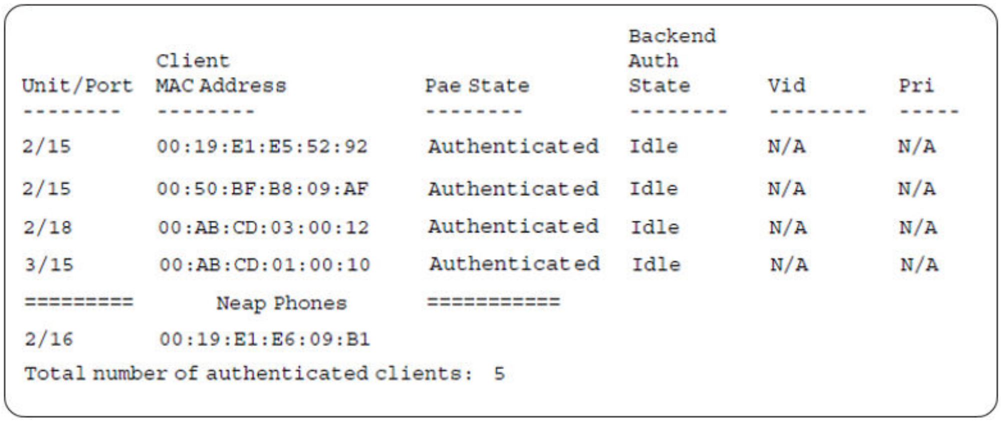
2. Confirm EAPOL MultiHost status.

```
Switch(config)#sho eapol multihost non-eap-mac status
```



```
           Client
Unit/Port  MAC Address         State                     Vid      Pri
--------   --------            --------                  -------  ------
2/16       00:19:E1:A2:4D:36   Authenticated Locally     N/A      N/A
2/17       00:19:E1:E5:52:4A   Authenticated Locally     N/A      N/A
2/17       00:AB:CD:02:00:20   Authenticated By RADIUS   N/A      N/A
2/18       00:19:E1:E2:40:46   Authenticated By RADIUS   N/A      N/A
3/15       00:AB:CD:01:00:20   Authenticated By RADIUS   N/A      N/A
3/15       00:AB:CD:01:00:21   Authenticated By RADIUS   N/A      N/A
Total number of authenticated clients:  6
```

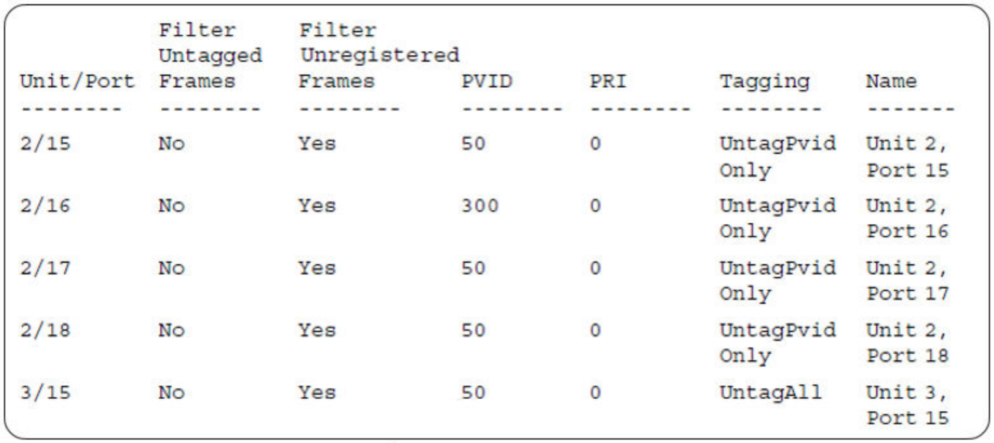
```
Switch(config)#show eapol multihost status
```



```
                                                   Backend
           Client                                  Auth
Unit/Port  MAC Address         Pae State           State      Vid       Pri
--------   --------            ---------           --------   --------  -----
2/15       00:19:E1:E5:52:92   Authenticated       Idle       N/A       N/A
2/15       00:50:BF:B8:09:AF   Authenticated       Idle       N/A       N/A
2/18       00:AB:CD:03:00:12   Authenticated       Idle       N/A       N/A
3/15       00:AB:CD:01:00:10   Authenticated       Idle       N/A       N/A
=========       Neap Phones    ===========
2/16       00:19:E1:E6:09:B1
Total number of authenticated clients:  5
```

3. Confirm the VLAN interface settings.

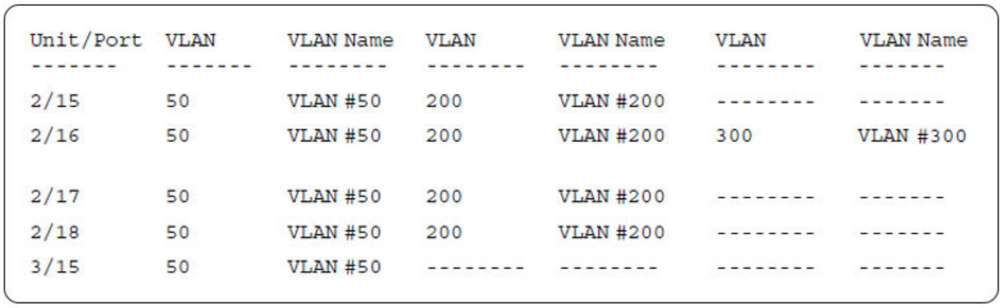
```
Switch(config)#show vlan interface info 2/15-18,3/15
```



```
          Filter    Filter
          Untagged  Unregistered
Unit/Port Frames    Frames        PVID      PRI       Tagging   Name
--------  --------  --------      --------  --------  --------  -------
2/15      No        Yes           50        0         UntagPvid Unit 2,
                                                      Only      Port 15
2/16      No        Yes           300       0         UntagPvid Unit 2,
                                                      Only      Port 16
2/17      No        Yes           50        0         UntagPvid Unit 2,
                                                      Only      Port 17
2/18      No        Yes           50        0         UntagPvid Unit 2,
                                                      Only      Port 18
3/15      No        Yes           50        0         UntagAll  Unit 3,
                                                                Port 15
```

4. Confirm the VLAN interface VIDs.

```
Switch(config)#show vlan interface vids 2/15-18,3/15
```



```
Unit/Port  VLAN     VLAN Name  VLAN      VLAN Name  VLAN      VLAN Name
-------    -------  --------   --------  --------   --------  -------
2/15       50       VLAN #50   200       VLAN #200  --------  -------
2/16       50       VLAN #50   200       VLAN #200  300       VLAN #300

2/17       50       VLAN #50   200       VLAN #200  --------  -------
2/18       50       VLAN #50   200       VLAN #200  --------  -------
3/15       50       VLAN #50   --------  --------   --------  -------
```

Sticky MAC address configuration examples

For the sticky MAC address feature to function properly, you must enable MAC security and auto-learning sticky mode globally, and for the specific interfaces on which you are configuring sticky MAC address.

The following configuration examples describe the basic steps required to configure a device to learn sticky MAC addresses on a range of ports, and to manually configure sticky MAC address on and individual port.

Example 1: Configuring a device to learn sticky MAC addresses on a range of ports :

(Ports 1/6 through 1/14 are used for this example.)

1. Enable MAC security and auto-learning globally.

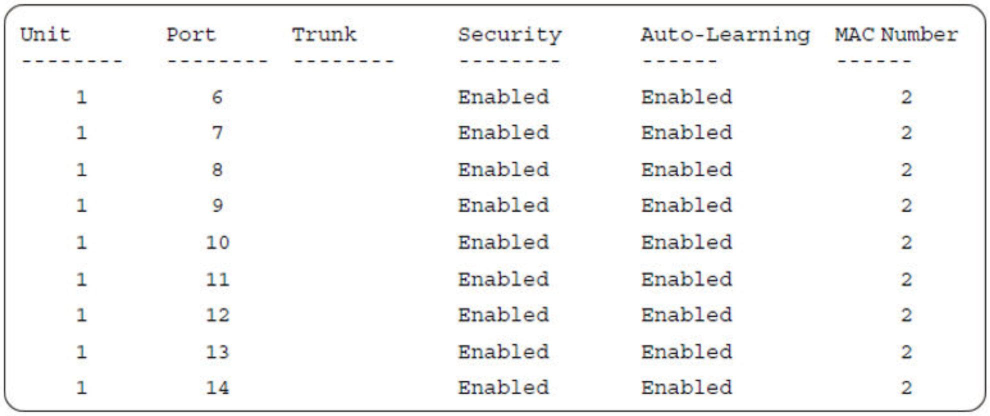
```
mac-security auto-learning stickySwitch(config)#
Avaya recommends disabling autosave when sticky mac is enabled
Switch(config)#mac-security enable
Switch(config)#no autosave enable
Switch(config)#copy config nvram
```

2. Enable MAC security and auto-learning on ports 1/6-14.

```
Switch(config)#interface Ethernet 1/6-14
Switch(config-if)#mac-security auto-learning enable
Switch(config-if)#mac-security auto-learning max-addrs <1-25>
Switch(config-if)#mac-security enable
Switch(config-if)#exit
```

3. Verify the MAC security configuration for the interfaces.

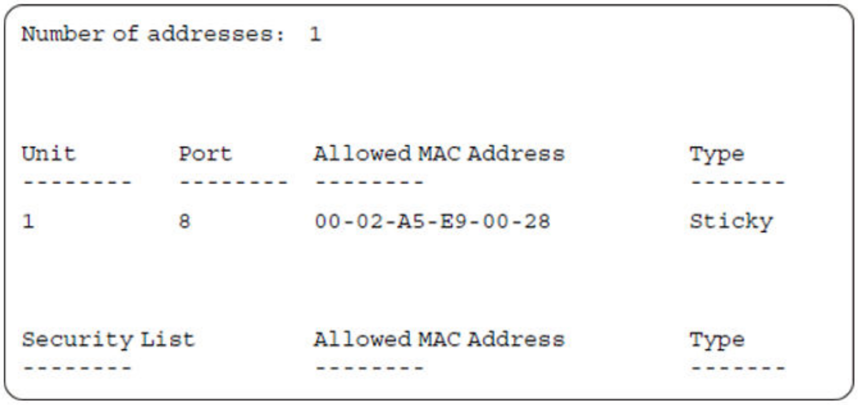
```
Switch(config)#show mac-security port 1/6-14
```



```
Unit      Port      Trunk       Security    Auto-Learning  MAC Number
--------  --------  --------    --------    ------         ------

    1       6                   Enabled     Enabled             2
    1       7                   Enabled     Enabled             2
    1       8                   Enabled     Enabled             2
    1       9                   Enabled     Enabled             2
    1      10                   Enabled     Enabled             2
    1      11                   Enabled     Enabled             2
    1      12                   Enabled     Enabled             2
    1      13                   Enabled     Enabled             2
    1      14                   Enabled     Enabled             2
```

4. Connect a PC to port 1/8 and verify the configuration by displaying the MAC security MAC address table.

```
Switch#show mac-security mac-address-table
Number of addresses: 1
```



```
Number of addresses:  1



Unit        Port       Allowed MAC Address        Type
--------    --------   --------                   -------
1           8          00-02-A5-E9-00-28          Sticky



Security List          Allowed MAC Address        Type
--------               --------                   -------
```

Example 2: Manually configuring sticky MAC address on and individual port:

(Port 1/6 is used for this example.)

1. Enable MAC security and auto-learning globally.

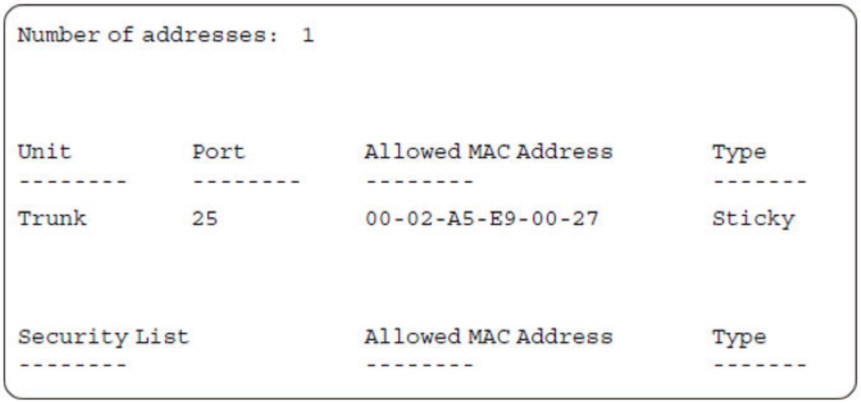
```
Switch(config)#mac-security auto-learning sticky
Avaya recommends disabling autosave when sticky mac is enabled
Switch(config)#copy config nvram
Switch(config)#mac-security enable
Switch(config)#no autosave enable
Switch(config)#mac-security mac-address-table sticky-address 00-02-A5-E9-00-27  port 1/6
```

2. Enable MAC security and auto-learning on port 1/6.

```
Switch(config)#interface Ethernet 1/6
Switch(config-if)#mac-security auto-learning enable
Switch(config-if)#mac-security auto-learning max-addrs <1-25>
Switch(config-if)#mac-security enable
Switch(config-if)#exit
```

3. Verify the configuration by displaying the MAC security MAC address table.

```
Switch#show mac-security mac-address-table
Number of addresses: 1
```



```
Number of addresses:  1


Unit          Port          Allowed MAC Address        Type
--------      --------      --------                   -------
Trunk         25            00-02-A5-E9-00-27          Sticky


Security List               Allowed MAC Address        Type
--------                    --------                   -------
```

First Hop Security configuration example

This section provides a configuration example for the overall deployment of the First Hop Security (FHS) feature.

FHS deployment scenario

In this example, consider there are four users (PC1, PC2, PC3, and PC4). a DHCP server, and an RA or DHCPv6-server Enabled Router connected to the FHS-enabled switch.

The following is the expected behavior:

- RA Enabled Router–Assigns IP subnet for PC1 user
- DHCPv6 Enabled Router–Assigns IP subnet for PC2 user
- DHCPv6-server–Assigns IP subnet for PC3 and PC4

The FHS-enabled switch can only protect the first hop host or network elements which are directly connected. In this scenario, the FHS-enabled switch can protect the hosts PC1, PC2, PC3, and PC4 from the host RTR-PC1 attack. On the other hand, this switch cannot protect the router from the attack caused by the host RTR-PC1. Similarly, an FHS-enabled switch can protect PC1, PC2, PC3, DHCPv6-server and the router from the host PC4 attack.

The following figure shows the FHS deployment scenario topology.

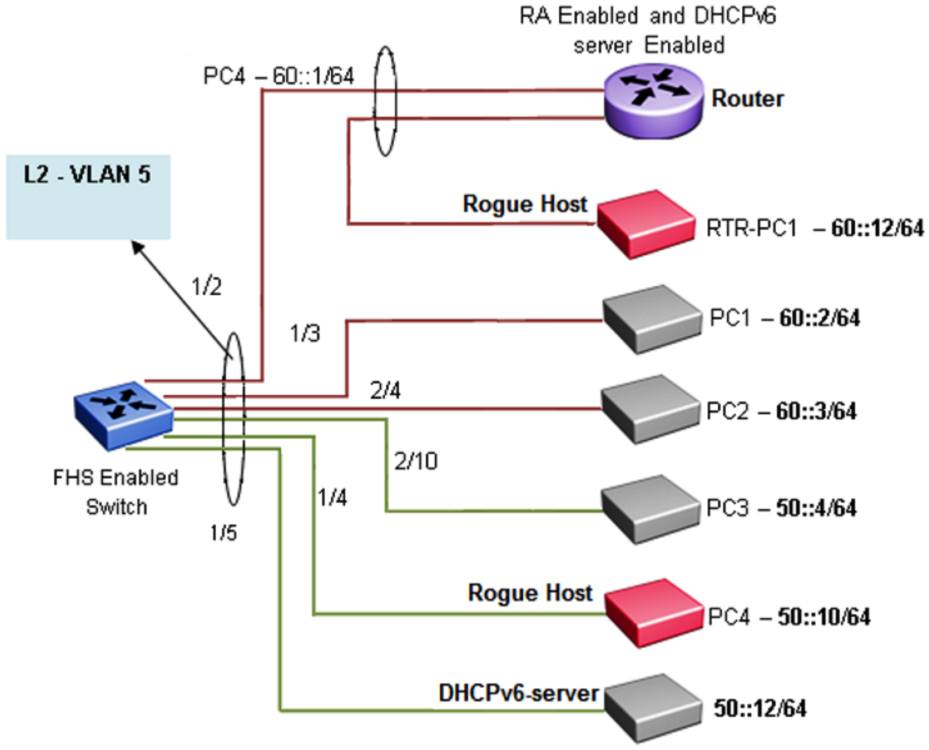


Figure 51: FHS deployment topology

By default, all the ports are trusted, until DHCP-guard or RA-guard policies are configured.

See the following procedures for configuring FHS RA-guard and DHCPv6-guard for the preceding topology.

Creating FHS IPv6 ACL

About this task

Filter IPv6 traffic by creating IPv6 Access Control Lists (ACLs) and applying them to the interfaces similar to the way that you create and apply IPv4 named ACLs.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Create an IP ACL name (rtr_sip) to match the source IP address of the router connected to the interface 1/2.

   ```
   ipv6 fhs ipv6-access-list rtr_sip 60::1/128 mode allow
   ```

3. Create an IP ACL name (rtr_pip) to match the IP prefix generated by the router connected to the interface 1/2.

   ```
   ipv6 fhs ipv6-access-list rtr_pip 60::0/64 mode allow
   ```

4. Create an IP ACL name (svr_sip) to match the source IP of the DHCPv6-server connected to the interface 1/5.

   ```
   ipv6 fhs ipv6-access-list svr_sip 50::12/128 mode allow
   ```

5. Create an IP ACL name (svr_rip) to match the prefix generated by the DHCPv6-server connected to the interface 1/5.

   ```
   ipv6 fhs ipv6-access-list svr_rip 50::12/128 mode allow
   ```

Next steps

Create FHS MAC ACL.

Creating FHS MAC ACL

About this task

Filter the IPv6 traffic by creating a MAC access list with the ACL mode.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Create an MAC ACL name (rtr_smac) to match the source MAC of router connected to the interface 1/2.

   ```
   ipv6 fhs ipv6-access-list rtr_smac 1:2:3:4:5:6 mode allow
   ```

Creating DHCPv6-guard policy for the Router

About this task

Create a DHCPv6–guard policy for the Router to provide Layer 2 security to DHCPv6 clients by protecting them against rogue DHCPv6 servers.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enter DHCP Guard mode with the DHCP-guard policy name (rtr_dhcpg). The DHCP-guard policy for the interface is connected to a Router.

```
ipv6 dhcp guard policy rtr_dhcpg
```

3. Determine the device role as server so that this policy allows the DHCPv6 server reply message.

   ```
   device-role server
   ```

4. Configure the source IP access list to allow only a DHCPv6 server reply originating from the IP address 60::1/128 and check the preceding IPv6 ACL configuration for rtr_sip list.

   ```
   match server access-list rtr_sip
   ```

5. Verify the prefixes sent in the DHCPv6 server reply message so that the rtr_pip IPv6 ACL configuration allows only the prefix 60::0/64.

   ```
   match reply prefix-list rtr_pip
   ```

Creating DHPv6-guard policy for the DHCPv6-Server attached to the switch

About this task

Configure a DHCP-guard policy for the interface connected to a DHCPv6-server to verify the prefixes sent in the DHCPv6 server reply message.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enter the DHCP Guard mode using the DHCP-guard policy name (svr_dhcpg).

   ```
   ipv6 dhcp guard policy svr_dhcpg
   ```

3. Determine the device role as server so that this policy allows the DHCPv6 server reply message.

   ```
   device-role server
   ```

4. Configure the source IP access list to allow only DHCPv6 server reply originating from the IP address 50::12/128 by checking the preceding IPv6 ACL configuration for svr_sip list.

   ```
   match server access-list svr_sip
   ```

5. Verify the prefixes sent in the DHCPv6 server reply message so that svr_rip IPv6 ACL configuration allows only the prefix 50::0/64.

   ```
   match reply prefix-list svr_rip
   ```

Creating DHPv6-guard host policy for PC1, PC2, PC3, and PC4 attached to the switch

About this task

Create a DHPv6-guard host policy for PC1, PC2, PC3, and PC4 attached to the switch to determine PC1, PC2, PC3, and PC4 as host.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enter the DHCP Guard mode using the DHCP-guard policy name (host_dhcpg).

   ```
   ipv6 dhcp guard policy host_dhcpg
   ```

   ✻ **Note:**

   In this case, the DHCP-guard policy is configured for the interface connected to a PC1, PC2, PC3, and PC4.

3. Determine the device role as host so that this policy does not allow the DHCPv6 server reply message.

   ```
   device-role host
   ```

Creating RA-guard policy for the Router

About this task

Create an **rtr_rag** RA-guard policy for the Router and configure the source IP access list to allow only the RA packets originating from the source IP address **60::1/128**. This configuration verifies the prefixes sent in the RA packets.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enter the RA Guard mode and configure RA-guard policy (rtr_rag) for the interface connected to a Router.

   ```
   ipv6 nd raguard policy rtr_rag
   ```

3. Determine the device role as router so that this policy allows the RA packets from the ingress interface on which the policy is attached.

```
device-role router
```

4. Configure the source IP access list to allow only RA packets originating from the source IP address 60::1/128 and check the preceding IPv6 ACL configuration for rtr_sip list.

   ```
   match ipv6 access-list rtr_sip
   ```

5. Verify the prefixes sent in the RA packets so that the rtr_pip IPv6 ACL configuration allows only the prefix 60::0/64.

   ```
   match reply prefix-list rtr_pip
   ```

6. Verify the source MAC address of the received RA packet. Depending on the rtr_smac MAC access list configuration, the packet is allowed or denied.

   ```
   match mac-access-list rtr_smac
   ```

Creating RA-guard policy for the non-RA hosts

About this task

Create a **host_rag** RA-guard policy for the interface connected to PC1, PC2, PC3, PC4 and DHCPv6-Server. This policy determines the device role as router and allows RA packets from the ingress interface on which the policy is attached.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

   ```
   configure terminal
   ```

2. Enter RA Guard mode and configure the RA-guard policy name (host_rag) for the interface connected to PC1, PC2, PC3, PC4 and DHCPv6-Server.

   ```
   ipv6 nd raguard policy host_rag
   ```

3. Determine the device role as router so that this policy allows the RA packets from the ingress interface on which the policy is attached.

   ```
   device-role host
   ```

Attaching FHS policies to the interfaces

About this task

Attach the FHS policies to the interfaces.

Procedure

1. Enter Global Configuration mode:

   ```
   enable
   ```

```
configure terminal
```

2. Configure DHCP-guard and RA-guard policy on the interface (1/2) connected to the Router.

```
interface ethernet 1/2
ipv6 dhcp guard attach-policy rtr_dhcpg
ipv6 nd raguard attach-policy rtr_rag
```

3. Configure DHCP-guard and RA policy on the interface (1/5) connected to DHCPv6-Server.

```
interface ethernet 1/5
ipv6 dhcp guard attach-policy svr_dhcpg
ipv6 nd raguard attach-policy host_rag
```

4. Configure DHCP-guard and RA policy on the interface (1/3,2/4,2/10,1/4) connected to PC1, PC2, PC3, and PC4 correspondingly.

```
interface ethernet 1/3,1/4,2/4,2/10
ipv6 dhcp guard attach-policy host_dhcpg
ipv6 nd raguard attach-policy host_rag
```

Enabling ND-inspection on the interfaces with IPv6 address assigned by DHCPv6 server attached to the interface 1/5

About this task

Enable ND-inspection on the interfaces 1/3,1/4, 2/4, 2/10 with IPv6 address assigned by DHCPv6 server attached to the interface 1/5.

Procedure

1. Enter Global Configuration mode:

```
enable
configure terminal
```

2. Enable IPv6 admin status.

```
ipv6 enable
```

3. Enable FHS globally.

```
ipv6 fhs enable
```

4. Enable ND inspection on the port 1/3, 1/4, 2/4, and 2/10.

```
interface ethernet 1/3,1/4,2/4,2/10
ipv6 nd inspection
```

5. Enable DHCP-guard policy on the port connected to the DHCPv6 server which assigns the IP address for the preceding ports. This ensures that the DHCP assigned IP address is taken into account while inspecting the ND packet.

   ```
   interface fa 1/5
   ```

   ```
   ipv6 dhcp guard attach-policy svr_dhcpg
   ```

RADIUS and SYSLOG server configuration examples for Enhanced Secure Mode

This section contains the following examples, which are applicable when enhanced secure mode is enabled:

- Radius switch and server configuration examples
- Syslog switch and server configuration examples
- Syslog messaging via RFC 3195

Configuration example: RADIUS configuration

Configuring the switch for RADIUS authentication

Use the following commands to configure the switch for RADIUS authentication.

1. Configure the RADIUS server IP address and shared secret.

   ```
   Switch(config)#radius server host 10.100.94.38 key
   Enter key:
   ```

2. Verify the RADIUS configuration.

   ```
   Switch:#show radius-server

   RADIUS Global Server
   -------------------------------------------------------------
   Primary Host            : 10.100.94.38
   Secondary Host          : 0.0.0.0
   Port                    : 1812
   Time-out                : 10
   Key                     : ***************
   Radius Accounting       : Disabled
   Radius Accounting Port  : 1813
   Radius Retry Limit      : 3
   Current Status          : Reachable via Primary
   Time Until Next Check   : 169

   RADIUS EAP Server
   -------------------------------------------------------------
   Primary Host            : 0.0.0.0
   Secondary Host          : 0.0.0.0
   Port                    : 1812
   Time-out                : 10
   Key                     : ***************
   Radius Accounting       : Disabled
   ```

```
Radius Accounting Port : 1813
Radius Retry Limit     : 3
Current Status         : None Reachable
Time Until Next Check  : 169

RADIUS Non-EAP Server
--------------------------------------------------------------
Primary Host           : 0.0.0.0
Secondary Host         : 0.0.0.0
Port                   : 1812
Time-out               : 10
Key                    : ***************
Radius Accounting      : Disabled
Radius Accounting Port : 1813
Radius Retry Limit     : 3
Current Status         : None Reachable
Time Until Next Check  : 169

Other Settings
--------------------------------------------------------------
Password Fallback      : Enabled
RADIUS Encapsulation   : PAP
```

3. Set the authentication method.

   By default the authentication method is set to local database – roles based access control (RBAC). You can also change the authentication method to remote authentication using a RADIUS server.

   ```
   Switch:(config)#show cli password type

   Console Password Type: Local Password
   Telnet/WEB Password Type: Local Password

   Switch:(config)#cli password serial radius
   Switch:(config)#cli password telnet radius
   ```

4. Verify the configuration.

   ```
   Switch:(config)#show cli password type

   Console Password Type: RADIUS Authentication
   Telnet/WEB Password Type: RADIUS Authentication
   ```

Configuring user account details – FreeRadius server on a UNIX machine

Use the following steps to modify the following configuration files to define the user account.

- clients.conf file for defining allowed client IP addresses and Radius shared secret.
- users file for defining the user accounts allowed to access the switch.

After defining the user accounts, only the authenticated user can connect to the network after the Network Authentication Server (NAS) validates the credentials.

1. Login as root on the UNIX machine.
2. Access Radius configuration files.

   By default, the configuration files are located at `/usr/local/etc/raddb` folder.

3. Edit clients.conf file to define client entries for a particular client IP or clients IP range.

Following is example. In this example, the client range is *ags1*, permitted IP address clients range is *10.100.0.0/16* subnet, and shared secret key is *bayproject*.

```
client ags1 {
ipaddr = 10.100.0.0
netmask = 16
secret = bayproject
shortname = ags1
}
```

4. Edit users file to define the user account entries that are allowed to access the switch.

   In the following example, the server is configured to allow security administrator, system administrator or application administrator.

```
appl_adm Auth-Type := Local, Cleartext-password := “MY!#xaxao_104274982”
Service-Type = Administrative-User,
Reply-Message := “Welcome appl_adm!”,
NAS-Filter-Rule = 1
security_adm Auth-Type := Local, Cleartext-password := “MY!#xexez_104274982”
Service-Type = Administrative-User,
Reply-Message := “Welcome security_adm!”,
NAS-Filter-Rule = 2
```

   Note:

   The NAS-Filter-Rule parameter is value 1 for application administrator role, value 2 for security administrator role or value 4 for system administrator.

5. Start the NAS server after completing the configuration changes to the FreeRadius server.

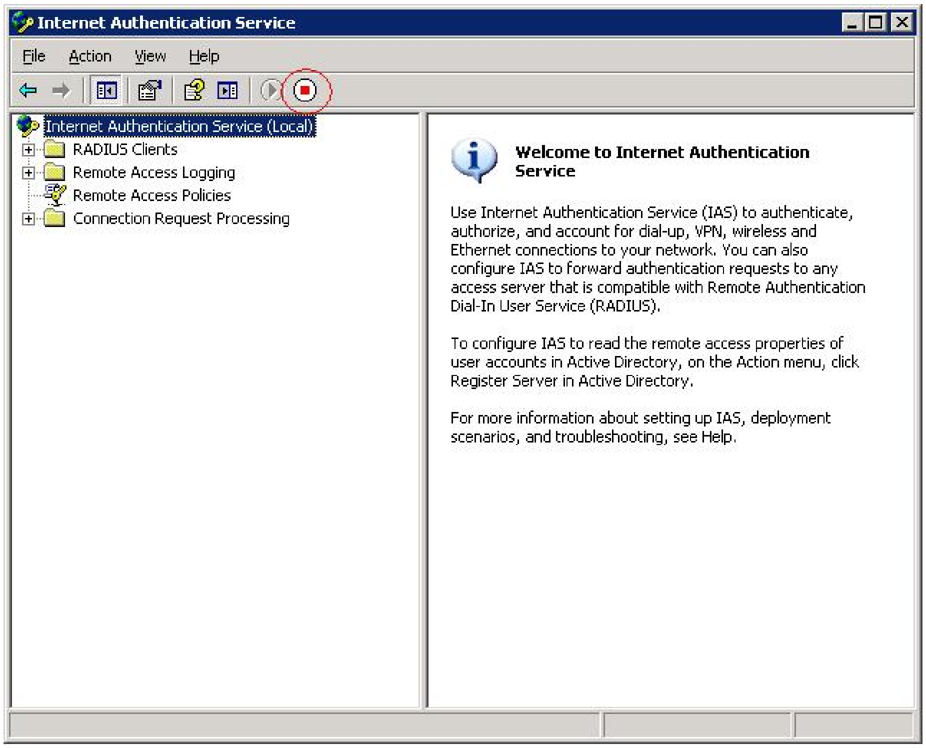
   radiusd –X

   As each user logs in, debugging traces can be inspected on the command screen.

Configuring RADIUS server running Windows Server 2003

Use the following steps to configure a RADIUS server running Windows 2003 Server.

1. Go to **Start** > **Control Panel** > **Administrative Tools** > **Internet Authentication Service** and select **Internet Authentication Service (Local)**.
2. Click Stop button to stop the Internet Authentication Service.


Internet Authentication Service
File Action View Help
Internet Authentication Service (Local)
RADIUS Clients
Remote Access Logging
Remote Access Policies
Connection Request Processing

Welcome to Internet Authentication Service

Use Internet Authentication Service (IAS) to authenticate, authorize, and account for dial-up, VPN, wireless and Ethernet connections to your network. You can also configure IAS to forward authentication requests to any access server that is compatible with Remote Authentication Dial-In User Service (RADIUS).

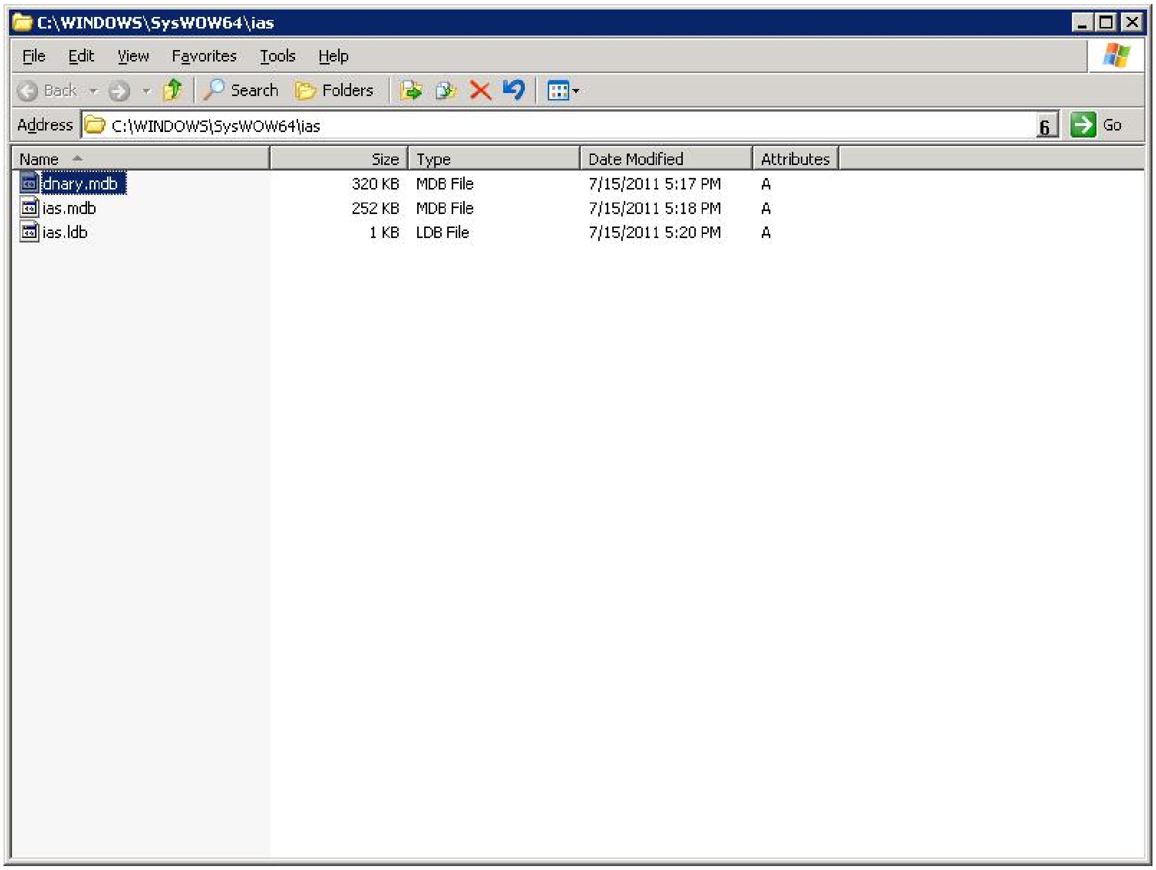
To configure IAS to read the remote access properties of user accounts in Active Directory, on the Action menu, click Register Server in Active Directory.

For more information about setting up IAS, deployment scenarios, and troubleshooting, see Help.

3. Go to location `C:\WINDOWS\SysWOW64\ias` and open dnary.mdb using Microsoft Access.

   Note:

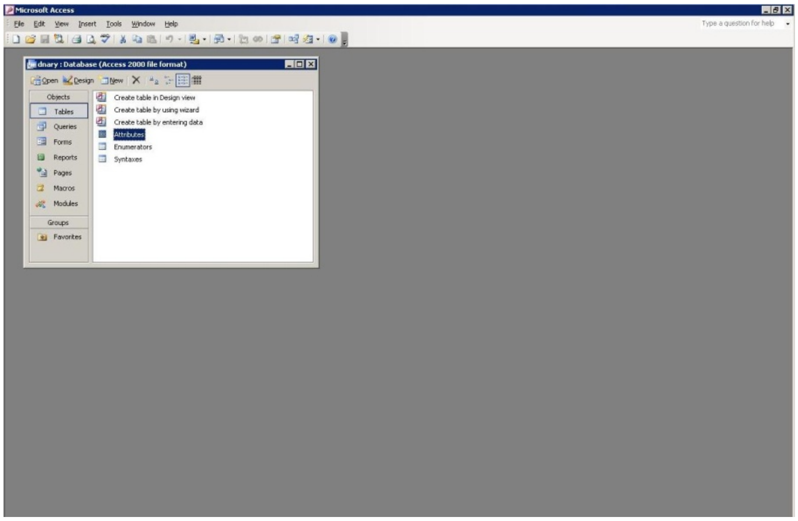
   This folder location can be different.



C:\WINDOWS\SysWOW64\ias
File Edit View Favorites Tools Help
Back Search Folders
Address C:\WINDOWS\SysWOW64\ias
Go

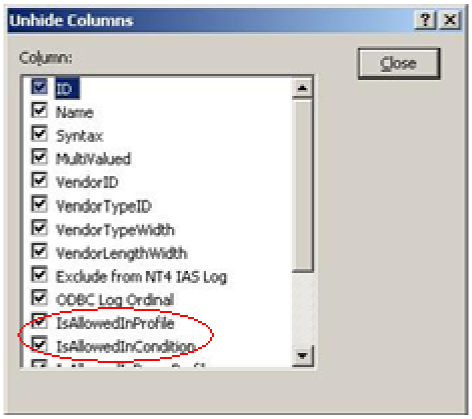
Name	Size	Type	Date Modified	Attributes
dnary.mdb	320 KB	MDB File	7/15/2011 5:17 PM	A
ias.mdb	252 KB	MDB File	7/15/2011 5:18 PM	A
ias.ldb	1 KB	LDB File	7/15/2011 5:20 PM	A

4. From the navigation tree, select **Tables** > **Attributes**.



Microsoft Access
File Edit View Insert Tools Window Help
Type a question for help
dnary : Database (Access 2000 file format)
Open Design New
Objects
Tables
Queries
Forms
Reports
Pages
Macros
Modules
Groups
Favorites
Create table in Design view
Create table by using wizard
Create table by entering data
Attributes
Enumerators
Syntaxes

5. Select **Format** > **Unhide columns**.
6. Select **IsAllowedInProfile** and **IsAllowedInCondition**.

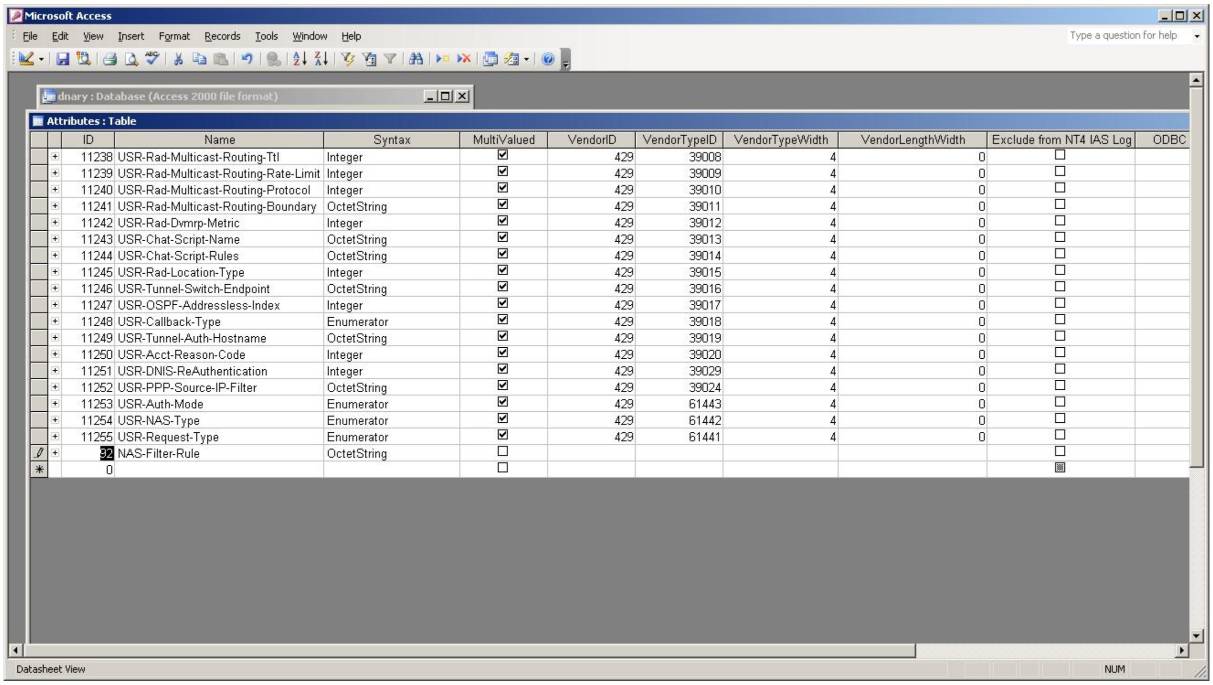


Unhide Columns

Column:

- ☑ ID
- ☑ Name
- ☑ Syntax
- ☑ MultiValued
- ☑ VendorID
- ☑ VendorTypeID
- ☑ VendorTypeWidth
- ☑ VendorLengthWidth
- ☑ Exclude from NT4 IAS Log
- ☑ ODBC Log Ordinal
- ☑ IsAllowedInProfile
- ☑ IsAllowedInCondition

7. Click Insert and New Record and enter `92` in the ID column and `NAS-Filter-Rule` in the Name column.



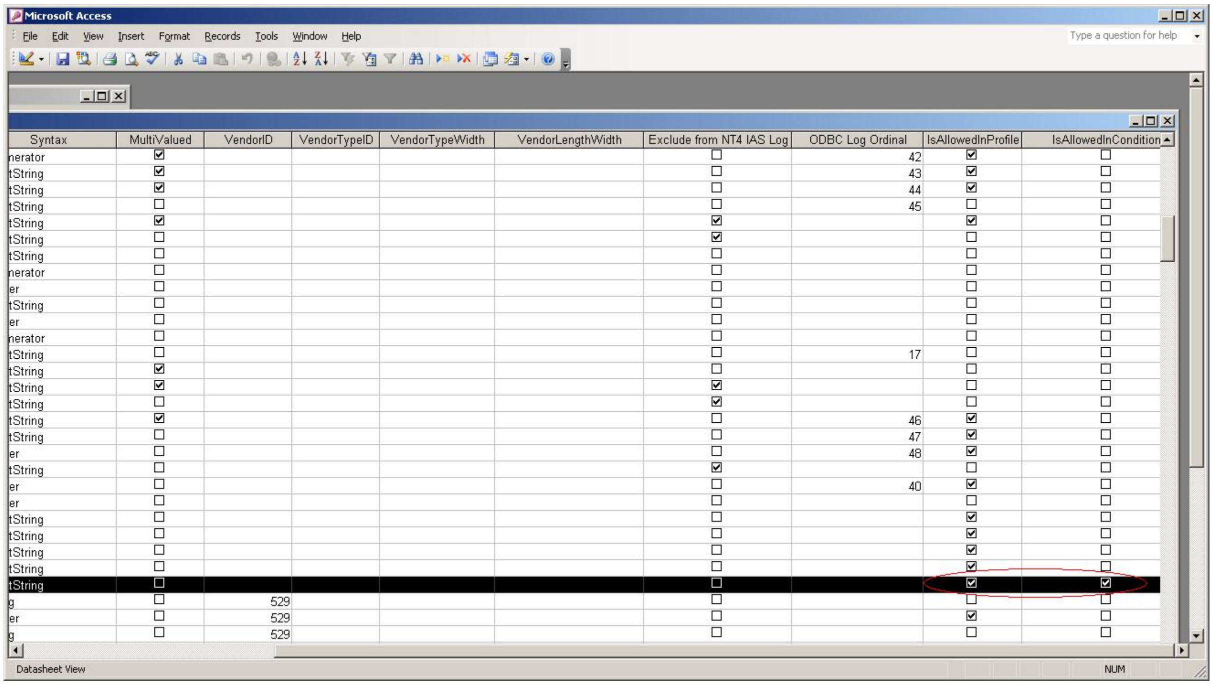
Microsoft Access
File Edit View Insert Format Records Tools Window Help
Type a question for help
dnary : Database (Access 2000 file format)
Datasheet View
NUM

Attributes : Table

ID	Name	Syntax	MultiValued	VendorID	VendorTypeID	VendorTypeWidth	VendorLengthWidth	Exclude from NT4 IAS Log	ODBC
11238	USR-Rad-Multicast-Routing-Ttl	Integer	☑	429	39008	4	0	□	
11239	USR-Rad-Multicast-Routing-Rate-Limit	Integer	☑	429	39009	4	0	□	
11240	USR-Rad-Multicast-Routing-Protocol	Integer	☑	429	39010	4	0	□	
11241	USR-Rad-Multicast-Routing-Boundary	OctetString	☑	429	39011	4	0	□	
11242	USR-Rad-Dvmrp-Metric	Integer	☑	429	39012	4	0	□	
11243	USR-Chat-Script-Name	OctetString	☑	429	39013	4	0	□	
11244	USR-Chat-Script-Rules	OctetString	☑	429	39014	4	0	□	
11245	USR-Rad-Location-Type	Integer	☑	429	39015	4	0	□	
11246	USR-Tunnel-Switch-Endpoint	OctetString	☑	429	39016	4	0	□	
11247	USR-OSPF-Addressless-Index	Integer	☑	429	39017	4	0	□	
11248	USR-Callback-Type	Enumerator	☑	429	39018	4	0	□	
11249	USR-Tunnel-Auth-Hostname	OctetString	☑	429	39019	4	0	□	
11250	USR-Acct-Reason-Code	Integer	☑	429	39020	4	0	□	
11251	USR-DNIS-ReAuthentication	Integer	☑	429	39029	4	0	□	
11252	USR-PPP-Source-IP-Filter	OctetString	☑	429	39024	4	0	□	
11253	USR-Auth-Mode	Enumerator	☑	429	61443	4	0	□	
11254	USR-NAS-Type	Enumerator	☑	429	61442	4	0	□	
11255	USR-Request-Type	Enumerator	☑	429	61441	4	0	□	
92	NAS-Filter-Rule	OctetString	□					□	
0			□					▨	

8. Select the two options.

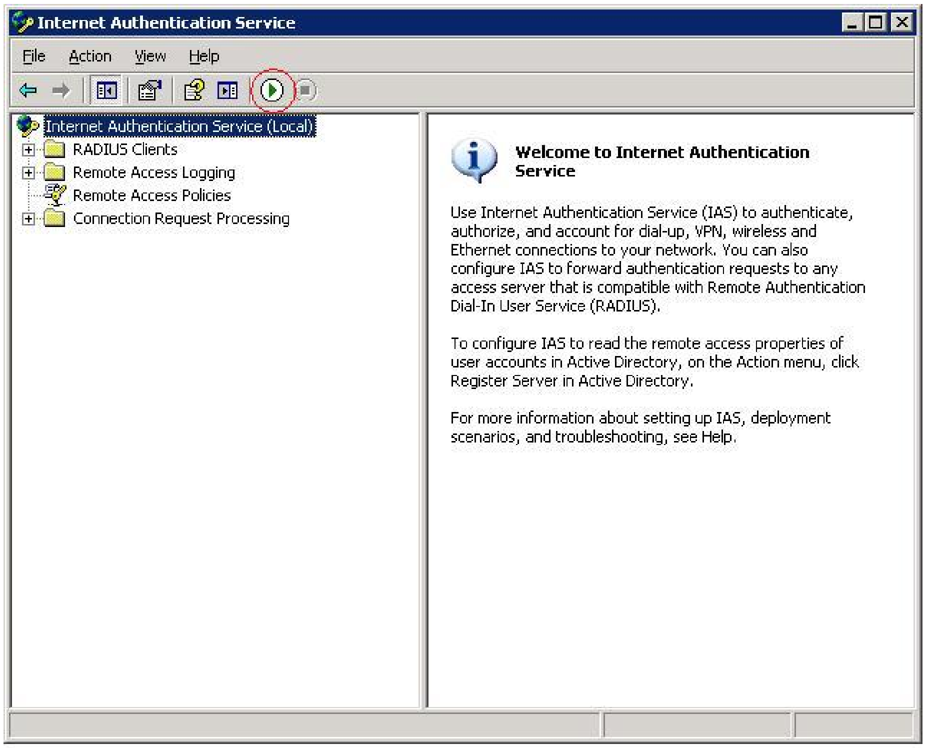
   In the following example, IsAllowedInProfile and IsAllowedInCondition are selected.



Syntax	MultiValued	VendorID	VendorTypeID	VendorTypeWidth	VendorLengthWidth	Exclude from NT4 IAS Log	ODBC Log Ordinal	IsAllowedInProfile	IsAllowedInCondition
nerator	☑					☐	42	☑	☐
tString	☑					☐	43	☑	☐
tString	☑					☐	44	☑	☐
tString	☐					☐	45	☐	☐
tString	☑					☑		☑	☐
tString	☐					☑		☐	☐
tString	☐					☐		☐	☐
nerator	☐					☐		☐	☐
er	☐					☐		☐	☐
tString	☐					☐		☐	☐
er	☐					☐		☐	☐
nerator	☐					☐		☐	☐
tString	☐					☐	17	☐	☐
tString	☑					☐		☐	☐
tString	☑					☑		☐	☐
tString	☐					☑		☐	☐
tString	☑					☐	46	☑	☐
tString	☐					☐	47	☑	☐
er	☐					☐	48	☑	☐
tString	☐					☑		☐	☐
er	☐					☐	40	☑	☐
er	☐					☐		☐	☐
tString	☐					☐		☑	☐
tString	☐					☐		☑	☐
tString	☐					☐		☑	☐
tString	☐					☐		☑	☐
tString	☐					☐		☑	☑
g	☐	529				☐		☐	☐
er	☐	529				☐		☑	☐
g	☐	529				☐		☐	☐

9. Save and close the database.

10. Click the Start button to start the Internet Authentication Service.


Internet Authentication Service
File Action View Help
Internet Authentication Service (Local)
RADIUS Clients
Remote Access Logging
Remote Access Policies
Connection Request Processing

Welcome to Internet Authentication Service

Use Internet Authentication Service (IAS) to authenticate, authorize, and account for dial-up, VPN, wireless and Ethernet connections to your network. You can also configure IAS to forward authentication requests to any access server that is compatible with Remote Authentication Dial-In User Service (RADIUS).

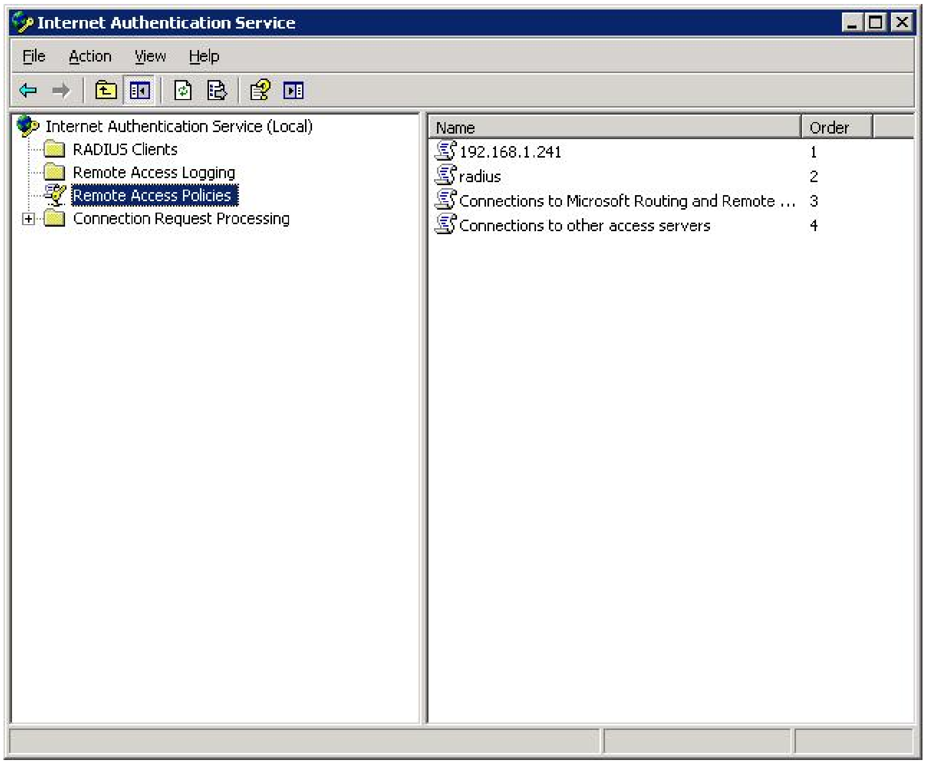
To configure IAS to read the remote access properties of user accounts in Active Directory, on the Action menu, click Register Server in Active Directory.

For more information about setting up IAS, deployment scenarios, and troubleshooting, see Help.

11. Restart the server.

Defining the RADIUS access policy using the NAS-Filter rule attribute on Windows 2003 Server

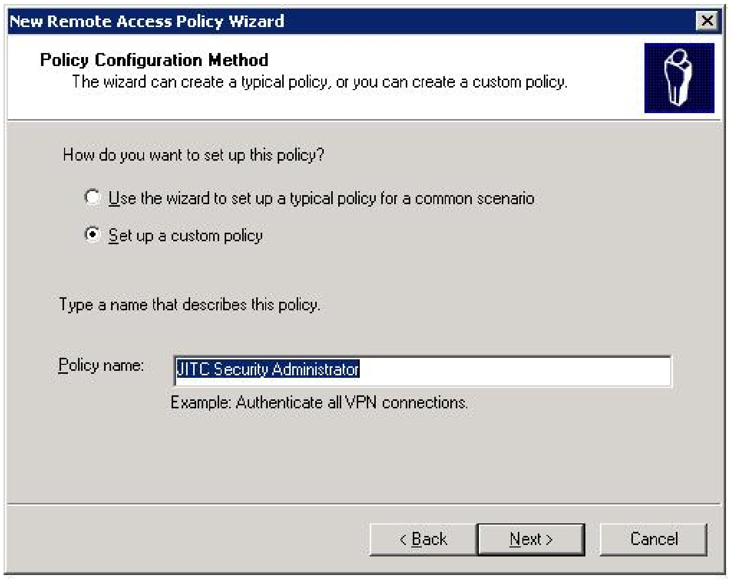
1. Go to **Start** > **Control Panel** > **Administrative Tools** > **Internet Authentication Service**.
2. Select **Remote Access Policies** and right-click to select **New Remote Access Policy**.



- Internet Authentication Service (Local)
  - RADIUS Clients
  - Remote Access Logging
  - Remote Access Policies
  - Connection Request Processing

Name	Order
192.168.1.241	1
radius	2
Connections to Microsoft Routing and Remote ...	3
Connections to other access servers	4

3. Select **Set up a custom policy** and in the Policy Name field, enter a name.



New Remote Access Policy Wizard

Policy Configuration Method

The wizard can create a typical policy, or you can create a custom policy.

How do you want to set up this policy?

○ Use the wizard to set up a typical policy for a common scenario

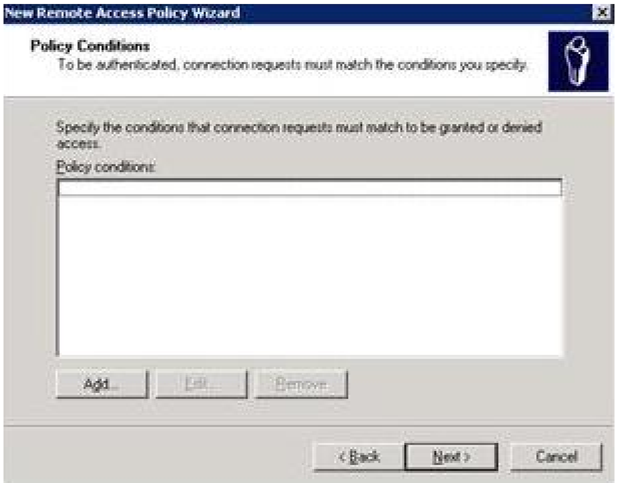
● Set up a custom policy

Type a name that describes this policy.

Policy name: JITC Security Administrator

Example: Authenticate all VPN connections.

4. Click **Next**.
5. Click **Add.**



New Remote Access Policy Wizard

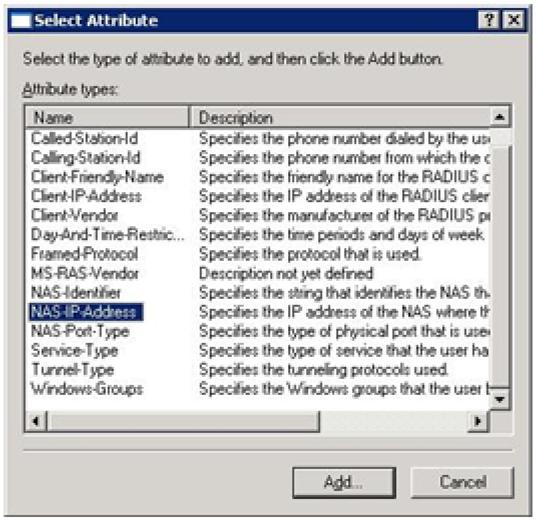
Policy Conditions

To be authenticated, connection requests must match the conditions you specify.

Specify the conditions that connection requests must match to be granted or denied access.

Policy conditions:

6. Select NAS-IP-Address and click **Add**.

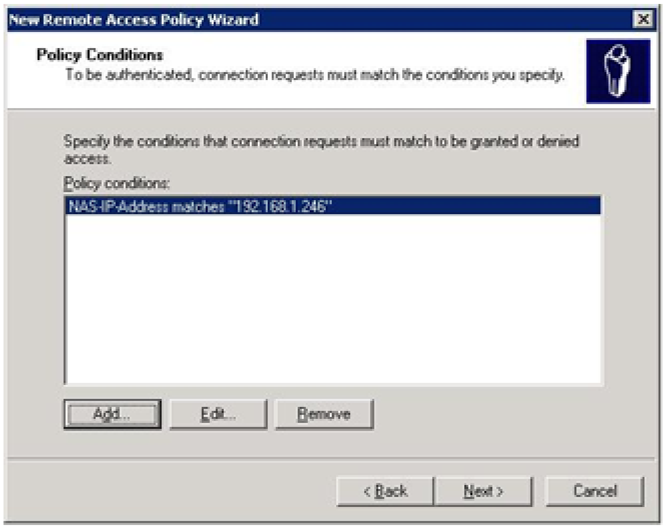


Select the type of attribute to add, and then click the Add button.

Attribute types:

Name	Description
Called-Station-Id	Specifies the phone number dialed by the us
Calling-Station-Id	Specifies the phone number from which the c
Client-Friendly-Name	Specifies the friendly name for the RADIUS c
Client-IP-Address	Specifies the IP address of the RADIUS clier
Client-Vendor	Specifies the manufacturer of the RADIUS pi
Day-And-Time-Restric...	Specifies the time periods and days of week
Framed-Protocol	Specifies the protocol that is used.
MS-RAS-Vendor	Description not yet defined
NAS-Identifier	Specifies the string that identifies the NAS th
NAS-IP-Address	Specifies the IP address of the NAS where th
NAS-Port-Type	Specifies the type of physical port that is use
Service-Type	Specifies the type of service that the user ha
Tunnel-Type	Specifies the tunneling protocols used.
Windows-Groups	Specifies the Windows groups that the user b

7. Configure the NAS IP address and click **Next**.



Policy Conditions

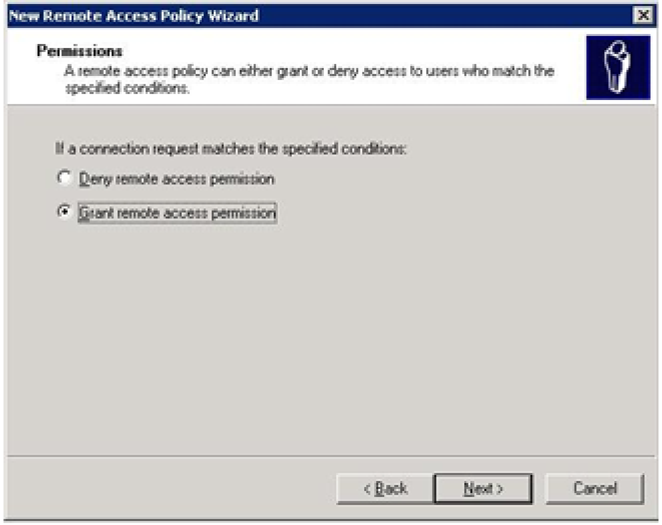
To be authenticated, connection requests must match the conditions you specify.

Specify the conditions that connection requests must match to be granted or denied access.

Policy conditions:

NAS-IP-Address matches "192.168.1.246"

8. Select **Grant remote access permission** and click **Next**.



New Remote Access Policy Wizard

Permissions

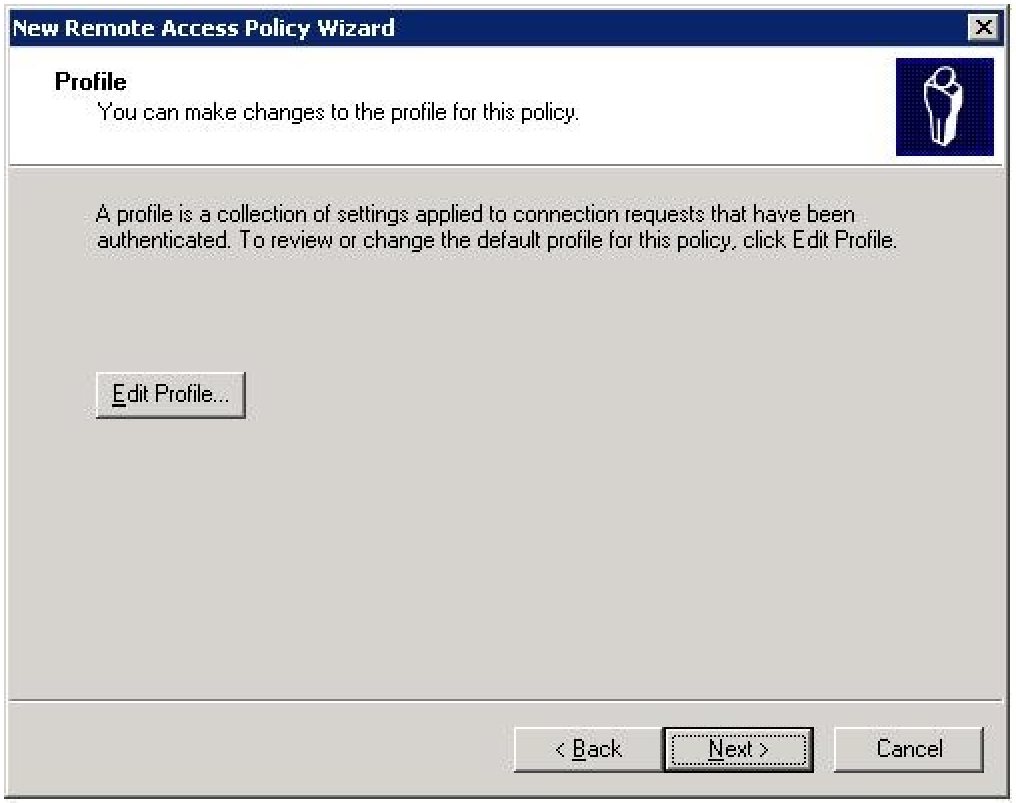
A remote access policy can either grant or deny access to users who match the specified conditions.

If a connection request matches the specified conditions:

○ Deny remote access permission

● Grant remote access permission

9. Click **Edit Profile**.



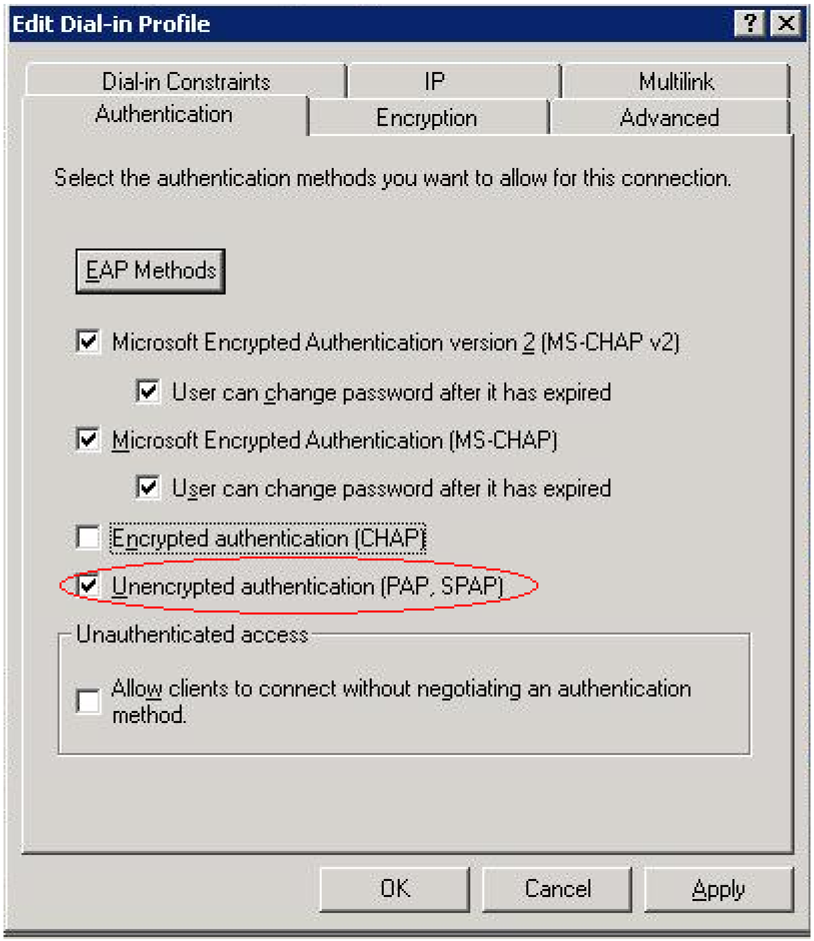
New Remote Access Policy Wizard

Profile

You can make changes to the profile for this policy.

A profile is a collection of settings applied to connection requests that have been authenticated. To review or change the default profile for this policy, click Edit Profile.

10. Select **Authentication** tab and then, select **Unencrypted authentication (PAP, SPAP)**.



Edit Dial-in Profile

Select the authentication methods you want to allow for this connection.

☑ Microsoft Encrypted Authentication version 2 (MS-CHAP v2)

☑ User can change password after it has expired

☑ Microsoft Encrypted Authentication (MS-CHAP)

☑ User can change password after it has expired

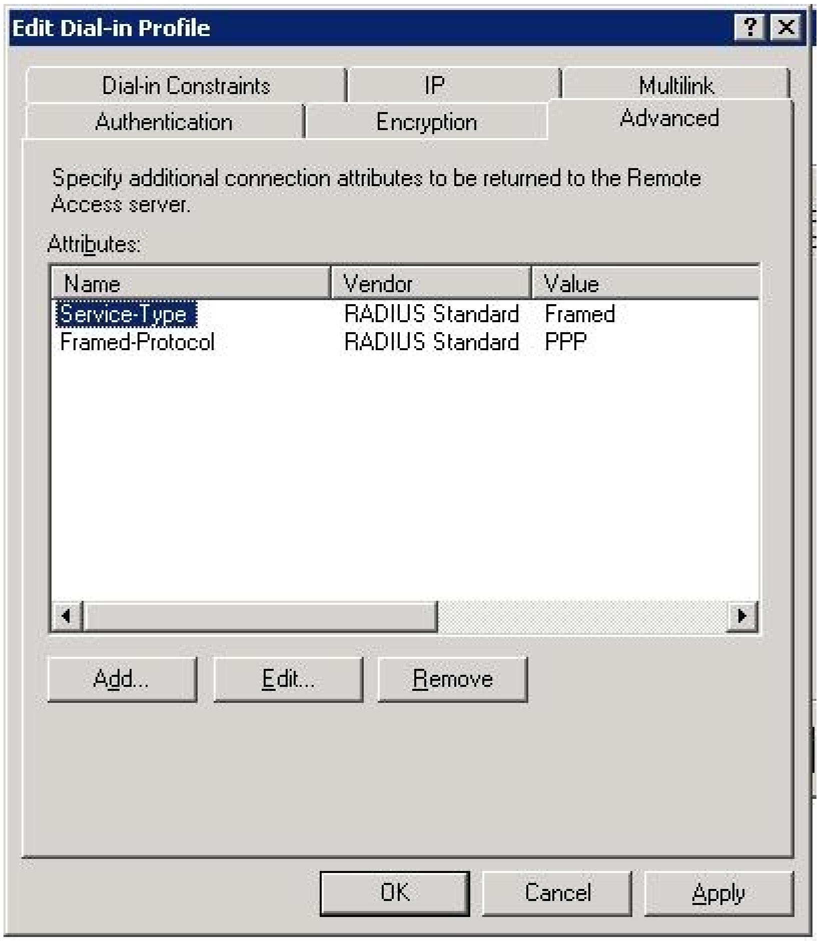
□ Encrypted authentication (CHAP)

☑ Unencrypted authentication (PAP, SPAP)

Unauthenticated access

□ Allow clients to connect without negotiating an authentication method.

11. Select **Advanced** tab and then, double-click **Service-Type**.

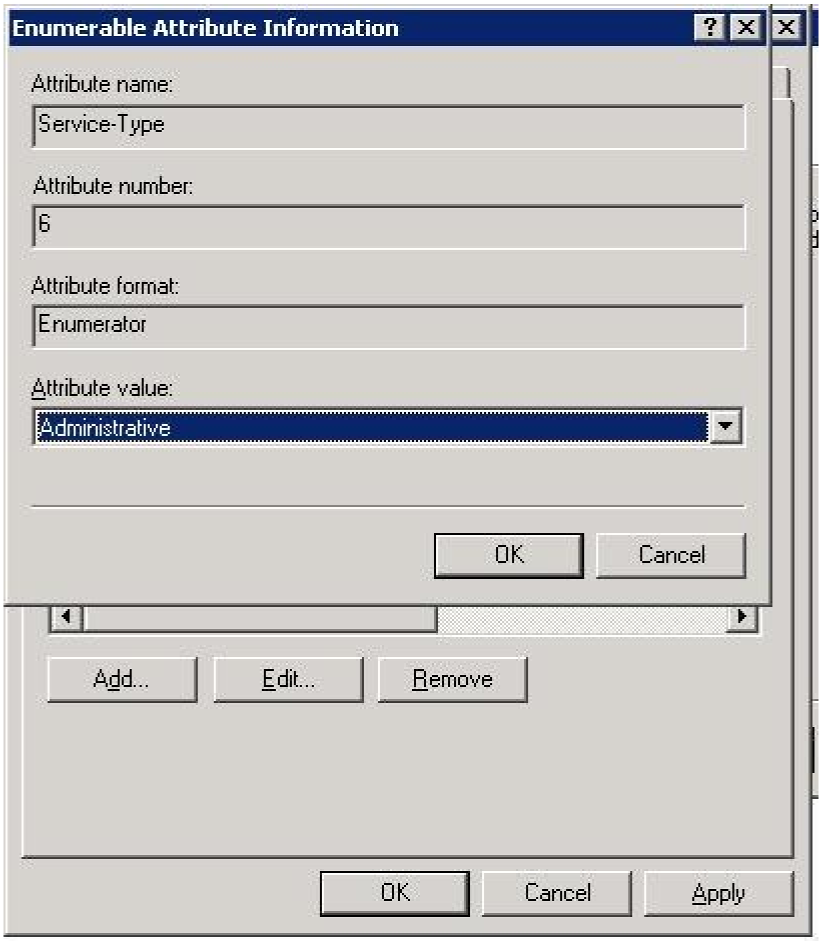


Specify additional connection attributes to be returned to the Remote Access server.

Attributes:

Name	Vendor	Value
Service-Type	RADIUS Standard	Framed
Framed-Protocol	RADIUS Standard	PPP

12. From the Attribute value drop-down, select Administrative.



Enumerable Attribute Information

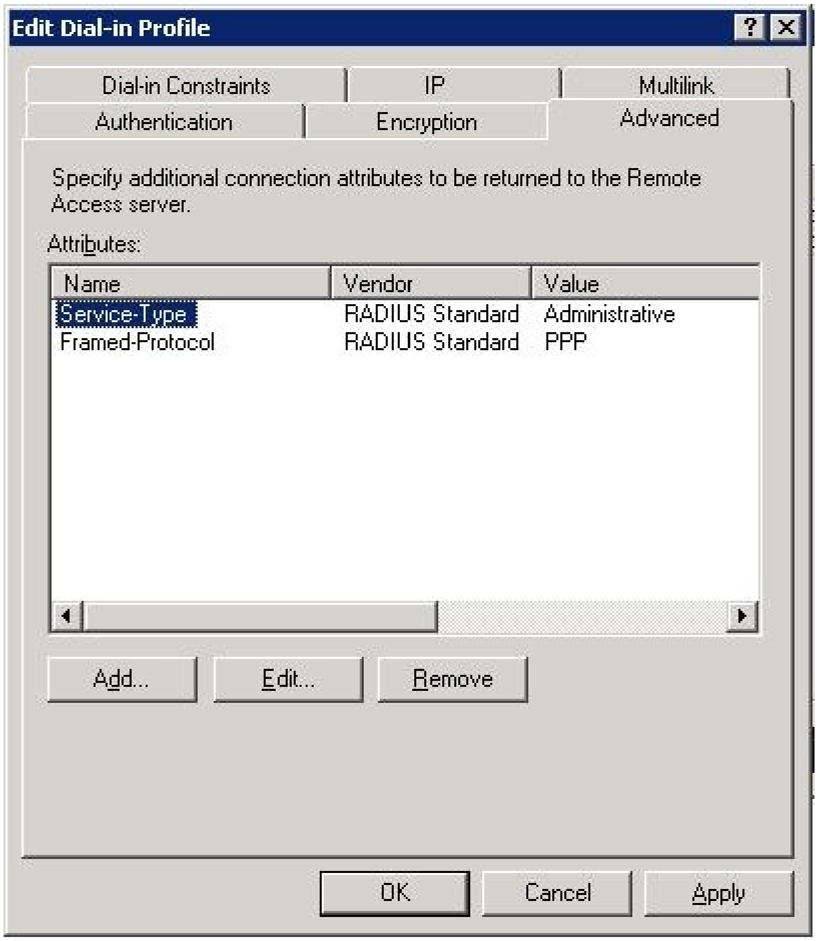
Attribute name: Service-Type

Attribute number: 6

Attribute format: Enumerator

Attribute value: Administrative

13. The Service-Type value is Administrative.

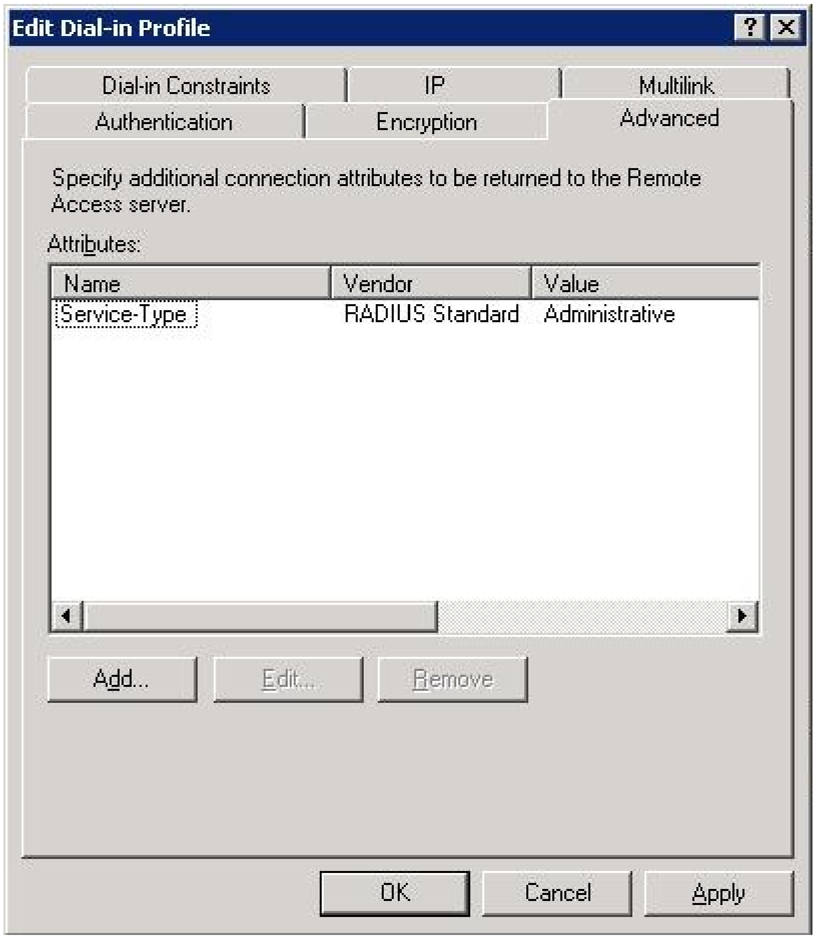


Specify additional connection attributes to be returned to the Remote Access server.

Attributes:

Name	Vendor	Value
Service-Type	RADIUS Standard	Administrative
Framed-Protocol	RADIUS Standard	PPP

14. Remove the Framed-Protocol attribute.

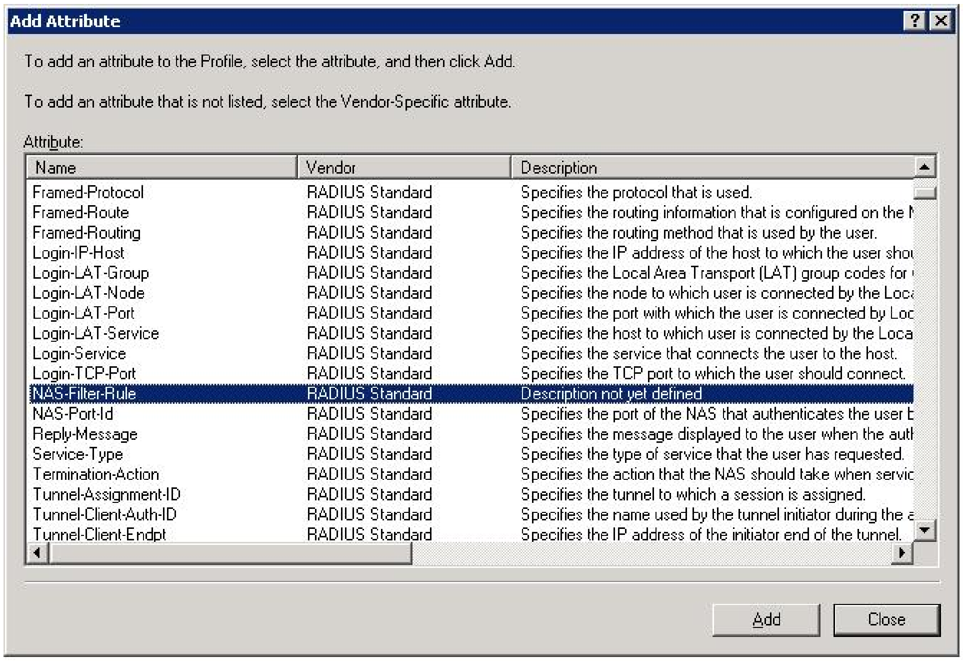


Specify additional connection attributes to be returned to the Remote Access server.

Attributes:

Name	Vendor	Value
Service-Type	RADIUS Standard	Administrative

15. Click **Add** and select NAS-Filter-Rule.



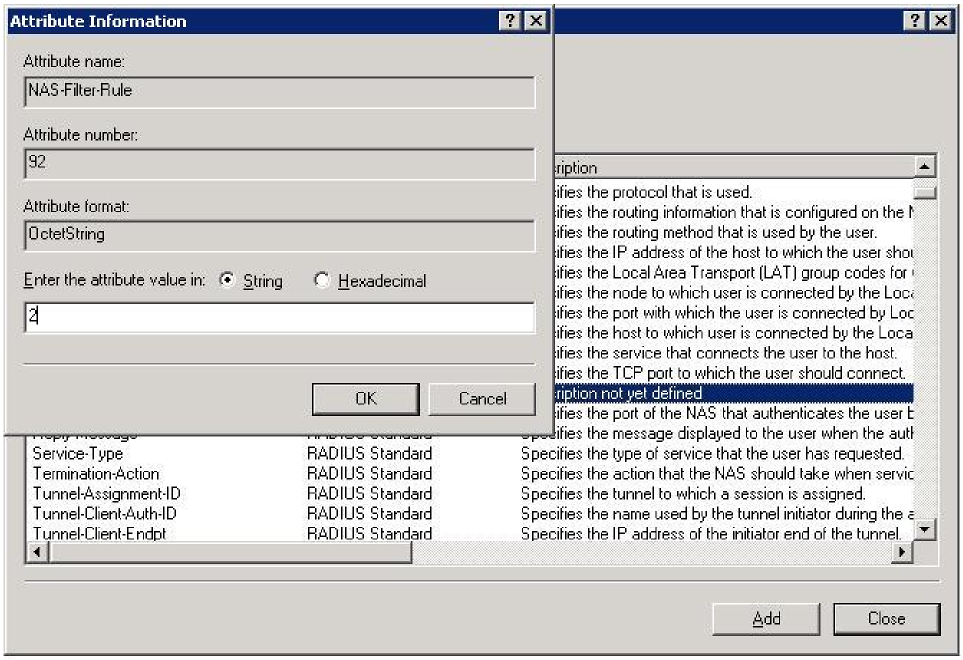
To add an attribute to the Profile, select the attribute, and then click Add.

To add an attribute that is not listed, select the Vendor-Specific attribute.

Attribute:

Name	Vendor	Description
Framed-Protocol	RADIUS Standard	Specifies the protocol that is used.
Framed-Route	RADIUS Standard	Specifies the routing information that is configured on the N
Framed-Routing	RADIUS Standard	Specifies the routing method that is used by the user.
Login-IP-Host	RADIUS Standard	Specifies the IP address of the host to which the user shou
Login-LAT-Group	RADIUS Standard	Specifies the Local Area Transport (LAT) group codes for (
Login-LAT-Node	RADIUS Standard	Specifies the node to which user is connected by the Loca
Login-LAT-Port	RADIUS Standard	Specifies the port with which the user is connected by Loc
Login-LAT-Service	RADIUS Standard	Specifies the host to which user is connected by the Loca
Login-Service	RADIUS Standard	Specifies the service that connects the user to the host.
Login-TCP-Port	RADIUS Standard	Specifies the TCP port to which the user should connect.
NAS-Filter-Rule	RADIUS Standard	Description not yet defined
NAS-Port-Id	RADIUS Standard	Specifies the port of the NAS that authenticates the user b
Reply-Message	RADIUS Standard	Specifies the message displayed to the user when the auth
Service-Type	RADIUS Standard	Specifies the type of service that the user has requested.
Termination-Action	RADIUS Standard	Specifies the action that the NAS should take when servic
Tunnel-Assignment-ID	RADIUS Standard	Specifies the tunnel to which a session is assigned.
Tunnel-Client-Auth-ID	RADIUS Standard	Specifies the name used by the tunnel initiator during the a
Tunnel-Client-Endpt	RADIUS Standard	Specifies the IP address of the initiator end of the tunnel.

16. Click **Add**.
17. In the Enter the Attribute value field, select **String** and enter the value `2`.



Attribute name:
NAS-Filter-Rule

Attribute number:
92

Attribute format:
OctetString

Enter the attribute value in: ● String ○ Hexadecimal

2

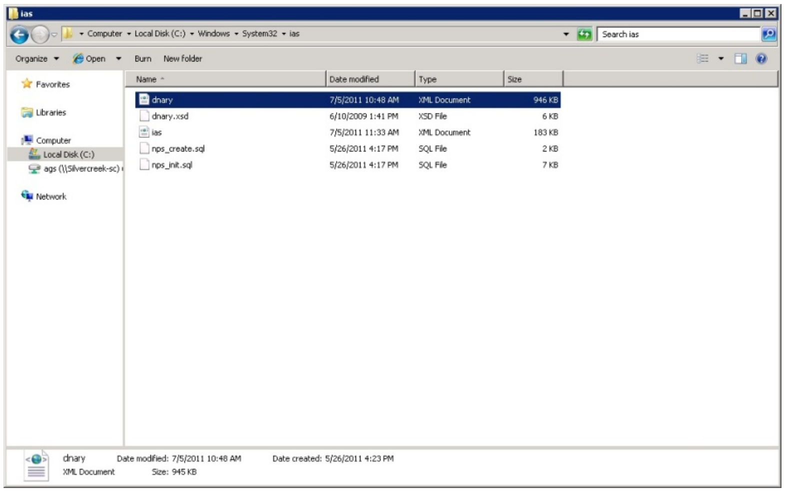
The access level used in this example is 2 to authenticate the Security-administrator. Repeat this procedure to add different access levels. The NAS-Filter Rule attribute is used to define a desired security access level based on RBAC implementation. The levels are:

- Application administrator NAS-Filter-Rule = 1
- System administrator NAS-Filter-Rule = 4
- Security administrator NAS-Filter-Rule = 2

Configuring RADIUS authentication on Windows 2008 Server

Use the following steps to define the attribute needed for RADIUS authentication on a Windows 2008 Server

1. Go to **Start** > **Computer** > **Windows** > **System32** > **ias**.

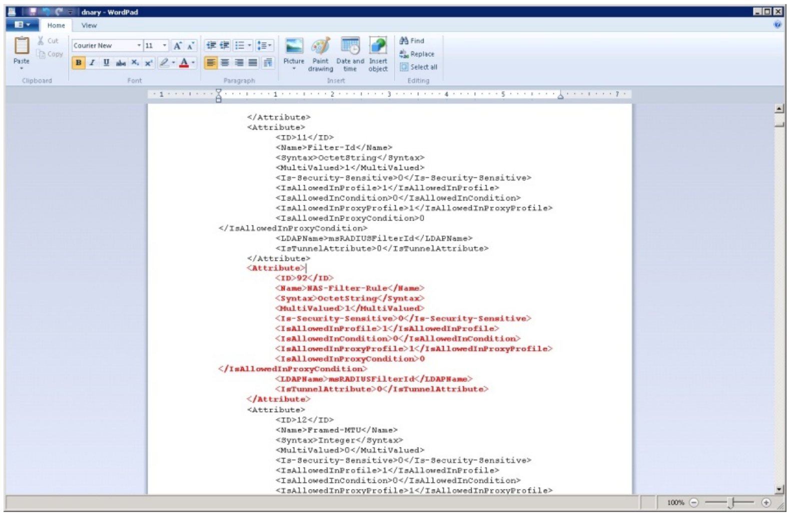


Name	Date modified	Type	Size
dnary	7/5/2011 10:48 AM	XML Document	946 KB
dnary.xsd	6/10/2009 1:41 PM	XSD File	6 KB
ias	7/5/2011 11:33 AM	XML Document	183 KB
nps_create.sql	5/26/2011 4:17 PM	SQL File	2 KB
nps_init.sql	5/26/2011 4:17 PM	SQL File	7 KB

dnary Date modified: 7/5/2011 10:48 AM Date created: 5/26/2011 4:23 PM
XML Document Size: 945 KB

2. Open the file dnary.xml and insert the following between Attribute 11 and 12:

```
<Attribute>
        <ID>92</ID>
        <Name>NAS-Filter-Rule</Name>
        <Syntax>OctetString</Syntax>
        <MultiValued>1</MultiValued>
        <Is-Security-Sensitive>0</Is-Security-Sensitive>
        <IsAllowedInProfile>1</IsAllowedInProfile>
        <IsAllowedInCondition>0</IsAllowedInCondition>
        <IsAllowedInProxyProfile>1</IsAllowedInProxyProfile>
        <IsAllowedInProxyCondition>0</IsAllowedInProxyCondition>
        <LDAPName>msRADIUSNASFilterRule</LDAPName>
        <IsTunnelAttribute>0</IsTunnelAttribute>
    </Attribute>
```



```
        </Attribute>
        <Attribute>
            <ID>11</ID>
            <Name>Filter-Id</Name>
            <Syntax>OctetString</Syntax>
            <MultiValued>1</MultiValued>
            <Is-Security-Sensitive>0</Is-Security-Sensitive>
            <IsAllowedInProfile>1</IsAllowedInProfile>
            <IsAllowedInCondition>0</IsAllowedInCondition>
            <IsAllowedInProxyProfile>1</IsAllowedInProxyProfile>
            <IsAllowedInProxyCondition>0
</IsAllowedInProxyCondition>
            <LDAPName>msRADIUSFilterId</LDAPName>
            <IsTunnelAttribute>0</IsTunnelAttribute>
        </Attribute>
        <Attribute>
            <ID>92</ID>
            <Name>NAS-Filter-Rule</Name>
            <Syntax>OctetString</Syntax>
            <MultiValued>1</MultiValued>
            <Is-Security-Sensitive>0</Is-Security-Sensitive>
            <IsAllowedInProfile>1</IsAllowedInProfile>
            <IsAllowedInCondition>0</IsAllowedInCondition>
            <IsAllowedInProxyProfile>1</IsAllowedInProxyProfile>
            <IsAllowedInProxyCondition>0
</IsAllowedInProxyCondition>
            <LDAPName>msRADIUSFilterId</LDAPName>
            <IsTunnelAttribute>0</IsTunnelAttribute>
        </Attribute>
        <Attribute>
            <ID>12</ID>
            <Name>Framed-MTU</Name>
            <Syntax>Integer</Syntax>
            <MultiValued>0</MultiValued>
            <Is-Security-Sensitive>0</Is-Security-Sensitive>
            <IsAllowedInProfile>1</IsAllowedInProfile>
            <IsAllowedInCondition>0</IsAllowedInCondition>
            <IsAllowedInProxyProfile>1</IsAllowedInProxyProfile>
```

3. Save the file and reboot Windows 2008 Server.

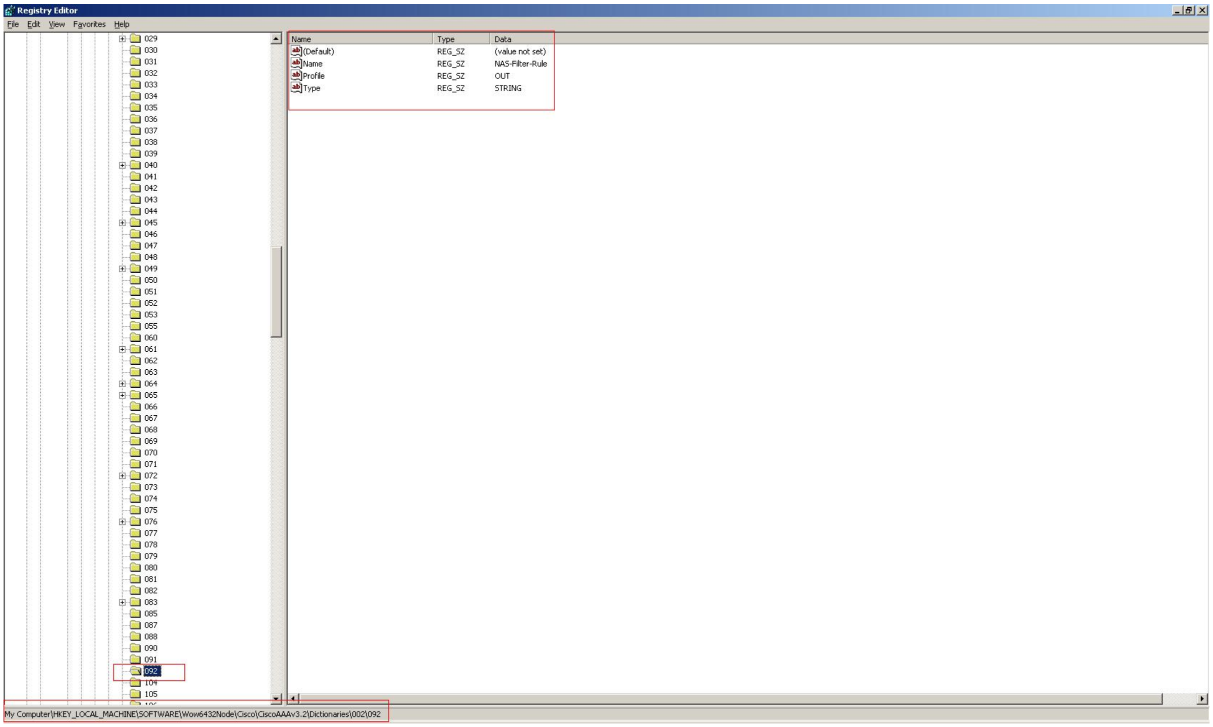
Configuring RADIUS server and RADIUS IETF new attribute information

Use the following steps to configure RADIUS on Windows 2008 using Cisco Server ACS.

1. Using Windows Registry editor, add the type 092 attribute to the RADIUS IETF attributes list used by CiscoSecure ACS:
    a. Open Windows Registry editor using regedit run command.
    b. Browse to `HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Cisco \CiscoAAAv3.2\Dictionaries\002` .

       Note:

       Key location depends on the Windows version in use or CiscoSecure ACS version.
    c. Create a new key named 092 corresponding to the attribute value.
    d. For the newly created key, assign the following values:
        - Name: NAS-Filter-Rule
        - Type: STRINGProfile: OUT



Name	Type	Data
(Default)	REG_SZ	(value not set)
Name	REG_SZ	NAS-Filter-Rule
Profile	REG_SZ	OUT
Type	REG_SZ	STRING

My Computer\HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Cisco\CiscoAAAv3.2\Dictionaries\002\092

2. Using Windows Registry editor, make the newly added attribute available to the CiscoSecure ACS configuration interface:

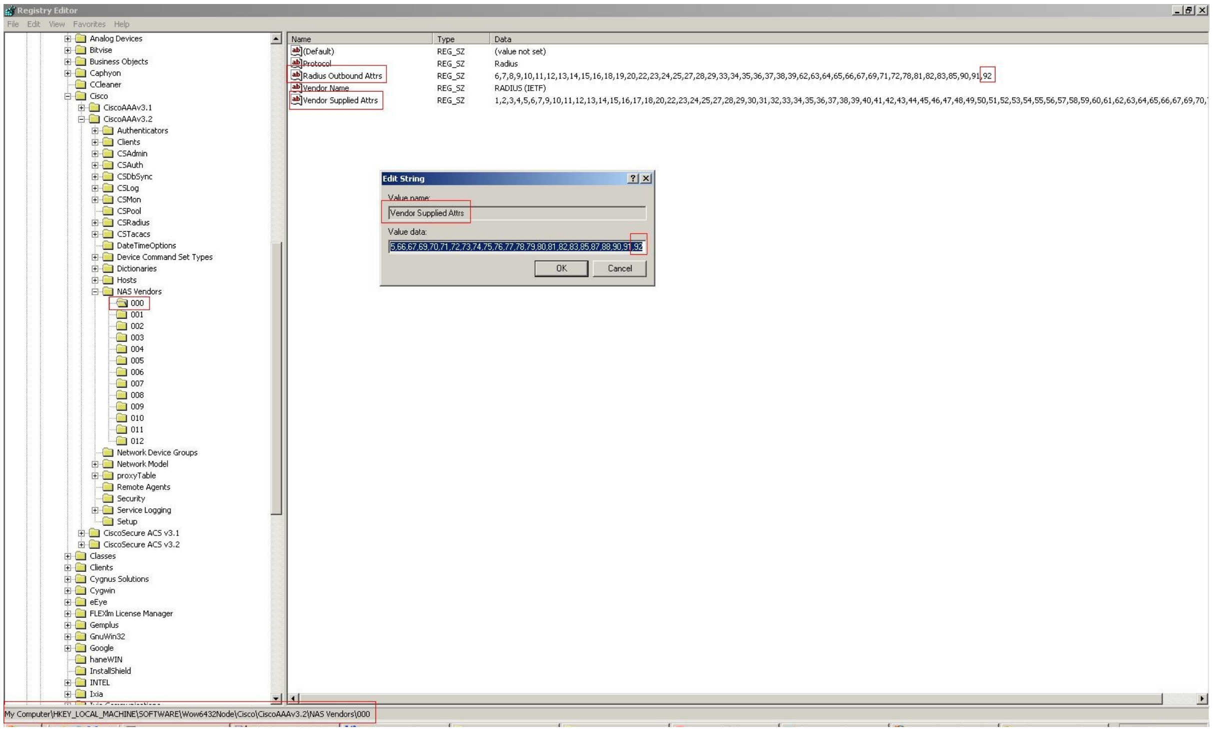
   a. Open Windows Registry editor using regedit run command.

   b. Browse to `HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Cisco\CiscoAAAv3.2\NAS Vendors\000`

      Note:

      Key location depends on the Windows version in use or CiscoSecure ACS version.

   c. In the Radius Outbound Attrs list and Vendor Supplied Attrs list make sure value 92 is added at the end.



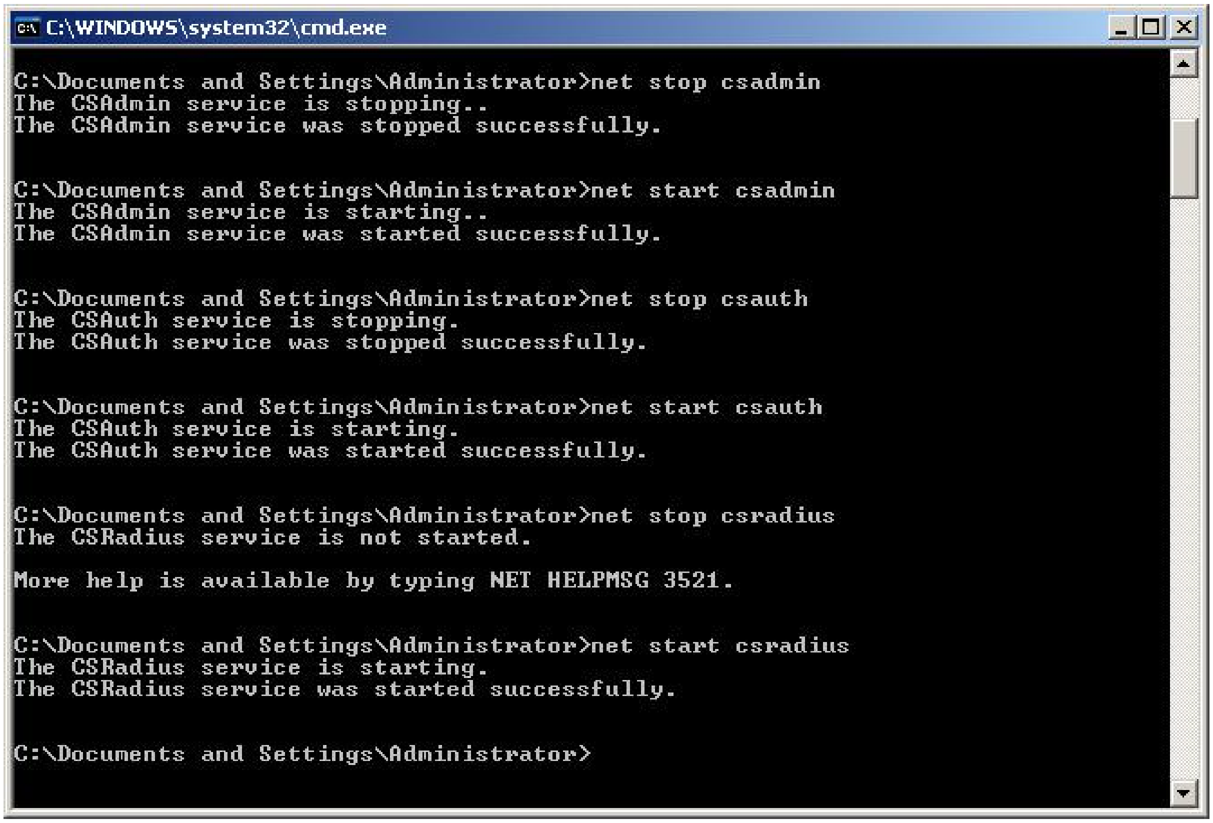
Name	Type	Data
(Default)	REG_SZ	(value not set)
Protocol	REG_SZ	Radius
Radius Outbound Attrs	REG_SZ	6,7,8,9,10,11,12,13,14,15,16,18,19,20,22,23,24,25,27,28,29,33,34,35,36,37,38,39,62,63,64,65,66,67,69,71,72,78,81,82,83,85,90,91,92
Vendor Name	REG_SZ	RADIUS (IETF)
Vendor Supplied Attrs	REG_SZ	1,2,3,4,5,6,7,9,10,11,12,13,14,15,16,17,18,20,22,23,24,25,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,69,70,

Value name: Vendor Supplied Attrs

Value data: 5,66,67,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,85,87,88,90,91,92

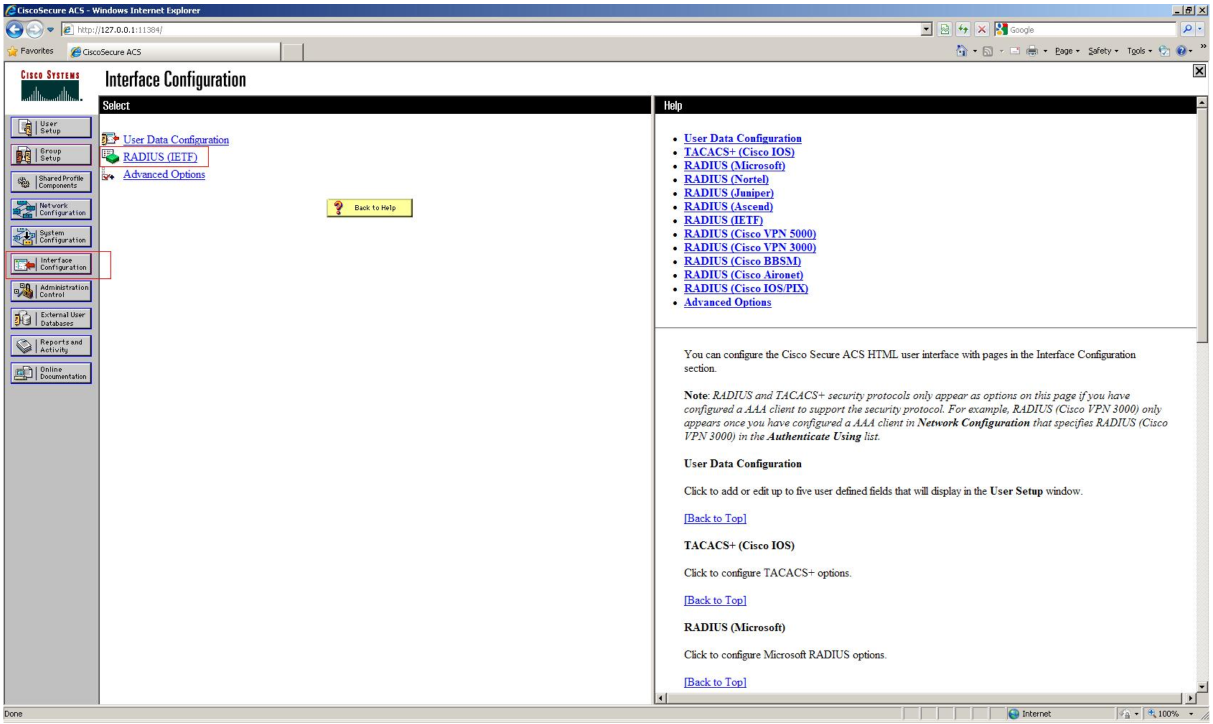
My Computer\HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Cisco\CiscoAAAv3.2\NAS Vendors\000

3. After modifying the registry, restart the CSAdmin, CSAuth and CSradius services. If the attribute is not available in CiscoSecure ACS configuration interface, restart the server machine.



```
C:\Documents and Settings\Administrator>net stop csadmin
The CSAdmin service is stopping..
The CSAdmin service was stopped successfully.


C:\Documents and Settings\Administrator>net start csadmin
The CSAdmin service is starting..
The CSAdmin service was started successfully.


C:\Documents and Settings\Administrator>net stop csauth
The CSAuth service is stopping.
The CSAuth service was stopped successfully.


C:\Documents and Settings\Administrator>net start csauth
The CSAuth service is starting.
The CSAuth service was started successfully.


C:\Documents and Settings\Administrator>net stop csradius
The CSRadius service is not started.

More help is available by typing NET HELPMSG 3521.


C:\Documents and Settings\Administrator>net start csradius
The CSRadius service is starting.
The CSRadius service was started successfully.


C:\Documents and Settings\Administrator>
```

4. Select **Interface configuration** and then, select **RADIUS (IETF)** to make the newly added RADIUS IETF attribute available to the Group Setup parameters.



Interface Configuration

- User Data Configuration
- RADIUS (IETF)
- Advanced Options

- User Data Configuration
- TACACS+ (Cisco IOS)
- RADIUS (Microsoft)
- RADIUS (Nortel)
- RADIUS (Juniper)
- RADIUS (Ascend)
- RADIUS (IETF)
- RADIUS (Cisco VPN 5000)
- RADIUS (Cisco VPN 3000)
- RADIUS (Cisco BBSM)
- RADIUS (Cisco Aironet)
- RADIUS (Cisco IOS/PIX)
- Advanced Options

You can configure the Cisco Secure ACS HTML user interface with pages in the Interface Configuration section.

Note: *RADIUS and TACACS+ security protocols only appear as options on this page if you have configured a AAA client to support the security protocol. For example, RADIUS (Cisco VPN 3000) only appears once you have configured a AAA client in **Network Configuration** that specifies RADIUS (Cisco VPN 3000) in the **Authenticate Using** list.*

User Data Configuration

Click to add or edit up to five user defined fields that will display in the **User Setup** window.

[Back to Top]

TACACS+ (Cisco IOS)

Click to configure TACACS+ options.

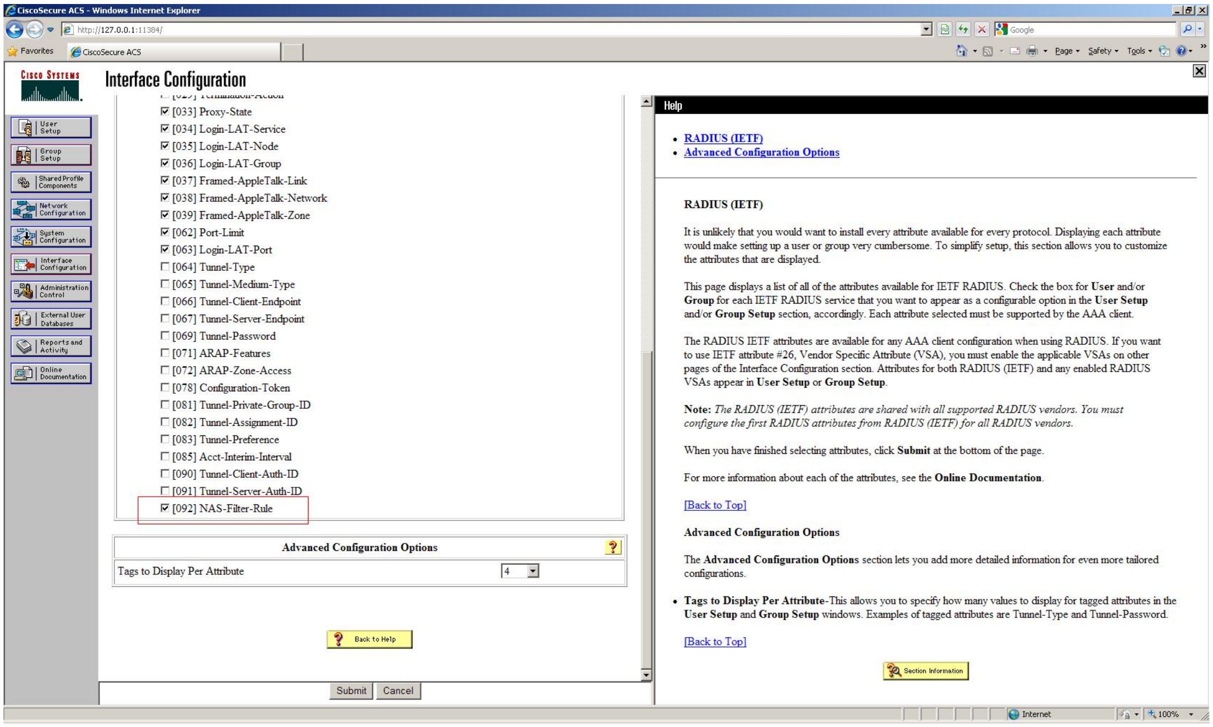
[Back to Top]

RADIUS (Microsoft)

Click to configure Microsoft RADIUS options.

[Back to Top]

5. Select the attribute at the end of the list.



Interface Configuration

- ☑ [033] Proxy-State
- ☑ [034] Login-LAT-Service
- ☑ [035] Login-LAT-Node
- ☑ [036] Login-LAT-Group
- ☑ [037] Framed-AppleTalk-Link
- ☑ [038] Framed-AppleTalk-Network
- ☑ [039] Framed-AppleTalk-Zone
- ☑ [062] Port-Limit
- ☑ [063] Login-LAT-Port
- ☐ [064] Tunnel-Type
- ☐ [065] Tunnel-Medium-Type
- ☐ [066] Tunnel-Client-Endpoint
- ☐ [067] Tunnel-Server-Endpoint
- ☐ [069] Tunnel-Password
- ☐ [071] ARAP-Features
- ☐ [072] ARAP-Zone-Access
- ☐ [078] Configuration-Token
- ☐ [081] Tunnel-Private-Group-ID
- ☐ [082] Tunnel-Assignment-ID
- ☐ [083] Tunnel-Preference
- ☐ [085] Acct-Interim-Interval
- ☐ [090] Tunnel-Client-Auth-ID
- ☐ [091] Tunnel-Server-Auth-ID
- ☑ [092] NAS-Filter-Rule

Advanced Configuration Options

Tags to Display Per Attribute: 4

Help

- RADIUS (IETF)
- Advanced Configuration Options

RADIUS (IETF)

It is unlikely that you would want to install every attribute available for every protocol. Displaying each attribute would make setting up a user or group very cumbersome. To simplify setup, this section allows you to customize the attributes that are displayed.

This page displays a list of all of the attributes available for IETF RADIUS. Check the box for **User** and/or **Group** for each IETF RADIUS service that you want to appear as a configurable option in the **User Setup** and/or **Group Setup** section, accordingly. Each attribute selected must be supported by the AAA client.

The RADIUS IETF attributes are available for any AAA client configuration when using RADIUS. If you want to use IETF attribute #26, Vendor Specific Attribute (VSA), you must enable the applicable VSAs on other pages of the Interface Configuration section. Attributes for both RADIUS (IETF) and any enabled RADIUS VSAs appear in **User Setup** or **Group Setup**.

Note: *The RADIUS (IETF) attributes are shared with all supported RADIUS vendors. You must configure the first RADIUS attributes from RADIUS (IETF) for all RADIUS vendors.*

When you have finished selecting attributes, click **Submit** at the bottom of the page.

For more information about each of the attributes, see the **Online Documentation**.

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Advanced Configuration Options

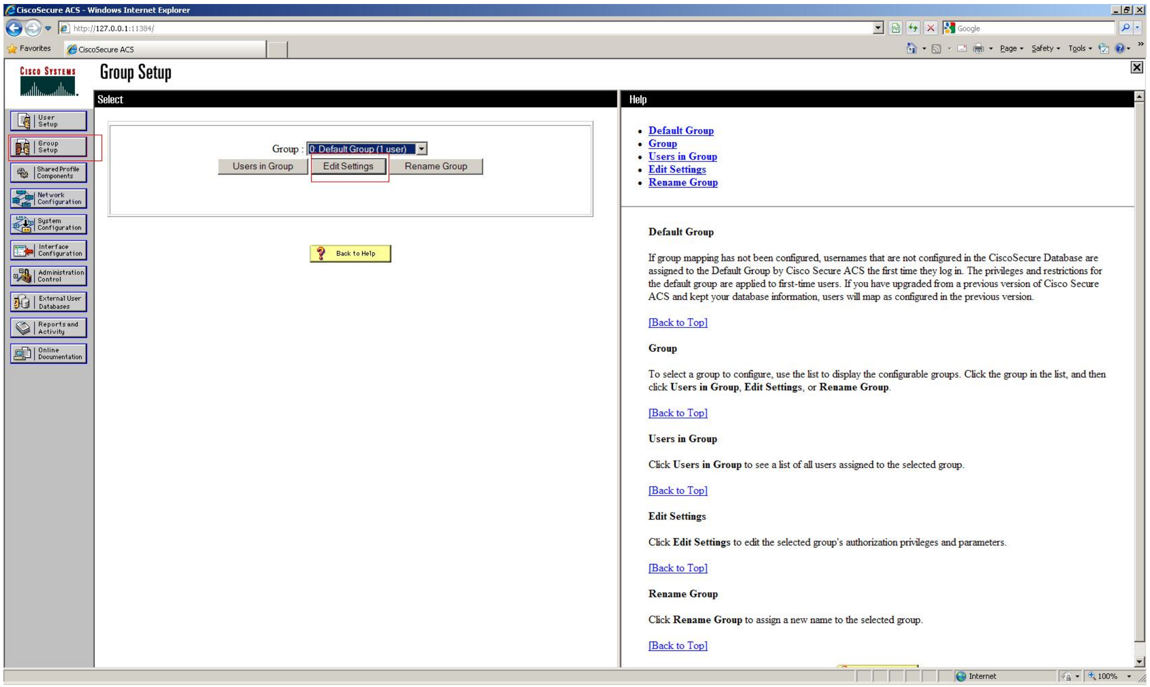
The **Advanced Configuration Options** section lets you add more detailed information for even more tailored configurations.

- **Tags to Display Per Attribute**-This allows you to specify how many values to display for tagged attributes in the **User Setup** and **Group Setup** windows. Examples of tagged attributes are Tunnel-Type and Tunnel-Password.

[Back to Top]

6. RADIUS attribute is available for any Group setup related to the user you want to configure to access the switch.

   a. Select **Group Setup** > **Select desired User Group** > **Edit Settings**.



Group Setup

Select

Group : 0: Default Group (1 user)

Help

- Default Group
- Group
- Users in Group
- Edit Settings
- Rename Group

Default Group

If group mapping has not been configured, usernames that are not configured in the CiscoSecure Database are assigned to the Default Group by Cisco Secure ACS the first time they log in. The privileges and restrictions for the default group are applied to first-time users. If you have upgraded from a previous version of Cisco Secure ACS and kept your database information, users will map as configured in the previous version.

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Group

To select a group to configure, use the list to display the configurable groups. Click the group in the list, and then click **Users in Group**, **Edit Settings**, or **Rename Group**.

[Back to Top]

Users in Group

Click **Users in Group** to see a list of all users assigned to the selected group.

[Back to Top]

Edit Settings

Click **Edit Settings** to edit the selected group's authorization privileges and parameters.

[Back to Top]

Rename Group

Click **Rename Group** to assign a new name to the selected group.

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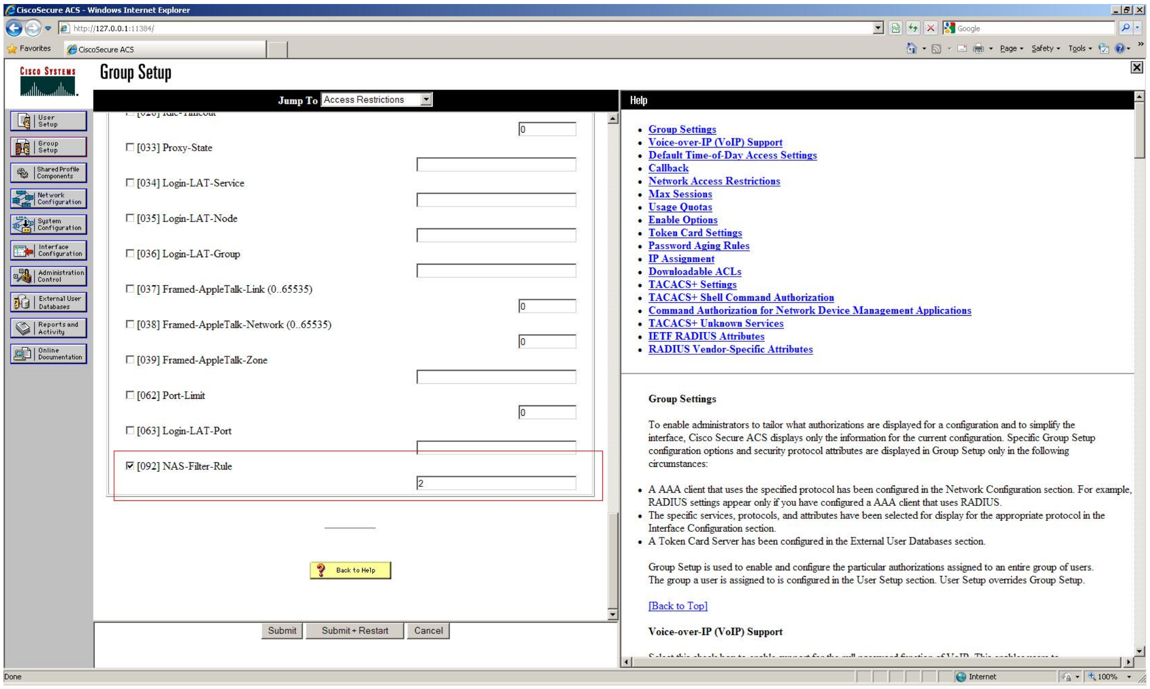
b. Select **[092] NAS-Filter-Rule** attribute, and enter the access level to provide access to the user. Following are the access levels:

   - Application administrator NAS-Filter-Rule = 1
   - System administrator NAS-Filter-Rule = 4
   - Security administrator NAS-Filter-Rule = 2



Jump To: Access Restrictions

☐ [033] Proxy-State
☐ [034] Login-LAT-Service
☐ [035] Login-LAT-Node
☐ [036] Login-LAT-Group
☐ [037] Framed-AppleTalk-Link (0..65535) 0
☐ [038] Framed-AppleTalk-Network (0..65535) 0
☐ [039] Framed-AppleTalk-Zone
☐ [062] Port-Limit 0
☐ [063] Login-LAT-Port
☑ [092] NAS-Filter-Rule 2

- Group Settings
- Voice-over-IP (VoIP) Support
- Default Time-of-Day Access Settings
- Callback
- Network Access Restrictions
- Max Sessions
- Usage Quotas
- Enable Options
- Token Card Settings
- Password Aging Rules
- IP Assignment
- Downloadable ACLs
- TACACS+ Settings
- TACACS+ Shell Command Authorization
- Command Authorization for Network Device Management Applications
- TACACS+ Unknown Services
- IETF RADIUS Attributes
- RADIUS Vendor-Specific Attributes

Group Settings

To enable administrators to tailor what authorizations are displayed for a configuration and to simplify the interface, Cisco Secure ACS displays only the information for the current configuration. Specific Group Setup configuration options and security protocol attributes are displayed in Group Setup only in the following circumstances:

- A AAA client that uses the specified protocol has been configured in the Network Configuration section. For example, RADIUS settings appear only if you have configured a AAA client that uses RADIUS.
- The specific services, protocols, and attributes have been selected for display for the appropriate protocol in the Interface Configuration section.
- A Token Card Server has been configured in the External User Databases section.

Group Setup is used to enable and configure the particular authorizations assigned to an entire group of users. The group a user is assigned to is configured in the User Setup section. User Setup overrides Group Setup.

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Voice-over-IP (VoIP) Support

Configuration example: SYSLOG

Use the following procedure to configure the switch for Sslog.

1. Configure the remote Syslog server IP address and the remote logging level.

```
Switch:(config)#logging remote address 192.100.0.14 udp-transport
Switch:(config)#logging remote level debug
Switch:(config)#logging remote enable
```

Note:

The valid Syslog levels are alert, critical, debug, emergency, error, information, notice, and warning.

2. Verify the configuration.

```
Switch:(config)#show logging config

#show logg conf
Event Logging: Enabled
Volatile Logging Option: Overwrite
Event Types To Log: Critical, Warning, Informational
Event Types To Log To NV Storage: Critical, Warning
Remote Logging: Enabled
Primary Remote Server
```

```
        Address: 192.100.0.14
        Connection Type: UDP
        SSH Protect: Disabled
        SSH Protect TCP Port: 1025
Secondary Remote Server
        Address: 0.0.0.0
        Connection Type: TCP
        SSH Protect: Disabled
        SSH Protect TCP Port: 1025
Event Types To Log Remotely:
Emergency, Alert, Critical, Error, Warning, Notice, Informational, Debug
Facility: Local7
```

Configuration example: Secure Syslog

The following is an example for configuring secure Syslog messaging via RFC 3195 and remote port forwarding.

The following is the high-level configuration of RFC 3195 method of secure Syslog delivery:

- Security Administrator user is created (if it does not exist).
- The ERS switch is configured to send Syslog messages securely to a remote TCP port on the Syslog server.
- The PuTTY client on the Syslog server establishes a secure SSHv2 connection to the ERS switch through which the messaging passes.
- The PuTTY client then uses the port to forward the received Syslog messages to the WinSyslog server residing on the same PC for viewing and writing to file.

Prerequisites:

- Remote logging must be globally enabled.
- Event types to be logged remotely must be properly specified (usually at Informational level).
- The remote Syslog server machines must be reachable at the IP level.

Switch configuration

1. Verify if a Security Administrator account is present on the switch:

```
#show username

Lockout timeout: 1 min
Emergency account timeout: 30 days

Username:           application_adm
-------------------------------------------
Role name:          app_administrator
Enabled:            Yes
Password aging-time:  90 days
Lockout status: Available
Access-start-hour:  0
Access-stop-hour:   24
Inactive period:    360 days
Maximum number of sessions: 12
SSH access: Enabled
TELNET access: Enabled
```

```
Username:           security_adm
-------------------------------------------
Role name:          security_administrator
Enabled:            Yes
Password aging-time:  90 days
Lockout status: Available
Access-start-hour:  0
Access-stop-hour:   24
Inactive period:    360 days
Maximum number of sessions: 12
SSH access: Enabled
TELNET access: Enabled

Username:           system_adm
-------------------------------------------
Role name:          system_administrator
Enabled:            Yes
Password aging-time:  90 days
Lockout status: Available
Access-start-hour:  0
Access-stop-hour:   24
Inactive period:    360 days
Maximum number of sessions: 12
SSH access: Enabled
TELNET access: Enabled

Username:           emergency_adm
-------------------------------------------
Role name:          emergency_administrator
Enabled:            Yes
Password aging-time:  90 days
Lockout status: Available
Access-start-hour:  0
Access-stop-hour:   24
Inactive period:    360 days
Maximum number of sessions: 12
SSH access: Enabled
TELNET access: Enabled
```

If a Security Administrator account is not present on the switch, create one using

2. Configure the maximum number of concurrent sessions allowed if you want to use a Security Administrator account for both Syslog and normal operations.

```
Switch(config)#username security_admin max-number-of-sessions 9
```

3. Create a new Security Administrator account:

```
Switch:(config)#username add syslog_adm role security_administrator password
Switch:(config)#show username

Lockout timeout: 1 min
Emergency account timeout: 30 days

Username:           application_adm
-------------------------------------------
Role name:          app_administrator
Enabled:            Yes
Password aging-time:  90 days
Lockout status: Available
Access-start-hour:  0
Access-stop-hour:   24
Inactive period:    360 days
Maximum number of sessions: 12
SSH access: Enabled
TELNET access: Enabled
```

```
Username:           security_adm
-------------------------------------------
Role name:          security_administrator
Enabled:            Yes
Password aging-time:  90 days
Lockout status: Available
Access-start-hour:  0
Access-stop-hour:   24
Inactive period:    360 days
Maximum number of sessions: 12
SSH access: Enabled
TELNET access: Enabled

Username:           system_adm
-------------------------------------------
Role name:          system_administrator
Enabled:            Yes
Password aging-time:  90 days
Lockout status: Available
Access-start-hour:  0
Access-stop-hour:   24
Inactive period:    360 days
Maximum number of sessions: 12
SSH access: Enabled
TELNET access: Enabled

Username:           emergency_adm
-------------------------------------------
Role name:          emergency_administrator
Enabled:            Yes
Password aging-time:  90 days
Lockout status: Available
Access-start-hour:  0
Access-stop-hour:   24
Inactive period:    360 days
Maximum number of sessions: 12
SSH access: Enabled
TELNET access: Enabled

Username:           syslog_adm
-------------------------------------------
Role name:          security_administrator
Enabled:            Yes
Password aging-time:  90 days
Lockout status: Available
Access-start-hour:  0
Access-stop-hour:   24
Inactive period:    360 days
Maximum number of sessions: 12
SSH access: Enabled
TELNET access: Enabled
```

Note:

The switch enforces the change of the temporary default password for each new created account before you can use the account.

Configure Secure Syslog on the ERS switch

1. Enter Global Configuration mode and enter the following commands:

```
Switch(config)#logging remote address 192.168.1.200 tcp-transport ssh-protect tcp-
port 1026
```

In this example, TCP port 1026 port is selected for secure forwarding and it is forwarded to the WinSyslog Server. The WinSyslog Server IP address is 192.168.1.200, where the SSH client with the remote port forwarder is configured.

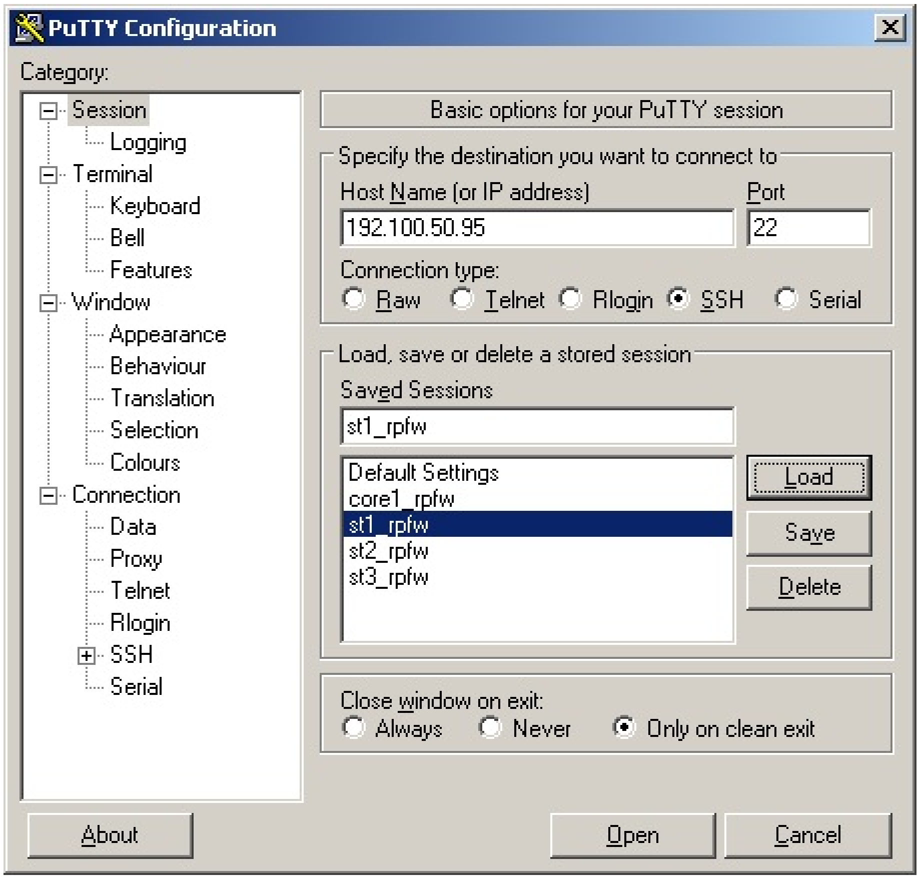
2. Configure the primary Syslog server.

```
Switch#show logging config
Event Logging: Enabled
Volatile Logging Option: Overwrite
Event Types To Log: Critical, Warning, Informational
Event Types To Log To NV Storage: Critical, Warning
Remote Logging: Enabled
Primary Remote Server
        Address: 192.168.1.200
        Connection Type: TCP
        SSH Protect: Enabled
        SSH Protect TCP Port: 1026
Secondary Remote Server
        Address: 0.0.0.0
        Connection Type: TCP
        SSH Protect: Disabled
        SSH Protect TCP Port: 1025
Event Types To Log Remotely:
Emergency, Alert, Critical, Error, Warning, Notice, Informational
Facility: Local7
```

3. Configure secondary remote Syslog server. The configuration command must be entered with secondary-address parameter instead of address.

Configuring PuTTY

1. Open PuTTY and create a regular profile that points to the ERS on SSH port 22



PuTTY Configuration

Basic options for your PuTTY session

Specify the destination you want to connect to

Host Name (or IP address): 192.100.50.95

Port: 22

Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

Load, save or delete a stored session

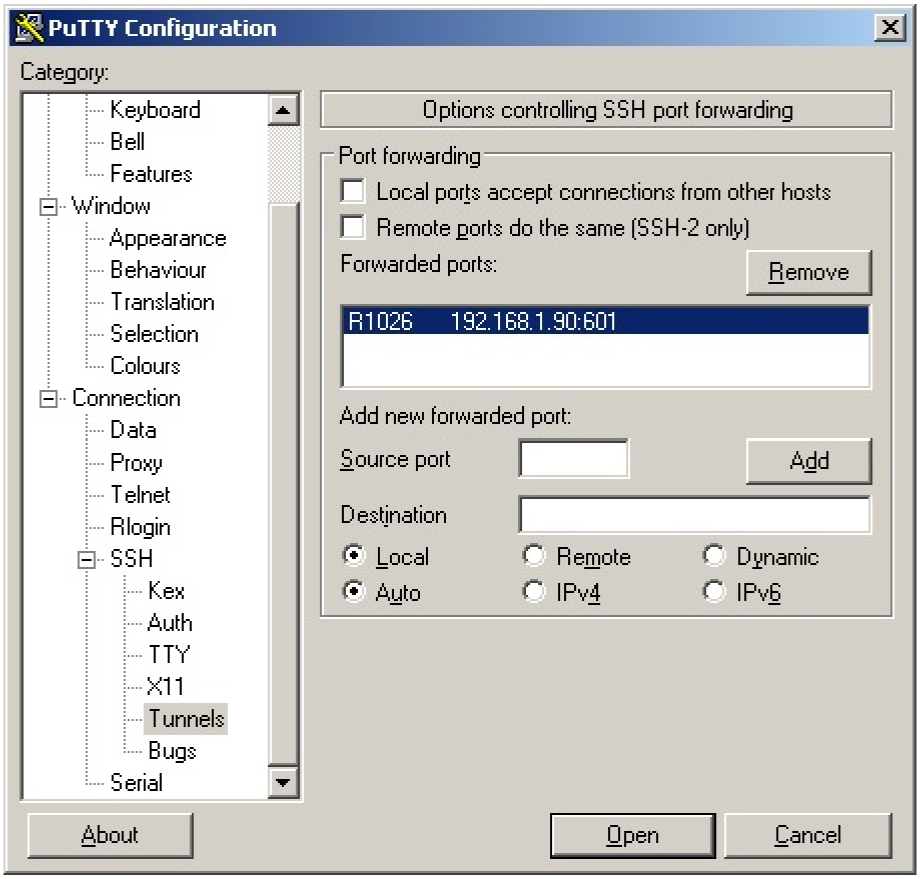
Saved Sessions: st1_rpfw

Default Settings
core1_rpfw
st1_rpfw
st2_rpfw
st3_rpfw

Close window on exit: ○ Always ○ Never ● Only on clean exit

2. Create the secure tunnel.

   Remote forwarder is configured within the SSH session. The administrator configures the remote port on the ERS (which was defined as the TCP secure forwarder port 1026) to this local PC’s port where the RFC3195 WinSyslog server is listening, in this example TCP is 601.



PuTTY Configuration

Options controlling SSH port forwarding

Port forwarding

□ Local ports accept connections from other hosts

□ Remote ports do the same (SSH-2 only)

Forwarded ports:

R1026 192.168.1.90:601

Add new forwarded port:

Source port

Destination

● Local ○ Remote ○ Dynamic

● Auto ○ IPv4 ○ IPv6

a. In Port forwarding section, select **Local Ports accept connections from other hosts**.

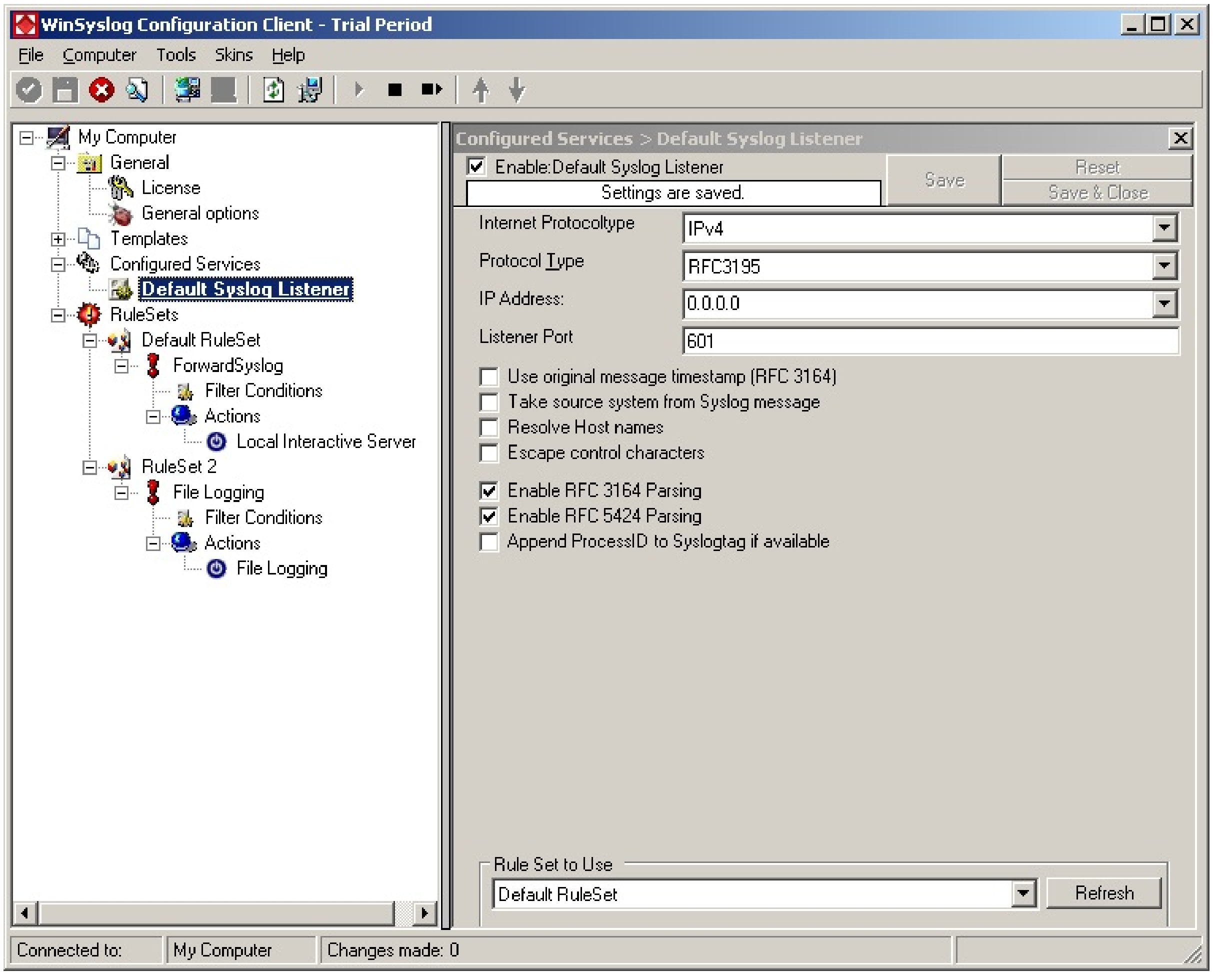
b. Ensure that Forwarding is set up for Remote not Local port forwarding.

c. Return to the beginning Session Screen and click **Save** to ensure that the Tunnel is saved to this profile.

Configuring the WinSyslog server

The following section describes the setup of the WinSyslog server to support the RFC 3195 secure Syslog.

1. Go to **Start** > **My Computer** > **Configured Services** > **Default Syslog Listener**.



☑ Enable:Default Syslog Listener

Settings are saved.

Internet Protocoltype IPv4

Protocol Type RFC3195

IP Address: 0.0.0.0

Listener Port 601

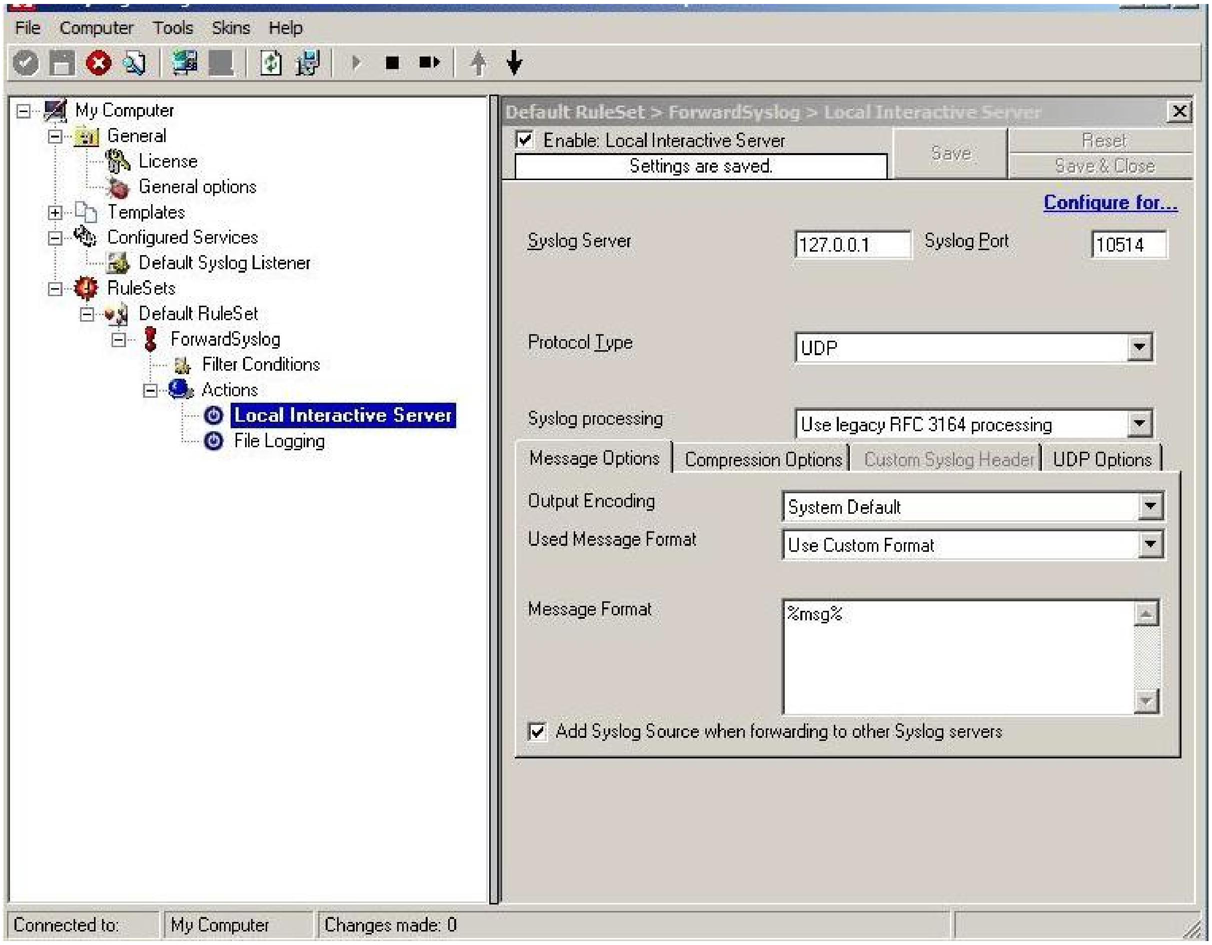
□ Use original message timestamp (RFC 3164)
□ Take source system from Syslog message
□ Resolve Host names
□ Escape control characters

☑ Enable RFC 3164 Parsing
☑ Enable RFC 5424 Parsing
□ Append ProcessID to Syslogtag if available

Rule Set to Use
Default RuleSet

Connected to: My Computer Changes made: 0

2. Select **Enable: Default Syslog Listener**.
3. From the Internet Protocoltype drop-down, select IPv4.
4. From the Protocol Type drop-down, select RFC3165.
5. From the IP Address drop-down, select 0.0.0.0.
6. From the Listener Port drop-down, select 601.
7. Select **Enable RFC 3164 Parsing** and **Enable RFC 5424 Parsing**.
8. From the My Computer navigation tree, expand Rule Sets/Default RuleSet options.
9. Select **Local Interactive Server**.



Default RuleSet > ForwardSyslog > Local Interactive Server

☑ Enable: Local Interactive Server

Settings are saved.

Syslog Server: 127.0.0.1 Syslog Port: 10514

Protocol Type: UDP

Syslog processing: Use legacy RFC 3164 processing

Output Encoding: System Default

Used Message Format: Use Custom Format

Message Format: %msg%

☑ Add Syslog Source when forwarding to other Syslog servers

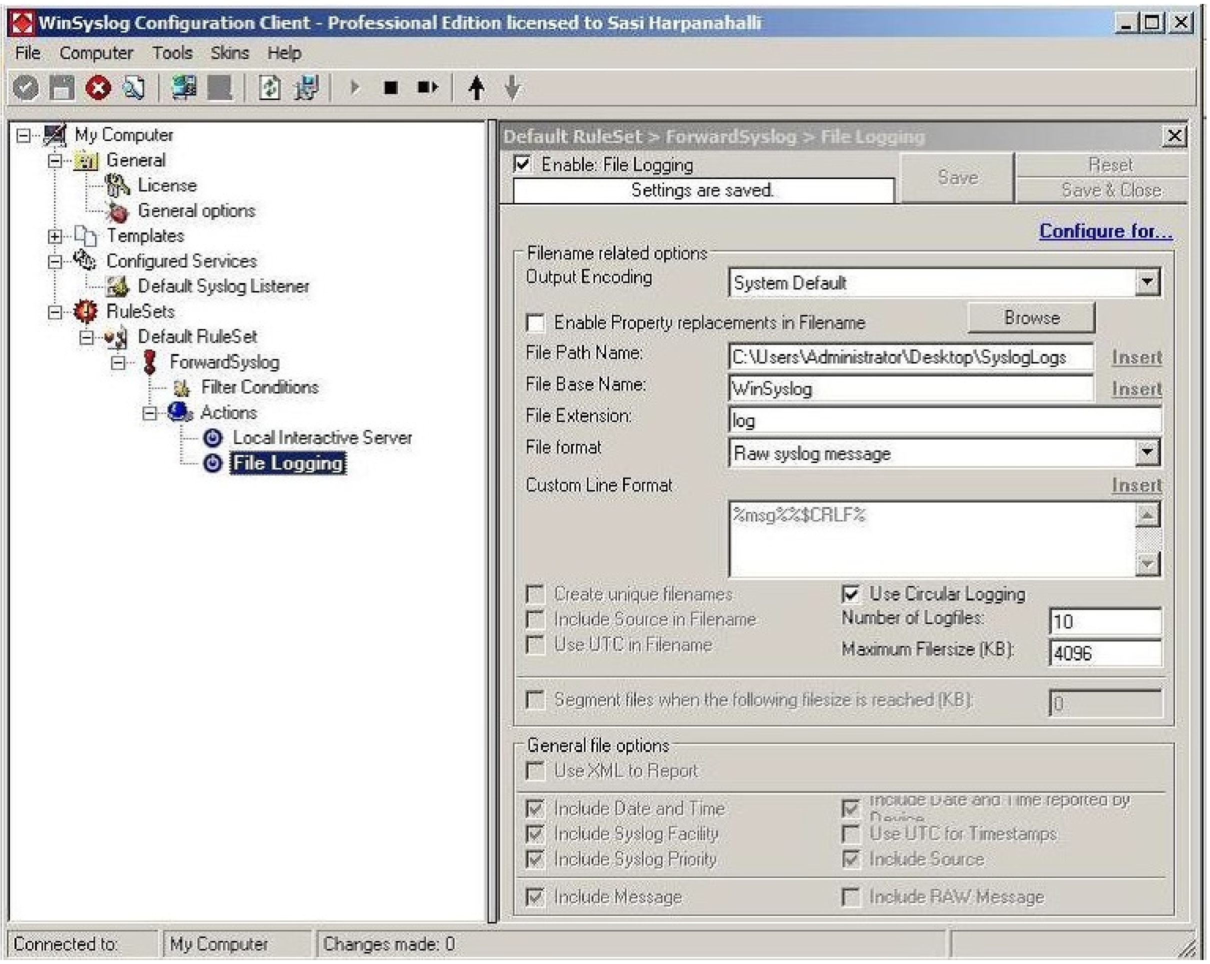
Connected to: My Computer Changes made: 0

The Default RuleSet consists of Local Interactive Server and File Logging. In this example, the Syslog messages are sent to the Local Interactive Server (another application that comes with WinSyslog) so that the messages can be displayed in real time as they are written to the server.

Note:

This communication is to the localhost 127.0.0.1, therefore this communication does not leave the server.

10. In the following example, the server is configured to write the Syslog messages to a file on the local machine.



☑ Enable: File Logging

Settings are saved.

Filename related options

Output Encoding: System Default

☐ Enable Property replacements in Filename

File Path Name: C:\Users\Administrator\Desktop\SyslogLogs

File Base Name: WinSyslog

File Extension: log

File format: Raw syslog message

Custom Line Format: %msg%%$CRLF%

☐ Create unique filenames

☐ Include Source in Filename

☐ Use UTC in Filename

☑ Use Circular Logging

Number of Logfiles: 10

Maximum Filesize (KB): 4096

☐ Segment files when the following filesize is reached (KB): 0

General file options

☐ Use XML to Report

☑ Include Date and Time

☑ Include Syslog Facility

☑ Include Syslog Priority

☑ Include Message

☑ Include Date and Time reported by Device

☐ Use UTC for Timestamps

☑ Include Source

☐ Include RAW Message

Connected to: My Computer Changes made: 0

11. Use the options at the top of the screen to stop and then restart the Syslog server.

Completing the configuration

Perform the following actions to complete configuration:

1. Launch the interactive Syslog Viewer application on the WinSyslog Server PC.
2. Launch PuTTY and establish the SSH forwarder session:
    a. Login using the desired Security Administrator user – either the default one or the created user (in the preceding example).
    b. After logging on to the PuTTY, this session must be left alone as it is the forwarded for the RFC 3195 logs.
    c. Ensure that all power saving settings on the server are disabled, else the Tunnel is terminated if the server enters sleep or hibernation mode.
3. After the PuTTY session establishes the secure Syslog tunnel to the ERS switch, the interactive Syslog viewer displays Syslog messages from the ERS switch.

Switch hardening in Enhanced Secure Mode

This section provides configuration examples for hardening the switch when Enhanced Secure Mode is enabled.

Initial login and basic configuration tasks

Initial login

1. Connect to the switch using an RJ-45 to DB-9 or a DB-9 to RJ-45 adapter.
2. Login to the switch for the first time using the factory default username and password pair of *admin / password*.
3. At the initial login, you must change the initial security administrator account using a new username/password pair. By default the switch does not allow repeated characters or sequential characters in the new passwords.
4. Login using the newly defined username/password pair for the initial security administrator account.
5. At the first login for this newly created account you must change and confirm the password.

Basic configuration tasks

Telnet access is configurable and is enabled by default on switch. To enhance security on switch, you can disable telnet access.

1. Disable TELNET Server:

   ```
   Switch:(config)#no telnet-access
   ```

2. Disable Web Server:

   ```
   Switch:(config)#web-server disable
   ```

3. Enable SSH Server:

   ```
   Switch:(config)#ssh
   ```

4. Enable Serial Console Security. Set this parameter to drop console sessions when the serial console cable is physically disconnected. Re-authentication is required to gain access to the switch.

   ```
   Switch:(config)#serial-security enable
   ```

5. Configure the switch for MSTP mode.

   Multiple Spanning Tree Protocol mode (IEEE 802.1s) is the default operation mode on the Avaya ERS 4900/5900 switches. MSTP is the best STP operational mode for both Heterogeneous configurations in which the Avaya switch is interoperating with another vendor switch and Homogeneous solutions involving only Avaya equipment.

   For more information about MSTP, see *Configuring VLANs, Spanning Tree, and Multi-Link Trunking on Avaya Ethernet Routing Switch 4900 and 5900 Series*, NN47211-502.

   To set the switch to use MSTP, enter the following command:

   ```
   Switch:(config)#spanning-tree mode mst
   ```

6. Save the running configuration to NVRAM:

```
Switch:(config)#copy config nvram
```

7. Power cycle the switch.
8. Verify the above configuration:

```
Switch:#show ipmgr

TELNET Access: Disabled
SNMP Access:   Disabled
WEB Access:    Disabled
SSH Access:    Enabled
TELNET IP List Access Control: Enabled
SNMP IP List Access Control:   Enabled
WEB IP List Access Control:    Enabled
SSH IP List Access Control:    Enabled
Allowed Source IP Address  Allowed Source Mask
-------------------------  -------------------
1  0.0.0.0                    0.0.0.0
2  255.255.255.255            255.255.255.255
3  255.255.255.255            255.255.255.255

Switch:#show serial-security

Serial security is enabled

Switch:#show spanning-tree mode

Current STP Operation Mode: MST
```

Configuring SSH

The following is an example of configuring SSH on switch.

1. Configure the idle session timeout to 10 minutes:

```
Switch:(config)#telnet-access inactive-timeout 10
```

2. Configure the login session timeout to 60 seconds. The login session timeout timer also controls the login session timeout for the serial console port.

```
Switch:(config)# ssh timeout 60
```

3. Configure the number of failed login retries:

```
Switch:(config)# ssh retries 3
```

4. Verify the above configuration:

```
Switch:(config)#show ssh global

Active SSH Sessions     :  0
Version                 :  Version 2 only
Port                    :  22
Authentication Timeout  :  60
DSA Authentication      :  True
RSA Authentication      :  True
Password Authentication :  True
Auth Retries            :  3
Auth Key TFTP Server    :  192.168.1.26
DSA Auth Key File Name  :
RSA Auth Key File Name  :
DSA Host Keys           :  Exist
```

```
RSA Host Keys           :  Exist
Enabled                 :  True
```

5. Configure the SSH access policy.

   Apply IP Manager access polices to SSH connections as Condition of Fielding. This command filters incoming IPv4 connections and permits SSH access only to addresses in the 192.168.1.0 subnet, further limit this filter to a specific IP address by using a 32 bit mask. The “1” parameter specifies the access list entry number for IPv4 addresses; for IPv4 the maximum number of IP Mgr access list entries is 50 (1-50). For IPv6 the maximum number of IP Mgr access list entries is 50 (51-100).

   ```
   Switch:(config)#ipmgr ssh
   Switch:(config)#ipmgr source ip 1 192.168.1.0 mask 255.255.255.0
   Switch:(config)#ipmgr source ip 51 2092::45/64
   ```

6. Verify the above configuration.

   ```
   Switch:(config)#show ipmgr ipv4

   TELNET Access: Disabled
   SNMP Access:   Disabled
   WEB Access:    Disabled
   SSH Access:    Enabled
   TELNET IP List Access Control: Enabled
   SNMP IP List Access Control:   Enabled
   WEB IP List Access Control:    Enabled
   SSH IP List Access Control:    Enabled
   Allowed Source IP Address  Allowed Source Mask
   -------------------------  -------------------
   1  192.168.1.0                255.255.255.0
   2  255.255.255.255            255.255.255.255
   3  255.255.255.255            255.255.255.255
   Switch:(config)#show ipmgr ipv6

   TELNET Access: Disabled
   SNMP Access:   Disabled
   WEB Access:    Disabled
   SSH Access:    Enabled
   TELNET IP List Access Control: Enabled
   SNMP IP List Access Control:   Enabled
   WEB IP List Access Control:    Enabled
   SSH IP List Access Control:    Enabled
   Allowed Source IPv6 Address
   --------------------------------------------
   51 2092::45/64
   52 ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff/128
   53 ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff/128
   ```

Configuring passwords

The following is an example of configuring password parameters.

1. Configure the global password aging interval:

   ```
   Switch:(config)#password aging-time 90
   ```

2. Configure the password aging interval account value for an existing user:

   ```
   Switch:(config)#password aging-time username security_adm 90
   ```

3. Configure the password change interval:

   ```
   Switch:(config)#password change-interval 30
   ```

4. Configure the maximum number of passwords retained in history:

   ```
   Switch:(config)#password password-history 3
   ```

5. Configure the password complexity:

   - Configure a minimum password length of 15 characters:

     ```
     Switch:(config)#password min-length 15
     ```

   - Configure the password rule 2 2 2 2:

     ```
     Switch:(config)#password complexity lower-case 2 numeric 2 special 2 upper-case 2
     ```

   - Enable the rejection of repeated characters in a password:

     ```
     Switch:(config)#password check-repeated enable
     ```

   - Enable the rejection of sequential characters. The switch checks the following strings, uppercase letters included, in forward and reverse order: "abcdefghijklmnopqrstuvwxyz","01234567890", "qwertyuiop", "asdfghjkl", "zxcvbnm", "!@#$%^&*()")

     ```
     Switch:(config)#password check-sequential enable
     ```

6. Configure the amount of delay time after 3 failed login attempts within one minute:

   ```
   Switch:(config)#password delay-time 60
   ```

7. Configure the notification message to users encountering a login failure:

   ```
   Switch:(config)#password login-failure-notification "Login failure"
   ```

8. Enable the switch to enforce a password change on first login for all new users:

   ```
   Switch:(config)#password password-change-on-first-login enable
   ```

9. Restrict number of times a password can be changed in a day:

   ```
   Switch:(config)#password password-change-rate-limiter 1
   ```

10. Configure the pre-expiry notification interval:

    ```
    Switch:(config)#password notifications 30
    ```

11. Configure the allowed grace interval for post-expiration login:

    ```
    Switch:(config)#password grace-period 3
    ```

12. Configure the number of allowed post-expiration logins:

    ```
    Switch:(config)#password post-expiration-login 3
    ```

13. Enable internal password encryption:

    ```
    Switch:(config)#password encryption-key aes-cbc
    <Enter and confim encryption key>
    ```

14. Configure the number of days after which a disabled account due to inactivity timeout will be re-enabled:

    ```
    Switch:(config)#password unlock-timer 7
    ```

15. Verify the configuration above. Enter a question mark after the command to display the permitted sub-commands.

    ```
    Switch:#show password ?

    Display password security restrictions
    ```

```
  aging-time                      Password validity period (in days)
  change-interval                 Display the password change interval
  check-repeated                  State of check-repeated-characters option
  check-sequential                State of check-sequential-characters option
  complexity                      Display password complexity rules settings
  delay-time                      Display the delay time after 3 failed login
                                  attempts within one minute
  grace-period                    Display the interval for post-expiration log
                                  in
  login-failure-notification      Display notification message to users
                                  encountering a login failure
  min-length                      Display the password minimum length
  notifications                   Display password expiration notifications
                                  intervals
  password-change-on-first-login  State of password-change-on-first-login
                                  option
  password-change-rate-limiter    Display number of times a password can pe
                                  changed in a day
  password-history                Number of passwords in history
  post-expiration-login           Display the number of post-expiration logins
  unlock-timer                    State of unlock-timer option
```

Customizing the login banner

The following is an example of customizing the login banner.

1. Configure the banner mode to custom and verify the setting:

```
Switch:(config)#banner custom
Switch:(config)#show banner

Current banner setting: CUSTOM
```

2. Configure the CUSTOM banner, line by line, entering up to 20 lines of text:

```
Switch:(config)#banner 1 "<Text for line 1>"
Switch:(config)#banner 2 "<Text for line 2>"
Switch:(config)#banner 3 "<Text for line 3>"
```

3. You can configure the switch to display a commonly used login banner from the Defense Switched Network (DSN) Security Technical Implementation Guide (STIG):

```
Switch:(config)#banner usg
"You are accessing a U.S. Government (USG) Information System (IS) that is
Provided for USG-authorized use only. By using this IS (which includes any device
attached to
this IS), you consent to the following conditions:
- The USG routinely intercepts and monitors communications on this IS for purposes
including, but not limited to, penetration testing, COMSEC monitoring, network
operations and defense, personnel misconduct (PM), law enforcement (LE), and
counterintelligence (CI) investigations.
- At any time, the USG may inspect and seize data stored on this IS.
- Communications using, or data stored on, this IS are not private, are subject to
routine monitoring, interception, and search, and may be disclosed or used for any
USG authorized purpose.
- This IS includes security measures (e.g., authentication and access controls) to
protect USG interests--not for your personal benefit or privacy.
- Notwithstanding the above, using this IS does not constitute consent to PM, LE or
CI investigative searching or monitoring of the content of privileged
communications,
or work product, related to personal representation or services by attorneys,
psychotherapists, or clergy, and their assistants. Such communications and work
product are private and confidential. See User Agreement for details
```

```
Enter Ctrl-Y to begin and acknowledge the above statements."
```

User account creation

The following is an example of creating user accounts for role based access control.

1. Display the available default roles that can be used for user account creation:

```
Switch:(config)#show role

Roles                            Groups                           Rights
-------------------------------- -------------------------------- ------------
app_administrator                cli-basic-group                  show-config
                                 system-cmds-group                show-only
security_administrator           cli-basic-group                  show-config
                                 security-cmds-group              show-config
                                 system-cmds-group                show-config
                                 audit-cmds-group                 show-config
system_administrator             cli-basic-group                  show-config
                                 system-cmds-group                show-config
                                 audit-cmds-group                 show-only
emergency_administrator          cli-basic-group                  show-config
                                 security-cmds-group              show-config
                                 system-cmds-group                show-config
                                 audit-cmds-group                 show-config
```

2. Create an additional user account with an appropriate role and provide the user account with an initial password:

```
account with an initial password:
Switch:(config)#username add systemadmn role-name system_administrator password
```

3. Verify the account created:

```
Switch:(config)#show username

Lockout timeout: 60 min
Lockout retries: 5
Emergency account timeout: not set

Username:           systemadmn
-------------------------------------------
ntp authentication-key 100 type md5/sha1
Enabled:            Yes
Password aging-time:  90 days
Lockout status: Available
Verify the NTP key:
FED1(config)#sh ntp key
Key Id      Key                     Key Type
--------------------------------------------
100         ********                MD5
200         ********                SHA1
SSH access: Enabled
TELNET access: Enabled

Username:           security_adm
-------------------------------------------
Role name:          security_administrator
Enabled:            Yes
Password aging-time:  90 days
Lockout status: Available
Access-start-hour:  0
Access-stop-hour:   24
```

```
Inactive period:    360 days
Maximum number of sessions: 12
SSH access: Enabled
TELNET access: Enabled
```

4. Configure the duration of session lockout time for failed login attempts:

   ```
   Switch:(config)#username lockout-time 1
   ```

5. Configure Number of retries in a session before a user gets locked:

   ```
   Switch:(config)#username lockout-retries 5
   ```

6. Configure the emergency account timeout:

   ```
   Switch:(config)#username emergency_account_timeout 30
   ```

7. Configure the per-user daily access interval:

   ```
   Switch:(config)#username systemadmn daily-access-interval access-start-hour 9
   access-stop-hour  18
   ```

8. Configure the per-user inactivity period after which the account will be disabled:

   ```
   Switch:(config)#username systemadmn inactive-period 30
   ```

9. Configure the maximum number of concurrent sessions allowed per user account:

   ```
   Switch:(config)#username systemadmn max-number-of-sessions 1
   ```

10. Enable or disable TELNET or SSH access for the user:

    ```
    Switch:(config)#username systemadmn telnet-access disable
    Switch:(config)#username systemadmn ssh-access enable
    ```

11. When needed, a security administrator can unlock a previously locked user account:

    ```
    Switch:(config)#username systemadmn unlock
    ```

12. (Optional) A security administrator can change the password and assigned role for another user account already defined in the system:

    ```
    Switch:(config)#username systemadmn password
    Switch:(config)#username systemadmn role-name app_administrator
    ```

Configuring the out of band management port

The following is an example of configuring the Out of Band (OOB) management port. The switch can use the OOB management port only for management traffic.

1. Configure IPv4 network management.

   Assign the management IP address.

   ```
   Switch:(config)#ip mgmt address 142.6.0.146 255.255.255.240
   ```

2. Assign the default gateway in order to manage the switch from remote subnets.

   ```
   Switch:(config #ip mgmt default-gateway 142.6.0.145
   ```

3. Verify the above configuration:

   ```
   Switch:#show mgmt status

   Unit Link Limit Shutdown Interval
   ---- ---- ----- ------------------
   1    Up   7000  180
   ```

```
Switch:#show ip

Bootp/DHCP Mode: Disabled

                             Configured       In Use        Last BootP/DHCP
                           --------------- --------------- --------------------
Stack IP Address:          192.168.1.2                     0.0.0.0
Switch IP Address:         192.168.1.1                     0.0.0.0
Stack Subnet Mask:         255.255.255.0   255.255.255.0   0.0.0.0
Mgmt Stack IP Address:     142.6.0.146     142.6.0.146
Mgmt Switch IP Address:    0.0.0.0
Mgmt Subnet Mask:          255.255.255.240 255.255.255.240
Mgmt Def Gateway:          142.6.0.145     142.6.0.145
Default Gateway:           0.0.0.0
```

4. Configure IPv6 network management.

```
Switch:(config)#ipv6 enable
Switch:(config)#ipv6 mgmt interface
Switch:(config)#ipv6 mgmt address 2142:142:6:1200::2/55
Switch:(config)#ipv6 mgmt default gateway 2142:142:6:1200::1
```

5. Verify the above configuration:

```
Switch:#show ipv6 global
forwarding                     : disabled
default-hop-cnt                : 30
number-of-interfaces           : 0
number-of-tunnels              : 0
admin-status                   : enabled
icmp-error-interval            : 1000
icmp-redirect-msg              : disabled
icmp-unreach-msg               : disabled
icmp port-unreach              : enabled
icmp addr-unreach              : enabled
multicast-admin-status         : disabled
icmp-error-quota               : 50
block-multicast-replies        : disabled
autoconfig                     : disabled
slow-path-to-cpu               : disabled


Switch:#show ipv6 mgmt address

Mgmt Switch Address: ::/0
Mgmt Stack Address:  2142:142:6:1200::2/55

Switch:#show ipv6 mgmt default-gateway

Mgmt Default Gateway: 2142:142:6:1200::1
Status: Active
```

Configuring network management VLAN

The following is an example of configuring network management VLAN.

1. Configure IPv4 Network Management.

   Create a single port VLAN different than VLAN 1. The example uses VLAN 50.

```
Switch:(config)#vlan create 50 name "Net Mgmt" type port
```

2. Configure this VLAN as the management VLAN and assign the management IP address:

```
Switch:(config)#vlan mgmt 50
Switch:(config)#ip address 192.100.5.254 255.255.255.0
```

3. Assign the VLAN to a data plane switch port (3/48) that is used solely for management traffic:

```
Switch:(config)#vlan members add 50 3/48
```

4. Assign the default gateway in order to manage the switch from remote subnets.

```
Switch:(config)#ip default-gateway 192.100.5.1
```

5. Verify the above configuration:

```
Switch:#show vlan

Id  Name                 Type     Protocol         PID      Active IVL/SVL Mgmt
--- -------------------- -------- ---------------- -------- ------ ------- ----
1   VLAN #1              Port     None             0x0000   Yes    IVL     No
        Port Members: NONE
50  Net Mgmt             Port     None             0x0000   Yes    IVL     Yes
        Port Members: 3/48
Total VLANs: 2


Switch:#show ip

Bootp/DHCP Mode: Disabled

                             Configured        In Use        Last BootP/DHCP
                           --------------- --------------- --------------------
Stack IP Address:          192.100.5.254   192.100.5.254   0.0.0.0
Switch IP Address:         192.168.1.1                     0.0.0.0
Stack Subnet Mask:         255.255.255.0   255.255.255.0   0.0.0.0
Mgmt Stack IP Address:     0.0.0.0
Mgmt Switch IP Address:    0.0.0.0
Mgmt Subnet Mask:          0.0.0.0
Mgmt Def Gateway:          0.0.0.0
Default Gateway:           192.100.5.1     192.100.5.1     0.0.0.0
```

6. Configure IPv6 Network Management:

```
Switch:(config)#ipv6 enable
Switch:(config)#interface vlan 50
Switch:(config-if)#ipv6 interface enable
Switch:(config-if)#exit
Switch:(config)#ipv6 address 2092::254/64
Switch:(config)#ipv6 default gateway 2092::1
```

7. Verify the above configuration:

```
Switch:#show ipv6 global
forwarding                     : disabled
default-hop-cnt                : 30
number-of-interfaces           : 2
number-of-tunnels              : 0
admin-status                   : enabled
icmp-error-interval            : 1000
icmp-redirect-msg              : disabled
icmp-unreach-msg               : disabled
icmp port-unreach              : enabled
icmp addr-unreach              : enabled
multicast-admin-status         : disabled
icmp-error-quota               : 50
block-multicast-replies        : disabled
autoconfig                     : disabled
slow-path-to-cpu               : disabled
```

```
Switch:#show ipv6 address

Switch Address: ::/0
Stack Address:  2092::254/64

Switch:#show ipv6 default-gateway

Default Gateway: 2092::1

Status: ActiveSta
```

Configuring NTP on switch

The following is an example of configuring the switch for NTP.

1. Configure the switch time source for NTP:

```
Switch:(config)#clock source ntp
Switch:(config)#ntp server 10.100.107.10
Switch:(config)#ntp
```

2. Verify the configuration above:

```
Switch:#show clock detail

System Clock time  :    THU OCT 06 11:09:04 2011
System Clock Source:    NTP
NTP time           :    2011-10-06 08:09:04 GMT
SNTP time           :    SNTP not synchronized.
SysUpTime           :    1 day, 20:13:05
Daylight saving recurring time is disabled
Daylight saving time is disabled
Time zone is set to 'itc', offset from UTC is 03:00

Switch:#show ntp

NTP client enabled : true
NTP polling interval : 15 minutes
Last NTP update:
latest update time : THU OCT 06 06:09:28 2011 itc
synchronized to : 10.100.107.10 (Stratum: 3)

Switch:#show ntp server

Server IP         Enabled   Auth      Key Id
----------------------------------------------
10.100.107.10     true      false     1
```

3. Create the NTP authentication-key :

```
Switch:(config)#ntp authentication-key 1
Secret key: ****
Confirm secret key: ****
```

4. Verify the NTP key:

```
Switch:(config)#show ntp key
Key Id      SHA1 Key
--------------------------------------------
1           ********
```

5. Enable SHA1 authentication for the NTP server and assign the authentication key to the NTP server:

   ```
   Switch:(config)#ntp server 10.100.92.3 auth-enable authentication-key 1
   ```

6. Verify the NTP server configuration:

   ```
   Switch:#show ntp serv
   Server IP          Enabled    Auth       Key Id
   ----------------------------------------------
   10.100.92.3        true       true       1
   10.100.100.15      true       false      0
   ```

Configuring NTP on server

Use the following settings to configure NTP on a server. In this example Ubuntu 14.04.4 LTS is installed on server, with NTP package version *ntpd 4.2.6p5*.

1. Configure the ntp.conf file as follows:

   ```
   keys /etc/ntp.keys
   trustedkey 1
   server 127.127.1.0      # local system clock
   fudge 127.127.1.0 stratum 5
   ```

2. Configure the ntp.keys file as follows:

   ```
   1 SHA1 myntpkey
   ```

   - *1* indicates the index
   - *SHA1* indicates the cryptographic algorithm
   - *myntpkey* specifies the key string

   ```
   2  MD5 myntpkey
   ```

   - *2* indicates the index
   - *MD5* indicates the cryptographic algorithm
   - *myntpkey* specifies the key string

IPv6 ICMP Message Rate Limiting

The following is an example of configuring IPv6 ICMP Message Rate Limiting.

1. Configure the IPv6 ICMP error message interval. Enter a time value in milliseconds.

   ```
   Switch:(config)#ipv6 icmp error-interval 1000
   ```

2. Configure the IPv6 ICMP error message quota. Enter a value for the number of packets.

   ```
   Switch:(config)#ipv6 icmp error-quota 50
   ```

3. Verify the configuration above:

   ```
   Switch:#show ipv6 global

   forwarding                      : disabled
   default-hop-cnt                 : 30
   number-of-interfaces            : 2
   ```

```
number-of-tunnels              : 0
admin-status                   : enabled
icmp-error-interval            : 1000
icmp-redirect-msg              : disabled
icmp-unreach-msg               : disabled
icmp port-unreach              : enabled
icmp addr-unreach              : enabled
multicast-admin-status         : disabled
icmp-error-quota               : 50
block-multicast-replies        : disabled
autoconfig                     : disabled
slow-path-to-cpu               : disabled
```

SNMPv3

The following is an example of configuring the switch for SNMPv3.

1. When enabling snmp-server for the first time, the switch prompts you to change the default SNMPv1/v2c RO and RW community strings and to define a default SNMPv3 user with SHA authentication method and a preferred encryption protocol.

   Enable the SNMP server:

   ```
   Switch:(config)#snmp-server enable
   ```

2. Create an SNMP view to use for defining a secure SNMPv3 user:

   ```
   Switch:(config)#snmp-server view root 1.3 -1.3.6.1.4
   Switch:#show snmp-server view

   View Name                        ST RS View Spec(s)
   -------------------------------- -- -- -------------------------------------
   root                             NV AC +1.3
                                    NV AC -1.3.6.1.4
   -------------------------------- -- -- -------------------------------------
   nncli                            RO AC +1.3
                                    RO AC +1.0.8802.1.1.1
                                    RO AC +1.0.8802.1.1.2
                                    RO AC +1.2.840.10006.300.43
   -------------------------------- -- -- -------------------------------------
   snmpv1Objs                       RO AC +1.3
                                    RO AC -1.3.6.1.6
                                    RO AC +1.0.8802.1.1.1
                                    RO AC +1.0.8802.1.1.2
                                    RO AC +1.2.840.10006.300.43
                                    RO AC +1.3.6.1.6.3.10
                                    RO AC +1.3.6.1.6.3.12
                                    RO AC +1.3.6.1.6.3.13
                                    RO AC +1.3.6.1.6.3.1.1.4
                                    RO AC +1.3.6.1.6.3.1.1.5
   -------------------------------- -- -- -------------------------------------
   webSnmpObjs                      RO AC +1.3
                                    RO AC +1.0.8802.1.1.1
                                    RO AC +1.0.8802.1.1.2
                                    RO AC +1.2.840.10006.300.43
   -------------------------------- -- -- -------------------------------------
   ```

3. Create a secure SNMPv3 user for management use. This user will use SHA authentication with AES encryption and the previously defined SNMP view.

   ```
   Switch:(config)#snmp-server user secureuser sha aes read-view root write-view root
   notify-view root
   Switch:#show snmp-server user
   ```

```
---------------------------------------------------------------------------
User Name:  initial
SNMP Engine ID:  Local
Authentication Protocol:  SHA
Privacy Protocol:  AES
Storage Type:  Non Volatile (NVRAM)
Status:  Active
Views for Unauthenticated Access:
    Read View:
    Write View:
    Notify View:
Views for Authenticated Access:
    Read View:
    Write View:
    Notify View:
Views for Authenticated and Encrypted Access:
    Read View:    snmpv1Objs
    Write View:   snmpv1Objs
    Notify View:  snmpv1Objs
---------------------------------------------------------------------------
User Name:  secureuser
SNMP Engine ID:  Local
Authentication Protocol:  SHA
Privacy Protocol:  AES
Storage Type:  Non Volatile (NVRAM)
Status:  Active
Views for Unauthenticated Access:
    Read View:
    Write View:
    Notify View:
Views for Authenticated Access:
    Read View:
    Write View:
    Notify View:
Views for Authenticated and Encrypted Access:
    Read View:    root
    Write View:   root
    Notify View:  root
---------------------------------------------------------------------------
```

4. Define an SNMPv3 trap receiver host to receive SNMP traps generated by the system. Traps are secured with both authentication and encryption.

```
Switch:(config)#snmp-server host 192.100.0.14 v3 auth-priv secureuser
```

5. Verify the above configuration.

```
Switch:#show snmp-server host

------------------------------------------------------------------------------
Notify Group: inform
  Type        : Inform
  Storage Type: Read-Only
  Status      : Active
------------------------------------------------------------------------------
Destination                           SNMP Security Community String
Address         Port   Timeout    Rtr Vers  Level     or User Name
--------------- ------ ---------- --- ---- -------- --------------------------
------------------------------------------------------------------------------
Notify Group: s5AgTrpRcvr
  Type        : Trap
  Storage Type: Read-Only
  Status      : Active
------------------------------------------------------------------------------
Destination                           SNMP Security Community String
Address         Port   Timeout    Rtr Vers  Level     or User Name
```

```
--------------- ------ ---------- --- ---- -------- --------------------------
------------------------------------------------------------------------------
Notify Group: trap
  Type        : Trap
  Storage Type: Read-Only
  Status      : Active
------------------------------------------------------------------------------
Destination                           SNMP Security Community String
Address          Port   Timeout    Rtr Vers  Level     or User Name
--------------- ------ ---------- --- ---- -------- --------------------------
192.100.0.14    162    1500        3   V3   AuthPriv secureuser


IPv6 Trap Destinations:

------------------------------------------------------------------------------
Notify Group: inform
  Type        : Inform
  Storage Type: Read-Only
  Status      : Active

------------------------------------------------------------------------------
Notify Group: s5AgTrpRcvr
  Type        : Trap
  Storage Type: Read-Only
  Status      : Active

------------------------------------------------------------------------------
Notify Group: trap
  Type        : Trap
  Storage Type: Read-Only
  Status      : Active
```

Assigning unused ports to Quarantine VLAN

As a best practice, assign all ports to a null VLAN. The “null” VLAN can be considered as the Quarantine VLAN, meaning that the ports have no VLAN assignment. This is the most secure setting.

To add ports to the null VLAN, simply remove them from the VLAN that they are currently configured for. Perform this procedure for all ports that are in VLAN 1, if any.

1. Verify the port VLANs assignment:

```
Switch:#show vlan
Id  Name                     Type     Protocol         PID      Active IVL/SVL Mgmt
--- -------------------- -------- ---------------- -------- ------ ------- ----
1   VLAN #1              Port     None             0x0000   Yes    IVL     No
        Port Members: 1/2-26,2/1-48,3/1-48
2   VLAN #50             Port     None             0x0000   Yes    IVL     Yes
        Port Members: 1/1
Total VLANs: 2
```

2. In this example VLAN #1 has some ports assigned. To assign them to the “null” VLAN you must remove them from VLAN #1 or from any other VLAN they are assigned to:

```
Switch:(config)#vlan members remove 1 1/2-26,2/1-48,3/1-48
Switch:#show vlan
Id  Name                     Type     Protocol         PID      Active IVL/SVL Mgmt
--- -------------------- -------- ---------------- -------- ------ ------- ----
```

```
1   VLAN #1              Port     None             0x0000   Yes    IVL     No
            Port Members: NONE
2   VLAN #50             Port     None             0x0000   Yes    IVL     Yes
            Port Members: 1/1
Total VLANs: 2
```

QoS configuration example

The following is an example of configuring QoS on switch.

By default the switch uses 2 priority queues. The switch supports up to 8 queues. The following is an example of changing the number of available queues for QoS.

1. Verify the default configuration, using 2 priority queues:

```
Switch:#show qos agent
QoS Operational Mode: Enabled
QoS NVRam Commit Delay: 10 seconds
QoS Current Queue Set: 2
QoS Next Boot Queue Set: 2
QoS Current Buffering: Large
QoS Next Boot Buffering: Large
QoS UBP Support Level: Disabled
QoS Default Statistics Tracking: Aggregate
QoS DoS Attack Prevention: Disabled
    Minimum TCP Header Length: 20
    Maximum IPv4 ICMP Length: 512
    Maximum IPv6 ICMP Length: 512
Auto QoS Mode: Disabled
Switch:#show qos queue-set 2

Set Queue        General        Bandwidth Bandwidth  Service  Size
ID   ID        Discipline          (%)    Allocation  Order  (Bytes)

___ _____ _____________________ _________ __________ _______ _______
2   1     Priority Queuing      100       Relative   1       180128
2   2     Priority Queuing      100       Relative   2       81952
```

2. Change the number of available queues for QoS to 6, or to the appropriate number of queues.

```
Switch:(config)#qos agent queue-set 6
```

3. Reboot the switch:

```
Switch:(config)#boot
```

4. Check the new queue-set in use and queue-set queues used:

```
Switch:#show qos agent
QoS Operational Mode: Enabled
QoS NVRam Commit Delay: 10 seconds
QoS Current Queue Set: 6
QoS Next Boot Queue Set: 6
QoS Current Buffering: Large
QoS Next Boot Buffering: Large
QoS UBP Support Level: Disabled
QoS Default Statistics Tracking: Aggregate
QoS DoS Attack Prevention: Disabled
    Minimum TCP Header Length: 20
    Maximum IPv4 ICMP Length: 512
    Maximum IPv6 ICMP Length: 512
Auto QoS Mode: Disabled
Switch:#show qos queue-set 6
```

```
Set Queue        General         Bandwidth Bandwidth  Service  Size
ID   ID        Discipline          (%)     Allocation  Order   (Bytes)


___ _____ _____________________ _________ __________ _______ ________
6   1     Priority Queuing      100       Relative   1       51168
6   2     Weighted Round Robin  52        Relative   2       49296
6   3     Weighted Round Robin  24        Relative   2       47216
6   4     Weighted Round Robin  14        Relative   2       43056
6   5     Weighted Round Robin  7         Relative   2       37440
6   6     Weighted Round Robin  3         Relative   2       34320
```

5. Configure 4 priority queues and trust for IPv4 DSCP and IPv6 Traffic Class values:

   - Configure queue set 4 and reboot:

   ```
   Switch:(config)#qos agent queue-set 4
   Switch:(config)#boot
   ```

   - Verify if the new queue-set is in use:

   ```
   Switch:#show qos agent
   QoS Operational Mode: Enabled
   QoS NVRam Commit Delay: 10 seconds
   QoS Current Queue Set: 4
   QoS Next Boot Queue Set: 4
   QoS Current Buffering: Large
   QoS Next Boot Buffering: Large
   QoS UBP Support Level: Disabled
   QoS Default Statistics Tracking: Aggregate
   QoS DoS Attack Prevention: Disabled
       Minimum TCP Header Length: 20
       Maximum IPv4 ICMP Length: 512
       Maximum IPv6 ICMP Length: 512
   Auto QoS Mode: Disabled
   ```

   - Configure QoS interface group for trusting IPv4 DSCP and IPv6 Traffic Class values, assign interface group to switch interfaces

   ```
   Switch:(config)#qos if-group name trust class trusted
   Switch:(config)#qos if-assign port 1/ALL,2/ALL,3/ALL,4/ALL name trust
   ```

   - Verify QoS interface group and interface assignment:

   ```
   Switch:#show qos if-group
          Role             Interface       Capabilities      Statistics   Storage
       Combination          Class                            Tracking     Type

   ____________________ ______________ ___________________ __________ ___________
   allQoSPolicyIfcs     Untrusted      Input 802, Input IP Aggregate  ReadOnly
   trust                Trusted        Input 802, Input IP Aggregate  NonVolatile
   $qosDisabledIfcs     Unrestricted   Input 802, Input IP Disabled   Other

   Switch:#show qos if-assign
   Unit Port IfIndex Role Combination Queue Set Capability  DAPP Support

   ____ ____ _______ ________________ _________ ___________ ____________
   1    1    1       trust            4         Version 1,2 Yes
   1    2    2       trust            4         Version 1,2 Yes
   1    3    3       trust            4         Version 1,2 Yes
   1    4    4       trust            4         Version 1,2 Yes
   ...
   ```

6. Queue custom egress maps and queues assignment for custom DSCP/Traffic Class values.

   - This example uses the following standard traffic pattern:
     - Voice - DSCP 49 & 15
     - Video - DSCP 39

  - Preferred Data - DSCP 11
  - Best Effort - DSCP 0

- Assign each traffic pattern to a specific queue. In this example voice traffic with DSCP 15 must be re-marked as DSCP 45.
- Change egressmap settings, map DSCP values to L2 COS values:

```
Switch:(config)#qos egressmap ds 11 1p 1 dp low-drop ds-new 11
Switch:(config)#qos egressmap ds 15 1p 5 dp low-drop ds-new 45
Switch:(config)#qos egressmap ds 39 1p 4 dp low-drop ds-new 39
Switch:(config)#qos egressmap ds 49 1p 5 dp low-drop ds-new 49
```

- Verify egressmap settings:

```
Switch:#show qos egressmap ds 0
DSCP 802.1p Priority Drop Precedence New DSCP       Name

____ _______________ _______________ ________ ________________
0    0               High Drop       0        Standard Service
Switch:#show qos egressmap ds 11
DSCP 802.1p Priority Drop Precedence New DSCP       Name

____ _______________ _______________ ________ ________________
11   1               Low Drop        11       Standard Service
Switch:#show qos egressmap ds 15
DSCP 802.1p Priority Drop Precedence New DSCP       Name

____ _______________ _______________ ________ ________________
15   5               Low Drop        45       Standard Service
Switch:#show qos egressmap ds 39
DSCP 802.1p Priority Drop Precedence New DSCP       Name

____ _______________ _______________ ________ ________________
39   4               Low Drop        39       Standard Service
Switch:#show qos egressmap ds 49
DSCP 802.1p Priority Drop Precedence New DSCP       Name

____ _______________ _______________ ________ ________________
49   5               Low Drop        49       Standard Service
```

- Assign L2 COS priorities to appropriate QoS queues. This examples assumes queue-set 4 configured above.

```
Switch:(config)#qos queue-set-assignment queue-set 4 1p 1 queue 3
Switch:(config)#qos queue-set-assignment queue-set 4 1p 4 queue 2
Switch:(config)#qos queue-set-assignment queue-set 4 1p 5 queue 1
```

- Verify QoS queue-set assignment:

```
Switch:#show qos queue-set-assignment queue-set 4

Queue Set 4
802.1p Priority Queue

_______________ _____
0               4
1               3
2               4
3               4
4               2
5               1
6               1
7               2
```

7. Configure interface queue shapers for specific queues.

   - Configure queue shapers per uplink ports with desired rates for Voice, Video and Preferred data queues above. This example assumes the following requirements:
     - Voice queue - shaped at 2.49 Gbps

  - Video queue - shaped at 1.49 Gbps
  - Preferred data queue - shaped at 3.99 Gbps

```
Switch:(config)#interface Ethernet ALL
Switch:(config-if)#qos if-queue-shaper port 1/36,1/51,2/28,3/27,4/28 queue 1
shape-rate 2490000 shape-min-rate 0
Switch:(config-if)#qos if-queue-shaper port 1/36,1/51,2/28,3/27,4/28 queue 2
shape-rate 1490000 shape-min-rate 0
Switch:(config-if)#qos if-queue-shaper port 1/36,1/51,2/28,3/27,4/28 queue 3
shape-rate 3990000 shape-min-rate 0
Switch:(config-if)#exit
```

8. Verify overall QoS config.

```
Switch:#show run mod qos
! Embedded ASCII Configuration Generator Script
! Base model = Ethernet Routing Switch 5952GTS-PWR+
! Base Software version = v7.2.0.009
!Stack Base Unit = 1
! Stack info:
!Unit# Switch Model     Pluggable Pluggable Pluggable  Pluggable SW Version
!                         Port      Port      Port       Port
!----- ---------------- --------- --------- --------- ---------- ----------
!1     5952GTS-PWR+     (49) SX   (50) None (51) SR    (52) None v7.2.0.009
!2     5928GTS-PWR+     (25) None (26) SX   (27) None  (28) SR   v7.2.0.009
!3     5928GTS-PWR+     (25) None (26) None (27) SR    (28) None v7.2.0.009
!4     5928GTS-uPWR     (25) None (26) None (27) None  (28) SR   v7.2.0.009
!
! Displaying only parameters different to default
!================================================
enable
configure terminal
!
! *** QOS ***
!
qos if-group name trust class trusted
interface Ethernet ALL
qos if-queue-shaper port 1/36,1/51,2/28,3/27,4/28 queue 1 shape-rate 2490000 shape-
min-rate 0
qos if-queue-shaper port 1/36,1/51,2/28,3/27,4/28 queue 2 shape-rate 1490000 shape-
min-rate 0
qos if-queue-shaper port 1/36,1/51,2/28,3/27,4/28 queue 3 shape-rate 3990000 shape-
min-rate 0
exit
qos if-assign port 1/ALL,2/ALL,3/ALL,4/ALL name trust
!qos agent queue-set 4
qos egressmap ds 11 1p 1 dp low-drop ds-new 11
qos egressmap ds 15 1p 5 dp low-drop ds-new 45
qos egressmap ds 39 1p 4 dp low-drop ds-new 39
qos egressmap ds 49 1p 5 dp low-drop ds-new 49
qos queue-set-assignment queue-set 4 1p 1 queue 3
qos queue-set-assignment queue-set 4 1p 4 queue 2
qos queue-set-assignment queue-set 4 1p 5 queue 1
```

Chapter 13: Resources

Support

Go to the Avaya Support website at http://support.avaya.com for the most up-to-date documentation, product notices, and knowledge articles. You can also search for release notes, downloads, and resolutions to issues. Use the online service request system to create a service request. Chat with live agents to get answers to questions, or request an agent to connect you to a support team if an issue requires additional expertise.

Documentation

For a list of the documentation for this product and more information about documents on how to configure other switch features, see *Documentation Reference for Avaya Ethernet Routing Switch 4800 Series*, NN47205–101.

For more information on new features of the switch and important information about the latest release, see *Release Notes for Avaya Ethernet Routing Switch 4800 Series*, NN47205-400.

For more information about how to configure security, see *Configuring Security on Avaya Ethernet Routing Switch 4800 Series*, NN47205-505.

For the current documentation, see the Avaya Support web site: www.avaya.com/support.

Training

Ongoing product training is available. For more information or to register, see http://avaya-learning.com/.

Enter the course code in the **Search** field and click **Go** to search for the course.

Course code	Course title
8D00020E	Stackable ERS and VSP Products Virtual Campus Offering

Viewing Avaya Mentor videos

Avaya Mentor videos provide technical content on how to install, configure, and troubleshoot Avaya products.

About this task

Videos are available on the Avaya Support website, listed under the video document type, and on the Avaya-run channel on YouTube.

Procedure

- To find videos on the Avaya Support website, go to http://support.avaya.com and perform one of the following actions:
  - In **Search**, type `Avaya Mentor Videos` to see a list of the available videos.
  - In **Search**, type the product name. On the Search Results page, select **Video** in the **Content Type** column on the left.
- To find the Avaya Mentor videos on YouTube, go to www.youtube.com/AvayaMentor and perform one of the following actions:
  - Enter a key word or key words in the **Search Channel** to search for a specific product or topic.
  - Scroll down Playlists, and click the name of a topic to see the available list of videos posted on the website.

  Note:

  Videos are not available for all products.

Searching a documentation collection

On the Avaya Support website, you can download the documentation library for a specific product and software release to perform searches across an entire document collection. For example, you can perform a single, simultaneous search across the collection to quickly find all occurrences of a particular feature. Use this procedure to perform an index search of your documentation collection.

Before you begin

- Download the documentation collection zip file to your local computer.
- You must have Adobe Acrobat or Adobe Reader installed on your computer.

Procedure

1. Extract the document collection zip file into a folder.
2. Navigate to the folder that contains the extracted files and open the file named <*product_name_release*>.pdx.

3. In the Search dialog box, select the option **In the index named <*product_name_release*>.pdx**.
4. Enter a search word or phrase.
5. Select any of the following to narrow your search:
   - Whole Words Only
   - Case-Sensitive
   - Include Bookmarks
   - Include Comments
6. Click **Search**.

   The search results show the number of documents and instances found. You can sort the search results by Relevance Ranking, Date Modified, Filename, or Location. The default is Relevance Ranking.

Subscribing to e-notifications

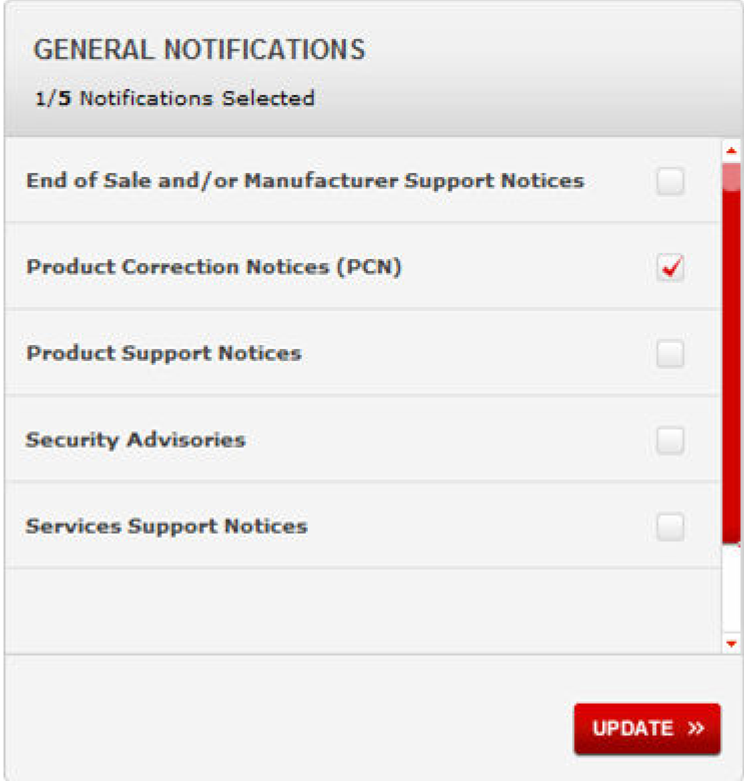
Subscribe to e-notifications to receive an email notification when documents are added to or changed on the Avaya Support website.

About this task

You can subscribe to different types of general notifications, for example, Product Correction Notices (PCN), which apply to any product or a specific product. You can also subscribe to specific types of documentation for a specific product, for example, Application & Technical Notes for Virtual Services Platform 7000.

Procedure

1. In an Internet browser, go to https://support.avaya.com.
2. Type your username and password, and then click **Login**.
3. Under **My Information**, select **SSO login Profile**.
4. Click **E-NOTIFICATIONS**.
5. In the GENERAL NOTIFICATIONS area, select the required documentation types, and then click **UPDATE**.



GENERAL NOTIFICATIONS

1/5 Notifications Selected

End of Sale and/or Manufacturer Support Notices □

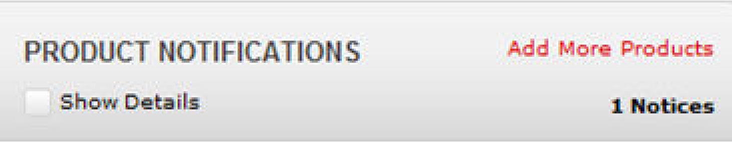
Product Correction Notices (PCN) ☑

Product Support Notices □

Security Advisories □

Services Support Notices □

6. Click **OK**.
7. In the PRODUCT NOTIFICATIONS area, click **Add More Products**.

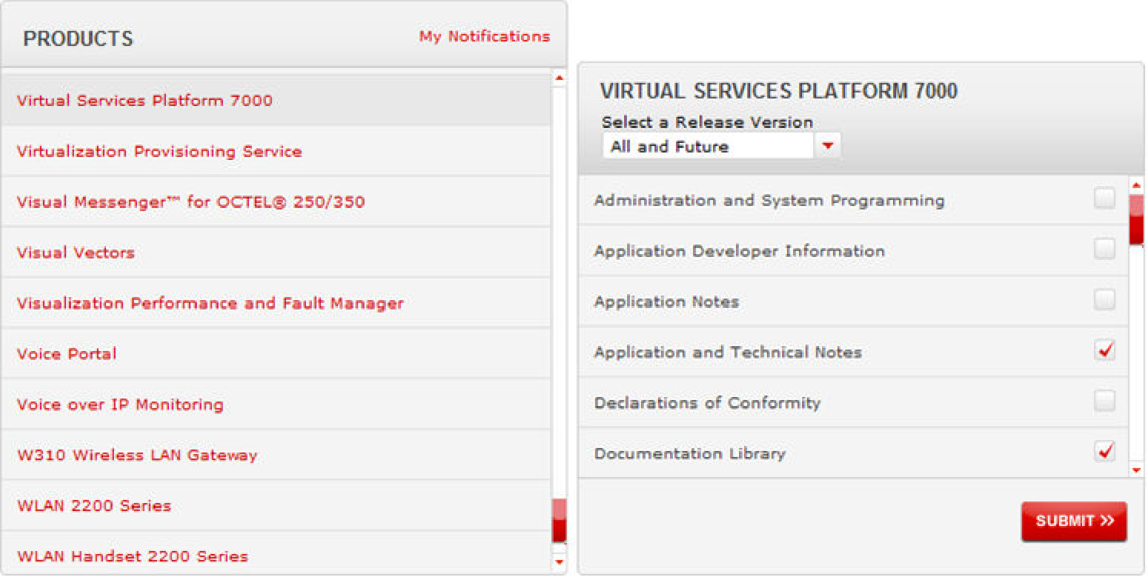


PRODUCT NOTIFICATIONS

□ Show Details

1 Notices

8. Scroll through the list, and then select the product name.
9. Select a release version.
10. Select the check box next to the required documentation types.



PRODUCTS

My Notifications

- Virtual Services Platform 7000
- Virtualization Provisioning Service
- Visual Messenger™ for OCTEL® 250/350
- Visual Vectors
- Visualization Performance and Fault Manager
- Voice Portal
- Voice over IP Monitoring
- W310 Wireless LAN Gateway
- WLAN 2200 Series
- WLAN Handset 2200 Series

VIRTUAL SERVICES PLATFORM 7000

Select a Release Version: All and Future

- Administration and System Programming □
- Application Developer Information □
- Application Notes □
- Application and Technical Notes ☑
- Declarations of Conformity □
- Documentation Library ☑

SUBMIT >>

11. Click **Submit**.

Glossary

ACLI

Avaya Command Line Interface (ACLI) is a text-based, common command line interface used for device configuration and management across Avaya products.

ACLI modes

Differing command modes are available within the text-based interface, dependant on the level of user permissions determined by logon password. Each successive mode level provides access to more complex command sets, from the most restrictive—show level only, to the highest configuration levels for routing parameters, interface configuration, and security.

Address Resolution Protocol (ARP)

Maps an IP address to a physical machine address, for example, maps an IP address to an Ethernet media access control (MAC) address.

Advanced Encryption Standard (AES)

A privacy protocol the U.S. government organizations use AES as the current encryption standard (FIPS-197) to protect sensitive information.

American Standard Code for Information Interchange (ASCII)

A code to represent characters in computers. ASCII uses uppercase and lowercase alphabetic letters, numeric digits, and special symbols.

application-specific integrated circuit (ASIC)

An application-specific integrated circuit developed to perform more quickly and efficiently than a generic processor.

Authentication, Authorization, and Accounting (AAA)

Authentication, Authorization, and Accounting (AAA) is a framework used to control access to a network, limit network services to certain users, and track what users do. Authentication determines who a user is before allowing the user to access the network and network services. Authorization allows you to determine what you allow a user to do. Accounting records what a user is doing or has done.

Auto-Detection and Auto-Configuration (ADAC)

Provides automatic switch configuration for IP phone traffic support and prioritization. ADAC can configure the switch whether it is directly connected to the Call Server or uses a network uplink.

Autotopology

An Enterprise Network Management System (ENMS) protocol that automates and simplifies discovery and collection of network topology information, presented in a table.

AV pairs

AV pairs are strings of text in the form “attribute-value” that are sent between a network access server (NAS) and a TACACS+ daemon as part of the TACACS+ protocol.

bandwidth

A measure of transmission capacity for a particular pathway, expressed in megabits per second (Mb/s).

base unit (BU)

When you connect multiple switches into a stack, one unit, and only one unit, must be designated as a base unit to perform stack configuration tasks. The position of the unit select switch, on the back of the switch, determines base unit designation.

bit error rate (BER)

The ratio of the number of bit errors to the total number of bits transmitted in a specific time interval.

Bootstrap Protocol (BootP)

A User Datagram Protocol (UDP)/Internet Protocol (IP)-based protocol that a booting host uses to configure itself dynamically and without user supervision.

brouter port

A single port VLAN that can route IP packets and bridge all non-routable traffic.

daemon

A program that services network requests for authentication and authorization. A daemon verifies, identifies, grants or denies authorizations, and logs accounting records.

Data Encryption Standard (DES)access control entry (ACE)

A cryptographic algorithm that protects unclassified computer data. The National Institute of Standards and Technology publishes the DES in the Federal Information Processing Standard Publication 46-1.

denial-of-service (DoS)

Attacks that prevent a target server or victim device from performing its normal functions through flooding, irregular protocol sizes (for example, ping requests aimed at the victim server), and application buffer overflows.

Distributed MultiLink Trunking (DMLT)

A point-to-point connection that aggregates similar ports from different modules to logically act like a single port, but with the aggregated bandwidth.

Dynamic Address Resolution Protocol Inspection (DAI)

Validates Address Resolution Protocol (ARP) packets in the network to prevent malicious user attacks on hosts, switches, and routers connected to the Layer 2 network by intercepting, logging, and discarding ARP packets with invalid IP-to-MAC address bindings. See also ARP Spoofing.

Dynamic Host Configuration Protocol (DHCP)

A standard Internet protocol that dynamically configures hosts on an Internet Protocol (IP) network for either IPv4 or IPv6. DHCP extends the Bootstrap Protocol (BOOTP).

Dynamic Host Configuration

Allows forwarding of client requests to DHCP servers residing on different IP subnets from the client.

Protocol relay (DHCP Relay)

Dynamic Host Configuration Protocol Snooping (DHCP Snooping)

Prevents DHCP Spoofing attacks by ensuring client ports can only request appropriate DHCP information and are not permitted to source DHCP leases.

Dynamic Host Configuration Protocol Spoofing (DHCP Spoofing)

Combats rogue DHCP servers by requiring the identification of the valid DHCP server address and ports where DHCP Spoofing support resides. This action causes the installation of policies on the interfaces that pass or drop traffic, depending on user-defined criteria in the policies.

Enterprise Device Manager (EDM)

A web-based embedded management system to support single-element management. EDM provides complete configuration management functionality for the supported devices and is supplied to the customer as embedded software in the device.

Extensible Authentication Protocol over LAN (EAPoL)

A port-based network access control protocol. EAPoL provides security in that it prevents users from accessing network resources before they are authenticated.

flash memory

All switch configuration parameters are stored in flash memory. If you store switch software images in flash memory, you can update switch software images without changing switch hardware.

Gigabit Interface Converter (GBIC)

A hotswappable input and output enhancement component, designed for use with Avaya products, that allows Gigabit Ethernet ports to link with other Gigabit Ethernet ports over various media types.

Hypertext Transfer Protocol (HTTP)

Communications protocol for the Web.

Hypertext Transfer Protocol, Secure (HTTPS)

Communications protocol used to access a secure Web server.

Internet Control Message Protocol (ICMP)

A collection of error conditions and control messages exchanged by IP modules in both hosts and gateways.

Internet Engineering Task Force (IETF)

A standards organization for IP data networks.

Internet Group Management Protocol (IGMP)

IGMP is a host membership protocol used to arbitrate membership in multicast services. IP multicast routers use IGMP to learn the existence of host group members on their directly attached subnets.

Internet Protocol Manager (IP Manager)

Used to limit access to switch management features by defining IP addresses allowed access to the switch.

Internet Protocol version 4 (IPv4)

The protocol used to format packets for the Internet and many enterprise networks. IPv4 provides packet routing and reassembly.

Internet Protocol version 6 (IPv6)

An improved version of the IP protocol, IPv6 improves the IPv4 limitations of security and user address numbers.

Layer 2

Layer 2 is the Data Link Layer of the OSI model. Examples of Layer 2 protocols are Ethernet and Frame Relay.

Layer 3

Layer 3 is the Network Layer of the OSI model. An example of a Layer 3 protocol is Internet Protocol (IP).

Link Aggregation

Provides the mechanism to create and manage trunk groups automatically using Link Aggregation Control Protocol (LACP).

Link Aggregation Control Protocol (LACP)

A network handshaking protocol that provides a means to aggregate multiple links between appropriately configured devices.

link aggregation group (LAG)

A group that increases the link speed beyond the limits of one single cable or port, and increases the redundancy for higher availability.

Link Layer Discovery Protocol (LLDP)

Link Layer Discovery Protocol is used by network devices to advertise their identities. Devices send LLDP information at fixed intervals in the form of Ethernet frames, with each frame having one Link Layer Discovery Protocol Data Unit.

Local Area Network (LAN)

A data communications system that lies within a limited spatial area, uses a specific user group and topology, and can connect to a public switched telecommunications network (but is not one).

management information base (MIB)

The MIB defines system operations and parameters used for the Simple Network Management Protocol (SNMP).

mask

A bit string that the device uses along with an IP address to indicate the number of leading bits in the address that correspond with the network part.

Media Access Control (MAC)

Arbitrates access to and from a shared medium.

Message Digest 5 (MD5)

A one-way hash function that creates a message digest for digital signatures.

MultiLink Trunking (MLT) A method of link aggregation that uses multiple Ethernet trunks aggregated to provide a single logical trunk. A multilink trunk provides the combined bandwidth of multiple links and the physical layer protection against the failure of a single link.

Multiple Spanning Tree Protocol (MSTP) Configures multiple instances of the Rapid Spanning Tree Protocol (RSTP) on the switch.

multiplexing Carriage of multiple channels over a single transmission medium; a process where a dedicated circuit is shared by multiple users. Typically, data streams intersperse on a bit or byte basis (time division), or separate by different carrier frequencies (frequency division).

network access server (NAS) A network access server (NAS) is a single point of access to a remote device. The NAS acts as a gateway to guard the remote device. A client connects to the NAS and then the NAS connects to another device to verify the credentials of the client. Once verified the NAS allows or disallows access to the device. Network access servers are almost exclusively used with Authentication, Authorization, and Accounting (AAA) servers.

Network Time Protocol (NTP) A protocol that works with TCP that assures accurate local time keeping with reference to radio and atomic clocks located on the Internet. NTP synchronizes distributed clocks within milliseconds over long time periods.

NonVolatile Random Access Memory (NVRAM) Random Access Memory that retains its contents after electrical power turns off.

Open Shortest Path First (OSPF) A link-state routing protocol used as an Interior Gateway Protocol (IGP).

out of band (OOB) Network dedicated for management access to chassis.

policing Ensures that a traffic stream follows the domain service-provisioning policy or service-level agreement (SLA).

port A physical interface that transmits and receives data.

Port Access Entity (PAE) Software that controls each port on the switch. The PAE, which resides on the device, supports authenticator functionality. The PAE works with the Extensible Authentication Protocol over LAN (EAPoL).

port mirroring A feature that sends received or transmitted traffic to a second destination.

port VLAN ID Used to coordinate VLANs across multiple switches. When you create a port-based VLAN on a switch, assign a VLAN identification number (VLAN ID) and specify the ports that belong to the VLAN.

prefix

A group of contiguous bits, from 0 to 32 bits in length, that defines a set of addresses.

Protocol Data Units (PDUs)

A unit of data that is specified in a protocol of a specific layer and that consists of protocol-control information of the specific layer and possibly user data of that layer.

quality of service (QoS)

QoS features reserve resources in a congested network, allowing you to configure a higher priority for certain devices. For example, you can configure a higher priority for IP deskphones, which need a fixed bit rate and split the remaining bandwidth between data connections if calls in the network are more important than the file transfers.

Random Access Memory (RAM)

Memory into which you can write and read data. A solid state memory device used for transient memory stores. You can enter and retrieve information from storage position.

Rapid Spanning Tree Protocol (RSTP)

Reduces the recovery time after a network breakdown. RSTP enhances switch-generated Topology Change Notification (TCN) packets to reduce network flooding.

rate limiting

Rate limiting sets the percentage of traffic that is multicast, broadcast, or both, on specified ports.

Read Write All (RWA)

An access class that lets users access all menu items and editable fields.

redundant power supply unit (RPSU)

Provides alternate backup power over a DC cable connection into an Avaya Ethernet Routing Switch.

Remote Authentication Dial-in User Service (RADIUS)

A protocol that authenticates, authorizes, and accounts for remote access connections that use dial-up networking and Virtual Private Network (VPN) functionality.

Remote Network Monitoring (RMON)

Creates and displays alarms for user-defined events, gathers cumulative statistics for Ethernet interfaces, and tracks statistical history for Ethernet interfaces.

request for comments (RFC)

A document series published by the Internet Engineering Task Force (IETF) that describe Internet standards.

Routing Information Protocol (RIP)

A distance vector protocol in the IP suite, used by IP network-layer protocol, that enables routers in the same AS to exchange routing information by means of periodic updates. You often use RIP as a very simple interior gateway protocol (IGP) within small networks.

routing switch

Virtualizes the physical router interfaces to switches. A virtual router port, or interface, acts as a router port to consolidate switching and routing functions in the broadcast domain, or between broadcast domains, and enable IP routing for higher traffic volumes.

Secure Shell (SSH) SSH uses encryption to provide security for remote logons and data transfer over the Internet.

Secure Sockets Layer (SSL) An Internet security encryption and authentication protocol for secure point-to-point connections over the Internet and intranets, especially between clients and servers.

Simple Network Time Protocol (SNTP) Provides a simple mechanism for time synchronization of the switch to any RFC 2030-compliant Network Time Protocol (NTP) or SNTP server.

spanning tree A simple, fully-connected active topology formed from the arbitrary physical topology of connected bridged Local Area Network components by relaying frames through selected bridge ports. The protocol parameters and states that are used and exchanged to facilitate the calculation of the active topology and to control the bridge relay function.

Spanning Tree Protocol (STP) MAC bridges use the STP to exchange information across Local Area Networks to compute the active topology of a bridged Local Area Network in accordance with the Spanning Tree Protocol algorithm.

Split MultiLink Trunking (SMLT) An extension to IEEE 802.1AX (link aggregation), provides nodal and link failure protection and flexible bandwidth scaling to improve on the level of Layer 2 resiliency.

stack Stackable Avaya Ethernet Routing Switches can be connected in a stack configuration of two or more units, up to eight units maximum. A switch stack operates and is managed as a single virtual switch.

stack IP address An IP address must be assigned to a stack so that all units can operate as a single entity.

stand-alone Refers to a single Avaya Ethernet Routing Switch operating outside a stack.

Terminal Access Controller Access Control System plus Terminal Access Controller Access Control System plus (TACACS+) is a security protocol that provides centralized validation of users who attempt to gain access to a router or network access server. TACACS+ uses Transmission Control Protocol (TCP) for its transport to ensure reliable delivery and encrypts the entire body of the packet. TACACS+ provides separate authentication, authorization, and accounting services. TACACS+ is not compatible with previous versions of TACACS.

Transmission Control Protocol (TCP) Provides flow control and sequencing for transmitted data over an end-to-end connection.

Transmission Control Protocol/ Provides communication across interconnected networks, between computers with diverse hardware architectures and various operating

Internet Protocol (TCP/IP)
systems—TCP/IP signifies the family of common Internet Protocols that define the Internet. Transmission Control Protcol is connection oriented and provides reliable communication and multiplexing, and IP is a connectionless protocol providing packet routing.

Trivial File Transfer Protocol (TFTP)
A protocol that governs transferring files between nodes without protection against packet loss.

trunk
A logical group of ports that behaves like a single large port.

User Datagram Protocol (UDP)
In TCP/IP, a packet-level protocol built directly on the Internet Protocol layer. TCP/IP host systems use UDP for application-to-application programs.

Virtual Link Aggregation Control Protocol (VLACP)
Virtual Link Aggregation Control Protocol (VLACP) is a Layer 2 handshaking protocol that can detect end-to-end failure between two physical Ethernet interfaces.

Virtual Local Area Network (VLAN)
A Virtual Local Area Network is a group of hosts that communicate as if they are attached to the same broadcast domain regardless of their physical location. VLANs are layer 2 constructs.

Virtual Private Network (VPN)
A Virtual Private Network (VPN) requires remote users to be authenticated and ensures private information is not accessible to unauthorized parties. A VPN can allow users to access network resources or to share data.

Voice over IP (VOIP)
The technology that delivers voice information in digital form in discrete packets using the Internet Protocol (IP) rather than the traditional circuit-committed protocols of the public switched telephone network (PSTN).

XFP
A pluggable 10 gigabit transceiver capable of providing different optical media for a switch. The XFP is similar to an SFP transceiver but is larger in size.