



Configuring Avaya VENA Fabric Connect on Avaya Ethernet Routing Switch 4000 Series

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Chapter 1: Introduction

Purpose

This document provides instructions to configure Avaya VENA Fabric Connect on the Ethernet Routing Switch 4800 Series. Fabric Connect includes Shortest Path Bridging (SPB, the MAC-in-MAC variant of IEEE 802.1aq), Intermediate System to Intermediate System (IS-IS), and Connectivity Fault Management (CFM).

Using the document

The document is organized into feature sections:

1. Infrastructure configuration — You must first configure your base SPB and IS-IS architecture described in the infrastructure configuration chapters. The chapter includes initial steps to configure the minimum SPB and IS-IS parameters to enable Fabric Connect on your network, and additional steps to configure optional SPB and IS-IS parameters. For more information, see [Configuring minimum SPBM and IS-IS parameters](#) on page 29
2. Services configuration — After you have completed the infrastructure configuration, you configure the appropriate services for your network to run on top of your base architecture. Services can include: Layer 2 VSNs, IP Shortcut Routing, Layer 3 VSNs, and Inter-VSN Routing.
3. Operations and management — Finally, Ethernet Routing Switch 4800 series provides tools to monitor and troubleshoot your Fabric Connect network.

The document also includes configuration examples at the end of each chapter to show basic configurations to implement Fabric Connect technology.

Related resources

Documentation

For a list of the documentation for this product, see *Documentation Reference for Avaya Ethernet Routing Switch 4000 Series*, NN47205–101.

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Before you begin

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- 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`, for example, `ers4000_5.7x.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:
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 - Case-Sensitive
 - Include Bookmarks
 - Include Comments
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-

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Chapter 2: New in this release

This is a new document for Avaya Ethernet Routing Switch 4800 Series Release 5.7. All of the features in this document are new.

New in this release

Chapter 3: SPBM and IS-IS fundamentals

Shortest Path Bridging MAC (SPBM) is a next generation virtualization technology that revolutionizes the design, deployment, and operations of enterprise campus core networks along with the enterprise data center. SPBM provides massive scalability while at the same time reducing the complexity of the network.

SPBM simplifies deployments by eliminating the need to configure multiple points throughout the network. When you add new connectivity services to an SPBM network you do not need intrusive core provisioning. The simple endpoint provisioning is done where the application meets the network, with all points in between automatically provisioned through the robust link-state protocol, Intermediate-System-to-Intermediate-System (IS-IS).

SPBM eliminates the need for multiple overlay protocols in the core of the network by reducing the core to a single Ethernet based link-state protocol that provides all virtualization services in an integrated model. In addition, by relying on endpoint service provisioning only, the idea of building your network once and not touching it again becomes a true reality. This technology provides all the features and benefits required by carrier-grade deployments to the enterprise market without the complexity of alternative technologies traditionally used in carrier deployments, for example, Multiprotocol Label Switching (MPLS).

Most Ethernet based networks use 802.1Q tagged interfaces between the routing switches. SPBM uses two Backbone VLANs (BVLANS) that are used as the transport instance. A B-VLAN is not a traditional VLAN in the sense that it does not flood unknown, broadcast or multicast traffic, but only forwards based on IS-IS provisioned backbone MAC (B-MAC) tables. After you configure the B-VLANs and the IS-IS protocol is operational, you can map the services to service instances.

SPBM uses IS-IS to discover and advertise the network topology, which enables computation of the shortest path to all nodes in the SPBM network. SPBM uses IS-IS shortest path trees to populate forwarding tables for the individual B-MAC addresses of each participating node.

To forward customer traffic across the core network backbone, SPBM uses IEEE 802.1ah Provider Backbone Bridging (PBB) MAC-in-MAC encapsulation, which hides the customer MAC (C-MAC) addresses in a backbone MAC (B-MAC) address pair. MAC-in-MAC encapsulation defines a B-MAC destination address (BMAC-DA) and a B-MAC source address (BMAC-SA). Encapsulating customer MAC addresses in B-MAC addresses improves network scalability (no end-user C-MAC learning is required in the core) and also significantly improves network robustness (loops have no effect on the backbone infrastructure.)

The SPBM header includes a Service Instance Identifier (I-SID) with a length of 32 bits with a 24 bit ID. I-SIDs identify and transmit virtualized traffic in an encapsulated SPBM frame. You can use I-SIDs in a Virtual Services Network (VSN) for VLANs or VRFs across the MAC-in-MAC backbone:

- For a Layer 2 VSN, the device associates the I-SID with a customer VLAN, which the device then virtualizes across the backbone.

Avaya ERS 4800 Series supports the IEEE 802.1aq standard of SPBM, which allows for larger Layer 2 topologies and permits faster convergence.

MAC-in-MAC encapsulation

To forward customer traffic across the core network backbone, SPBM uses IEEE 802.1ah Provider Backbone Bridging (PBB) MAC-in-MAC encapsulation, which hides the customer MAC (C-MAC) addresses in a backbone MAC (B-MAC) address pair. MAC-in-MAC encapsulation defines a B-MAC-DA and B-MAC-SA to identify the backbone destination and source addresses.

The originating node creates a MAC header that is used for delivery from end to end. As the MAC header stays the same across the network, there is no need to swap a label or do a route lookup at each node, allowing the frame to follow the most efficient forwarding path end to end.

The encapsulation of customer MAC addresses in backbone MAC addresses greatly improves network scalability, as no end-user MAC learning is required in the backbone, and also significantly improves network robustness, as customer-introduced network loops have no effect on the backbone infrastructure.

*** Note:**

By default, the chassis MAC becomes the B-MAC address for the switch. This address can be used, but it is highly recommended to change the B-MAC to an easy-to-recognize value.

I-SID

SPBM introduces a service instance identifier called I-SID. SPBM uses I-SIDs to separate services from the infrastructure. After you create an SPBM infrastructure, you can add additional services (such as VLAN extensions) by provisioning the endpoints only. The SPBM endpoints are Backbone Edge Bridges (BEBs), which mark the boundary between the core MAC-in-MAC SPBM domain and the edge customer 802.1Q domain. I-SIDs are provisioned on the BEBs to be associated with a particular service instance. In the SPBM core, the bridges are Backbone Core Bridges (BCBs). BCBs forward encapsulated traffic based on the B-MAC-DA.

The SPBM header includes an I-SID. The length of the I-SID is 32 bits with a 24-bit ID. I-SIDs identify and transmit virtualized traffic in an encapsulated SPBM frame. These I-SIDs are used in a VSN for VLANs across the MAC-in-MAC backbone:

*** Note:**

I-SID configuration is required only for virtual services such as Layer 2 VSN.

BCBs and BEBs

The boundary between the core MAC-in-MAC SPBM domain and the edge customer 802.1Q domain is handled by Backbone Edge Bridges (BEBs). I-SIDs are provisioned on the BEBs to be associated with a particular service instance.

In the SPBM core, the bridges are referred to as Backbone Core Bridges (BCBs). BCBs forward encapsulated traffic based on the B-MAC-DA.

! Important:

SPBM separates the payload from the transport over the SPBM infrastructure. Configure all virtualization services on the BEBs at the edge of the network. There is no provisioning required on the core SPBM switches. This provides a robust carrier grade architecture where configuration on the core switches never needs to be touched when adding new services.

A BEB performs the same functionality as a BCB, but it also terminates one or more Virtual Service Networks (VSN). A BCB does not terminate any VSNs and is unaware of the VSN traffic it transports. A BCB simply knows how to reach any other BEB in the SPBM backbone.

* Note:

ERS 4800 devices are currently meant to function strictly as BEB devices.

Basic SPBM network topology

The following figure shows a basic SPBM network topology, specifically a Layer 2 VSN. Switches B and C are the Backbone Core Bridges (BCB) that form the core of the SPBM network. Switches A and D are the Backbone Edge Bridges (BEB) where the services such as L2 VSNs are provisioned. Only bridges A and B perform both customer MAC (C-MAC) and B-MAC learning and forwarding while bridges B and C only perform B-MAC learning and forwarding.

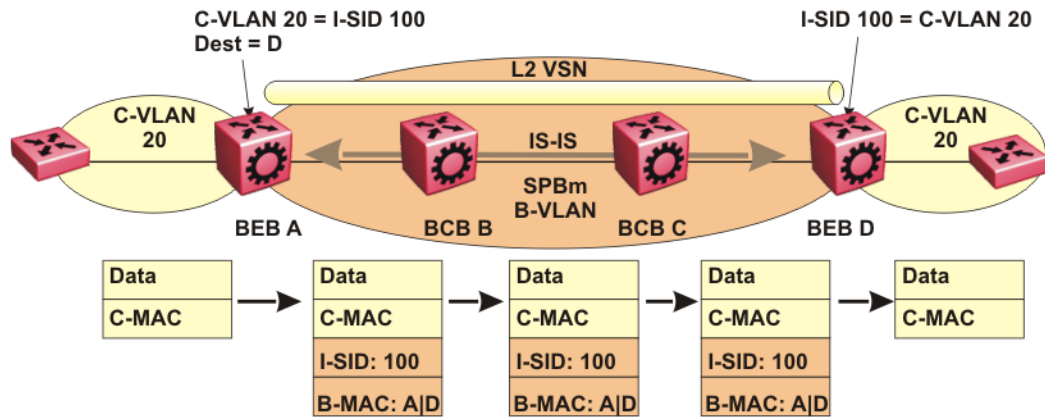


Figure 1: SPBM L2 VSN

SPBM uses IS-IS in the core so that all BEBs and BCBs learn the IS-IS System-ID (B-MAC) of every other switch in the network. For example, BEB-A uses IS-IS to build an SPBM unicast forwarding table containing the B-MAC of switches BCB-B, BCB-C, and BEB-D.

The BEBs provide the boundary between the SPBM domain and the virtualized services domain. For a Layer 2 VSN service, the BEBs map a C-VLAN to an I-SID based on local service provisioning. Any BEB in the network that has the same I-SID configured can participate in the same Layer 2 VSN. The C-VLAN ID is only of local significance, as the I-SID defines the service identifier

In this example, BEB A and BEB D are provisioned to associate C-VLAN 20 with I-SID 100. When BEB A receives traffic from C-VLAN 20 that must be forwarded to the far-end location, it performs a lookup and determines that C-VLAN 20 is associated with I-SID 100 and that BEB D is the destination for I-SID 100. BEB A then encapsulates the data and C-MAC header into a new B-MAC header, using its own nodal B-MAC: A as the source address and B-MAC: D as the destination address. BEB A then forwards the encapsulated traffic to BCB B.

To forward traffic in the core toward the destination node D, BCB B and BCB C perform Ethernet switching using the B-MAC information only.

At BEB D, the node strips off the B-MAC encapsulation, and performs a lookup to determine the destination for traffic with I-SID 100. BEB D identifies the destination on the C-VLAN header as C-VLAN 20 and forwards the packet to the appropriate destination VLAN and port.

IS-IS

To provide a loop-free network and to learn and distribute network information, SPBM uses the Intermediate-System-to-Intermediate-System (IS-IS) link state routing protocol. IS-IS is designed to find the shortest path from any one destination to any other in a dynamic fashion. IS-IS creates any-to-any connectivity in a network in an optimized, loop-free manner, without the long convergence delay experienced with the Spanning Tree Protocol. IS-IS does not block ports from use, but rather employs a specific path. As such, all links are available for use.

IS-IS is a link-state, interior gateway protocol that was developed for the International Organization for Standardization (ISO). ISO terminology refers to routers as Intermediate Systems (IS), hence the name Intermediate System-to-Intermediate System (IS-IS).

SPBM eliminates the need for multiple overlay protocols in the core of the network by reducing the core to a single Ethernet-based, link-state protocol (IS-IS). IS-IS provides virtualization services, using a pure Ethernet technology base. SPBM also uses IS-IS to discover and advertise the network topology, which enables it to compute the shortest path to all nodes in the SPBM network.

IS-IS dynamically learns the topology of a network and constructs unicast and multicast mesh connectivity. Each node in the network calculates a shortest-path tree to every other network node based on System-IDs (B-MAC addresses).

Unlike in an IP Open Shortest Path First (OSPF) environment, the SPBM use of IS-IS does not require transport of any IP addressing for topology calculations. In the SPBM environment for Layer 2 VSNs, IS-IS carries only pure Layer 2 information with no requirement for an underlying IP control plane or forwarding path. IS-IS runs directly over Layer 2.

In SPBM networks, IS-IS performs the following functions:

- Discovers the network topology
- Builds shortest path trees between the network nodes:
 - Forwards unicast traffic
 - Determines the forwarding table for multicast traffic
- Communicates network information in the control plane:
 - Service Instance Identifier (I-SID) information

SPBM can distribute I-SID service information to all SPBM nodes, as the I-SIDs are created. SPBM includes I-SID information in the IS-IS Link State protocol data units (PDUs). When a new service instance is provisioned on a node, its membership is flooded throughout the topology using an IS-IS advertisement.

Standard TLVs

IS-IS uses Type-Length-Value (TLV) encoding. SPBM employs IS-IS as the interior gateway protocol and implements additional TLVs to support additional functionality. ERS 4800 also supports Sub-TLVs. TLVs exist inside IS-IS packets and Sub-TLVs exist as additional information in TLVs.

Avaya ERS 4800 Series supports standard 802.1aq TLVs. The IEEE ratified the 802.1aq standard that defines SPBM and the Type-Length-Value (TLV) encoding that IS-IS uses to support SPBM services. Avaya is in full compliance with the IEEE 802.1aq standard. The following table lists the TLVs that the ERS 4800 Series supports.

Figure 2: Standard TLVs

TLV	Description	Usage
1	Area addresses — The Area Addresses TLV contains the area addresses to which the IS-IS is connected.	IS-IS area
22	Extended IS reachability — The Extended IS Reachability TLV contains information about adjacent neighbors.	SPBM link metric Sub TLV (type 29) is carried within this TLV.
129	Protocol supported — The Protocol supported TLV carries the Network Layer Protocol Identifiers (NLPID) for the Network Layer protocols where the IS-IS can be used.	SPBM in addition to existing NLPID (IPV4 0xCC, IPV6 0xE..), IEEE 802.1aq defined SPBM NLPID as 0xC1.
135	TE IP reachability — The Extended IP Reachability TLV 135 is used to distribute IP reachability between IS-IS peers.	SPBM uses this existing IS-IS TLV to carry IP Shortcut routes through the SPBM core.
143	Multi-topology port aware capability (MT-Port-Capability) TLV This TLV carries the SPB instance ID in a multiple SPB instances environment. This TLV is carried within IS-IS Hello Packets (IIH).	This TLV carries the following SPBM Sub TLVs: <ul style="list-style-type: none"> • MCID Sub TLV: The MCID is a digest of the VLANs and MSTI. Neighboring SPBM nodes must agree on the MCID to form an adjacency. In the current

TLV	Description	Usage
		<p>release, the MCID is set to all zeros (0). After the ERS 4800 receives a non-zero MCID Sub TLV, it reflects content back to the neighbor.</p> <ul style="list-style-type: none"> • SPB B-VID Sub TLV (type 6): The Sub TLV indicates the mapping between a VLAN and its equal cost tree (ECT) algorithm. To form an adjacency, both nodes must have a matching primary (BVLAN, ECT) pair, and secondary (BVLAN, ECT) pair.
144	<p>Multi-topology Capability (MT-Capability) TLV. This TLV carries the SPB instance ID in a multiple SPB instance environment. This TLV is carried within LSPs.</p>	<p>This TLV carries the following Sub TLVs:</p> <ul style="list-style-type: none"> • SPB instance Sub TLV (type 1): This Sub TLV contains a unique SPSourceID (nickname) to identify the SPBM node within this SPB topology. • SPB Service ID Sub TLV (type 3): This Sub TLV carries service group membership (I-SIDs) for a particular SPB BVLAN.
184	<p>SPBM IP VPN reachability — IS-IS TLV 184 is used to advertise SPBM L3 VSN route information across the SPBM cloud.</p>	<p>IP reachability for Layer 3 VSNs</p>

IS-IS hierarchies

IS-IS is a dynamic routing protocol that operates within an autonomous system (or domain). IS-IS provides support for hierarchical routing, which enables you to partition large routing domains into smaller areas. IS-IS uses a two-level hierarchy, dividing the domain into multiple

Level 1 areas and one Level 2 area. The Level 2 area serves as backbone of the domain, connecting to all the Level 1 areas.

! Important:

The IEEE 802.1aq standard currently only defines the use of one hierarchy, Level 1. Level 2 function is disabled in the current release.

IS-IS PDUs

Intermediate System to Intermediate System Hello (IIH) packets discover IS-IS neighbors and establish and maintain IS-IS adjacencies. An IIH is sent in every Hello-interval to maintain the established adjacency. If a node has not heard IIHs from its neighbor within the adjacency holdtime (hello-interval x hello-multiple) seconds, the node tears down the adjacency. In the current release, IIH carries TLV 143 and SPB-B-VLAN Sub-TLV (among other sub-TLVs). For two nodes to form an adjacency the B-VLAN pairs for primary B-VLAN and secondary B-VLAN must match.

Link State Packets (LSP) advertise link state information. The system uses the link state information to compute the shortest path. LSP also advertises MT-capability TLV 144 and SPB instance Sub-TLV, and SPB I-SIDs Sub-TLV.

Complete Sequence Number Packets (CSNP) contain the most recent sequence numbers of all LSPs in the database. CSNP notifies neighbors about the local LSDB. After a neighbor receives a CSNP, it compares the LSPs in the CSNP with the LSP in the local LSDB. If the neighbor is missing LSPs, it sends a Partial Sequence Number Packets (PSNP) to request the missing LSPs. This process synchronizes the LSDBs among neighbors. A synchronized LSDB among all nodes in the network is crucial to producing a loop-free shortest path.

IS-IS configuration parameters

The following sections describe IS-IS configuration parameters.

IS-IS system identifiers

The IS-IS system identifiers consist of three parts:

- System ID — The system ID is any 6 bytes that are unique in a given area or level. The system ID defaults to the baseMacAddress of the chassis but you can configure a default value.
- Manual area — The manual area or area ID is up to 13 bytes long. The first byte of the area number (for example, 49) is the Authority and Format Indicator (AFI). The next bytes are the assigned domain (area) identifier, which is up to 12 bytes (for example,

49.0102.0304.0506.0708.0910.1112). IS-IS supports a maximum of three manual areas, but the current ES 4800 release only supports one manual area.

- NSEL — The last byte (00) is the n-selector. In the ERS 4800 implementation, this part is automatically attached. There is no user input accepted.

The Network Entity Title (NET) is the combination of all three global parameters.

All routers have at least one manual area. Typically, a Level 1 router does not participate in more than one area.

The following are the requirements for system IDs:

- All IS-IS enabled routers must have one manual area and a unique system ID.
- All routers in the same area must have the same area ID.
- All routers must have system IDs of the same length (6 bytes).
- All IS-IS enabled routers must have a unique nickname.

PSNP interval

You can change the PSNP interval rate. A longer interval reduces overhead, while a shorter interval speeds up convergence.

CSNP periodic and interval rate

You can configure the CSNP periodic and interval rate. A longer interval reduces overhead, while a shorter interval speeds up convergence.

Parameters for the link state packet (LSP)

LSPs contain vital information about the state of adjacencies, which must be exchanged with neighboring IS-IS systems. Routers periodically flood LSPs throughout an area to maintain synchronization. You can configure the LSP to reduce overhead or speed up convergence.

The following list describes IS-IS parameters related to LSPs:

- The `max-lsp-gen-interval` is the time interval at which the generated LSP is refreshed. The default is 900 seconds with a range of 30 to 900.
- The `retransmit-lspint` is the minimum amount of time between retransmission of an LSP. When transmitting or flooding an LSP an acknowledgement (ACK) is expected. If the ack is not received within `retransmit-lspint`, the LSP is re-transmitted. The default is 5 seconds with a range of 1 to 300.

Point-to-point mode

All SPBM links are point-to-point links. ERS 4800 does not support broadcast links.

IS-IS interface authentication

Configure IS-IS interface authentication to improve security and to guarantee that only trusted routers are included in the IS-IS network. Interface level authentication only checks the IIH PDUs. If the authentication type or key in a received IIH does not match the locally-configured type and key, the IIH is rejected. By default, authentication is disabled.

You can use either one of the following authentication methods:

- Simple password authentication — Uses a text password in the transmitted packet. The receiving router uses an authentication key (password) to verify the packet.
- MD5 authentication — Creates a Message Digest (MD5) key.

Password considerations

The passwords for all authentications are saved as cleartext in the configuration file on the Avaya Ethernet Routing Switch 4800. The passwords for simple and HMAC-MD5 are displayed in cleartext through ACLI. The HMAC-MD5 packet is encrypted when transmitted over the network.

To reset the authentication password type, you must set the type to none.

The current release supports only interface level authentication. The current release does not support area level or domain level authentication.

Hellos

To update the identities of neighboring routers, you can configure the:

- Interface Hello interval
- Interface Hello multiplier

Interface Hello interval

IS-IS uses Hello packets to initialize and maintain adjacencies between neighboring routers.

You can configure the interface level Hello interval to change how often Hello packets are sent out from an interface level.

Hello multiplier

You can configure the Hello multiplier to specify how many Hellos the Avaya Ethernet Routing Switch 4800 must miss before it considers the adjacency with a neighboring switch down. The hold (wait) time is the Hello interval multiplied by the Hello multiplier. By default, if the Hello interval is 9 and the Hello multiplier is 3, the hold time is 27. If the Hello multiplier is increased to 10, the hold time is increased to 90.

Link metric

You can configure the link metric to overwrite the default metric value. By configuring the metric, you can specify a preferred path. Low cost reflects high-speed media, and high cost reflects slower media. For the wide metric, the value ranges from 1 to 16,777,215.

In this release, only the wide metric is supported.

The total cost of a path equals the sum of the cost of each link.

The default value for wide metrics is 10.

Disabling IS-IS

You can disable IS-IS globally or at the interface level. If IS-IS is globally disabled, then all IS-IS functions stop. If IS-IS is enabled at the global level and disabled at one of the interface levels, then IS-IS continues on all other interfaces.

Overload bit

If the overload bit parameter is configured, the Avaya Ethernet Routing Switch 4800 sets the overload bit in its LSP. The `overload` parameter works in conjunction with the `overload-on-startup` parameter. When the `overload-on-startup` timer expires, the SPBM node clears the overload bit and re-advertises its LSP. ERS 4800 devices are currently meant to function strictly as BEB devices, and will always set the overload bit (this option cannot be modified on this release), and cannot work as transit devices (BCBs).

When an LSP with an overload bit is received from a neighboring transit-capable SPBM device, the Avaya ERS 4800 ignores the LSP in its SPF calculation so that the transit traffic will not go through the overloaded node. The overloaded node can still receive traffic that is destined for the node itself. The overload bit is usually enabled on stub nodes, which are not used for traversing traffic. By default, overload is set to true on ERS4800 devices, and cannot be modified in this release.

SPBM B-VLAN

Each SPBM network instance is associated with at least one backbone VLAN (B-VLAN) in the core SPBM network.

This VLAN is used for both control plane traffic and dataplane traffic.

*** Note:**

Always configure two B-VLANs in the core to allow load distribution over both B-VLANs.

SPBM alters the behavior of the VLAN. When a B-VLAN is associated with an SPBM network the following VLAN attributes and behaviors are modified for the B-VLAN:

- Flooding is disabled
- Broadcasting is disabled
- Source address learning is disabled
- Unknown MAC discard is disabled

Ports cannot be added to a B-VLAN manually, IS-IS takes care of adding ports to the B-VLAN. Ports assigned by IS-IS into B-VLAN are automatically tagged and port state is not restored after IS-IS is disabled.

Essentially the B-MAC addresses are programmed into the B-VLAN Forwarding Information Bases (FIBs) by IS-IS instead of the traditional VLANs flooding and learning approach.

Modification of the VLAN behavior is necessary to ensure proper control over the SPBM traffic.

*** Note:**

When configuring a VLAN ID (VID) for a B-VLAN, some VIDs might be unavailable due to other system features. For example, the STP tagged PBDUs default VID range is 4001–

4008. Tagged BPDUs cannot use the same VID as an active B-VLAN. For more information, see *Configuring VLANs, Spanning Tree, and Multi-Link Trunking on Avaya Ethernet Routing Switch 4000 Series*, NN47205-501.

Pre-populated FIB

An Ethernet network usually learns MAC addresses as frames are sent through the switch. This process is called reverse learning and is accomplished through broadcast.

SPBM does not allow any broadcast flooding of traffic on the B-VLAN in order to prevent looping accomplished through flooding packets with unknown destinations (although multicast traffic is supported). As such, MAC addresses must be distributed within SPBM. This is accomplished by carrying the necessary B-MAC addresses inside the IS-IS link state database. To that end, SPBM supports an IS-IS TLV that advertises the I-SID and B-MAC information across the network. This functionality enables the powerful end-point-provisioning of SPBM.

These Backbone MAC addresses are populated into the SPBM VLAN Forwarding Information Base (FIB) to maximize efficiency and to allow Reverse Path Forwarding Check (RPFC) to operate properly.

RPFC

A loop prevention mechanism is required at Layer 2 to stop wayward traffic from crippling the network. Reverse Path Forwarding Check (RPFC) is the chosen method of suppressing loop traffic with SPBM. RPFC was originally designed for IP traffic at Layer 3 where it checks the source address of the packet against the routing entry in the routing table. The source address must match the route for the port it came in on otherwise the packet is illegitimate and therefore dropped.

With SPBM, the node matches the source MAC address against the ingress port to establish validity. If the frame is not supposed to come in that port, it is immediately suppressed imposing a guaranteed loop control. If there is no VLAN FDB entry to the source MAC address with the outgoing port as the ingress port, the frame will be dropped.

SPBM FIB

This section describes the SPBM unicast and multicast FIBs.

Unicast FIB

The unicast computation runs a single Dijkstra (unlike all pair Dijkstras for multicast). SPBM produces only one Shortest Path First (SPF) tree and the tree is rooted on the computing node.

The unicast computation generates an entry for each node in the network. The Destination Address (DA) for that entry is the system-id of the node. In addition, if a node advertises MAC addresses other than the system-id, each MAC address has an entry in the unicast FIB table, and the shortest path to that MAC should be exactly the same as the path to the node.

Unicast FIB entries are installed to the vlan-fdb table.

The following text shows an example of the unicast FIB.

```
4850GTS-PWR+(config-if)#show isis spbm unicast-fib
=====
                        SPBM UNICAST FIB ENTRY INFO
=====
DESTINATION          BVLAN  SYSID          HOST-NAME      OUTGOING      COST
ADDRESS                                     NAME           INTERFACE
-----
00:01:20:00:00:d1   1000   0001.2000.00d1 D1              Port: 37      10
00:01:20:00:00:d1   1001   0001.2000.00d1 D1              Port: 37      10
00:01:20:00:00:d2   1000   0001.2000.00d2 D2              Port: 37      20
00:01:20:00:00:d2   1001   0001.2000.00d2 D2              Port: 37      20
00:01:20:00:00:d3   1000   0001.2000.00d3 D3              Port: 37      20
00:01:20:00:00:d3   1001   0001.2000.00d3 D3              Port: 37      20
00:01:20:00:00:d4   1000   0001.2000.00d4 D4              Port: 37      20
00:01:20:00:00:d4   1001   0001.2000.00d4 D4              Port: 37      20
```

Multicast FIB

SPBM runs all pair Dijkstras to produce the multicast FIB. The computing node loops through each node to run Dijkstra using that node as the root, and then prunes paths to only keep the shortest paths. The computing node then computes the intersection of the set of I-SIDs for which the root node transmits, with the set of I-SIDs for which the path endpoints receive.

The multicast addresses are built out of two pieces: the instance-ID (nickname) and the I-SID ID converted to hexadecimal format to form the multicast MAC address.

```
|-----3 bytes -----|-----|
      nickname & 3             hexadecimal I-SID
```

For example, if the nickname is 0.00.10 and the I-SID is 100 (0x64), the multicast address is 03:00:10:00:00:64.

The following text shows an example of the multicast FIB.

```
4850GTS-PWR+(config)#show isis spbm multicast-fib
=====
                        SPBM MULTICAST FIB ENTRY INFO
```

```

=====
MCAST DA          ISID   BVLAN  SYSID          HOST-NAME        OUTGOING
-INTERFACES
-----
03:00:61:00:00:64   100     10    0080.2dc1.37ce  4000-1          4/7
03:00:61:00:00:c8   200     10    0080.2dc1.37ce  4000-1          4/2,4/1
-----
Total number of SPBM MULTICAST FIB entries 2
=====

```

Stacking

The Ethernet Routing Switch 4000 series supports pure or mixed modes of stack operation.

In a pure mode, you can create a pure stack with up to eight Ethernet Routing Switches from 4800 series cabled together. In a mixed mode, you can create a mixed stack with up to eight Ethernet Routing Switches from both 4500 or 4800 series cabled together. You can view and change the stack operation mode only on the ERS 4800 series. By default, the stacking mode on ERS 4800 series is mixed.

 **Note:**

You can configure SPBM only on pure ERS 4800 series stack, or standalone ERS 4800 units.

Using the `spbm` command, you can enable or disable the SPBM. If SPBM is enabled, the stack is configured in pure mode. After stack operation mode is changed using the command `spbm`, the switch or stack is rebooted.

Chapter 4: SPBM and IS-IS infrastructure configuration using ACLI

This section provides procedures to configure SPBM and IS-IS using Avaya Command Line Interface (ACLI).

Configuring minimum SPBM and IS-IS parameters

Use the following procedure to configure the minimum required SPBM and IS-IS parameters to allow SPBM to operate on the switch.

Procedure

1. Enter Global Configuration mode:

```
enable  
configure terminal
```
2. Enable SPBM globally:

```
spbm
```
3. Log on to the IS-IS Router Configuration mode:

```
router isis
```
4. Create the SPBM instance (in this release, only one SPBM instance is supported):

```
spbm <1-100>
```
5. Exit IS-IS Router Configuration mode to Global Configuration mode:

```
exit
```
6. Create the primary SPBM backbone VLAN (B-VLAN):

```
vlan create <2-4094> type spbm-bvlan
```
7. Create the secondary SPBM backbone VLAN (B-VLAN):

```
vlan create <2-4094> type spbm-bvlan
```
8. Log on to the IS-IS Router Configuration mode:

```
router isis
```
9. Add the SPBM B-VLANs to the SPBM instance:

```
spbm <1-100> b-vid {<vlan-id [-vlan-id][, ...]} [primary <1-4094>]
```

To remove the specified B-VLAN from the SPBM instance, use the following command:

```
no spbm <1-100> b-vid {<vlan-id [-vlan-id] [,...]}
```

10. Configure the system nickname (2.5 bytes in the format <x.xx.xx>):

```
spbm <1-100> nick-name <x.xx.xx>
```

To delete the configured nickname, use one of the following commands:

```
no spbm <1-100> nick-name
```

OR

```
default spbm <1-100> nick-name
```

*** Note:**

Although it is not strictly required for SPBM operation, Avaya recommends that you change the IS-IS system ID from the default B-MAC value to a recognizable address to easily identify a switch (Log on to IS-IS Router configuration mode and use the `system-id <xxxx.xxxx.xxxx>` command). This helps to recognize source and destination addresses for troubleshooting purposes.

11. Configure an IS-IS manual area (1-13 bytes in the format <xx.xxxx.xxxx...xxx>. In this release, only one manual area is supported.):

```
manual-area <xx.xxxx.xxxx...xxx>
```

To delete the manual area, use one of the following commands:

```
no manual-area
```

OR

```
default manual-area
```

12. Exit IS-IS Router Configuration mode to Global Configuration mode:

```
exit
```

13. Log on to Interface Configuration mode, by specifying the ports that are going to link to the SPBM network:

```
interface {Ethernet {slot/port [-slot/port] [,...]}
```

14. Create an IS-IS circuit and interface on the selected ports:

```
isis
```

15. Enable the SPBM instance on the IS-IS interfaces:

```
isis spbm <1-100>
```

16. Enable the IS-IS circuit/interface on the selected ports:

```
isis enable
```

To disable IS-IS on the specified interface, use the following command:

```
no isis enable
```

17. Exit Interface Configuration mode:

```
exit
```

18. Remove the selected port for IS-IS from the default VLAN.

```
vlan member remove [vlan-id] [port]
```

*** Note:**

By default, all ports are enabled in VLAN 1. Ensure the port for the IS-IS interface is removed from VLAN 1 and all other normal VLANs.

19. Enable IS-IS globally:

```
router isis enable
```

20. Display the SPBM configurations:

```
show isis spbm
```

21. Display the global IS-IS configuration:

```
show isis
```

22. Display the interface IS-IS configuration:

```
show isis interface
```

Example

```
4850GTS-PWR+> enable
4850GTS-PWR+# configure terminal
4850GTS-PWR+(config)# spbm
4850GTS-PWR+(config)# router isis
4850GTS-PWR+(config-isis)# spbm 1
4850GTS-PWR+(config-isis)# exit
4850GTS-PWR+(config)# vlan create 1000 type spbm-bvlan
4850GTS-PWR+(config)# vlan create 2000 type spbm-bvlan
4850GTS-PWR+(config)# router isis
4850GTS-PWR+(config-isis)# spbm 1 b-vid 1000,2000 primary 1000
4850GTS-PWR+(config-isis)# spbm 1 nick-name 1.11.16
4850GTS-PWR+(config-isis)# manual-area c0.2000.0000.0000
4850GTS-PWR+(config-isis)# exit
4850GTS-PWR+config)# interface Ethernet 3
4850GTS-PWR+(config-if)# isis
4850GTS-PWR+(config-if)# isis spbm 1
```

SPBM and IS-IS infrastructure configuration using ACLI

```
4850GTS-PWR+(config-if)# isis enable
4850GTS-PWR+(config-if)# exit
4850GTS-PWR+(config)# vlan member remove 1 3
4850GTS-PWR+(config)# router isis enable
4850GTS-PWR+(config)# show isis spbm
```

```
=====
                        ISIS SPBM Info
=====
```

SPBM INSTANCE	B-VID	PRIMARY VLAN	NICK NAME	LSDB TRAP
1	1000,2000	1000	1.11.16	disable

```
=====
```

```
4850GTS-PWR+(config)# show isis
```

```
=====
                        ISIS General Info
=====
```

AdminState	: enabled
RouterType	: Level 1
System ID	:0014.c7e1.33df
Max LSP Gen Interval	: 900
Min LSP Gen Interval	: 30
Metric	: wide
Overload-on-startup	: 20
Overload	: false
Csnp Interval	: 10
PSNP Interval	: 2
Rxmt LSP Interval	: 5
spf-delay	: 100
Router Name	:
Num of Interfaces	: 2
Num of Area Addresses	: 1

```
4850GTS-PWR+(config)# show isis interface
```

```
=====
                        ISIS Interfaces
=====
```

IFIDX	TYPE	LEVEL	OP-STATE	ADM-STATE	ADJ	UP-ADJ	SPBM-L1-METRIC
Mlt2	pt-pt	Level 1	UP	UP	1	1	10
Port3	pt-pt	Level 1	UP	UP	1	1	10

Variable definitions

Use the data in the following table to use the **isis** command.

Variable	Value
enable	Enables or disables the IS-IS circuit/interface on the specified port.

Variable	Value
	The default is disabled. Use the no option to disable IS-IS on the specified interface.
spbm <1–100>	Enable the SPBM instance on the IS-IS interfaces.

Use the data in the following table to use the **manual-area** command.

Variable	Value
<xx.xxxx.xxxx...xxxx>	Specifies the IS-IS manual-area in hexadecimal format (1–13 bytes in the format <xx.xxxx.xxxx...xxxx>). In this release, only one manual area is supported. For IS-IS to operate, you must configure at least one area. Use the no option to delete the manual area.

Use the data in the following table to use the **spbm** command.

Variable	Value
<1–100>	Creates the SPBM instance. In this release, only one SPBM instance is supported.
b-vid {<vlan-id [-vlan-id] [...]}>	Sets the ISIS SPBM instance data VLANs. Use the no option to remove the specified B-VLAN from the SPBM instance.
nick-name <x.xx.xx>	Specifies a nickname for the SPBM instance globally. The value is 2.5 bytes in the format <x.xx.xx>. Use the no or default options to delete the configured nickname.
primary <1–4094>	Sets the IS-IS instance primary data VLAN.

Use the data in the following table to use the **vlan create** command.

Variable	Value
<2–4094>	Specifies the VLAN ID. Creates an SPBM Backbone VLAN (B-VLAN). You can optionally specify a name for the SPBM B-VLAN.
type {port protocol-decEther2 protocol-ipEther2 protocol-ipv6Ether2 protocol-ipx802.2 protocol-ipx802.3 protocol-ipxEther2 protocol-ipxSnap protocol-	Specifies the type of VLAN created. <ul style="list-style-type: none"> port — port-based protocol-decEther2 — Specify a decEther2 protocol-based VLAN.

Variable	Value
<p>Netbios protocol-RarpEther2 protocol-sna802.2 protocol-snaEther2 protocol-Userdef protocol-vinesEther2 protocol-xnsEther2 spbm-bvlan spbm-switchedUni voice-vlan}</p>	<ul style="list-style-type: none"> • protocol-ipEther2 — Specify an ipEther2 protocol-based VLAN. • protocol-ipv6Ether2 — Specify an ipv6Ether2 protocol-based VLAN. • protocol-ipx802.2 — Specify an ipx802.2 protocol-based VLAN. • protocol-ipx802.3 — Specify an ipx802.3 protocol-based VLAN. • protocol-ipxEther2 — Specify an ipxEther2 protocol-based VLAN. • protocol-ipxSnap — Specify an ipxSnap protocol-based VLAN. • protocol-Netbios — Specify a NetBIOS protocol-based VLAN. • protocol-RarpEther2 — Specify a RarpEther2 protocol-based VLAN. • protocol-sna802.2 — Specify a sna802.2 VLAN. • protocol-snaEther2 — Specify an snaEther2 protocol-based VLAN. • protocol-Userdef — Specify a user-defined protocol-based VLAN. Enter optional parameters. <ul style="list-style-type: none"> - all – display all Userdef VLANs - ether – display Ethernet II Userdef VLANs - llc – display LLC Userdef VLANs • protocol-vinesEther2 — Specify a vinesEther2 protocol-based VLAN. • protocol-xnsEther2 — Specify an xnsEther2 protocol-based VLAN. • spbm-bvlan — Specify an SPBM-BVLAN. • spbm-switchedUni — Specify an SPBM-switchedUni • voice-vlan — Specify voice VLAN information

Job aid

Important:

After you configure the SPBM nickname and enable IS-IS, if you require a change of the system ID, you must also change the nickname. However, for naming convention purposes or configuration purposes, you might not want to change the nickname. To maintain the same nickname with a different system ID, perform the following steps:

1. Disable IS-IS.
2. Change the system ID.
3. Change the nickname to a temporary one.
4. Enable IS-IS.
5. Disable IS-IS.
6. Change the nickname to the original nickname.
7. Enable IS-IS.

Displaying global SPBM parameters

Use the following procedure to display and verify the proper global SPBM configuration.

Procedure

1. Log on to ACLI to enter User EXEC mode.
2. At the command prompt, enter the following command to check if SPBM is enabled:
`show spbm`
3. At the command prompt, enter the following command:
`show isis spbm`
4. You can also use the following command to identify SPBM VLANs. For `spbm-bvlan`, the attribute `TYPE` displays `B-VLAN` instead of `Port`.
`show vlan`

Example

```
4850GTS-PWR+(config)#show spbm
SPBM Global: Disabled
SPBM Ethertype: 0x8100
```

```
=====
ISIS SPBM Info
```

```

=====
SPBM          B-VID          PRIMARY          NICK          LSDB
INSTANCE      1000,2000          VLAN            NAME          TRAP
-----
1              1000,2000          1000            1.11.16      disable
=====

```

```

4850GTS-PWR+# show vlan
Id  Name                Type      Protocol      PID      Active  IVL/SVL  Mgmt
---  ---                ---      ---          ---      ---     ---     ---
1    VLAN #1              Port     None          0x0000   Yes     IVL      Yes
    Port Members: ALL
2    VLAN #2              Port     None          0x0000   Yes     IVL      No
    Port Members: 15-18
3    VLAN #3              Port     None          0x0000   Yes     IVL      No
    Port Members: NONE
4    VLAN #4              B-VLAN   None          0x0000   Yes     IVL      No
    Port Members: NONE

```

Variable definitions

Use the data in the following table to use the `show spbm` command.

Parameter	Description
SPBM Global	Indicates if SPBM is enabled or disabled.
SPBM Ethertype	Indicates if the stacking mode is 0x88a8 (pure) or 0x8100 (mixed). You can enable SPBM only when the stack operational mode is pure.

Use the data in the following table to use the `show isis spbm` command.

Parameter	Description
SPBM INSTANCE	Indicates the SPBM instance identifier. You can only create one SPBM instance.
B-VID	Indicates the SPBM B-VLAN associated with the SPBM instance.
PRIMARY VLAN	Indicates the primary SPBM B-VLAN.
NICK NAME	Indicates the SPBM node nickname. The nickname is used to calculate the I-SID multicast MAC address.
LSDB TRAP	Indicates the status of the IS-IS SPBM LSDB update trap on this SPBM instance. The default is disable.

Displaying global IS-IS parameters

Use the following procedure to display the global IS-IS parameters.

Procedure

1. Log on to ACLI to enter User EXEC mode.
2. Display IS-IS configuration information:

```
show isis
```
3. Display the IS-IS system-id:

```
show isis system-id
```
4. Display IS-IS net info:

```
show isis net
```

Example

```
4850GTS-PWR+#show isis
=====
                ISIS General Info
=====
AdminState : enabled
RouterType : Level 1
System ID  : 0000.0000.0000
Max LSP Gen Interval : 900
Min LSP Gen Interval : 30
Metric      : wide
Overload-on-startup : 20
Overload    : false
Csnp Interval : 10
PSNP Interval : 2
Rxmt LSP Interval : 5
Spf-delay    : 100
Num of Interfaces : 2
Num of Area Addresses : 1
```

```
4850GTS-PWR+#show isis system-id
=====
                ISIS System-Id
=====
SYSTEM-ID
=====
0014.c7e1.33df
```

```
4850GTS-PWR+#show isis net
=====
                ISIS Network Entity Title Info
=====
NET
=====
c0.2000.0000.0000.14c7.e133.df00
```

Variable definitions

The following sections describe the fields in the outputs for the global IS-IS show commands.

show isis

The following table describes the fields in the output for the `show isis` command.

Parameter	Description
AdminState	Indicates the administrative state of the router.
RouterType	Indicates the router Level: I1, I2, or I1/2.
System ID	Indicates the system ID.
Max LSP Gen Interval	Indicates the maximum time between LSP updates in seconds.
Min LSP Gen Interval	Indicates the minimum time between LSP updates in seconds.
Metric	Indicates if the metric is narrow or wide.
Overload-on-startup	Indicates the overload-on-startup value.
Overload	Indicates if there is an overload condition.
Csnp Interval	Indicates the interval between CSNP updates in seconds.
PSNP Interval	Indicates the interval between PSNP updates in seconds.
Rxmt LSP Interval	Indicates the received LSP time interval.
spf-delay	Indicates the Shortest Path First delay in milliseconds.
Router Name	Indicates the IS-IS name of the router.
Num of Interfaces	Indicates the number of interfaces on the router.
Num of Area Addresses	Indicates the number of area addresses on the router.

show isis system-id

The following table describes the fields in the output for the `show isis system-id` command.

Parameter	Description
SYSTEM-ID	Shows the system ID. Output from this show command is from the global IS-IS configuration of the system ID. There is one system ID configured. The system ID is 6 bytes in length.

show isis net

The following table describes the fields in the output for the `show isis net` command.

Parameter	Description
NET	Shows the NET address. Output from this command is from the global IS-IS configuration of the manual area and the configuration of the system ID. There is only one manual area defined and only one system ID. The manual area is from 1-13 bytes in length. The system ID is 6 bytes in length.

Displaying IS-IS areas

Use the following procedure to display IS-IS areas.

Procedure

1. Log on to ACLI to enter User EXEC mode.
2. At the command prompt, enter the following command:

```
show isis manual-area
```

Example

```
4850GTS-PWR+#show isis manual-area
```

```
=====
                        ISIS Manual Area Address
=====
AREA ADDRESS
-----
c0.2000.0000.00
```

Variable definitions

The following table describes the fields in the output for the `show isis manual-area` command.

Parameter	Description
AREA ADDRESS	Shows the manual areas defined. There can only be one area. The manual area can be from 1-13 bytes in length.

Configuring optional SPBM parameters

Use the following procedure to configure optional SPBM parameters.

Procedure

1. Enter Global Configuration mode:

```
enable  
configure terminal
```
2. Configure the stack operation mode:

```
spbm ethertype {0x8100 | 0x88a8}
```
3. Configure the optional link-state database (LSDB) trap global parameter. To configure this parameter, you must globally disable IS-IS on the switch:
 - a. Disable IS-IS on the switch:

```
no router isis enable
```
 - b. Log on to the IS-IS Router Configuration mode:

```
router isis
```
 - c. Enable a trap when the SPBM LSDB changes:

```
spbm <1-100> lsdb-trap enable
```

To disable LSDB traps, use the following command:

```
no spbm <1-100> lsdb-trap enable
```
 - d. Enable IS-IS on the switch:

```
router isis enable
```
 - e. Exit IS-IS Router Configuration mode:

```
exit
```
4. Configure the optional SPBM interface parameters. To configure these parameters, you must disable IS-IS on the interface:
 - a. Specify an SPBM interface to configure:

```
interface Ethernet <port>
```
 - b. Disable IS-IS on the interface:

```
no isis enable
```
 - c. Configure SPBM instance interface-type on IS-IS interface. SPBM supports only pt-pt:

```
isis spbm <1-100> interface-type ptpt
```
 - d. Configure the SPBM instance level 1 metric on the IS-IS interface:

```
isis spbm <1-100> l1-metric <1-16777215>
```


To set the l1-metric to the default value of 10, use one of the following commands:

```
no isis spbm <1-100> l1-metric
```

OR

```
default isis spbm <1-100> l1-metric
```

e. Enable IS-IS on the switch:

```
isis enable
```

Example

```
4850GTS-PWR+> enable
4850GTS-PWR+# configure terminal
4850GTS-PWR+(config)# spbm ethertype 0x8100
4850GTS-PWR+(config-isis)# no router isis enable
4850GTS-PWR+(config)# router isis
4850GTS-PWR+(config-isis)# spbm 1 lsdB-trap enable
4850GTS-PWR+(config-isis)# router isis enable
4850GTS-PWR+(config-isis)# exit
4850GTS-PWR+(config)# interface ethernet 3
4850GTS-PWR+(config-if)# no isis enable
4850GTS-PWR+(config-if)# isis spbm 1 interface-type ptpt
4850GTS-PWR+(config-if)# isis spbm 1 l1-metric 500
4850GTS-PWR+(config-if)# isis enable
```

Variable definitions

Use the data in the following table to use the `spbm` command.

Variable	Value
ethertype {0x8100 0x88a8}	Configures the stack operation mode to either pure or mixed. The default value is 0x8100 (mixed mode). SPBM can be enabled on the ERS 4800 series only when the stack operation mode is 0x88a8 (pure mode).

Variable	Value
<1-100> lsdb-trap enable	Configures whether to enable or disable a trap when the SPBM LSDB changes. The default is disabled. Use the no or default options to disable LSDB traps.

Use the data in the following table to use the `isis spbm` command.

Variable	Value
<1-100> interface-type ptpt	Configures the SPBM instance interface-type on the IS-IS interface located on the specified port or MLT. SPBM only supports the point-to-point (pt-pt) interface type. The default is pt-pt. Use the no or default options to set this parameter to the default value of pt-pt.
<1-100> l1-metric <1-16777215>	Configures the SPBM instance l1-metric on the IS-IS interface located on the specified port or MLT. The default value is 10. Use the no or default options to set this parameter to the default.

Configuring optional IS-IS global parameters

Use the following procedure to configure optional IS-IS global parameters.

Procedure

1. Enter IS-IS Router Configuration mode:


```
enable
configure terminal
router isis
```
2. Configure optional IS-IS global parameters:
 - a. Specify the Complete Sequence Number Packet (CSNP) interval in seconds:


```
csnp-interval <1-600>
```
 - b. Configure the router type globally:


```
is-type {l1}
```
 - c. Configure the maximum level, in seconds, between generated LSPs by this Intermediate System:


```
max-lsp-gen-interval <30-900>
```
 - d. Configure the IS-IS metric type:

- ```
metric {wide}
```
- e. Configure the Partial Sequence Number Packet (PSNP) in seconds:  
`psnp-interval <1-120>`
  - f. Configure the minimum time between retransmission of an LSP:  
`retransmit-lsp-interval <1-300>`
  - g. Configure the SPF delay in milliseconds:  
`spf-delay <0-5000>`
  - h. Configure the name for the system:  
`sys-name WORD <1-255>`
  - i. Configure the IS-IS system ID for the switch:  
`system-id <xxxx.xxxx.xxxx>`

**\* Note:**

The IS-IS “overload” bit is always set, and no NNI to NNI traffic is forwarded.

---

### Example

```
4850GTS-PWR+> enable
4850GTS-PWR+# configure terminal
4850GTS-PWR+(config)# router isis
4850GTS-PWR+(config-isis)# csnp-interval 10
4850GTS-PWR+(config-isis)# is-type ll
4850GTS-PWR+(config-isis)# max-lsp-gen-interval 800
4850GTS-PWR+(config-isis)# metric wide
4850GTS-PWR+(config-isis)# psnp-interval 10
4850GTS-PWR+(config-isis)# retransmit-lsp-interval 10
4850GTS-PWR+(config-isis)# default sys-name
4850GTS-PWR+(config-isis)# spf-delay 200
4850GTS-PWR+(config-isis)# default system-id
```

---

## Variable definitions

Use the data in the following table to use the `csnp-interval` command.

| Variable | Value                                                                                                                                                                                                                                                                                                                             |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <1-600>  | Specifies the CSNP interval in seconds. This is a system level parameter that applies for level 1 CSNP generation on all interfaces. A longer interval reduces overhead, while a shorter interval speeds up convergence. The default value is 10. Use the no or default options to set this parameter to the default value of 10. |

Use the data in the following table to configure the **is-type** command.

| Variable | Value                                                                                                                                                                                                               |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| {l1}     | Sets the router type globally: <ul style="list-style-type: none"> <li>• l1: Level-1 router type</li> </ul> The default value is l1. Use the no or default options to set this parameter to the default value of l1. |

Use the data in the following table to configure the **max-lsp-gen-interval** command.

| Variable | Value                                                                                                                                                                                                              |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <30-900> | Specifies the maximum interval, in seconds, between generated LSPs by this Intermediate System. The default value is 900 seconds. Use the no or default options to set this parameter to the default value of 900. |

Use the data in the following table to configure the **metric** command.

| Variable | Value                                                                                                                                                                                 |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| {wide}   | Specifies the IS-IS metric type. Only wide is supported in this release. The default value is wide. Use the no or default options to set this parameter to the default value of wide. |

Use the data in the following table to configure the **psnp-interval** command.

| Variable | Value                                                                                                                                  |
|----------|----------------------------------------------------------------------------------------------------------------------------------------|
| <1-120>  | Specifies the PSNP interval in seconds. This is a system level parameter that applies for level 1 PSNP generation on all interfaces. A |

| Variable | Value                                                                                                                                                                                    |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          | longer interval reduces overhead, while a shorter interval speeds up convergence. The default value is 2. Use the no or default options to set this parameter to the default value of 2. |

Use the data in the following table to configure the **retransmit-lsp-interval** command.


| Variable | Value                                                                                                                                                                                                                                                                                                               |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <1-300>  | Specifies the minimum time between retransmission of an LSP. This defines how fast the switch resends the same LSP. This is a system level parameter that applies for Level1 retransmission of LSPs. The default value is 5 seconds. Use the no or default options to set this parameter to the default value of 5. |

Use the data in the following table to configure the **spf-delay** command.

| Variable | Value                                                                                                                                                                                                                                                                                                                                                                      |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <0-5000> | Configures the delay, in milliseconds, to pace successive Shortest Path First (SPF) runs. The timer prevents more than two SPF runs from being scheduled back-to-back. The mechanism for pacing SPF allows two back-to-back SPF runs. The default value is 100 milliseconds. Use the no or default options to set this parameter to the default value of 100 milliseconds. |

Use the data in the following table to configure the **sys-name** command.

| Variable    | Value                                                                                                                                                                                                                                                                                                     |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WORD<1-255> | Specifies a name for the system. This may be used as the host name for dynamic host name exchange in accordance with RFC 2763. By default, the system name comes from the host name configured at the system level. Use the no or default options to set this parameter to the default value (host name). |

| Variable | Value                                                                                                                                                                                          |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          | <p> <b>Note:</b></p> <p>In this release, no consistency checks appear when you edit sys-name on ERS 4800.</p> |

Use the data in the following table to configure the `system-id` command.

| Variable         | Value                                                                                                                                                                |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <xxxx.xxxx.xxxx> | <p>Specifies the IS-IS system ID for the switch. Use the <code>no</code> or <code>default</code> options to set this parameter to the default value (node BMAC).</p> |

---

## Job aid

 **Important:**

After you configure the SPBM nickname and enable IS-IS, if you require a change of the system ID, you must also change the nickname. However, for naming convention purposes or configuration purposes, you might not want to change the nickname. To maintain the same nickname with a different system ID, perform the following steps:

1. Disable IS-IS.
2. Change the system ID.
3. Change the nickname to a temporary one.
4. Enable IS-IS.
5. Disable IS-IS.
6. Change the nickname to the original nickname.
7. Enable IS-IS.

---

## Configuring optional IS-IS interface parameters

Use the following procedure to configure optional IS-IS interface parameters.

### Procedure

1. Enter Ethernet Interface Configuration mode:

```
enable
configure terminal
interface Ethernet <port>
```

## 2. Configure optional IS-IS interface parameters:

- a. Specify the authentication type used for IS-IS hello packets on the interface:
 

```
isis hello-auth type {none|simple|hmac-md5}
```
- b. If you select `simple` as the `hello-auth` type, you must also specify a key value but the key-id is optional:
 

```
isis hello-auth type simple key WORD<1-16> [key-id <1-255>]
```
- c. If you select `hmac-md5`, you must also specify a key value but the key-id is optional:
 

```
isis hello-auth type hmac-md5 key WORD<1-16> [key-id <1-255>]
```
- d. Configure the level 1 IS-IS designated router priority:
 

```
isis [l1-dr-priority <0-127>]
```

### Note:

This parameter is not used for SPBM because SPBM only runs on point-to-point interfaces. This parameter is for designated router election on a broadcast LAN segment, which is not supported.

- e. Configure the level 1 hello interval:
 

```
isis [l1-hello-interval <1-600>]
```
- f. Configure the level 1 hello multiplier:
 

```
isis [l1-hello-multiplier <1-600>]
```

---

## Example

```
4850GTS-PWR+> enable
4850GTS-PWR+# configure terminal
4850GTS-PWR+(config)# interface ethernet 3
4850GTS-PWR+(config-if)# isis
4850GTS-PWR+(config-if)# isis hello-auth type hmac-md5 key test
4850GTS-PWR+(config-if)# isis l1-dr-priority 100
4850GTS-PWR+(config-if)# isis l1-hello-interval 20
4850GTS-PWR+(config-if)# isis l1-hello-multiplier 10
```

## Variable definitions

Use the data in the following table to configure the `isis` command.

| Variable                                                                             | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| hello-auth type {none simple <br>hmac-md5}][key[key WORD<1–<br>16>] [key-id <1–255>] | <p>Specifies the authentication type used for IS-IS hello packets on the interface. type can be one of the following:</p> <ul style="list-style-type: none"> <li>• none</li> <li>• simple: If selected, you must also specify a key value but the key id is optional. Simple password authentication uses a text password in the transmitted packet. The receiving router uses an authentication key (password) to verify the packet.</li> <li>• hmac-md5: If selected, you must also specify a key value but the key-id is optional. MD5 authentication creates an encoded checksum in the transmitted packet. The receiving router uses an authentication key (password) to verify the MD5 checksum of the packet. There is an optional key ID.</li> </ul> <p>The default is none. Use the no or default options to set the hello-auth type to none.</p> |
| l1-dr-priority <0–127>                                                               | <p>Configures the level 1 IS-IS designated router priority to the specified value. The default value is 64. Use the no or default options to set this parameter to the default value of 64.</p> <p><b>* Note:</b></p> <p>This parameter is not used for SPBM because SPBM only runs on point-to-point interfaces. This parameter is for designated router election on a broadcast LAN segment, which is not supported.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| l1-hello-interval <1–600>                                                            | <p>Configures the level 1 hello interval. The default value is 9 seconds. Use the no or default options to set this parameter to the default value of 9 seconds.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| l1-hello-multiplier <1–600>                                                          | <p>Configures the level 1 hello multiplier. The default value is 3 seconds. Use the no or default options to set this parameter to the default value of 3 seconds.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |



## Displaying IS-IS interface parameters

Use the following procedure to display the IS-IS interface parameters.

### Procedure

1. Log on to ACLI to enter User EXEC mode.
2. Display IS-IS interface configuration and status parameters (including adjacencies):  

```
show isis interface [l1]
```
3. Display IS-IS interface authentication configuration:  

```
show isis int-auth
```
4. Display IS-IS interface timers:  

```
show isis int-timers
```
5. Display IS-IS circuit level parameters:  

```
show isis int-ckt-level
```

### Example

```
4850GTS-PWR+#show isis interface
```

```
=====
ISIS Interfaces
=====
```

| IFIDX    | TYPE  | LEVEL   | OP-STATE | ADM-STATE | ADJ | UP-ADJ | SPBM-L1-METRIC |
|----------|-------|---------|----------|-----------|-----|--------|----------------|
| Trunk: 2 | pt-pt | Level 1 | UP       | UP        | 1   | 1      | 10             |
| Port: 21 | pt-pt | Level 1 | UP       | UP        | 1   | 1      | 10             |

```
4850GTS-PWR+#show isis int-auth
```

```
=====
ISIS Interface Auth
=====
```

| IFIDX    | AUTH-TYPE | AUTH-KEYID | AUTH-KEY |
|----------|-----------|------------|----------|
| Trunk: 3 | none      | 0          |          |
| Port: 21 | none      | 0          |          |

```
4850GTS-PWR+#show isis int-timers
```

```
=====
ISIS Interface Timers
=====
```

| IFIDX    | LEVEL   | HELLO INTERVAL | HELLO MULTIPLIER | HELLO DR |
|----------|---------|----------------|------------------|----------|
| Trunk: 2 | Level 1 | 9              | 3                | 3        |
| Port: 21 | Level 1 | 9              | 3                | 3        |

```
4850GTS-PWR+#show isis int-ckt-level
```

```
=====
ISIS Circuit level parameters
=====
```

| IFIDX | LEVEL | DIS | CKTID |
|-------|-------|-----|-------|
|-------|-------|-----|-------|

```
Trunk: 2 Level 1 1
Port: 21 Level 1 2
```

## Variable definitions

Use the data in the following table to use the IS-IS interface show command.

| Variable | Value                                                           |
|----------|-----------------------------------------------------------------|
| [I1]     | Displays the interface information for the specified level: I1. |

## Job aid

The following sections describe the fields in the outputs for the IS-IS interface show commands.

### show isis interface

The following table describes the fields in the output for the `show isis interface` command.

| Parameter      | Description                                                                            |
|----------------|----------------------------------------------------------------------------------------|
| IFIDX          | Indicates the interface index for the Ethernet or MLT interface.                       |
| TYPE           | Indicates the type of interface configured (in this release, only pt-pt is supported). |
| LEVEL          | Indicates the level of the IS-IS interface (Level 1 [default] or Level 2).             |
| OP-STATE       | Shows the physical connection state of the interface.                                  |
| ADM-STATE      | Shows the configured state of the interface.                                           |
| ADJ            | Shows how many adjacencies are learned through the interface.                          |
| UP-ADJ         | Shows how many adjacencies are active through the interface.                           |
| SPBM-L1-METRIC | Indicates the SPBM instance Level 1 metric on the IS-IS interface.                     |

### show isis int-auth

The following table describes the fields in the output for the `show isis int-auth` command.

| Parameter  | Description                                                                                                                                                                                                                                    |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IFIDX      | Shows the interface index for the Ethernet or MLT interface.                                                                                                                                                                                   |
| AUTH-TYPE  | Shows the type of authentication configured for the interface. Types include: <ul style="list-style-type: none"> <li>• none for no authentication.</li> <li>• simple for a simple password.</li> <li>• hmac-md5 for MD5 encryption.</li> </ul> |
| AUTH-KEYID | Shows the authentication password configured for the interface.                                                                                                                                                                                |
| AUTH-KEY   | Shows the HMAC-MD5 key needed for encryption. This is used only for HMAC-MD5.                                                                                                                                                                  |

### show isis int-timers

The following table describes the fields in the output for the `show isis int-auth` command.

| Parameter        | Description                                                                                                             |
|------------------|-------------------------------------------------------------------------------------------------------------------------|
| IFIDX            | Indicates the interface index for the Ethernet or MLT interface.                                                        |
| LEVEL            | Indicates the IS-IS interface level.                                                                                    |
| HELLO INTERVAL   | Indicates the interval at which a Hello packet is sent to the IS-IS network.                                            |
| HELLO MULTIPLIER | Indicates the multiplier that is used in conjunction with the Hello Interval.                                           |
| HELLO DR         | Indicates the interval at which a Hello packet is sent to the IS-IS network if the router is a designated router (DIS). |

### show isis int-ckt-level

The following table describes the fields in the output for the `show isis int-ckt-level` command.

| Parameter | Description                                                            |
|-----------|------------------------------------------------------------------------|
| IFIDX     | Shows the interface index for the ethernet or MLT interface.           |
| LEVEL     | Shows the level of the IS-IS interface (Level 1 [default] or Level 2). |
| DIS       | Shows the Designated Intermediate System (DIS) of the circuit.         |
| CKT ID    | Displays the CKT ID.                                                   |

## Displaying the multicast FIB, unicast FIB, and unicast tree

Use the following procedure to display SPBM IP unicast Forwarding Information Base (FIB), SPBM multicast FIB, unicast FIB, and the unicast tree.

In SPBM, Backbone MAC (B-MAC) addresses are carried within the IS-IS link-state database. To do this, SPBM supports an IS-IS Type-Length-Value (TLV) that advertises the Service Instance Identifier (I-SID) and B-MAC information across the network. Each node has a System ID, which also serves as B-MAC of the switch. These B-MAC addresses are populated into the SPBM Forwarding Information Base (FIB).

When the network topology is discovered and stored in the IS-IS link-state database, each node calculates shortest path trees for each source node, so that a unicast path now exists from every node to every other node. With this information, each node populates unicast information received from SPBM into the FIB for forwarding purposes.

I-SIDs are only used for virtual services (Layer 2 VSNs and Layer 3 VSNs). If you only enable IP Shortcuts on the Backbone Edge Bridges, I-SIDs are never exchanged in the network as IP Shortcuts allows for Global Routing Table (GRT) IP networks to be transported across IS-IS.

### Procedure

1. Log on to ACLI to enter User EXEC mode.
2. Display the SPBM multicast FIB:  

```
show isis spbm multicast-fib [vlan <0-4094>] [i-sid <1-16777215>] [nick-name <x.xx.xx>] [summary]
```
3. Display the SPBM unicast FIB:  

```
show isis spbm unicast-fib [b-mac <0x00:0x00:0x00:0x00:0x00:0x00>] [vlan <0-4094>] [summary]
```
4. Display the SPBM unicast tree:  

```
show isis spbm unicast-tree <1-4094> [destination <xxxx.xxxx.xxxx>]
```

### Example

```
4850GTS-PWR+#show isis spbm multicast-fib
=====
 SPBM MULTICAST FIB ENTRY INFO
=====
MCAST DA ISID BVLAN SYSID HOST-NAME OUTGOING-INTERFACES

13:11:16:00:00:c8 200 1000 0014.c7e1.33df SPBM-1 MLT-2,3/21,3/37
13:11:16:00:01:2c 300 1000 0014.c7e1.33df SPBM-1 MLT-2,4/21
13:11:16:00:01:90 400 1000 0014.c7e1.33df SPBM-1 MLT-2,3/21
13:11:16:00:00:c8 200 2000 0014.c7e1.33df SPBM-1 MLT-2,3/21,3/31,3/37
```

```

Total number of SPBM MULTICAST FIB entries 4

4850GTS-PWR+#show isis spbm unicast-fib
=====
 SPBM UNICAST FIB ENTRY INFO
=====
DESTINATION BVLAN SYSID HOST-NAME OUTGOING COST
ADDRESS

00:16:ca:23:73:df 1000 0016.ca23.73df SPBM-1 3/21 10
00:16:ca:23:73:df 2000 0016.ca23.73df SPBM-1 3/21 10
00:18:b0:bb:b3:df 1000 0018.b0bb.b3df SPBM-2 MLT-2 10
00:14:c7:e1:33:e0 1000 0018.b0bb.b3df SPBM-2 MLT-2 10
00:18:b0:bb:b3:df 2000 0018.b0bb.b3df SPBM-2 MLT-2 10

Total number of SPBM UNICAST FIB entries 5

4850GTS-PWR+#show isis spbm unicast-tree 1000
Node:0018.b0bb.b3df.00 (4850GTS-PWR+) -> ROOT
Node:0016.ca23.73df.00 (4850GTS-PWR+) -> ROOT

```

## Variable definitions

Use the data in the following table to use the `show isis spbm multicast-fib` command.

| Variable            | Value                                         |
|---------------------|-----------------------------------------------|
| vlan <0-4094>       | Displays the FIB for the specified SPBM VLAN. |
| i-sid <1-16777215>  | Displays the FIB for the specified I-SID.     |
| nick-name <x.xx.xx> | Displays the FIB for the specified nickname.  |
| summary             | Displays a summary of the FIB.                |

Use the data in the following table to use the `show isis spbm unicast-fib` command.

| Variable                                 | Value                                         |
|------------------------------------------|-----------------------------------------------|
| b-mac<br><0x00:0x00:0x00:0x00:0x00:0x00> | Displays the FIB for the specified BMAC.      |
| vlan <0-4094>                            | Displays the FIB for the specified SPBM VLAN. |
| summary                                  | Displays a summary of the FIB.                |

Use the data in the following table to use the `show isis spbm unicast-tree` command.

| Variable                     | Value                                                    |
|------------------------------|----------------------------------------------------------|
| <1-4094>                     | Specifies the SPBM B-VLAN ID.                            |
| destination <xxxx.xxxx.xxxx> | Displays the unicast tree for the specified destination. |

## Job aid

The following sections describe the fields in the outputs for SPBM multicast FIB, unicast FIB, and unicast tree show commands.

### show isis spbm multicast-fib

The following table describes the fields in the output for the `show isis spbm multicast-fib` command.

| Parameter           | Description                                                                 |
|---------------------|-----------------------------------------------------------------------------|
| MCAST DA-INTERFACES | Indicates the multicast destination MAC address of the multicast FIB entry. |
| ISID                | Indicates the I-SID of the multicast FIB entry.                             |
| BVLAN               | Indicates the B-VLAN of the multicast FIB entry.                            |
| SYSID               | Indicates the system identifier of the multicast FIB entry.                 |
| HOST-NAME           | Indicates the host name of the multicast FIB entry.                         |
| OUTGOING            | Indicates the outgoing interface of the multicast FIB entry.                |

### show isis spbm unicast-fib

The following table describes the fields in the output for the `show isis spbm unicast-fib` command.

| Parameter           | Description                                                           |
|---------------------|-----------------------------------------------------------------------|
| DESTINATION ADDRESS | Indicates the destination MAC Address of the unicast FIB entry.       |
| BVLAN               | Indicates the B-VLAN of the unicast FIB entry.                        |
| SYSID               | Indicates the destination system identifier of the unicast FIB entry. |
| HOST-NAME           | Indicates the destination host name of the unicast FIB entry.         |
| OUTGOING INTERFACE  | Indicates the outgoing interface of the unicast FIB entry.            |
| COST                | Indicates the cost of the unicast FIB entry.                          |

## Displaying IS-IS LSDB and adjacencies

Use the following procedure to display the IS-IS LSDB and adjacencies.

### Procedure

1. Log on to ACLI to enter User EXEC mode.
2. Display the IS-IS LSDB:  

```
show isis lsdb [level {l1|l2|l12}] [sysid <xxxx.xxxx.xxxx>]
[lspid <xxxx.xxxx.xxxx.xx-xx>] [tlv <1-184>] [detail]
```
3. Display IS-IS adjacencies:  

```
show isis adjacencies
```
4. Clear IS-IS LSDB:  

```
clear isis lsdb
```

### Example

```
4850GTS-PWR+#show isis lsdb
```

```
=====
 ISIS LSDB
=====
LSP ID LEVEL LIFETIME SEQNUM CHKSUM HOST-NAME

0014.c7e1.33df.00-00 1 545 0xb1 0xed28 NewYork
0016.ca23.73df.00-00 1 1119 0x9f 0x9c9d VSP-Lab2
0018.b0bb.b3df.00-00 1 708 0xb9 0xcb1a VSP-Lab1

Level-1 : 3 out of 3 Total Num of LSP Entries
Level-2 : 0 out of 0 Total Num of LSP Entries
```

```
4850GTS-PWR+# show isis adjacencies
```

```
=====
 ISIS Adjacencies
=====
INTERFACE L STATE UPTIME PRI HOLDTIME SYSID HOST-NAME

Mlt2 1 UP 1d 03:57:25 127 20 0018.b0bb.b3df ERS-Lab1
Port3/21 1 UP 1d 03:57:16 127 27 0016.ca23.73df ERS-Lab2

 2 out of 2 Total Num of Adjacencies

```

```
4850GTS-PWR+>show isis lsdb detail
```

```
=====
 ISIS LSDB (DETAIL)
=====
Level-1 LspID: 0001.bcb0.0003.00-001 SeqNum: 0x00000522 Lifetime: 1144
 Chksum: 0x32f7 PDU Length: 312
```

## SPBM and IS-IS infrastructure configuration using ACLI

```
Host_name: C0
Attributes: IS-Type 1
TLV:1 Area Addresses: 1
 c1.3000.0000.00

TLV:22 Extended IS reachability:
Adjacencies: 7
TE Neighbors: 7
 0000.beb1.0007.01 (ERS0) Metric:10
 SPBM Sub TLV:
 port id: 640 num_port 1
 Metric: 10
 0000.beb1.00b1.01 (VSP1) Metric:10
 SPBM Sub TLV:
 port id: 643 num_port 1
 Metric: 10
 0000.bcb1.0004.01 (C1) Metric:10
 SPBM Sub TLV:
 port id: 6144 num_port 1
 Metric: 10
 0000.beb1.00ca.01 (VSP2) Metric:10
 SPBM Sub TLV:
 port id: 6156 num_port 1
 Metric: 10
 0000.beb1.00a5.01 (VSS0) Metric:10
 SPBM Sub TLV:
 port id: 651 num_port 1
 Metric: 10
 0000.beb1.00b2.01 (VSS1) Metric:10
 SPBM Sub TLV:
 port id: 645 num_port 1
 Metric: 10
 0000.beb1.0008.01 (VSP1) Metric:10
 SPBM Sub TLV:
 port id: 652 num_port 1
 Metric: 10

TLV:129 Protocol Supported: SPBM
TLV:137 Host_name: C0#
TLV:144 SUB-TLV 1 SPBM INSTANCE:
```



```

Instance: 0
bridge_pri: 0
OUI: 00-33-33
num of trees: 2
vid tuple : u-bit 1 m-bit 1 ect-alg 0x80c201 base vid 1000
vid tuple : u-bit 1 m-bit 1 ect-alg 0x80c202 base vid 1001
TLV:144 SUB-TLV 3 ISID:
Instance: 0
Metric: 0
B-MAC: 00-00-bc-b1-00-03
BVID:1000
Number of ISID's:8
3001 (Both) , 3002 (Rx) , 3003 (Both) , 3004 (Rx) , 4001 (Both) , 4002 (
Rx) , 4003 (Both) , 4004 (Rx)

Instance: 0
Metric: 0
B-MAC: 00-00-bc-b1-00-03

--More-- (q = quit)

```

## Variable definitions

Use the data in the following table to use the `show isis lsdb` command.

| Variable                     | Value                                                                                                                     |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| level {1 2 12}               | Displays the LSDB for the specified level: l1, l2, or l12.<br><br>* <b>Note:</b><br>Level 1 is supported in this release. |
| sysid <xxxx.xxxx.xxxx>       | Displays the LSDB for the specified system ID.                                                                            |
| lspid <xxxx.xxxx.xxxx.xx-xx> | Displays the LSDB for the specified LSP ID.                                                                               |
| tlv <1-184>                  | Displays the LSDB by TLV type.                                                                                            |
| detail                       | Displays detailed information.                                                                                            |

Use the data in the following table to use the `clear isis` command.

| Variable | Value                                                                                                                                                                                                                                                                        |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| lsdb     | Clears the IS-IS Link State Database (LSDB). The command clears learned LSPs only. The command does not clear local generated LSPs. As soon as the platform clears the LSDB the LSP synchronization process starts immediately and the LSDB synchronizes with its neighbors. |

---

## Job aid

The following sections describe the fields in the outputs for the IS-IS LSDB and adjacencies show commands.

### show isis lsdb

The following table describes the fields in the output for the `show isis lsdb` command.

| Parameter | Description                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LSP ID    | Indicates the LSP ID assigned to external IS-IS routing devices.                                                                                                                                                                                                                                                                                                                                                             |
| LEVEL     | Indicates the level of the external router: L1, L2, or L12.                                                                                                                                                                                                                                                                                                                                                                  |
| LIFETIME  | Indicates the maximum age of the LSP. If the max-lsp-gen-interval is set to 900 (default) then the lifetime value begins to count down from 1200 seconds and updates after 300 seconds if connectivity remains. If the timer counts down to zero, the counter adds on an additional 60 seconds, then the LSP for that router is lost. This happens because of the zero age lifetime, which is detailed in the RFC standards. |
| SEQNUM    | Indicates the LSP sequence number. This number changes each time the LSP is updated.                                                                                                                                                                                                                                                                                                                                         |
| CHKSUM    | Indicates the LSP checksum. This is an error checking mechanism used to verify the validity of the IP packet.                                                                                                                                                                                                                                                                                                                |
| HOST-NAME | Indicates the hostname listed in the LSP. If the host name is not configured, then the system name is displayed.                                                                                                                                                                                                                                                                                                             |

### show isis adjacencies

The following table describes the fields in the output for the `show isis adjacencies` command.

| Parameter | Description                                                                                                          |
|-----------|----------------------------------------------------------------------------------------------------------------------|
| INTERFACE | Indicates the interface port or MLT on which IS-IS exists.                                                           |
| L         | Indicates the level of the adjacent router.                                                                          |
| STATE     | Indicates the state of IS-IS on the interface (enabled [UP] or disabled [DOWN]). The state is non-configurable.      |
| UPTIME    | Indicates the length of time the adjacency has been up in ddd hh:mm:ss format.                                       |
| PRI       | Indicates the priority of the neighboring Intermediate System for becoming the Designated Intermediate System (DIS). |

| Parameter | Description                                                                                                                                                                   |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HOLDTIME  | Indicates the calculated hold time for the Hello (hello multiplier x hello interval); if the route is determined to be a designated router, then the product is divided by 3. |
| SYSID     | Indicates the adjacent system ID of the router.                                                                                                                               |
| HOST-NAME | Indicates the hostname listed in the LSP. If the host name is not configured, then the system name is displayed.                                                              |

## Displaying IS-IS statistics and counters

Use the following procedure to display the IS-IS statistics and counters.

### Procedure

1. Log on to ACLI to enter User EXEC mode.
2. Display IS-IS system statistics:  
`show isis statistics`
3. Display IS-IS interface counters:  
`show isis int-counters`
4. Display IS-IS level 1 control packet counters:  
`show isis int-l1-ctrl-pkts`

**\* Note:**

The current release uses level 1 IS-IS. The current release does not support level 2 IS-IS. The ACLI command `show isis int-l2-ctrl-pkts` is not supported in the current release because the IEEE 802.1aq standard currently only defines the use of one hierarchy, Level 1.

5. Clear IS-IS statistics:  
`clear isis stats [error-counters] [packet-counters]`

### Example

```
4850GTS-PWR+# show isis statistics
=====
 ISIS System Stats
=====
LEVEL CORR AUTH AREA MAX SEQ SEQ NUM OWN LSP BAD ID PART LSP DB
 LSPs FAILS DROP EXCEEDED SKIPS PURGE LEN CHANGES OLOAD
=====
```

```
Level-1 0 0 0 0 1 0 0 0 0
```

```
4850GTS-PWR+#show isis int-counters
```

```
=====
 ISIS Interface Counters
=====
IFIDX LEVEL AUTH ADJ INIT REJ ID LEN MAX AREA LAN DIS
 FAILS CHANGES FAILS ADJ CHANGES

Mlt2 Level 1 0 1 0 0 0 0 0
Port3/21 Level 1 0 1 0 0 0 0 0
```

```
4850GTS-PWR+#show isis int-l1-ctrl-pkts
```

```
=====
 ISIS L1 Control Packet counters
=====
IFIDX DIRECTION HELLO LSP CSNP PSNP

Mlt2 Transmitted 13346 231 2 229
Mlt2 Received 13329 230 1 230
Port3/21 Transmitted 13340 227 2 226
Port3/21 Received 13335 226 1 227
```

## Variable definitions

Use the data in the following table to use the `clear isis stats` command.

| Variable        | Value                                   |
|-----------------|-----------------------------------------|
| error-counters  | Clears IS-IS stats for error-counters.  |
| packet-counters | Clears IS-IS stats for packet-counters. |

## Job aid

### show isis statistics

The following table describes the fields in the output for the `show isis statistics` command.

| Parameter  | Description                                                              |
|------------|--------------------------------------------------------------------------|
| LEVEL      | Shows the level of the IS-IS interface.                                  |
| CORR LSPs  | Shows the number of corrupted LSPs detected.                             |
| AUTH FAILS | Shows the number of times authentication has failed on the global level. |

| Parameter        | Description                                                         |
|------------------|---------------------------------------------------------------------|
| AREA DROP        | Shows the number of manual addresses dropped from the area.         |
| MAX SEQ EXCEEDED | Shows the number of attempts to exceed the maximum sequence number. |
| SEQ NUM SKIPS    | Shows the number of times the sequence number was skipped.          |
| OWN LSP PURGE    | Shows how many times the local LSP was purged.                      |
| BAD ID LEN       | Shows the number of ID field length mismatches.                     |
| PART CHANGES     | Shows the number of partition link changes.                         |
| LSP DB OLOAD     | Show the number of times the ERS 4800 was in the overload state.    |

### show isis int-counters

The following table describes the fields in the output for the `show isis int-counters` command.

| Parameter       | Description                                                              |
|-----------------|--------------------------------------------------------------------------|
| IFIDX           | Shows the interface index for the Ethernet or MLT interface.             |
| LEVEL           | Shows the level of the IS-IS interface (Level 1 in the current release). |
| AUTH FAILS      | Shows the number of times authentication has failed per interface.       |
| ADJ CHANGES     | Shows the number of times the adjacencies have changed.                  |
| INIT FAILS      | Shows the number of times the adjacency has failed to establish.         |
| REJ ADJ         | Shows the number of times the adjacency was rejected by another router.  |
| ID LEN          | Shows the ID field length mismatches.                                    |
| MAX AREA        | Shows the maximum area address mismatches.                               |
| LAN DIS CHANGES | Shows the number of times the DIS has changed.                           |

### show isis int-l1-cntl-pkts

The following table describes the fields in the output for the `show isis int-l1-cntl-pkts` command.

| Parameter | Description                                                  |
|-----------|--------------------------------------------------------------|
| IFIDX     | Shows the interface index for the Ethernet or MLT interface. |

| <b>Parameter</b> | <b>Description</b>                                 |
|------------------|----------------------------------------------------|
| DIRECTION        | Shows the packet flow (Transmitted or Received).   |
| HELLO            | Shows the number of interface-level Hello packets. |
| LSP              | Shows the number of LSP packets.                   |
| CSNP             | Shows the number of CSNPs.                         |
| PSNP             | Shows the number of PSNPs.                         |

# Chapter 5: SPBM and IS-IS infrastructure configuration using EDM

This section provides procedures to configure basic SPBM and IS-IS infrastructure using Enterprise Device Manager (EDM).

---

## Configuring required SPBM and IS-IS parameters

Use the following procedure to configure the minimum required SPBM and IS-IS parameters to allow SPBM to operate on the switch. SPBM uses the Intermediate-System-to-Intermediate-System (IS-IS) link state routing protocol to provide a loop free Ethernet topology that creates a shortest path topology from every node to every other node in the network based on node MAC addresses.

### Procedure

1. From the navigation tree, select **Configuration > VLAN > VLANs**.
2. Click the **Basic** tab.
3. Click **Insert**.
4. In the **Type** field, click **spbm-bvlan**.
5. Click **Insert** to create the primary B-VLAN.
6. Click **Insert**.
7. In the **Type** field, click **spbm-bvlan**.
8. Click **Insert** to create the secondary B-VLAN.
9. In the navigation tree, select **Configuration > IS-IS > SPBM**.
10. From the **Globals** tab, select **enable** to enable SPBM globally, and click **Apply**.
11. Click the **SPBM** tab.
12. Click **Insert** to create an SPBM instance (in this release, only one SPBM instance is supported).
13. In the **Id** field, specify the SPBM instance ID.
14. In the **NodeNickName** field, specify the node nickname (valid value is 2.5 bytes in the format <x.xx.xx>)

15. Click **Insert**.
16. In the **Vlans** field, specify the IDs of the SPBM B-VLANs to add to the SPBM instance.
17. In the **PrimaryVlan** field, specify which of the SPBM B-VLANs specified in the previous step is the primary B-VLAN.
18. Click **Apply**.
19. In the navigation tree, select **Configuration > IS-IS > IS-IS**.
20. Click the **Manual Area** tab.
21. In the Manual Area tab, click **Insert** to add a manual area (in this release, only one manual area is supported).
22. Specify the Manual Area Address (valid value is 1–13 bytes in the format <xx.xxxx.xxxx...xxx>).
23. Click **Insert**.
24. Under the IS-IS tab, click the **Globals** tab.

**\* Note:**

Although it is not strictly required for SPBM operation, Avaya recommends that you change the IS-IS system ID from the default B-MAC value to a recognizable address to easily identify a switch (using the **SystemID** field under the IS-IS Globals tab) . This helps to recognize source and destination addresses for troubleshooting purposes.

25. In the AdminState field, click **on**, and click **Apply**.
26. Under the IS-IS tab, click the **Interfaces** tab.
27. Click **Insert** to create an IS-IS circuit.
28. In the **IfIndex** field, specify the port or MLT on which to create the IS-IS interface.
29. Click **Insert**.

**\* Note:**

By default, all ports are enabled in VLAN 1. You can remove the port for the IS-IS interface from VLAN 1 at the end of this procedure.

30. Select the newly created IS-IS circuit entry, and click **SPBM**.
31. In the **Interfaces SPBM** tab, click **Insert**.
32. In the **Spbmid** field, specify a SPBM identifier.
33. In the **State** field, select **enable**.
34. Click **Insert** to enable the SPBM instance on the IS-IS circuit.
35. Under the IS-IS tab, click the **Interfaces** tab.



36. In the **AdminState** field for the IS-IS circuitry entry, select **on** to enable the IS-IS circuit.
37. Click **Apply**.
38. From the navigation tree, select **Configuration > VLAN > VLANs**.
39. Click the **Basic** tab.
40. Select the row for VLAN#1, and double-click the **PortMembers** cell.
41. Click the **port number** you specified for the IS-IS interface to remove it from the default VLAN, and click **Ok**.
42. In the toolbar, click **Apply**.

**\* Note:**

Ensure you remove the port specified for the IS-IS interface from all non-SPBM VLANs.

## SPBM field descriptions

**\* Note:**

The following tables list the minimum required SPBM and IS-IS parameters to allow SPBM to operate on the switch. For more detailed information on all of the parameters see the procedures that follow. For more information on how to configure VLANs, see *Configuring VLANs, Spanning Tree, and Multi-Link Trunking on Avaya Ethernet Routing Switch 4000 Series*, NN47205-501.

Use the data in the following table to use the **SPBM > Globals** tab.

| Name                   | Description                                                                            |
|------------------------|----------------------------------------------------------------------------------------|
| <b>GlobalEnable</b>    | Enables or disables SPBM globally.                                                     |
| <b>GlobalEtherType</b> | Specifies the global Ethertype value as 0x8100 or 0x88a8. The default value is 0x8100. |

Use the data in the following table to use the **SPBM > SPBM** tab.

| Name      | Description                                                                           |
|-----------|---------------------------------------------------------------------------------------|
| <b>Id</b> | Specifies the SPBM instance ID. In this release, only one SPBM instance is supported. |

| Name                | Description                                                                                            |
|---------------------|--------------------------------------------------------------------------------------------------------|
| <b>NodeNickName</b> | Specifies a nickname for the SPBM instance globally. Valid value is 2.5 bytes in the format <x.xx.xx>. |
| <b>PrimaryVlan</b>  | Specifies the primary SPBM B-VLANs to add to the SPBM instance.                                        |
| <b>Vlans</b>        | Specifies the SPBM B-VLANs to add to the SPBM instance.                                                |
| <b>LsdbTrap</b>     | Enables or disables LSDB trap for the SPBM instance.                                                   |

Use the data in the following table to use the **VLANs > Basic** tab.



| Name        | Description                                                                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Type</b> | Specifies the type of VLAN: <ul style="list-style-type: none"> <li>• byPort</li> <li>• byProtocolId</li> <li>• spbm-bvlan</li> <li>• spbm-switchedUni</li> </ul> |

Use the data in the following table to use the **IS-IS > Manual Area** tab.

| Name            | Description                                                                                                                                                                                                         |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AreaAddr</b> | Specifies the IS-IS manual area. Valid value is 1–13 bytes in the format <xx.xxx.xxx...xxx>. In this release, only one manual area is supported. For IS-IS to operate, you must configure at least one manual area. |

Use the data in the following table to use the **IS-IS > Globals** tab.

| Name              | Description                                                                                                                                                                                                     |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AdminState</b> | Specifies the global status of IS-IS on the switch: on or off. The default is off.                                                                                                                              |
| <b>LevelType</b>  | Sets the router type globally: <ul style="list-style-type: none"> <li>• level1 — Level-1 router type</li> <li>• level2 — Level-2 router type</li> <li>• Level1and2 — Level-1 and Level-2 router type</li> </ul> |

| Name      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | <p> <b>Note:</b></p> <p>level2 and level1and2 is not supported in this release.</p>                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>ID</b> | <p>Specifies the system ID. Valid value is a 6-byte value in the format &lt;xxxx.xxxx.xxxx&gt;</p> <p> <b>Note:</b></p> <p>Although it is not strictly required for SPBM operation, Avaya recommends that you change the IS-IS system ID from the default B-MAC value to a recognizable address to easily identify a switch (using the <b>ID</b> field under the IS-IS Globals tab) . This helps to recognize source and destination addresses for troubleshooting purposes.</p> |

Use the data in the following table to use the **IS-IS > Interfaces** tab.

| Name              | Description                                                                                                                                                                                                               |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>IfIndex</b>    | The identifier of this circuit, unique within the Intermediate System. This value is for SNMP Indexing purposes only and need not have any relation to any protocol value. This object cannot be modified after creation. |
| <b>AdminState</b> | Specifies the administrative state of the circuit: on or off. The default is off.                                                                                                                                         |

Use the data in the following table to use the **SPBM > Interface SPBM** tab.

| Name         | Description                                                  |
|--------------|--------------------------------------------------------------|
| <b>State</b> | Specifies whether the SPBM interface is enabled or disabled. |

---

## Job aid

### **Important:**

After you configure the SPBM nickname and enable IS-IS, if you require a change of the system ID, you must also change the nickname. However, for naming convention purposes or configuration purposes, you might not want to change the nickname. To maintain the same nickname with a different system ID, perform the following steps:

1. Disable IS-IS.
2. Change the system ID.
3. Change the nickname to a temporary one.
4. Enable IS-IS.
5. Disable IS-IS.
6. Change the nickname to the original nickname.
7. Enable IS-IS.

---

## Displaying the SPBM I-SID information

Use the following procedure to display the SPBM Service Instance Identifier (I-SID) information. The SPBM B-MAC header includes an I-SID with a length of 24 bits. This I-SID can be used to identify and transmit any virtualized traffic in an encapsulated SPBM frame.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
2. Click **SPBM**.
3. Click the **I-SID** tab.

---

## I-SID field descriptions

Use the data in the following table to use the **I-SID** tab.

| Name                    | Description                                                                                                 |
|-------------------------|-------------------------------------------------------------------------------------------------------------|
| <b>SysId</b>            | Indicates the system identifier.                                                                            |
| <b>Vlan</b>             | Indicates the B-VLAN where this I-SID was configured or discovered.                                         |
| <b>McastDestMacAddr</b> | Indicates the multicast destination MAC address based on the NickName and I-SID to build the Multicast-FIB. |
| <b>Isid</b>             | Indicates the IS-IS SPBM I-SID identifier.                                                                  |
| <b>NickName</b>         | Indicates the nickname of the node where this I-SID was configured or discovered.                           |

| Name            | Description                                                                                       |
|-----------------|---------------------------------------------------------------------------------------------------|
| <b>HostName</b> | Indicates the host name listed in the LSP, or the system name if the host name is not configured. |
| <b>Type</b>     | Indicates the SPBM I-SID type; either configured or discovered.                                   |

---

## Displaying Level 1 Area information

Use the following procedure to display Level 1 area information. IS-IS provides support for hierarchical routing, which enables you to partition large routing domains into smaller areas. IS-IS uses a two-level hierarchy, dividing the domain into multiple Level 1 areas and one Level 2 area. The Level 2 area serves as backbone of the domain, connecting to all the Level 1 areas.

### Important:

The IEEE 802.1aq standard currently only defines the use of one hierarchy, Level 1. Level 2 function is disabled in the current release.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
  2. Click **IS-IS**.
  3. Click the **L1 Area** tab.
- 

---

## L1 Area field descriptions

Use the data in the following table to use the **L1 Area** tab.

| Name            | Description                                                                                                                 |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>AreaAddr</b> | Specifies an area address reported in a Level 1 link-state packets (LSP) generated or received by this Intermediate System. |

---

## Enabling or disabling SPBM globally

Use the following procedure to enable or disable SPBM at the global level. SPBM uses the Intermediate-System-to-Intermediate-System (IS-IS) link state routing protocol to provide a

loop free Ethernet topology that creates a shortest path topology from every node to every other node in the network based on node MAC addresses.

**Procedure**

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
2. Click **SPBM**.
3. Click the **Globals** tab.
4. To enable or disable SPBM, click **enable** or **disable** in the **GlobalEnable** field.
5. To configure the global ethertype value, click the desired option in the **GlobalEtherType** field.
6. Click **Apply**.

## Globals field descriptions

Use the data in the following table to use the **Globals** tab.

| Name                   | Description                                                                            |
|------------------------|----------------------------------------------------------------------------------------|
| <b>GlobalEnable</b>    | Enables or disables SPBM globally. The default is disabled.                            |
| <b>GlobalEtherType</b> | Specifies the global ethertype value as 0x8100 or 0x88a8. The default value is 0x8100. |

## Configuring SPBM parameters

Use the following procedure to configure SPBM global parameters. SPBM uses the Intermediate-System-to-Intermediate-System (IS-IS) link state routing protocol to provide a loop free Ethernet topology that creates a shortest path topology from every node to every other node in the network based on node MAC addresses.

**Procedure**

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
2. Click **SPBM**.
3. Click the **SPBM** tab.
4. To create an SPBM instance, click **Insert**.

5. Configure the SPBM parameters.
  6. Click **Apply**.
- 

---

## SPBM field descriptions

Use the data in the following table to use the **SPBM** tab.

| Name                | Description                                                                                            |
|---------------------|--------------------------------------------------------------------------------------------------------|
| <b>Id</b>           | Specifies the SPBM instance ID. In this release, only one SPBM instance is supported.                  |
| <b>NodeNickName</b> | Specifies a nickname for the SPBM instance globally. Valid value is 2.5 bytes in the format <x.xx.xx>. |
| <b>PrimaryVlan</b>  | Specifies the primary SPBM B-VLANs to add to the SPBM instance.                                        |
| <b>Vlans</b>        | Specifies the SPBM B-VLANs to add to the SPBM instance.                                                |
| <b>LsdbTrap</b>     | Configures whether to enable or disable a trap when the SPBM LSDB changes. The default is disable.     |

---

## Displaying SPBM nicknames

Use the following procedure to display SPBM nicknames.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
  2. Click **SPBM**.
  3. Click the **Nick Names** tab.
-

---

## Nickname field descriptions

Use the data in the following table to use the **NickName** tab.

| Name                  | Description                                                                                      |
|-----------------------|--------------------------------------------------------------------------------------------------|
| <b>Level</b>          | Indicates the level at which this LSP appears.                                                   |
| <b>ID</b>             | Indicates the 8 byte LSP ID, consisting of the SystemID, Circuit ID, and Fragment Number.        |
| <b>LifetimeRemain</b> | Indicates the remaining lifetime in seconds for the LSP.                                         |
| <b>NickName</b>       | Indicates the nickname for the SPBM node.                                                        |
| <b>HostName</b>       | Indicates the hostname listed in the LSP, or the system name if the host name is not configured. |

---

## Configuring interface SPBM parameters

Use the following procedure to configure SPBM interface parameters.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
  2. Click **SPBM**.
  3. Click the **Interface SPBM** tab.
  4. Configure the SPBM interface parameters.
  5. Click **Apply**.
- 

---

## Interface SPBM field descriptions

Use the data in the following table to use the **Interface SPBM** tab.

| Name          | Description                                      |
|---------------|--------------------------------------------------|
| <b>Index</b>  | Specifies an Index value for the SPBM interface. |
| <b>SpbmId</b> | Specifies an ID value for the SPBM interface.    |



| Name                | Description                                                                                                                                                                                          |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>State</b>        | Specifies whether the SPBM interface is enabled or disabled.                                                                                                                                         |
| <b>Type</b>         | Configures the SPBM instance interface-type on the IS-IS interface located on the specified port or MLT: ptpt or bcast. In this release, only the point-to-point (ptpt) interface type is supported. |
| <b>WideL1Metric</b> | Configures the SPBM instance l1-metric on the IS-IS interface located on the specified port or MLT. The default value is 10.                                                                         |

---

## Configuring SPBM on an interface

Use the following procedure to configure SPBM on an interface.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
  2. Click **IS-IS**.
  3. Click the **Interfaces** tab.
  4. Click the **SPBM** button.
  5. In the **Interfaces SPBM** tab, click **Insert**.
  6. Click **Insert**.
- 

---

## Interface SPBM field descriptions

Use the data in the following table to use the **Interfaces SPBM** tab.

| Name         | Description                                                                                                 |
|--------------|-------------------------------------------------------------------------------------------------------------|
| <b>Index</b> | Specifies an Index value for the SPBM interface.                                                            |
| <b>Id</b>    | Specifies the SPBM instance ID.                                                                             |
| <b>State</b> | Specifies whether the SPBM interface is enabled or disabled. The default is disabled.                       |
| <b>Type</b>  | Configures the SPBM instance interface-type on the IS-IS interface located on the specified port or MLT. In |

| Name                | Description                                                                                                                  |
|---------------------|------------------------------------------------------------------------------------------------------------------------------|
|                     | this release, only the pt-pt interface type is supported. The default is pt-pt.                                              |
| <b>WideL1Metric</b> | Configures the SPBM instance I1-metric on the IS-IS interface located on the specified port or MLT. The default value is 10. |

---

## Displaying the unicast FIB

Use the following procedure to display the unicast FIB.

In SPBM, B-MAC addresses are carried within the IS-IS link-state database. SPBM supports an IS-IS TLV that advertises the I-SID and B-MAC information across the network. Each node has a System ID, which also serves as Backbone MAC address (B-MAC) of the switch. The Backbone MAC addresses are populated into the SPBM VLAN Forwarding Information Base (FIB).

When the network topology is discovered and stored in the IS-IS link-state database, each node calculates shortest path trees for each source node. A unicast path now exists from every node to every other node. With this information, each node populates unicast information received from SPBM into the FIB for forwarding purposes.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
2. Click **SPBM**.
3. Click the **Unicast FIB** tab.

---

## Unicast FIB field descriptions

Use the data in the following table to use the **Unicast FIB** tab.

| Name                      | Description                                                                 |
|---------------------------|-----------------------------------------------------------------------------|
| <b>SysId</b>              | Specifies the system ID of the node where the unicast FIB entry originated. |
| <b>Vlan</b>               | Specifies the VLAN of the unicast FIB entry.                                |
| <b>DestinationMacAddr</b> | Specifies the destination MAC Address of the unicast FIB entry.             |

| Name                | Description                                                             |
|---------------------|-------------------------------------------------------------------------|
| <b>OutgoingPort</b> | Specifies the outgoing port of the unicast FIB entry.                   |
| <b>HostName</b>     | Specifies the host name of the node where unicast FIB entry originated. |
| <b>Cost</b>         | Specifies the cost of the unicast FIB entry.                            |

---

## Displaying the multicast FIB

Use the following procedure to display the multicast FIB.

In SPBM, B-MAC addresses are carried within the IS-IS link-state database. SPBM supports an IS-IS TLV that advertises the I-SID and B-MAC information across the network. Each node has a System ID, which also serves as Backbone MAC address (B-MAC) of the switch. The B-MAC addresses are populated into the SPBM VLAN Forwarding Information Base (FIB).

When the network topology is discovered and stored in the IS-IS link-state database, each node calculates shortest path trees for each source node. A unicast path now exists from every node to every other node. With this information, each node populates unicast information received from SPBM into the FIB for forwarding purposes.

The multicast FIB is not produced until virtual services are configured and learned.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
2. Click **SPBM**.
3. Click the **Multicast FIB** tab.

---

## Multicast FIB field descriptions

Use the data in the following table to use the **Multicast FIB** tab.

| Name                    | Description                                                     |
|-------------------------|-----------------------------------------------------------------|
| <b>SysId</b>            | System ID of the node where the multicast FIB entry originated. |
| <b>Vlan</b>             | VLAN of the multicast FIB entry.                                |
| <b>McastDestMacAddr</b> | Multicast destination MAC Address of the multicast FIB entry    |

| Name                 | Description                                                     |
|----------------------|-----------------------------------------------------------------|
| <b>Isid</b>          | I-SID of the multicast FIB entry.                               |
| <b>OutgoingPorts</b> | NNI port of the multicast FIB entry.                            |
| <b>HostName</b>      | Host name of the node where the multicast FIB entry originated. |

---

## Displaying LSP summary information

Use the following procedure to display link-state packet (LSP) summary information. Link State Packets (LSP) contain information about the state of adjacencies or defined and distributed static routes. Intermediate System to Intermediate System (IS-IS) exchanges this information with neighboring IS-IS routers at periodic intervals.

### Procedure

1. From the navigation tree, choose **Configuration > IS-IS**.
2. Click **IS-IS**.
3. Click the **LSP Summary** tab.

---

## LSP Summary field descriptions

Use the data in the following table to use the **LSP Summary** tab.

| Name                  | Description                                                                               |
|-----------------------|-------------------------------------------------------------------------------------------|
| <b>Level</b>          | Specifies the level at which this LSP appears.                                            |
| <b>ID</b>             | Specifies the 8 byte LSP ID, consisting of the SystemID, Circuit ID, and Fragment Number. |
| <b>Seq</b>            | Specifies the sequence number for this LSP.                                               |
| <b>Checksum</b>       | Specifies the 16 bit Fletcher Checksum for this LSP.                                      |
| <b>LifetimeRemain</b> | The remaining lifetime in seconds for this LSP.                                           |
| <b>HostName</b>       | The hostname listed in LSP, or the system name if host name is not configured.            |

---

## Displaying IS-IS adjacencies

Use the following procedure to display IS-IS adjacency information. The platform sends IS-IS Hello (IIH) packets to discover IS-IS neighbors and establish and maintain IS-IS adjacencies. The platform continues to send IIH packets to maintain the established adjacencies. For two nodes to form an adjacency the B-VLAN pairs for the primary B-VLAN and secondary B-VLAN must match.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
  2. Click **IS-IS**.
  3. Click the **Adjacency** tab.
- 

---

## Adjacency field descriptions

Use the data in the following table to use the **Adjacency** tab.

| Name              | Description                                                                                                                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CirclIndex</b> |                                                                                                                                                                                                                                 |
| <b>Index</b>      | A unique value identifying the IS adjacency from all other such adjacencies on this circuit. This value is automatically assigned by the system when the adjacency is created.                                                  |
| <b>IfIndex</b>    | Specifies the IS-IS interface on which the adjacency is found.                                                                                                                                                                  |
| <b>Usage</b>      | Specifies how the adjacency is used. On a point-to-point link, this can be level 1 and 2. But on a LAN, the usage is level 1 on the adjacency between peers at level 1, and level 2 for the adjacency between peers at level 2. |
| <b>State</b>      | Specifies the state of the adjacency: <ul style="list-style-type: none"> <li>• down</li> <li>• initializing</li> <li>• up</li> <li>• failed</li> </ul>                                                                          |

| Name                 | Description                                                                                                                                                                                                                                       |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LastUpTime</b>    | Indicates when the adjacency most recently entered the state <b>up</b> , measured in hundredths of a second since the last re-initialization of the network management subsystem. Displays 0 if the adjacency has never been in state <b>up</b> . |
| <b>NeighPriority</b> | Specifies the priority of the neighboring Intermediate System for becoming the Designated Intermediate System.                                                                                                                                    |
| <b>HoldTimer</b>     | Specifies the holding time in seconds for this adjacency. This value is based on received IS-IS Hello (IIH) PDUs and the elapsed time since receipt.                                                                                              |
| <b>NeighSysID</b>    | Specifies the system ID of the neighboring Intermediate System.                                                                                                                                                                                   |
| <b>HostName</b>      | Specifies the host name listed in the LSP, or the system name if host name is not configured.                                                                                                                                                     |

---

## Configuring IS-IS globally

Use the following procedure to configure IS-IS global parameters. SPBM uses IS-IS to discover network topology, build shortest path trees between network nodes, and communicate network information in the control plane.

### Procedure



1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
  2. Click **IS-IS**.
  3. From the **Globals** tab, configure the global IS-IS parameters.
  4. Click **Apply**.
- 

---

## Globals field descriptions

Use the data in the following table to use the **Globals** tab.

| Name              | Description                                                                        |
|-------------------|------------------------------------------------------------------------------------|
| <b>AdminState</b> | Specifies the global status of IS-IS on the switch: on or off. The default is off. |

| Name                | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LevelType</b>    | Sets the router type globally: <ul style="list-style-type: none"> <li>• level1 — Level-1 router type</li> <li>• level2 — Level-2 router type</li> <li>• Level1and2 — Level-1 and Level-2 router type</li> </ul> <p> <b>Note:</b><br/>level2 and level1and2 is not supported in this release.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>ID</b>           | Specifies the IS-IS system ID for the switch. Valid value is a 6-byte value in the format <xxxx.xxxx.xxxx>. <p> <b>Important:</b><br/>After you configure the SPBM nickname and enable IS-IS, if you require a change of the system ID, you must also change the nickname. However, for naming convention purposes or configuration purposes, you might not want to change the nickname. To maintain the same nickname with a different system ID, perform the following steps:</p> <ol style="list-style-type: none"> <li>1. Disable IS-IS.</li> <li>2. Change the system ID.</li> <li>3. Change the nickname to a temporary one.</li> <li>4. Enable IS-IS.</li> <li>5. Disable IS-IS.</li> <li>6. Change the nickname to the original nickname.</li> <li>7. Enable IS-IS.</li> </ol> |
| <b>MaxLSPGenInt</b> | Specifies the maximum interval, in seconds, between generated LSPs by this Intermediate system. The value must be greater than any value configured for RxmtLspInt.<br>The default value is 900 seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Csnplnt</b>      | Specifies the Complete Sequence Number Packet (CSNP) interval in seconds. This is a system level parameter that applies for L1 CSNP generation on all interfaces.<br>The default value is 10.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>RxmtLspInt</b>   | Specifies the minimum time between retransmission of an LSP. This defines how fast the switch resends the same LSP. This is a system level parameter that applies for L1 retransmission of LSPs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

| Name                | Description                                                                                                                                                                                                            |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | The default value is 5 seconds.                                                                                                                                                                                        |
| <b>PSNPInterval</b> | Specifies the Partial Sequence Number Packet (PSNP) interval in seconds. This is a system level parameter that applies for L1 PSNP generation on all interfaces.<br>The default value is 2.                            |
| <b>SpfDelay</b>     | Specifies the SPF delay in milliseconds. This value is used to pace successive SPF runs. The timer prevents two SPF runs from being scheduled very closely.<br>The default value is 100 milliseconds.                  |
| <b>HostName</b>     | Specifies a name for the system. This may be used as the host name for dynamic host name exchange in accordance with RFC 2763.<br>By default, the system name comes from the host name configured at the system level. |

---

## Configuring system level IS-IS parameters

Use the following procedure to configure system-level IS-IS parameters.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > IS-IS > IS-IS**.
2. Click the **System Level** tab.
3. Configure the IS-IS system level parameters.
4. Click **Apply**.

---

## System Level field descriptions

Use the data in the following table to use the **System Level** tab.

| Name         | Description                                                                                                          |
|--------------|----------------------------------------------------------------------------------------------------------------------|
| <b>Index</b> | Specifies the level: I1 or I2.<br>In this release, only I1 is supported.                                             |
| <b>State</b> | Specifies the state of the database at this level. The value 'off' indicates that IS-IS is not active at this level. |



| Name                | Description                                                                                                                                                                                                                                                                                                                                                                |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | The value 'on' indicates that IS-IS is active at this level, and not overloaded. The value 'waiting' indicates a database that is low on an essential resources, such as memory. The administrator may force the state to 'overloaded' by setting the object <b>SetOverload</b> . If the state is 'waiting' or 'overloaded', you originate LSPs with the Overload bit set. |
| <b>MinLSPGenInt</b> | Specifies the minimum time between successive generation of LSPs with the same LSPID. This a system level parameter that applies to both L1 and L2 LSP generation.<br>The default value is 30 seconds.                                                                                                                                                                     |
| <b>MetricStyle</b>  | Specifies the IS-IS metric type. Available values are narrow, wide or both. Only wide is supported in this release.                                                                                                                                                                                                                                                        |

---

## Configuring IS-IS interfaces

Use the following procedure to configure IS-IS interfaces. SPBM uses IS-IS to discover network topology, build shortest path trees between network nodes, and communicate network information in the control plane.

### Procedure


1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
  2. Click **IS-IS**.
  3. Click the **Interfaces** tab.
  4. Configure the IS-IS interface parameters.
  5. Click **Apply**.
- 

---

## Interfaces field descriptions

Use the data in the following table to use the **Interfaces** tab.

| Name         | Description                                                                                            |
|--------------|--------------------------------------------------------------------------------------------------------|
| <b>Index</b> | The identifier of this circuit, unique within the Intermediate System. This value is for SNMP Indexing |

| Name              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   | purposes only and need not have any relation to any protocol value.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>IfIndex</b>    | Specifies the interface on which the circuit is configured (port or MLT).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Type</b>       | Specifies the IS-IS circuit type. In this release, only the point-to-point (PtToPt) interface type is supported.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>AdminState</b> | Specifies the administrative state of the circuit: on or off.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>OperState</b>  | Specifies the operational state of the circuit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>AuthType</b>   | <p>Specifies the authentication type:</p> <ul style="list-style-type: none"> <li>• none</li> <li>• simple: If selected, you must also specify a key value but the key id is optional. Simple password authentication uses a text password in the transmitted packet. The receiving router uses an authentication key (password) to verify the packet.</li> <li>• hmac-md5: hmac-md5: If selected, you must also specify a key value but the key-id is optional. MD5 authentication creates an encoded checksum in the transmitted packet. The receiving router uses an authentication key (password) to verify the MD5 checksum of the packet. There is an optional key ID.</li> </ul> <p>The default is none.</p> |
| <b>AuthKey</b>    | Specifies the authentication key.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>KeyId</b>      | Specifies the authentication key ID.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>LevelType</b>  | <p>Sets the router type globally:</p> <ul style="list-style-type: none"> <li>• level1 — Level-1 router type</li> <li>• level2 — Level-2 router type</li> <li>• Level1and2 — Level-1 and Level-2 router type</li> </ul> <p> <b>Note:</b><br/>level2 and level1and2 is not supported in this release.</p>                                                                                                                                                                                                                                                                                                                         |
| <b>NumAdj</b>     | Specifies the number of adjacencies on this circuit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>NumUpAdj</b>   | Specifies the number of adjacencies that are up.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## Configuring IS-IS interface level parameters


Use the following procedure to configure IS-IS interface level parameters. SPBM uses IS-IS to discover network topology, build shortest path trees between network nodes, and communicate network information in the control plane.

### Procedure

1. From the navigation tree, choose **Configuration > IS-IS**.
2. Click **IS-IS**.
3. Click the **Interfaces Level** tab.
4. Configure the IS-IS interface level parameters.
5. Click **Apply**.

## Interfaces Level field descriptions

Use the data in the following table to use the **Interfaces Level** tab.

| Name              | Description                                                                                                                                                                                                                                                           |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Index</b>      | Indicates the identifier of the circuit, unique within the Intermediate System. This value is for SNMP Indexing purposes only and does not have any relation to any protocol value.                                                                                   |
| <b>LevelIndex</b> | Specifies the router type globally: <ul style="list-style-type: none"> <li>• I1: Level1 router type</li> <li>• I12: Level1/Level2 router type. Not supported in this release.</li> </ul> The default value is I1.                                                     |
| <b>ISPriority</b> | Specifies an integer sub-range for IS-IS priority. Range of 0–127. The default is 0 for SPBM interfaces. <p> <b>Note:</b><br/>ISPriority only applies to broadcast interfaces.</p> |
| <b>HelloTimer</b> | Specifies the level 1 hello interval. Specifies the maximum period, in seconds, between IS-IS Hello Packets (IIH) PDUs on multiaccess networks at this level for LANs. The value at Level1 is                                                                         |

| Name                   | Description                                                                                                                                                                                                                    |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | used as the period between Hellos on Level1/Level2 point to point circuits. Setting this value at Level 2 on an Level1/Level2 point-to-point circuit results in an error of InconsistentValue. The default value is 9 seconds. |
| <b>HelloMultiplier</b> | Specifies the level 1 hello multiplier. The default value is 3 seconds.                                                                                                                                                        |
| <b>DRHelloTimer</b>    | Specifies the period, in seconds, between Hello PDUs on multiaccess networks when this Intermediate System is the Designated Intermediate System. The default is 3 seconds.                                                    |

---

## Configuring an IS-IS Manual Area

Use the following procedure to configure an IS-IS manual area.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
2. Click **IS-IS**.
3. Click the **Manual Area** tab.
4. Click **Insert**.
5. Specify an Area Address in the **AreaAddr** field, and click **Insert**.

---

## Manual Area field descriptions

Use the data in the following table to use the **Manual Area** tab.

| Name            | Description                                                                                                                                                                                                            |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AreaAddr</b> | Specifies the IS-IS manual area. Valid value is 1-13 bytes in the format <xx.xxxx.xxxx...xxxx>. In this release, only one manual area is supported. For IS-IS to operate, you must configure at least one manual area. |

---

## Displaying IS-IS system statistics

Use the following procedure to display Intermediate-System-to-Intermediate-System (IS-IS) system statistics.

### Procedure

1. In the navigation tree, choose **Configuration > IS-IS**.
  2. Click **Stats**.
  3. Click the **System Stats** tab.
- 

---

## System Stats field descriptions

Use the data in the following table to use the **System Stats** tab.

| Name                        | Description                                                                                                                                                           |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CorrLSPs</b>             | Indicates the number of corrupted in-memory link-state packets (LSPs) detected. LSPs received from the wire with a bad checksum are silently dropped and not counted. |
| <b>AuthFails</b>            | Indicates the number of authentication key failures recognized by this Intermediate System.                                                                           |
| <b>LSPDbaseOloads</b>       | Indicates the number of times the LSP database has become overloaded.                                                                                                 |
| <b>ManAddrDropFromAreas</b> | Indicates the number of times a manual address has been dropped from the area.                                                                                        |
| <b>AttmptToExMaxSeqNums</b> | Indicates the number of times the IS has attempted to exceed the maximum sequence number.                                                                             |
| <b>SeqNumSkips</b>          | Indicates the number of times a sequence number skip has occurred.                                                                                                    |
| <b>OwnLSPPurges</b>         | Indicates the number of times a zero-aged copy of the system's own LSP is received from some other node.                                                              |
| <b>IDFieldLenMismatches</b> | Indicates the number of times a PDU is received with a different value for ID field length to that of the receiving system.                                           |
| <b>PartChanges</b>          | Indicates partition changes.                                                                                                                                          |

| Name                 | Description                                              |
|----------------------|----------------------------------------------------------|
| <b>AbsoluteValue</b> | Displays the counter value.                              |
| <b>Cumulative</b>    | Displays the total value since you opened the Stats tab. |
| <b>Average/sec</b>   | Displays the average value for each second.              |
| <b>Minimum/sec</b>   | Displays the minimum value for each second.              |
| <b>Maximum/sec</b>   | Displays the maximum value for each second.              |
| <b>LastVal/sec</b>   | Displays the last value for each second.                 |

---

## Displaying IS-IS interface counters

Use the following procedure to display IS-IS interface counters.

### Procedure

1. From the navigation tree, choose **Configuration > IS-IS**.
2. Click **Stats**.
3. Click the **Interface Counters** tab.

---

## Interface Counters field descriptions

Use the data in the following table to use the **Interface Counters** tab.

| Name              | Description                                                                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Index</b>      | Shows a unique value identifying the IS-IS interface.                                                                                                                           |
| <b>uitType</b>    |                                                                                                                                                                                 |
| <b>AdjChanges</b> | Shows the number of times an adjacency state change has occurred on this circuit.                                                                                               |
| <b>InitFails</b>  | Shows the number of times initialization of this circuit has failed. This counts events such as PPP NCP failures. Failures to form an adjacency are counted by isisCircRejAdjs. |
| <b>RejAdjs</b>    | Shows the number of times an adjacency has been rejected on this circuit.                                                                                                       |

| Name                         | Description                                                                                                                                  |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>IDFieldLenMismatches</b>  | Shows the number of times an IS-IS control PDU with an ID field length different to that for this system has been received.                  |
| <b>MaxAreaAddrMismatches</b> | Shows the number of times an IS-IS control PDU with a max area address field different to that for this system has been received.            |
| <b>AuthFails</b>             | Shows the number of times an IS-IS control PDU with the correct auth type has failed to pass authentication validation.                      |
| <b>LANDesISChanges</b>       | Shows the number of times the Designated IS has changed on this circuit at this level. If the circuit is point to point, this count is zero. |

---

## Displaying IS-IS interface control packets

Use the following procedure to display IS-IS interface control packets.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
2. Click **Stats**.
3. Click the **Interface Control Packets** tab.

---

## Interface Control Packets field descriptions

Use the data in the following table to use the **Interface Control Packets** tab.

| Name             | Description                                                                                        |
|------------------|----------------------------------------------------------------------------------------------------|
| <b>Index</b>     | Shows a unique value identifying the Intermediate-System-to-Intermediate-System (IS-IS) interface. |
| <b>Level</b>     | Indicates the level at which this LSP appears.                                                     |
| <b>Direction</b> | Indicates whether the switch is sending or receiving the PDUs.                                     |
| <b>IIHello</b>   | Indicates the number of IS-IS Hello frames seen in this direction at this level.                   |

| Name        | Description                                                                                                        |
|-------------|--------------------------------------------------------------------------------------------------------------------|
| <b>LSP</b>  | Indicates the number of IS-IS LSP frames seen in this direction at this level.                                     |
| <b>CSNP</b> | Indicates the number of IS-IS Complete Sequence Number Packets (CSNP) frames seen in this direction at this level. |
| <b>PSNP</b> | Indicates the number of IS-IS Partial Sequence Number Packets (PSNP) frames seen in this direction at this level.  |



# Chapter 6: Layer 2 VSN configuration fundamentals

This section provides fundamentals concepts for Layer 2 Virtual Services Networks (VSN).

---

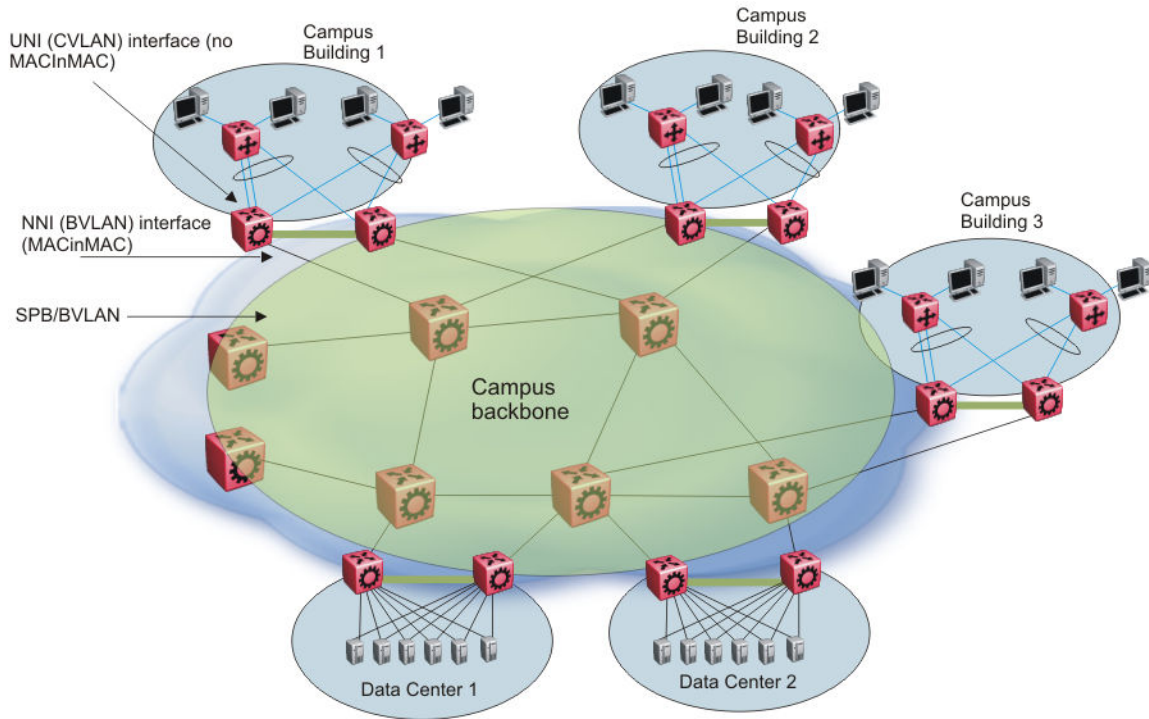
## SPBM L2 VSN

Shortest Path Bridging MAC (SPBM) supports Layer 2 VSN functionality where customer VLANs (C-VLANs) and Switched UNIs are bridged over the SPBM core infrastructure.

At the Backbone Edge Bridges (BEBs), customer VLANs (C-VLAN) and Switched UNIs are mapped to I-SIDs based on the local service provisioning. Outgoing frames are encapsulated in a MAC-in-MAC header, and then forwarded across the core to the far-end BEB, which strips off the encapsulation and forwards the frame to the destination network based on the I-SID to C-VLAN or I-SID to Switched UNI provisioning.

In the backbone VLAN (B-VLAN), Backbone Core Bridges (BCBs) forward the encapsulated traffic based on the B-MAC-DA, using the shortest path topology learned using IS-IS.

The following figure shows a sample campus SPBM Layer 2 VSN network.



**Figure 3: SPBM L2 VSN in a campus**

One of the key advantages of the SPBM Layer 2 VSN is that you can achieve network virtualization provisioning by configuring only the edge of the network (BEBs). As a result, the intrusive core provisioning that other Layer 2 virtualization technologies require is not needed when you add connectivity services to the SPBM network. For example, when you create new virtual server instances that require their own VLAN instances, you can provision at the network edge only and do not need configure throughout the rest of the network infrastructure.

Based on its I-SID scalability, this solution can scale much higher than any 802.1Q tagging based solution. Also, due to the fact that there is no need for Spanning Tree in the core, this solution does not need any core link provisioning for normal operation.

### **C-VLAN UNI**

C-VLAN UNIs are created by the association of VLANs to I-SIDs. A VLAN with an I-SID configured becomes a C-VLAN. All ingress traffic of the VLAN from any member ports belong to the configured I-SID. C-MAC learning occurs inside the I-SID, on both UNI and NNI side (C-MAC + I-SID pointing to UNI port from the UNI side traffic, or C-MAC + I-SID pointing to a remote SPBM node - where the source C-MAC is connected).

Broadcast, unknown multicast and unknown unicast traffic in the I-SID is replicated to all local I-SID endpoints, including all C-VLAN member ports along with switched UNIs, and to all remote endpoints carried by the I-SID's multicast group. For UNI originated broadcast traffic, the originating endpoint is excluded from flooding, and the ingress port for broadcast traffic coming in on an NNI is excluded from flooding.

## Switched UNI

Switched UNI allows association of local endpoints to I-SIDs based on local port and VLAN together. With switched UNI, the same VLAN can be used on one port to create an endpoint to one I-SID, and on another port to create an endpoint to another I-SID.

**\* Note:**

IP forwarding cannot be enabled on an ERS 4800 if SPB is enabled. The only way to manage the switch is via a Layer 2 VLAN.

If the ERS 4800 switch is connected to an SPB network that has IP Shortcuts or L3VSN enabled, you can create a management VLAN on the ERS 4800 with no port members, and assign it to an I-SID for L2 VSN terminated on an ERS 8800, VSP 9000 or VSP 4000 with the same I-SID and IP subnet.

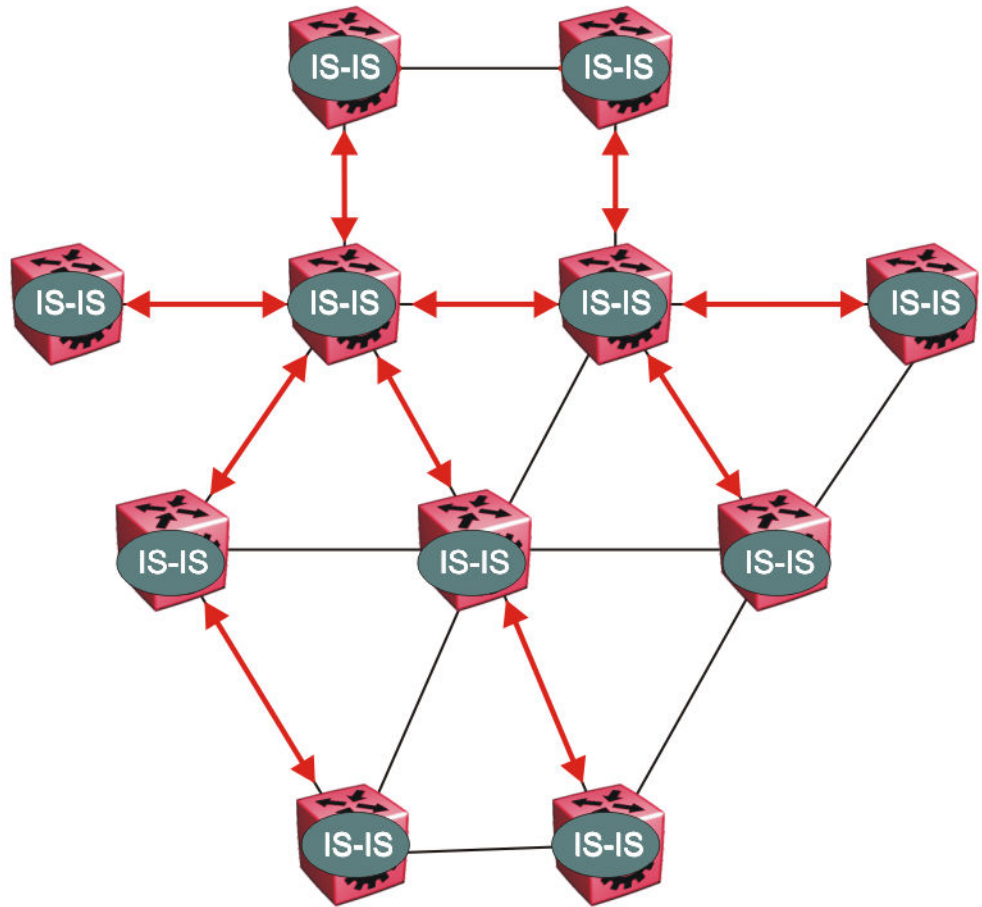
To allow IP connectivity to the ERS 4800, on the ERS 8800, VSP 9000, or VSP 4000 where the L2 VSN is configured, add an IP address to the VLAN that terminates the L2VSN.

---

## SPBM L2 VSN sample operation

The following section shows how a SPBM network is established, in this case, a Layer 2 VSN.

1. *Discover network topology*



**Figure 4: SPBM topology discover**

IS-IS runs on all nodes of the SPBM domain. IS-IS is the basis of SPBM, the IS-IS adjacency must be formed first. After the neighboring nodes see hellos from each other, the nodes look for the same Level (Level 1) and the same area (for example, Area 2f.8700.0000.00). After the hellos are confirmed both nodes send Link State Protocol Data Units, which contain connectivity information for the SPBM node. These nodes also send copies of all other LSPs they have in their databases. This establishes a network of connectivity providing the necessary information for each node to find the best and proper path to all destinations in the network.

Each node has a system ID, which is used in the topology announcement. This system ID also serves as the switch Backbone MAC address (B-MAC), which is used as the source and destination MAC address in the SPBM network.

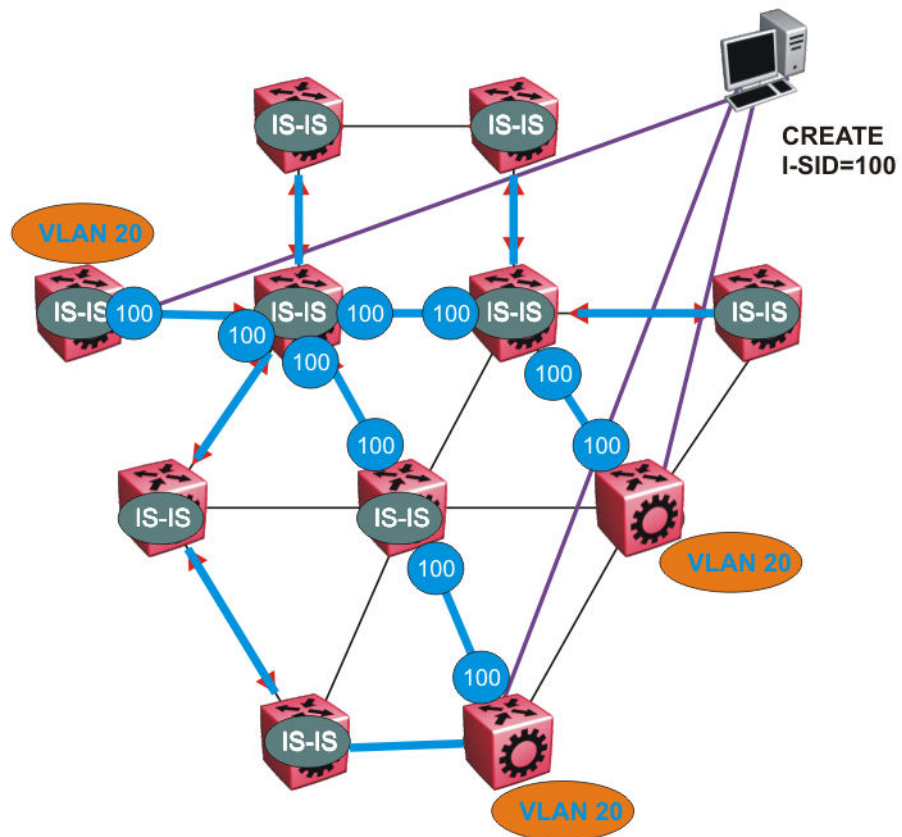
2. *Each IS-IS node automatically builds trees from itself to all other nodes*

When the network topology is discovered and stored in the IS-IS link state database (LSDB), each node calculates shortest path trees for each source node. A unicast path now exists from every node to every other node

With this information, each node populates unicast information received from SPBM into the FIB for forwarding purposes. Multicast FIB is not produced until Layer 2 VSN services are configured and learned.

### 3. IS-IS advertises new service communities of interest

When a new service is provisioned, its membership is flooded throughout the topology with an IS-IS advertisement.



**Figure 5: SPBM BMAC and I-SID population**

BMAC and I-SID information floods throughout the network to announce new I-SID memberships. In this case, VLAN 20 is mapped to I-SID 100.

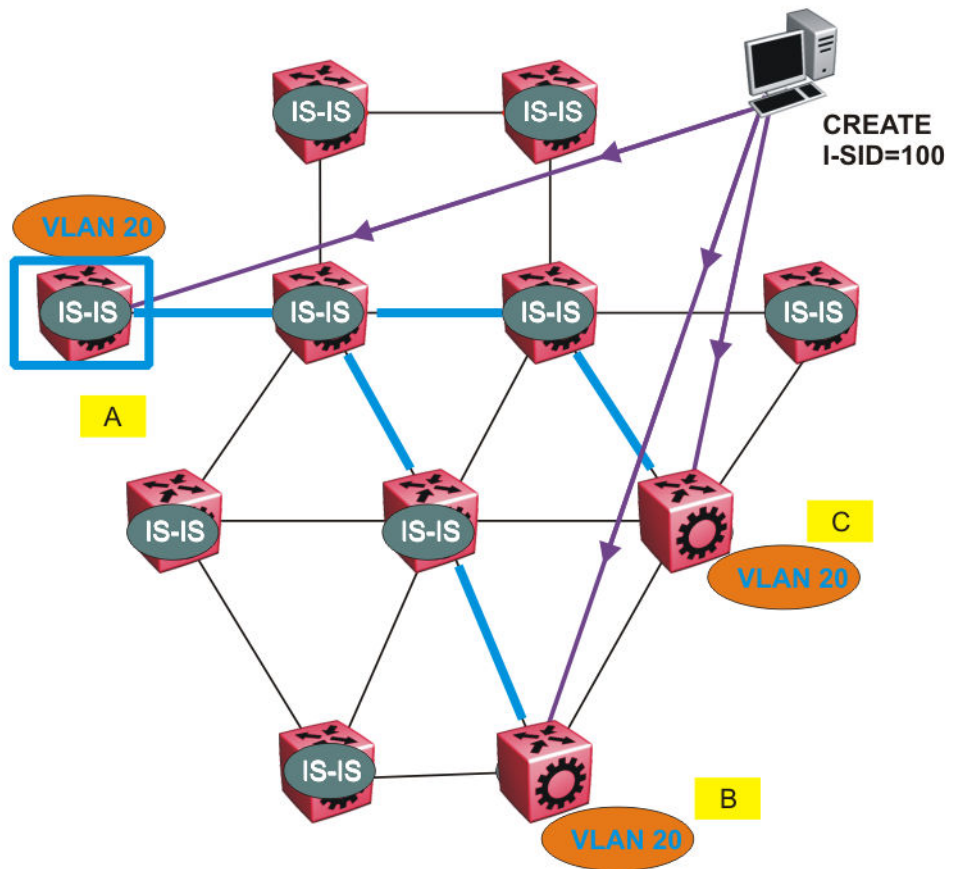
**\* Note:**

I-SIDs are only used for virtual services (Layer 2 VSNs and Layer 3 VSNs). If IP Shortcuts only is enabled on the BEBs, I-SIDs are never exchanged in the network as IP Shortcuts allow for IP networks to be transported across IS-IS.

Each node populates its FDB with the B-MAC information derived from the IS-IS shortest path tree calculations. No traditional flooding and learning mechanism in place for the B-VLAN, but FDBs are programmed by the IS-IS protocol.

4. *When a node receives notice of a new service AND is on the shortest path, it updates the FDB*

In this scenario, where there are three source nodes having a membership on I-SID 100, three shortest path trees are calculated (not counting the Equal Cost Trees (ECTs)).



**Figure 6: Shortest path tree for source node A**

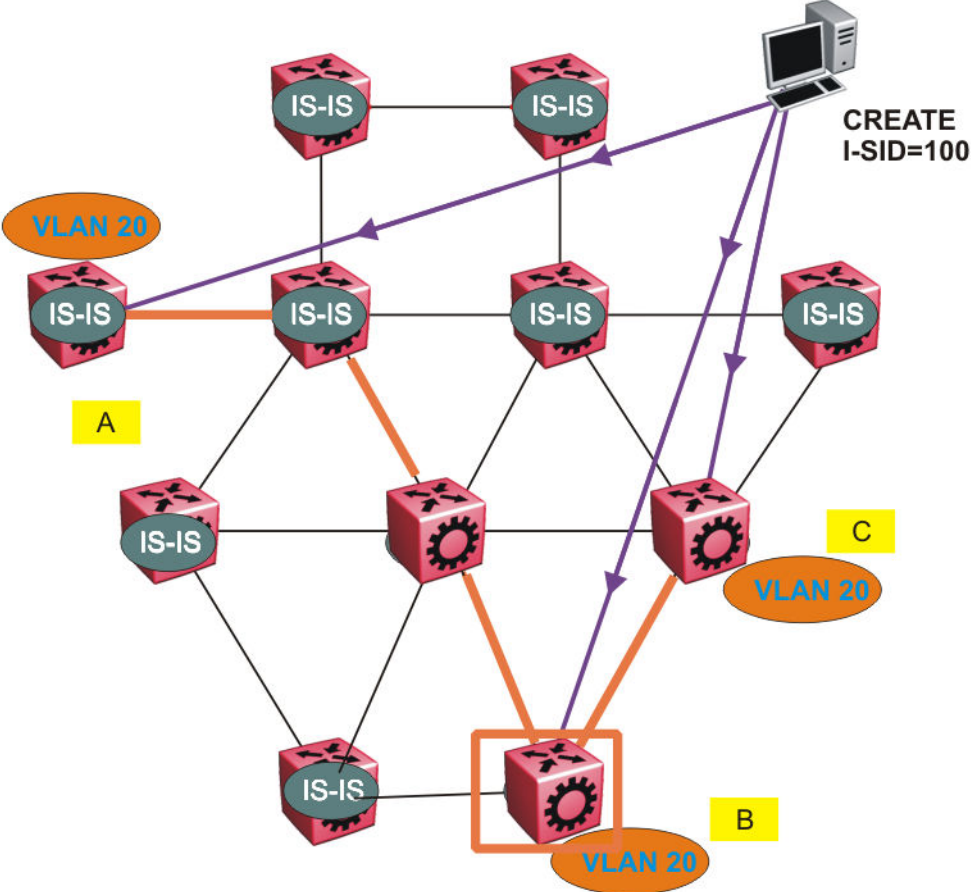
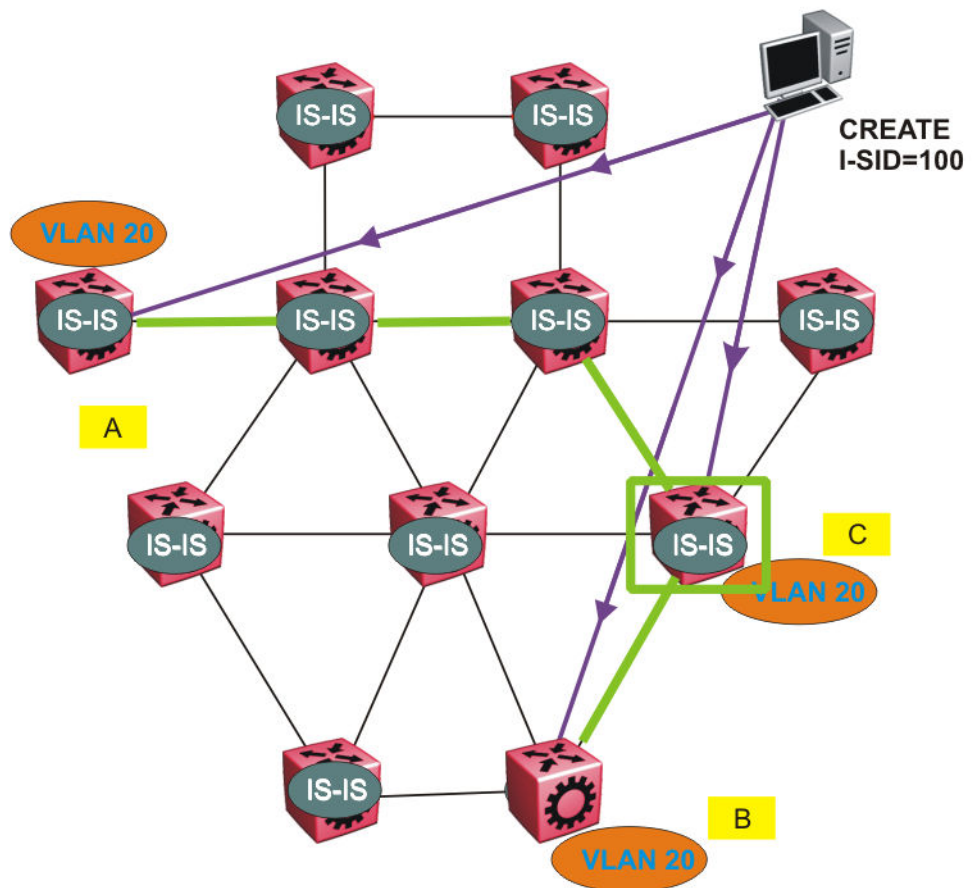


Figure 7: Shortest path tree for source node B



**Figure 8: Shortest path tree for source node C**

The paths between any two nodes are always the shortest paths. Also, the paths in either direction are congruent, therefore a bidirectional communication stream can be monitored easily by mirroring ingress and egress on a link to a network analyzer.

VLAN traffic arriving on switch A and VLAN 20 is forwarded following the blue path, traffic arriving on switch B and VLAN 20 the orange path and on switch C VLAN 20 traffic is following the green path.

If the destination CMAC is unknown at the SPBM ingress node or the traffic is of type broadcast or multicast, then the traffic is sent as a multicast destination frame, where the multicast MAC is created from the Nick-name of the source bridge and the I-SID. If the destination CMAC is already known, then the traffic is only forwarded as a unicast to the appropriate destination. In the SPBM domain, the traffic is switched on the BMAC header only. The bridge filtering database (FDB) at the VLAN to I-SID boundary (backbone edge bridge BEB), maintains a mapping between CMACs and corresponding BMACs.



For example, Switch B learns all CMACs which are on VLAN 20 connected to switch A with the BMAC of A in its FDB and the CMACs that are behind C are learned with the BMAC of C.



# Chapter 7: Layer 2 VSN configuration using ACLI

This section provides procedures to configure Layer 2 Virtual Services Networks (VSN) using Avaya Command Line Interface (ACLI).

---

## Configuring a SPBM Layer 2 VSN C-VLAN

Shortest Path Bridging MAC (SPBM) supports Layer 2 Virtual Service Network (VSN) functionality where customer VLANs (C-VLANs) are bridged over the SPBM core infrastructure.

At the BEBs, customer VLANs (C-VLAN) are mapped to I-SIDs based on the local service provisioning. Outgoing frames are encapsulated in a MAC-in-MAC header, and then forwarded across the core to the far-end BEB, which strips off the encapsulation and forwards the frame to the destination network based on the I-SID-to-C-VLAN provisioning.

### Before you begin

- You must configure the required SPBM and IS-IS infrastructure, which includes the creation of SPBM BVLANS.
- You must create the customer VLANs (C-VLANs) and add slots/ports.

### Procedure

1. Enter Global Configuration mode:  
`enable`  
`configure terminal`
2. Map a customer VLAN (C-VLAN) to a Service Instance Identifier (I-SID):  
`i-sid <1-16777214> vlan <1-4094>`
3. Display C-VLAN information:  
`show i-sid <1-16777214>`

---

### Example

```
4850GTS-PWR+> enable
4850GTS-PWR+# configure terminal
```

```
4850GTS-PWR+(config)# i-sid 200 vlan 200
```

```
4850GTS-PWR+(config)# show i-sid 200
```

| I-SID | Vid | UNI-type | Ports |
|-------|-----|----------|-------|
| 200   | 200 | C-VLAN   | 7     |

## Variable definitions

Use the data in the following table to use the `i-sid vlan` command.

| Variable                                                 | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>i-sid &lt;1-16777214&gt; vlan&lt;1-4094&gt;</code> | <p>Specifies the customer VLAN (CVLAN) to associate with the I-SID.<br/>Use the <code>no</code> or <code>default</code> options to remove the I-SID from the specified VLAN.</p> <p><b>* Note:</b><br/>Ethernet Routing Switch 4800 series reserves I-SID 0x00ffffff. ERS 4800 uses this I-SID to advertise the virtual B-MAC in a SMLT dual-homing environment. The platform clears the receive and transmit bit of this I-SID, therefore I-SID 0x00ffffff cannot be used for any other service.</p> |

## Configuring a SPBM Layer 2 VSN Switched UNI

Shortest Path Bridging MAC (SPBM) supports Layer 2 Virtual Service Network (VSN) functionality where Switched UNIs are bridged over the SPBM core infrastructure.

At the BEBs, Switched UNIs are mapped to I-SIDs based on the local service provisioning. Outgoing frames are encapsulated in a MAC-in-MAC header, and then forwarded across the core to the far-end BEB, which strips off the encapsulation and forwards the frame to the destination network based on the I-SID-to-Switched UNI VLAN provisioning.

### Before you begin

- You must configure the required SPBM and IS-IS infrastructure, which includes the creation of SPBM BVLANS.

### About this task

To configure a Switched UNI, you must create a Switched UNI VLAN, and map an I-SID to the Switched UNI VLAN and a port.

## Procedure

1. Enter Global Configuration mode:  

```
enable
configure terminal
```
2. Create a Switched UNI VLAN:  

```
vlan create <2-4094> type spbm-switchedUni
```
3. Map a Switched UNI VLAN to a Service Instance Identifier (I-SID):  

```
i-sid <1-16777214> vlan <2-4094> port <portlist>
```

**\* Note:**

You can run this command again to map a Switched UNI VLAN to multiple I-SIDs.

4. Display the Switched UNI information:  

```
show i-sid <1-16777214>
```

**\* Note:**

You can verify the Switched UNI VLAN using `show i-sid` only. The `show vlan i-sid` command does not display Switched UNI details.

## Example

```
4850GTS-PWR+> enable
4850GTS-PWR+# configure terminal
4850GTS-PWR+(config)# vlan create 100 type spbm-switchedUni
4850GTS-PWR+(config)# i-sid 100 vlan 100 port 1
4850GTS-PWR+(config)# show i-sid 100
```

| I-SID | Vid | UNI-type | Ports |
|-------|-----|----------|-------|
| 100   | 100 | switched | 1     |

You can map a Switched VLAN UNI to multiple I-SIDs.

```
4850GTS-PWR+(config)# i-sid 101 vlan 100 port 2
4850GTS-PWR+(config)# show i-sid
```

| I-SID | Vid | UNI-type | Ports |
|-------|-----|----------|-------|
| 100   | 100 | switched | 1     |
| 101   | 100 | switched | 2     |

## Variable definitions

Use the data in the following table to use the `i-sid vlan` command to configure a Switched UNI.

| Variable                                                                       | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>i-sid &lt;1-16777215&gt; vlan&lt;2-4094&gt; port &lt;portlist&gt;</code> | <p>Specifies the Switched UNI VLAN to associate with the I-SID, and a port.<br/>Use the <code>no</code> or <code>default</code> options to remove the I-SID from the specified VLAN.</p> <p><b>* Note:</b><br/>Avaya Ethernet Routing Switch 4800 series reserves I-SID 0x00ffffff. ERS 4800 uses this I-SID to advertise the virtual B-MAC in a SMLT dual-homing environment. The platform clears the receive and transmit bit of this I-SID, therefore I-SID 0x00ffffff cannot be used for any other service.</p> |

## Displaying C-VLAN and Switched UNI I-SID information

Use the following procedure to display C-VLAN I-SID information.

### Procedure

1. Enter Privileged EXEC mode:  
`enable`
2. Display the C-VLAN to I-SID associations:  
`show vlan i-sid <1-4094>`
3. Display I-SID information and Switched UNI to I-SID associations:  
`show i-sid <1-16777215>`
4. Display the IS-IS SPBM multicast-FIB calculation results by I-SID:  
`show isis spbm i-sid {all|config|discover} [vlan <1-4094>]  
[id <1-16777215>] [nick-name <x.xx.xx>]`

### Example

```
4850GTS-PWR+#show vlan i-sid
=====
 Vlan I-SID
=====
VLAN_ID I-SID
```

```

1
2
5 5
10
20

4850GTS-PWR+#show i-sid
I-SID Vid UNI-type Ports

5 5 CVLAN 4
100 100 switched 1

4850GTS-PWR+#show isis spbm i-sid all
=====
 SPBM ISID INFO
=====
ISID SOURCE NAME VLAN SYSID TYPE HOST_NAME

200 1.11.16 1000 0014.c7e1.33df config ERS-4000
300 1.11.16 1000 0014.c7e1.33df config ERS-4000
400 1.11.16 1000 0014.c7e1.33df config ERS-4000
200 1.11.16 2000 0014.c7e1.33df config ERS-4000
300 1.11.16 2000 0014.c7e1.33df config ERS-4000
400 1.11.16 2000 0014.c7e1.33df config ERS-4000
200 1.12.45 1000 0016.ca23.73df discover VSP-9001
300 1.12.45 1000 0016.ca23.73df discover VSP-9001

Total number of SPBM ISID entries configed: 6

Total number of SPBM ISID entries discovered: 2

Total number of SPBM ISID entries: 8

```

## Variable definitions

Use the data in the following table to use the **show vlan i-sid** commands.

| Variable             | Value                                                                                          |
|----------------------|------------------------------------------------------------------------------------------------|
| <1-4094><1-16777215> | Displays I-SID information for the specified C-VLAN. You can specify the VLAN ID and I-SID ID. |

Use the data in the following table to use the **show i-sid** commands

| Variable     | Value                                                     |
|--------------|-----------------------------------------------------------|
| <1-16777215> | Displays I-SID information. You can specify the I-SID ID. |

Use the data in the following table to use the **show isis** commands.

| Variable                         | Value                                                                                                                                                                                           |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| spbm i-sid {all config discover} | <ul style="list-style-type: none"> <li>• all: displays all I-SID entries</li> <li>• config: displays configured I-SID entries</li> <li>• discover: displays discovered I-SID entries</li> </ul> |
| vlan <1–4094>                    | Displays I-SID information for the specified SPBM VLAN.                                                                                                                                         |
| id <1–16777215>                  | Displays I-SID information for the specified I-SID.                                                                                                                                             |
| nick-name <x.xx.xx>              | Displays I-SID information for the specified nickname.                                                                                                                                          |

## Job aid

The following sections describe the fields in the outputs for the C-VLAN I-SID show commands.

### show vlan i-sid

The following table describes the fields in the output for the `show vlan i-sid` command.

| Parameter | Description                                                 |
|-----------|-------------------------------------------------------------|
| VLAN_ID   | Indicates the VLAN IDs.                                     |
| I-SID     | Indicates the I-SIDs associated with the specified C-VLANs. |

### show i-sid


The following table describes the fields in the output for the `show i-sid` command.

| Parameter | Description                                                    |
|-----------|----------------------------------------------------------------|
| I-SID     | Indicates the I-SID IDs.                                       |
| Vid       | Indicates the VLAN IDs.                                        |
| UNI-type  | Indicates the UNI-type as CVLAN or Switched                    |
| Ports     | Indicates ports associated with the specific I-SIDs and VLANs. |

### show isis spbm i-sid

The following describes the fields in the output for the `show isis spbm i-sid` command.



| Parameter                      | Description                                                                                                                                                                                                                        |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ISID {all   discover   config} | Indicates the IS-IS SPBM I-SID identifier. <ul style="list-style-type: none"> <li>• all: display all SPBM I-SID</li> <li>• discover: display discovered SPBM I-SID</li> <li>• config: display configured SPBM I-SID</li> </ul>     |
| SOURCE_NAME                    | Indicates the nickname of the node where this I-SID was configured or discovered. <p> <b>Note:</b><br/>SOURCE_NAME is equivalent to nickname.</p> |
| VLAN                           | Indicates the B-VLAN where this I-SID was configured or discovered.                                                                                                                                                                |
| SYSID                          | Indicates the system identifier.                                                                                                                                                                                                   |
| TYPE                           | Indicates the SPBM I-SID type as either configured or discovered.                                                                                                                                                                  |
| HOST_NAME                      | Indicates the host name of the multicast FIB entry.                                                                                                                                                                                |

---

## Managing the switch via Layer 2

Use this procedure to manage the switch via Layer 2.

### About this task

To manage the switch via Layer 2, create a management VLAN on the ERS 4800 with no port members, and assign it to an I-SID for L2 VSN terminated on an ERS 8800, VSP 9000 or VSP 4000 with the same I-SID and IP subnet.

To allow IP connectivity to the ERS 4800, on the ERS 8800, VSP 9000, or VSP 4000 where the L2 VSN is configured, add an IP address to the VLAN that terminates the L2VSN.

### Procedure

1. Enter Global Configuration Mode:

```
enable
configure terminal
```
2. To create a management VLAN, enter the following commands at the command prompt:

```
vlan create <vlan_ID> type port
```

```
vlan mgmt <vlan_ID>
```

3. To assign the management VLAN to an I-SID, enter the following command at the command prompt:

```
i-sid <1-16777214> vlan <vlan_ID>
```

---

### Next steps

On the ERS8800, VSP 9000, or VSP 4000, assign a VLAN to an I-SID with the same ID as the I-SID with which the management VLAN is associated on the ERS 4800, and add an IP address to this VLAN.

### Related topics:

[Variable definitions](#) on page 106

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## Variable definitions

| Variable           | Value                                                             |
|--------------------|-------------------------------------------------------------------|
| vlan_ID            | Specifies the management VLAN ID. Range is <2-4094>.              |
| i-sid <1-16777214> | Specifies the I-SID with which the management VLAN is associated. |

# Chapter 8: Layer 2 VSN configuration using EDM

This section provides procedures to configure Layer 2 Virtual Services Networks (VSNs) using Enterprise Device manager (EDM).

---

## Configuring SPBM Layer 2 VSN C-VLANs

After you configure the SPBM infrastructure, you can enable the SPBM Layer 2 Virtual Service Network (VSN) using the following procedure.

SPBM supports Layer 2 VSN functionality where customer VLANs (C-VLANs) are bridged over the SPBM core infrastructure.

At the BEBs, customer VLANs (C-VLAN) are mapped to I-SIDs based on the local service provisioning. Outgoing frames are encapsulated in a MAC-in-MAC header, and then forwarded across the core to the far-end BEB, which strips off the encapsulation and forwards the frame to the destination network based on the I-SID-to-C-VLAN provisioning.

### Before you begin

- You must configure the required SPBM and IS-IS infrastructure, which includes the creation of SPBM B-VLANs.
- You must create the customer VLANs (C-VLANs) and add slots/ports.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > VLAN**.
2. Click **VLANs**.
3. Click the **Basic** tab.
4. To map a C-VLAN to a Service instance identifier (I-SID), in the **I-sid** column, specify the I-SID to associate with the specified VLAN.
5. Click **Apply**.

#### Important:

- When a protocol VLAN is created, all ports are added to the VLAN including SPBM ports. To configure a protocol-based VLAN as a C-VLAN, you must first

remove the SPBM-enabled ports from the protocol based VLAN, and then configure the protocol-based VLAN as a C-VLAN.

## Displaying the MAC address table for a C-VLAN

Use the following procedure to view the MAC Address table for a C-VLAN.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
2. Click **SPBM**.
3. In the work area, click the **MAC Addresses** tab.

## MAC Addresses field descriptions

Use the data in the following table to use the **MAC Addresses** tab.

| Name             | Description                                                                                                                                                                                                                                                                    |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Isid</b>      | Indicates the I-SID for this MAC address.                                                                                                                                                                                                                                      |
| <b>Addr</b>      | Indicates the customer MAC address for which the bridge has forwarding and/or filtering information                                                                                                                                                                            |
| <b>CPort</b>     | Either displays the value 0, or indicates the port on which a frame came from.                                                                                                                                                                                                 |
| <b>CVlanId</b>   | Indicates the VLAN ID for this MAC address.                                                                                                                                                                                                                                    |
| <b>BDestAddr</b> | Indicates the provider MAC address for which the bridge has forwarding and/or filtering information.                                                                                                                                                                           |
| <b>Type</b>      | Indicates the MAC address learned type as local (C-VLAN or Switched UNI) or remote (B-VLAN). <ul style="list-style-type: none"> <li>• Type remote shows a BDestAddr associated, but no CVlanID.</li> <li>• Type local shows a CVlanID associated, but no BDestAddr.</li> </ul> |
| <b>Status</b>    | Indicates the status of this entry: <ul style="list-style-type: none"> <li>• other</li> <li>• invalid</li> </ul>                                                                                                                                                               |

| Name | Description                                                                                 |
|------|---------------------------------------------------------------------------------------------|
|      | <ul style="list-style-type: none"> <li>• learned</li> <li>• self</li> <li>• mgmt</li> </ul> |

---

## Configuring SPBM switched UNIs

Use the following procedure to configure SPBM switched UNIs by mapping I-SIDs, VLANs, and ports.

### About this task

The VLAN must be type spbm-switchedUni. The port does not need to be a member of the VLAN, it is automatically added to the associated VLAN when you create the Switched UNI.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > IS-IS**.
2. Click **SPBM**.
3. Click the **Switched UNIs** tab.
4. To create a Switched UNI, click **Insert**.
5. Configure the Switched UNI parameters.
6. Click **Apply**.

---

## Switched UNIs field descriptions

Use the data in the following table to use the **Switched UNIs** tab.

| Name        | Description                              |
|-------------|------------------------------------------|
| <b>Isid</b> | Specifies the I-SID of the switched UNI. |
| <b>Port</b> | Specifies the port of the switched UNI.  |
| <b>Vlan</b> | Specifies the VLAN of the switched UNI.  |

---

## Managing the switch via Layer 2

Use this procedure to manage the switch via Layer 2.

### Before you begin

Create a management VLAN on the ERS 4800.

### About this task

To manage the ERS 4800 via Layer 2, create a management VLAN on the ERS 4800 with no port members, and assign it to an I-SID for L2 VSN terminated on an ERS 8800, VSP 9000 or VSP 4000 with the same I-SID and IP subnet.

To allow IP connectivity to the ERS 4800, on the ERS 8800, VSP 9000, or VSP 4000 where the L2 VSN is configured, add an IP address to the VLAN that terminates the L2VSN.

### Procedure

1. From the navigation tree, double-click **VLAN**.
2. In the VLAN tree, click **VLANs**.
3. Click the **Basic** tab.
4. To map the management VLAN to an I-SID, specify the I-SID to associate with the management VLAN in the **I-sid** column.
5. Click **Apply**.

---

### Next steps

On the ERS8800, VSP 9000, or VSP 4000, assign a VLAN to an I-SID with the same ID as the I-SID with which the management VLAN is associated on the ERS 4800, and add an IP address to this VLAN.

### Related topics:

[Variable definitions](#) on page 110

---

## Variable definitions

| Variable           | Value                                                             |
|--------------------|-------------------------------------------------------------------|
| I-sid <1-16777214> | Specifies the I-SID with which the management VLAN is associated. |

# Chapter 9: CFM fundamentals

The Shortest Path Bridging MAC (SPBM) network needs a mechanism to debug connectivity issues and to isolate faults. Connectivity Fault Management (CFM) operates at Layer 2 and provides an equivalent of ping and traceroute. To support troubleshooting of the SPBM cloud, Avaya Ethernet Routing switch 4800 Series supports a subset of CFM functionality.

CFM is based on the IEEE 802.1ag standard.

IEEE 802.1ag Connectivity Fault Management (CFM) provides OAM tools for the service layer, which allows you to monitor and troubleshoot an end-to-end Ethernet service instance. CFM is the standard for Layer 2 ping, Layer 2 traceroute, and the end-to-end connectivity check of the Ethernet network.

The 802.1ag feature divides or separates a network into administrative domains called Maintenance Domains (MD). Each MD is further subdivided into logical groupings called Maintenance Associations (MA). A single MD can contain several MAs.

Each MA is defined by a set of Maintenance Points (MP). An MP is a demarcation point on an interface that participates in CFM within an MD. Two types of MP exist:

- Maintenance End Point (MEP)
- Maintenance Intermediate Point (MIP)

CFM supports three kinds of standard CFM messages: Continuity Check Message (CCM), Loopback Message (LBM), and Link Trace Message (LTM). Messages are sent between Maintenance Points (MP) in the system.

On Avaya Ethernet Routing Switch 4800 Series, CFM is implemented using the LBM and LTM features only to debug SPBM. CCM messages are not required or supported in the current release.

---

## MD

A Maintenance Domain (MD) is the part of a network that is controlled by a single administrator. For example, a customer can engage the services of a service provider, who, in turn, can engage the services of several operators. In this scenario, there can be one MD associated with the customer, one MD associated with the service provider, and one MD associated with each of the operators.

You assign one of the following eight levels to the MD:

- 0–2 (operator levels)
- 3–4 (provider levels)
- 5–7 (customer levels)

The levels separate MDs from each other and provide different areas of functionality to different devices using the network. An MD is characterized by a level and an MD name (optional).

A single MD can contain several Maintenance Associations (MA).

**\* Note:**

Avaya ERS 4800 Series supports one global MD, named spbm. The spbm MD has a default maintenance level of 4.

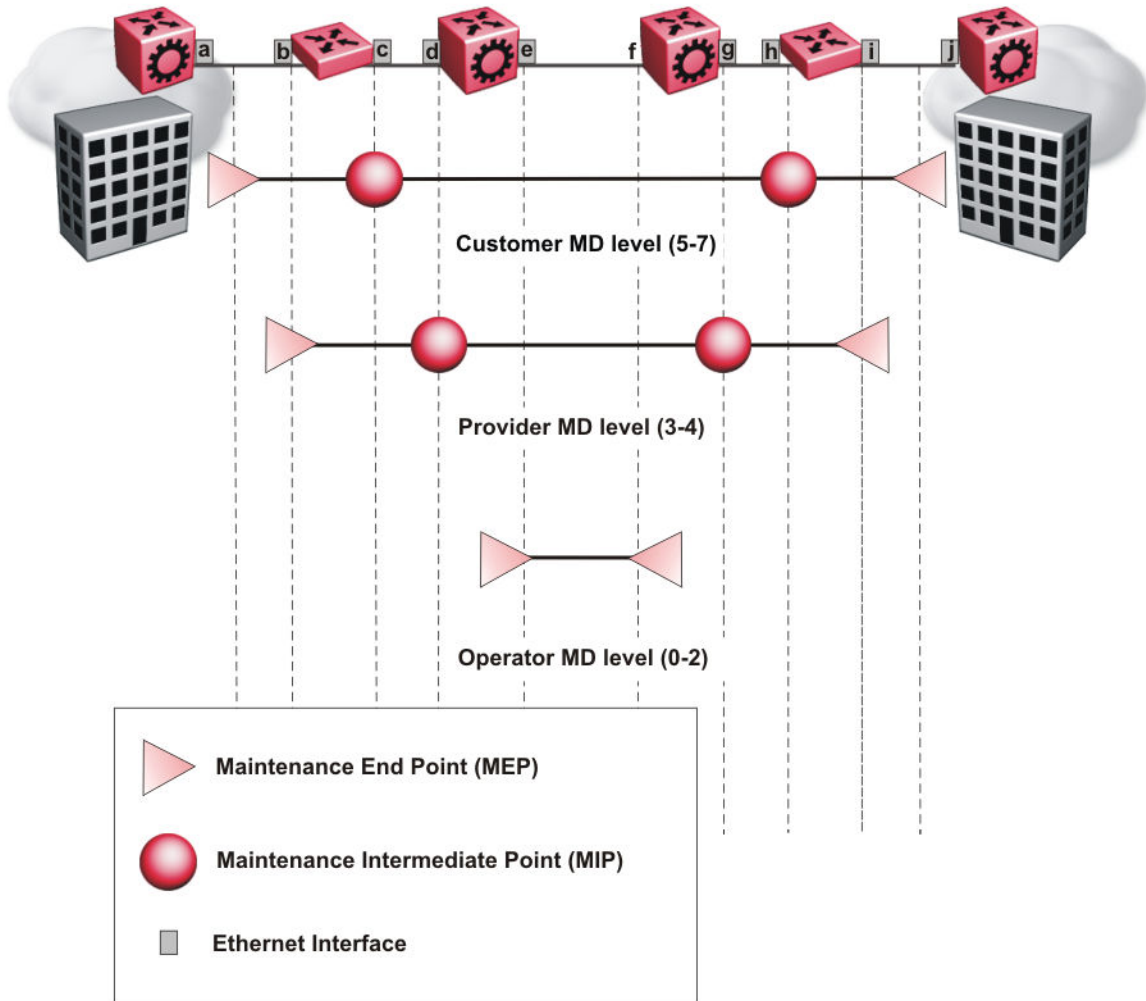
---

## MA

A Maintenance Association (MA) represents a logical grouping of monitored entities within its Domain. It can therefore represent a set of Maintenance association End Points (MEPs), each configured with the same Maintenance Association ID (MAID) and MD Level, established to verify the integrity of a single service instance.

The following figure shows MD level assignment in accordance with the 802.1ag standard. As shown in the figure, MIPs can be associated with MEPs. However, MIPs can also function independently of MEPs.





## MEP

A Maintenance Endpoint (MEP) represents a managed CFM entity, associated with a specific Domain Service Access Point (DoSAP) of a service instance, which can generate and receive CFM Protocol Data Units (PDU) and track any responses. A MEP is created by MEP ID under the context of an MA. MEP functionality can be divided into the following functions:

- Fault Detection
- Fault Verification

- Fault Isolation
- Fault Notification

Fault detection and notification are achieved through the use of Continuity Check Messages (CCM). CCM messages are not supported in the current release.

---

## Fault verification

Fault verification is achieved through the use of Loopback Messages (LBM). An LBM is a unicast message triggered by the operator issuing an operational command. LBM can be addressed to either a MEP or Maintenance Intermediate Point (MIP) but only a MEP can initiate an LBM. The destination MP can be addressed by its MAC address. The receiving MP responds with a Loopback Response (LBR). LBM can contain an arbitrary amount of data that can be used to diagnose faults as well as performance measurements. The receiving MP copies the data to the LBR.

---

## LBM

The Loopback Message (LBM) packet is often compared to a ping. A MEP transmits the LBM packet. This packet can be addressed to another MEP or to the MAC address of the MP; in the case of SPBM, this is the SPBM system ID. Only the MP for which the packet is addressed responds with an LBR message. You can trigger an LBM with the `l2ping` command.

- Provides “ICMP ping like” functionality natively at Layer 2.
- DA is the MAC address of the target.
- Includes a transaction identifier that allows the corresponding LBR to be identified when more than one LBM request is waiting for a response.
- Only the target (MIP or MEP) responds.
- Initiator can choose the size and content of the data portion of the LBM frame.
- Can be used to check the ability of the network to forward different sized frames.

---

## Layer 2 ping

The `l2ping` command is a proprietary command that allows a user to trigger an LBM message.

For B-VLANs, specify either the destination MAC address or node name.

The `l2ping` command provides a ping equivalent at Layer 2 for use with nodes on the SPBM B-VLAN in the customer domain.

 **Note:**

Layer 2 ping supports B-VLANs only.

---

## Fault isolation

Fault isolation is achieved through the use of Linktrace Messages (LTM). LTM is intercepted by all the MPs on the way to the destination MP. ERS 4800 supports two types of LTM.

The first type, the unicast LTM, can be addressed to either MEP or MIP MAC address. Each MP on the way decrements the TTL field in the LTM frame, sends Linktrace Reply (LTR), and forwards the original LTM to the destination. The LTM forwards until it reaches the destination or the TTL value is decremented to zero. LTR is a unicast message addressed to the originating MEP.

The second type, the proprietary LTM, is used to map the MAC addresses of the SPBM network; in this case the target MAC is a service instance identifier (I-SID), not an MP.

---

## LTM

CFM offers Linktrace message (LTM) for fault isolation. LTM allow operators, service providers and customers to verify the connectivity that they provide or use and to debug systems.

### Link trace message — unicast

The LTM is often compared to traceroute. A MEP transmits the LTM packet. This packet specifies the target MAC address of an MP, which is the SPBM system ID. MPs on the path

to the target address respond with an Linktrace reply (LTR). You can trigger an LTM with the `l2tracroute` command.

- LTM trace the path to any given MAC address or System Name.
- DA is unicast
- LTM contains:
  - Time to live (TTL)
  - Transaction Identifier
  - Originator MAC address
  - Target MAC address
- CFM forward the frame like any other data frame.
- MIP or MEP that is not on the path to the target discards the LTM and does not reply.
- MIP that is on the path to the target
  - Forwards the LTM after decrementing the TTL and replacing the SA with its own address.
  - Sends an LTR to the originator.
  - Identifies itself in the forwarded LTM and LTR by modifying TLV information.
- If the MIP or MEP is a target
  - Sends an LTR to the originator.
  - Identifies itself in the forwarded LTM and LTR by modifying TLV information.
- A MEP that is not the target but is on the path to the target
  - Generates a reply as described above.
  - It also sets one of the flags fields in the reply to indicate that it is the terminal MEP.

### **Link trace message — multicast**

The multicast LTM can be used to trace the multicast tree from any node on any I- SID using the nickname MAC address and the I-SID multicast address.

Specifying a multicast target address for an LTM allows for the tracing of the multicast tree corresponding to that destination address (DA). With a multicast target every node that is in the active topology for that multicast address responds with a LTR and also forwards the LTM frame along the multicast path. Missing LTRs from the nodes in the path indicate the point of first failure.

This functionality allows you to better troubleshoot I-SID multicast paths in a SPBM network. You can use the command `l2tracetree` to trace the I-SID tree root.

---

## Layer 2 traceroute

The `12traceroute` command is a proprietary command that allows a user to trigger an LTM message.

For B-VLANs, specify either the destination MAC address or node name.

The `12 traceroute` command provides a trace equivalent at Layer 2 for use with nodes on the SPBM B-VLAN in the customer domain.

 **Note:**

Layer 2 traceroute supports B-VLANs only.

---

## Layer 2 tracetree

The `12tracetree` command is a proprietary command that allows you to trigger a multicast LTM by specifying the B-VLAN and I-SID. Layer 2 tracetree allows you to view a multicast tree on the SPBM B-VLAN from the source node to the destination nodes for a particular I-SID.

---

## MIP

Maintenance domain intermediate points (MIPs) do not initialize any CFM messages. MIPs passively receive CFM messages, process the messages received and respond back to the originating MEP. By responding to received CFM messages, MIPs can support discovery of hop-by-hop path among MEPs, allow connection failures to be isolated to smaller segments of the network to help discover location of faults along the paths. MIP functionality can be summarized as:

- Respond to Loopback (ping) messages at the same level as itself and addressed to it.
- Respond to Linktrace (traceroute) messages.
- Forward Linktrace messages after decrementing the TTL.

---

## Nodal MPs

Nodal MPs provide both MEP and MIP functionality for SPBM deployments. Nodal MPs are associated with a B-VLAN and are VLAN encapsulated packets. The Nodal MEP provides traceability and troubleshooting at the system level for a given B-VLAN. Each switch has a given MAC address and communicates with other switches. The SPBM instance MAC address is used as the MAC address of the Nodal MP. The Nodal B-VLAN MPs supports eight levels of CFM.

---

## Configuration considerations

When you configure CFM, be aware of the following configuration considerations:

- The Maintenance level for MEPs and MIPs on a given B-VID (in a network) must be configured to the same level for them to respond to a given CFM command.
- CFM is supported only on B-VLANs.

# Chapter 10: CFM configuration using ACLI

This section provides procedures to configure and use Connectivity Fault Management (CFM) using Avaya Command Line Interface (ACLI). The Shortest Path Bridging MAC (SPBM) network needs a mechanism to debug connectivity issues and to isolate faults. This is performed at Layer 2, not Layer 3. To support troubleshooting of the SPBM cloud, Ethernet Routing Switch 4800 Series supports a subset of CFM functionality

## Note:

When you enable CFM in an SBPM network, Avaya recommends that you enable CFM on the Backbone Edge Bridges (BEB) and on all Backbone Core Bridges (BCB). If you do not enable CFM on a particular node, you cannot obtain CFM debug information from that node.

---

## Configuring CFM

Use this procedure to configure auto-generated CFM Maintenance End Points (MEPs) and Maintenance Intermediate Point (MIP) level for every SPBM B-VLAN on the ERS 4800. This procedure automatically configures a Maintenance Domain (MD), Maintenance Associations (MAs), MEP ID, and also associates the MEPs and MIP level to the SPBM VLANs.

### About this task

When you enable CFM, you create a global MD (named `spbm`) for all the SPBM Nodal MEPs. The `spbm` MD has a default maintenance level of 4, which you can change with the `level` attribute. All the MEPs created use the MEP ID configured under the global context, which has a default value of 1. You can only modify the global context when CFM is disabled. The Nodal MEPs automatically associate with SPBM VLANs and associate to any SPBM VLAN added later. The MIP level maps to the global level. The MIP level automatically associates with the SPBM VLANs when CFM is enabled, and associate to any SPBM VLAN added later.

### Procedure

1. Enter Global Configuration mode:  

```
enable
```

```
configure terminal
```
2. Configure the maintenance level for every CFM MEP and MIP level on all SPBM VLANs:

**\* Note:**

You can change the level before or after CFM is enabled. The default level is 4.

```
cfm spbm [level <0-7>]
```

3. Assign a global CFM MEP ID for all CFM SPBM MEPs:

**\* Note:**

You can change the MEP ID only when CFM is disabled.

```
cfm spbm mepid <1-8191>
```

4. Enable the CFM:

```
cfm spbm enable
```

5. Display the global CFM SPBM configuration:

```
show cfm spbm
```

6. If you want to default the CFM MD level, use the following command:

```
default cfm spbm level
```

7. If you want to default the MEP identifier, use the following command:

```
default cfm spbm mepid
```

8. If you want to disable CFM, use one of the following commands:

```
no cfm spbm enable
```

```
default cfm spbm enable
```

---

## Example

```
4850GTS-PWR+> enable
```

```
4850GTS-PWR+# configure terminal
```

```
4850GTS-PWR+(config)# cfm spbm level 4
```

```
4850GTS-PWR+(config)# cfm spbm mepid 200
```

```
4850GTS-PWR+(config)# cfm spbm enable
```

```
4850GTS-PWR+(config)# show cfm spbm
```


```
CFM Admin State: Enabled
CFM Spbm Level: 4
CFM Mep Id: 200
```



---

## Variable definitions

Use the data in the following table to use the `cfm spbm` commands.

| Variable                                   | Value                                                                                                                                                                                                 |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>cfm spbm level &lt;0–7&gt;</code>    | Specifies the CFM MD level. The default is 4.                                                                                                                                                         |
| <code>cfm spbm mepid &lt;1–8191&gt;</code> | Specifies the MEP ID. The default is 1.<br><br> <b>Note:</b><br>You can only modify the MEP ID when CFM is disabled. |
| <code>cfm spbm enable</code>               | Enables CFM globally.                                                                                                                                                                                 |
| <code>no cfm spbm enable</code>            | Disables CFM globally.                                                                                                                                                                                |
| <code>default cfm spbm level</code>        | Defaults the CFM MD level.                                                                                                                                                                            |
| <code>default cfm spbm mepid</code>        | Defaults the CFM MEP ID.                                                                                                                                                                              |
| <code>default cfm spbm enable</code>       | Defaults CFM. Default is globally disabled.                                                                                                                                                           |
| <code>show cfm spbm</code>                 | Displays the current CFM configuration.                                                                                                                                                               |

---

## Triggering an LBM Layer 2 ping

Use this procedure to trigger a Layer 2 ping, which acts like native ping. This feature enables CFM to debug Layer 2.

### Before you begin

CFM SPBM must be enabled.

### About this task

The LBM packet is often compared to ping. An MEP transmits the loopback message to an intermediate or endpoint within a domain for the purpose of fault verification. This can be used to check the ability of the network to forward different sized frames.

### Procedure

1. Enter Privileged EXEC mode:  

```
enable
```
2. Trigger a Layer 2 ping:  

```
l2ping {vlan <1-4094> routernodename WORD<0-255> | vlan <1-4094> mac <0x00:0x00:0x00:0x00:0x00:0x00>} [burst-count <1-200>] [data-tlv-size <0-400>] [frame-size <64-1500>]
```

```
[priority <0-7>] [testfill-pattern <all-zero|all-zero-crc|
pseudo-random-bit-sequence|pseudo-random-bit-sequence-crc>]
[time-out <1-10>]
```

## Example

```
4850GTS-PWR+# l2ping vlan 500 mac 00.14.0d.bf.a3.df
```

```
Please wait for l2ping to complete or press any key to abort
----00:14:0d:bf:a3:df L2 PING Statistics---- 0(68) bytes of data
1 packets transmitted, 0 packets received, 100.00% packet loss
```

```
4850GTS-PWR+# l2ping vlan 500 routernodename ERS-MONTIO
```

```
Please wait for l2ping to complete or press any key to abort
----00:14:0d:a2:b3:df L2 PING Statistics---- 0(68) bytes of data
1 packets transmitted, 1 packets received, 0.00% packet loss
round-trip (us) min/max/ave/stdv = 26895/26895/26895.00/ 0.00
```

## Variable definitions

Use the data in the following table to configure the **l2ping** parameters.

| Variable                                                                                                         | Value                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| vlan <1-4094> routernodename<br><i>WORD</i> <0-255><br>vlan <1-4094> mac<br><0x00:0x00:0x00:0x00:0x00:0x00><br>> | Specifies the destination for the L2 ping: <ul style="list-style-type: none"> <li>• &lt;1-4094&gt; — Specifies the VLAN ID.</li> <li>• <i>WORD</i>&lt;0-255&gt; — Specifies the Router node name.</li> <li>• &lt;XX:XX:XX:XX:XX:XX&gt; — Specifies the MAC address.</li> </ul>                                                                                                                                                                                      |
| burst-count <1-200>                                                                                              | Specifies the burst count.                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| data-tlv-size <0-400>                                                                                            | Specifies the data TLV size. The default is 0.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| frame-size <64-1500>                                                                                             | Specifies the frame size. The default is 0.                                                                                                                                                                                                                                                                                                                                                                                                                         |
| testfill-pattern <all-zero all-zero-crc <br>pseudo-random-bit-sequence <br>pseudo-random-bit-sequence-crc>       | Specifies the testfill pattern: <ul style="list-style-type: none"> <li>• all-zero — null signal without cyclic redundancy check</li> <li>• all-zero-crc — null signal with cyclic redundancy check with 32-bit polynomial</li> <li>• pseudo-random-bit-sequence — pseudo-random-bit-sequence without cyclic redundancy check</li> <li>• pseudo-random-bit-sequence-crc — pseudo-random-bit-sequence with cyclic redundancy check with 32-bit polynomial.</li> </ul> |

| Variable        | Value                                                                                |
|-----------------|--------------------------------------------------------------------------------------|
|                 | A cyclic redundancy check is a code that detects errors.<br>The default is all-zero. |
| priority <0-7>  | Specifies the priority. The default is 7.                                            |
| time-out <1-10> | Specifies the interval in seconds. The default is 3.                                 |

## Triggering an LTM Layer 2 traceroute

Use this procedure to trigger a Layer 2 traceroute, which acts like native traceroute. This feature enables CFM to debug Layer 2.

### Important:

The MAC address must be learned before you can trace a route to a MAC address. For B-VLANs, IS-IS learns the MAC addresses and populates the FDB table.

**linktrace** traces the path up to the closest device to that MAC address that supports CFM.

### Before you begin

CFM SPBM must be enabled.

### About this task

The link trace message is often compared to traceroute. An MEP transmits the Linktrace Message packet to a maintenance endpoint with intermediate points responding to indicate the path of the traffic within a domain for the purpose of fault isolation. The packet specifies the target MAC address of an MP, which is the SPBM system ID. MPs on the path to the target address respond with an LTR.

### Procedure

1. Enter Privileged EXEC mode:  
enable
2. Trigger a Layer 2 traceroute:  
l2traceroute {<vlan <1-4094> routernodename WORD<0-255> |  
<vlan <1-4094> mac <0x00:0x00:0x00:0x00:0x00:0x00>}  
[priority <0-7>] [ttl <1-255>]

### Example

```
4850GTS-PWR+# l2traceroute vlan 500 routernodename ERS-MONTIO
```

```
Please wait for l2traceroute to complete or press any key to abort
```

```
l2tracertoe to VSP-MONTIO (00:14:0d:a2:b3:df), vlan 500
0 ERS-PETER4 (00:15:9b:11:33:df)
1 ERS-MONTIO (00:14:0d:a2:b3:df)
```

## Variable definitions

Use the data in the following table to use the `l2tracertoe` command.

| Variable                                                                                                  | Value                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| vlan <1–4094> routernodename<br>WORD<0–255>}<br>vlan <1–4094> mac<br><0x00:0x00:0x00:0x00:0x00:0x00<br>>} | Specifies the destination for the L2 traceroute: <ul style="list-style-type: none"> <li>• &lt;1–4094&gt; — Specifies the VLAN ID</li> <li>• WORD&lt;0–255&gt; — Specifies the Router Node Name</li> <li>• &lt;XX:XX:XX:XX:XX:XX&gt; — Specifies the MAC address</li> </ul> |
| ttl<1–255>                                                                                                | Specifies the TTL value. The default is 64.                                                                                                                                                                                                                                |
| priority <0–7>                                                                                            | Specifies the priority. The default is 7.                                                                                                                                                                                                                                  |

## Triggering an LTM Layer 2 tracertoe

Use this procedure to trigger a Layer 2 tracertoe. Layer 2 tracertoe allows a user to trigger a multicast LTM message by specifying the B-VLAN and I-SID. The command allows the user to view a multicast tree on the SPBM B-VLAN from the source node to the destination nodes for a particular I-SID.

### Before you begin

CFM SPBM must be enabled.

### Procedure

1. Enter Privileged EXEC mode:
 

```
enable
```
2. Trigger a Layer 2 tracertoe:
 

```
l2tracertoe vlan <1-4094> isid <1-16777215> [routernodename
WORD<0-255> | mac <0x00:0x00:0x00:0x00:0x00:0x00>] [priority
<0-7>] [ttl <1-255>]
```

### Example

```
4850GTS-PWR+# l2tracertoe vlan 2 isid 1 mac 53:55:10:00:00:01
```

```
Please wait for l2tracertoe to complete or press any key to abort
```

```

12tracetree to 53:55:10:00:00:01, vlan 2 i-sid 1 nickname 5.55.10
hops 64
1 ERS-PETER4 00:15:9b:11:33:df -> ERS-MONTIO 00:14:0d:a2:b3:df
2 ERS-MONTIO 00:14:0d:a2:b3:df -> ERS-LEE2 00:15:e8:b8:a3:df

```

## Variable definitions

Use the data in the following table to use the `12tracetree` command.

| Variable                               | Value                                                                                                                                            |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| vlan<1-4094>isid <1-16777215>          | <ul style="list-style-type: none"> <li>• &lt;1-4094&gt; — Specifies the VLAN ID.</li> <li>• &lt;1-16777215&gt; — Specifies the I-SID.</li> </ul> |
| routernodename WORD<0-255>             | WORD<0-255> — Specifies the Router Node Name.                                                                                                    |
| mac<br><0x00:0x00:0x00:0x00:0x00:0x00> | <0x00:0x00:0x00:0x00:0x00:0x00> — Specifies the MAC address.                                                                                     |
| tll <1-255>                            | Specifies the TTL value. The default is 64.                                                                                                      |
| priority <0-7>                         | Specifies the priority value. The default is 7.                                                                                                  |



# Chapter 11: CFM configuration using EDM

This section provides procedures to configure Connectivity Fault management (CFM) using Enterprise Device Manager (EDM).

 **Note:**

When you enable CFM in an SBPM network, Avaya recommends that you enable CFM on the Backbone Edge Bridges (BEB) and on all Backbone Core Bridges (BCB). If you do not enable CFM on a particular node, you cannot obtain CFM debug information from that node.

---

## Configuring CFM

Use this procedure to configure auto-generated CFM Maintenance End Points (MEPs) and Maintenance Intermediate Point (MIP) level for every SPBM B-VLAN on the ERS 4800. This procedure automatically configures a Maintenance Domain (MD), Maintenance Associations (MAs), MEP ID, and also associates the MEPs and MIP level to the SPBM VLANs.

### About this task

When you enable CFM, you create a global MD (named `spbm`) for all the SPBM Nodal MEPs. The `spbm` MD has a default maintenance level of 4, which you can change with the `level` attribute. All the MEPs created use the MEP ID configured under the global context, which has a default value of 1. You can only modify the global context when CFM is disabled. The Nodal MEPs automatically associate with SPBM VLANs and associate to any SPBM VLAN added later. The MIP level maps to the global level. The MIP level automatically associates with the SPBM VLANs when CFM is enabled, and associate to any SPBM VLAN added later.

### Procedure

1. From the navigation tree, expand the following folders: **Configuration > Edit > Diagnostics**.
2. Click **CFM**.
3. Click the **Globals** tab.
4. In the **SpbmAdminState** field, click a radio button to enable or disable CFM. specify an index value, name, and level for the MD.
5. In the **SpbmLevel** field, configure the maintenance level for every CFM MEP and MIP level on all the SPBM VLANs.
6. In the **SpbmMepld** field, assign a global CFM MEP ID for all CFM SPBM MEPs.

- On the toolbar, click **Apply**.
- 

## Globals field descriptions

Use the data in the following table to use the **Globals** tab.

| Name                  | Description                                                                    |
|-----------------------|--------------------------------------------------------------------------------|
| <b>EtherType</b>      | Read only Ethernet type value. Value of 0x8902                                 |
| <b>SpbmAdminState</b> | Enables or disables the SPBM CFM MD. Click the enable or disable radio button. |
| <b>SpbmLevel</b>      | Specifies the MD level. Default is level 4.                                    |
| <b>SpbmMepId</b>      | Specifies the MEP identifier. Default is 1                                     |

## Displaying CFM MD

Use this procedure to display the Connectivity Fault Management (CFM) Maintenance Domain (MD). An MD is the part of a network that is controlled by a single administrator. A single MD can contain several Maintenance Associations (MA).

### Procedure

- From the navigation tree, expand the following folders: **Configuration > Edit > Diagnostics**.
  - Click **CFM**.
  - Click the **MD** tab.
  - On the toolbar, click **Refresh** to display the current MD configuration.
- 

## MD field descriptions

Use the data in the following table to use the **MD** tab.

| Name         | Description                                 |
|--------------|---------------------------------------------|
| <b>Index</b> | Specifies a maintenance domain entry index. |



| Name            | Description                                                         |
|-----------------|---------------------------------------------------------------------|
| <b>Name</b>     | Specifies the MD name.                                              |
| <b>NumOfMa</b>  | Indicates the number of MAs that belong to this maintenance domain. |
| <b>Level</b>    | Specifies the MD maintenance level. The default is 4.               |
| <b>NumOfMip</b> | Indicates the number of MIPs that belong to this maintenance domain |
| <b>Type</b>     | Indicates the type of domain.                                       |

---

## Displaying CFM MA

Use this procedure to display a CFM Maintenance Association (MA). An MA represents a logical grouping of monitored entities within its Domain. It can therefore represent a set of Maintenance Endpoints (MEPs), each configured with the same Maintenance Association ID (MAID) and MD Level, established to verify the integrity of a single service instance.

### Before you begin

You must configure a CFM MD.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > Edit > Diagnostics**.
2. Click **CFM**.
3. Click the **MD** tab.
4. Select an existing MD.
5. On the toolbar, click **MaintenanceAssociation**.

---

## MA field descriptions

Use the data in the following table to use the **MA** tab.

| Name               | Description                                   |
|--------------------|-----------------------------------------------|
| <b>DomainIndex</b> | Specifies the maintenance domain entry index. |

| Name                    | Description                                                               |
|-------------------------|---------------------------------------------------------------------------|
| <b>AssociationIndex</b> | Specifies a maintenance association entry index.                          |
| <b>DomainName</b>       | Specifies the MD name.                                                    |
| <b>AssociationName</b>  | Specifies the MA name.                                                    |
| <b>NumOfMep</b>         | Indicates the number of MEPs that belong to this maintenance association. |

---

## Displaying CFM MEP

Use this procedure to display the CFM Maintenance Endpoint (MEP). A MEP represents a managed CFM entity, associated with a specific Domain Service Access Point (DoSAP) of a service instance, which can generate and receive CFM Protocol Data Units (PDU) and track any responses. A MEP is created by MEP ID under the context of an MA.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > Edit > Diagnostics**.
  2. Click **CFM**.
  3. Click the **MD** tab.
  4. Select an existing MD, and then click **MaintenanceAssociation**.
  5. In the **MA** tab, select an existing MA, and then click **MaintenanceEndpoint**.
- 

---

## MEP field descriptions

Use the data in the following table to use the **MEP** tab.

| Name                    | Description             |
|-------------------------|-------------------------|
| <b>DomainIndex</b>      | Specifies the MD index. |
| <b>AssociationIndex</b> | Specifies the MA index. |
| <b>Id</b>               | Specifies the MEP ID.   |
| <b>DomainName</b>       | Specifies the MD name.  |
| <b>AssociationName</b>  | Specifies the MA name.  |

| Name                      | Description                                                                                                                                                                                                                                                                                                                         |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AdminState</b>         | Specifies the administrative state of the MEP. The default is disable.                                                                                                                                                                                                                                                              |
| <b>MepType</b>            | Specifies the MEP type: <ul style="list-style-type: none"> <li>• trunk</li> <li>• sg</li> <li>• endpt</li> <li>• vlan</li> <li>• port</li> <li>• endptClient</li> <li>• nodal</li> <li>• remotetrunk</li> <li>• remotesg</li> <li>• remoteendpt</li> <li>• remoteVlan</li> <li>• remotePort</li> <li>• remoteEndptClient</li> </ul> |
| <b>ServiceDescription</b> | Specifies the service to which this MEP is assigned.                                                                                                                                                                                                                                                                                |

---

## Configuring Layer 2 ping

Use this procedure to configure a Layer 2 ping. This feature enables CFM to debug Layer 2. It can also help you debug ARP problems by providing the ability to troubleshoot next hop ARP records.

### Before you begin

CFM SPBM must be enabled.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > Edit > Diagnostics**.
2. Click **L2Ping/L2Trace Route**.
3. From the **L2Ping** tab, configure the Layer 2 ping properties.
4. To initiate a Layer 2 ping, highlight an entry and click the **Start** button.

5. To update a Layer 2 ping, click the **Refresh** button.
6. To stop the Layer 2 ping, click the **Stop** button.

---

## L2Ping field descriptions

Use the data in the following table to use the **L2Ping** tab.

| Name                  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>VlanId</b>         | Identifies the backbone VLAN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>DestMacAddress</b> | Specifies the target MAC address.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>HostName</b>       | Specifies the target host name.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>DestIsHostName</b> | Indicates whether the host name is (true) or is not (false) used for L2Ping transmission.                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Messages</b>       | Specifies the number of L2Ping messages to be transmitted. The default is 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Status</b>         | <p>Specifies the status of the transmit loopback service:</p> <ul style="list-style-type: none"> <li>• ready: the service is available.</li> <li>• transmit: the service is transmitting, or about to transmit, the L2Ping messages.</li> <li>• abort: the service aborted or is about to abort the L2Ping messages.</li> </ul> <p>This field is also used to avoid concurrency or race condition problems that can occur if two or more management entities try to use the service at the same time.<br/>The default is ready.</p> |
| <b>ResultOk</b>       | <p>Indicates the result of the operation:</p> <ul style="list-style-type: none"> <li>• true: the L2Ping Messages will be (or have been) sent.</li> <li>• false: the L2Ping Messages will not be sent.</li> </ul> <p>The default is true.</p>                                                                                                                                                                                                                                                                                        |
| <b>Priority</b>       | <p>Specifies a 3-bit value to be used in the VLAN header, if present in the transmitted frame.<br/>The default is 7.</p>                                                                                                                                                                                                                                                                                                                                                                                                            |

| Name               | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TimeoutInt</b>  | Specifies the interval to wait for an L2Ping time-out. The default value is 3 seconds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>TestPattern</b> | <p>Specifies the test pattern to use in the L2Ping PDU:</p> <ul style="list-style-type: none"> <li>• allZero: null signal without cyclic redundancy check</li> <li>• allZeroCrc: null signal with cyclic redundancy check with 32-bit polynomial</li> <li>• pseudoRandomBitSequence: pseudo-random-bit-sequence without cyclic redundancy check</li> <li>• pseudoRandomBitSequenceCrc: pseudo-random-bit-sequence with cyclic redundancy check with 32-bit polynomial.</li> </ul> <p>A cyclic redundancy check is a code that detects errors. The default value is allZero.</p> |
| <b>DataSize</b>    | Specifies an arbitrary amount of data to be included in the data TLV, if the data size is selected to be sent. The default is 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>FrameSize</b>   | Specifies the frame size. If the frame size is specified then the data size is internally calculated and the calculated data size is included in the data TLV. The default is 0.                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>SourceMode</b>  | <p>Specifies the source modes of the transmit loopback service:</p> <ul style="list-style-type: none"> <li>• nodal</li> <li>• smltVirtual</li> </ul> <p>The default is nodal.</p>                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>SeqNumber</b>   | The transaction identifier/sequence number of the first loopback message (to be) sent. The default is 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Result</b>      | Displays the Layer 2 Ping result.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

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## Initiating a Layer 2 traceroute

Use this procedure to trigger a Layer 2 traceroute. This feature enables CFM to debug Layer 2.

If you configure **IsTraceTree** to false then EDM performs Traceroute on the unicast path. If you configure **IsTraceTree** to true then EDM performs TraceTree on the multicast tree.

**! Important:**

The MAC address must be learned before you can trace a route to a MAC address.

For B-VLANs, IS-IS learns the MAC address and populates the FDB table.

Linktrace traces the path up to the closest device to that MAC address that supports CFM.

### Before you begin

CFM SPBM must be enabled.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > Edit > Diagnostics**.
2. Click **L2Ping/L2Trace Route**.
3. Click the **L2 Traceroute/TraceTree** tab.
4. To configure the traceroute or tracetree, highlight an entry and populate the required column fields.
5. To start the traceroute, click the **Start** button.
6. To update the traceroute, click the **Refresh** button.
7. To stop the traceroute, click the **Stop** button.

---

## L2Traceroute field descriptions

Use the data in the following table to use the **L2Traceroute** tab.

| Name                  | Description                                                                                                   |
|-----------------------|---------------------------------------------------------------------------------------------------------------|
| <b>VlanId</b>         | Specifies a value that uniquely identifies the Backbone VLAN (B-VLAN).                                        |
| <b>Priority</b>       | Specifies a 3-bit value to be used in the VLAN header, if present in the transmitted frame. The default is 7. |
| <b>DestMacAddress</b> | Specifies the target MAC address.                                                                             |
| <b>HostName</b>       | Specifies the target host name.                                                                               |

| Name                  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>DestIsHostName</b> | Specifies whether the host name is (true) or is not (false) used for the L2Trace transmission.                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Isid</b>           | Specifies the Service Instance Identifier (I-SID).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>NickName</b>       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>IsTraceTree</b>    | Specifies whether the multicast tree or unicast path is traced. If you configure <b>IsTraceTree</b> to false then EDM performs Traceroute on the unicast path. If you configure <b>IsTraceTree</b> to true then EDM performs TraceTree on the multicast tree.                                                                                                                                                                                                                                                                     |
| <b>Status</b>         | <p>Indicates the status of the transmit loopback service:</p> <ul style="list-style-type: none"> <li>• ready: the service is available.</li> <li>• transmit: the service is transmitting, or about to transmit, the L2Trace messages.</li> <li>• abort: the service aborted or is about to abort the L2Trace messages.</li> </ul> <p>This field is also used to avoid concurrency or race condition problems that can occur if two or more management entities try to use the service at the same time. The default is ready.</p> |
| <b>ResultOk</b>       | <p>Indicates the result of the operation:</p> <ul style="list-style-type: none"> <li>• true: the L2Trace messages will be (or have been) sent.</li> <li>• false: the L2Trace messages will not be sent.</li> </ul> <p>The default is true.</p>                                                                                                                                                                                                                                                                                    |
| <b>Ttl</b>            | <p>Specifies the number of hops remaining to this L2Trace.</p> <p>This value is decremented by 1 by each Bridge that handles the L2Trace. The decremented value is returned in the L2Trace. If 0 on output, the L2Trace is not transmitted to the next hop. The value of the time-to-live (TTL) field in the L2Trace is defined by the originating MEP. The default value is 64.</p>                                                                                                                                              |

| Name              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SourceMode</b> | Specifies the source mode of the transmit loopback service. The default is nodal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>SeqNumber</b>  | Specifies the transaction identifier/sequence number of the first loopback message (to be) sent. The default is 0.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Flag</b>       | <p>L2Trace result flag indicating L2Trace status or error code:</p> <ul style="list-style-type: none"> <li>• none (1): No error</li> <li>• internalError (2): L2Trace internal error</li> <li>• invalidMac (3): Invalid MAC address</li> <li>• mepDisabled (4): MEP must be enabled in order to perform L2Trace</li> <li>• noL2TraceResponse (5): No L2Trace response received</li> <li>• I2TraceToOwnMepMac (6): L2Trace to own MEP MAC is not sent</li> <li>• I2TraceComplete (7): L2Trace completed</li> <li>• I2TraceLookupFailure (8): Lookup failure for L2Trace</li> <li>• I2TraceLeafNode (9): On a leaf node in the I-SID tree</li> <li>• I2TraceNotInTree (10): Not in the I-SID tree</li> </ul> |

---

## Viewing Layer 2 traceroute results

Use this procedure to view Layer 2 traceroute results. This feature enables CFM to debug Layer 2. You can use Layer 2 traceroute to debug ARP problems by troubleshooting next hop ARP records.

### About this task

You can display Layer 2 tracetree results to view a multicast tree on the SPBM B-VLAN from the source node to the destination nodes for a particular I-SID.

### Procedure

1. In the navigation tree, expand the following folders: **Configuration > Edit > Diagnostics**.



2. Click **L2Ping/L2Trace Route**.
3. Click the **L2Traceroute/TraceTree** tab.
4. Click the **Refresh** button to update the results.
5. To view the traceroute results, highlight an entry, and then click **Result**.

---

## L2 Traceroute Result field descriptions

Use the data in the following table to use the **L2 Traceroute Result** tab.

| Name                | Description                                                                                                                                                                                                              |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>VlanId</b>       | A value that uniquely identifies the Backbone VLAN (B-VLAN).                                                                                                                                                             |
| <b>SeqNumber</b>    | The transaction identifier/sequence number returned by a previous transmit linktrace message command, indicating which L2Trace's response of the L2Trace is going to be returned. The default is 0.                      |
| <b>Hop</b>          | The number of hops away from L2Trace initiator.                                                                                                                                                                          |
| <b>ReceiveOrder</b> | An index to distinguish among multiple L2Trace responses with the same Transaction Identifier field value. This value is assigned sequentially from 1, in the order that the Linktrace Initiator received the responses. |
| <b>Ttl</b>          | Time-to-Live (TTL) field value for a returned L2Trace response.                                                                                                                                                          |
| <b>SrcMac</b>       | MAC address of the MP that responds to the L2Trace request for this L2TraceReply.                                                                                                                                        |
| <b>HostName</b>     | The host name of the replying node.                                                                                                                                                                                      |
| <b>LastSrcMac</b>   | The MAC address of the node that forwarded the L2Trace to the responding node.                                                                                                                                           |
| <b>LastHostName</b> | The host name of the node that forwarded the L2Trace to the responding node.                                                                                                                                             |



## Glossary

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ACLI</b>                                 | Avaya Command Line Interface (ACLI) is a text-based, common command line interface used for device configuration and management across Avaya products.                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>ACLI modes</b>                           | 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.                                                                                                                                                                                                            |
| <b>Address Resolution Protocol (ARP)</b>    | Maps an IP address to a physical machine address, for example, maps an IP address to an Ethernet media access control (MAC) address.                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Autonomous System (AS)</b>               | A set of routers under a single technical administration, using a single IGP and common metrics to route packets within the AS, and using an EGP to route packets to other ASs.                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Bridge Protocol Data Unit (BPDU)</b>     | A data frame used to exchange information among the bridges in local or wide area networks for network topology maintenance.                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Bridging</b>                             | A forwarding process, used on Local Area Networks (LAN) and confined to network bridges, that works on Layer 2 and depends on the Spanning Tree Protocol (STP) or Rapid Spanning Tree Protocol (RSTP). Bridging is also known as MAC forwarding.                                                                                                                                                                                                                                                                                                                                  |
| <b>cyclic redundancy check (CRC)</b>        | Ensures frame integrity is maintained during transmission. The CRC performs a computation on frame contents before transmission and on the receiving device. The system discards frames that do not pass the CRC.                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Designated Intermediate System (DIS)</b> | A Designated Intermediate System (DIS) is the designated router in Intermediate System to Intermediate System (IS-IS) terminology. You can modify the priority to affect the likelihood of a router being elected the designated router. The higher the priority, the more likely the router is to be elected as the DIS. If two routers have the same priority, the router with the highest MAC address (Sequence Number Packet [SNP] address) is elected as the DIS.                                                                                                            |
| <b>designated router (DR)</b>               | A single router elected as the designated router for the network. In a broadcast or nonbroadcast multiple access (NBMA) network running the Open Shortest Path First (OSPF) protocol, a DR ensures all network routers synchronize with each other and advertises the network to the rest of the Autonomous System (AS). In a multicast network running Protocol Independent Multicast (PIM), the DR acts as a representative router for directly connected hosts. The DR sends control messages to the rendezvous point (RP) router, sends register messages to the RP on behalf |

of directly connected sources, and maintains RP router status information for the group.

|                                                                 |                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Enterprise Device Manager (EDM)</b>                          | 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.                   |
| <b>Institute of Electrical and Electronics Engineers (IEEE)</b> | An international professional society that issues standards and is a member of the American National Standards Institute, the International Standards Institute, and the International Standards Organization.                                            |
| <b>Internet Control Message Protocol (ICMP)</b>                 | A collection of error conditions and control messages exchanged by IP modules in both hosts and gateways.                                                                                                                                                 |
| <b>Internet Protocol version 4 (IPv4)</b>                       | The protocol used to format packets for the Internet and many enterprise networks. IPv4 provides packet routing and reassembly.                                                                                                                           |
| <b>Internet Protocol version 6 (IPv6)</b>                       | An improved version of the IP protocol, IPv6 improves the IPv4 limitations of security and user address numbers.                                                                                                                                          |
| <b>Layer 2</b>                                                  | Layer 2 is the Data Link Layer of the OSI model. Examples of Layer 2 protocols are: Ethernet and Frame Relay.                                                                                                                                             |
| <b>Layer 3</b>                                                  | Layer 3 is the Network Layer of the OSI model. An example of a Layer 3 protocol is Internet Protocol (IP).                                                                                                                                                |
| <b>link-state database (LSDB)</b>                               | A database built by each OSPF router to store LSA information. The router uses the LSDB to calculate the shortest path to each destination in the Autonomous System (AS), with itself at the root of each path.                                           |
| <b>Local Area Network (LAN)</b>                                 | 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).                                                          |
| <b>media</b>                                                    | A substance that transmits data between ports; usually fiber optic cables or category 5 unshielded twisted pair (UTP) copper wires.                                                                                                                       |
| <b>Media Access Control (MAC)</b>                               | Arbitrates access to and from a shared medium.                                                                                                                                                                                                            |
| <b>Message Digest 5 (MD5)</b>                                   | A one-way hash function that creates a message digest for digital signatures.                                                                                                                                                                             |
| <b>MultiLink Trunking (MLT)</b>                                 | 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. |

|                                                              |                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>multiple spanning tree instance (MSTI)</b>                | One of a number of spanning trees calculated by the Multiple Spanning Tree Protocol (MSTP) within an MST region, to provide a simple and fully connected active topology for frames that belong to a VLAN mapped to the MSTI.                                                                                                                            |
| <b>Open Shortest Path First (OSPF)</b>                       | A link-state routing protocol used as an Interior Gateway Protocol (IGP).                                                                                                                                                                                                                                                                                |
| <b>operation, administration, and maintenance (OA&amp;M)</b> | All the tasks necessary for providing, maintaining, or modifying switching system services.                                                                                                                                                                                                                                                              |
| <b>port</b>                                                  | A physical interface that transmits and receives data.                                                                                                                                                                                                                                                                                                   |
| <b>Protocol Data Units (PDUs)</b>                            | 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.                                                                                                                                                                         |
| <b>request for comments (RFC)</b>                            | A document series published by the Internet Engineering Task Force (IETF) that describe Internet standards.                                                                                                                                                                                                                                              |
| <b>routing switch</b>                                        | 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.                                                                               |
| <b>shortest path first (SPF)</b>                             | A class of routing protocols that use Dijkstra's algorithm to compute the shortest path through a network, according to specified metrics, for efficient transmission of packet data.                                                                                                                                                                    |
| <b>spanning tree</b>                                         | 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. |
| <b>Spanning Tree Protocol (STP)</b>                          | 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.                                                                                                                                                       |
| <b>Split MultiLink Trunking (SMLT)</b>                       | An Avaya 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.                                                                                                                                                                          |
| <b>Virtual Local Area Network (VLAN)</b>                     | 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.                                                                                                                                                              |

|                                      |                                                                                                                                                                                                                          |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Virtual Private Network (VPN)</b> | 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. |
| <b>stack</b>                         | 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.                  |
| <b>time-to-live (TTL)</b>            | The field in a packet used to determine the valid duration for the packet. The TTL determines the packet lifetime. The system discards a packet with a TTL of zero.                                                      |
| <b>trunk</b>                         | A logical group of ports that behaves like a single large port.                                                                                                                                                          |