Ethernet Edge Switch
NN48500-598
Engineering

# Wake On LAN Technical Configuration Guide

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# Abstract

This Technical Configuration Guide provides information on Wake on LAN technology and the requirements of the Ethernet Switching infrastructure. Test scenarios are covered with the switching infrastructure supporting 802.1x authentication and with no 802.1x authentication.

For any comments, edits, corrections, or general feedback please contact Dan DeBacker (ddebacke@avaya.com).

# Table of Contents

# 1. Overview: Wake on LAN

Wake on LAN (WOL) is an Ethernet computer networking standard that allows a shut-down computer to be booted remotely. WOL is both hardware and software technology to wakeup machines that have been powered off. This becomes a very valuable tool for administrators that need to perform software distribution to PC's. Now, administrators have the ability to perform updates without visiting each machine and the updates can be performed off-hours so as not to interrupt the end user.

## 1.1 System Requirements

Wake on LAN support is implemented in the motherboard of the computer. The motherboard must have a WAKEUP-LINK header onboard and connected to the network card via a special 3-pin cable; however, systems supporting the PCI 2.2 standard coupled with a PCI 2.2 compliant network adapter typically do not require a WOL cable as the required standby power is relayed through the PCI bus. Wake on LAN must also be enabled in the Power Management section of the motherboard's BIOS. It may also be necessary to configure the computer to reserve power for the network card when the system is shut down.

## 1.2 How It Works

The general process of waking a computer up remotely in a LAN can be explained as such:

The target computer is shut down, with power reserved for the network card. The network card listens for a specific packet, called the Magic Packet. The Magic Packet is broadcasted on the broadcast address for that particular subnet or the entire LAN. The listening computer receives this packet, checks it for the correct information, and then boots if the Magic Packet is valid.

## 1.3 Magic Packet

The Magic Packet is a broadcast frame, transmitted over port 7 or 9. It can be sent over a variety of connectionless protocols (UDP, IPX) but UDP is most commonly used. The data that is contained in a Magic Packet is the defined constant as represented in hexadecimal: FF:FF:FF:FF:FF:FF followed by sixteen repetitions of the target computer's MAC address, possibly followed by a four or six byte password.

# 2. Ethernet Switches and Wake on LAN

This section covers the Network Topology and PC Configuration used to test the Wake on LAN capability with the Avaya switching infrastructure.

## 2.1 Network Topology

The following diagrams show the network topology used for testing the WOL functionality.

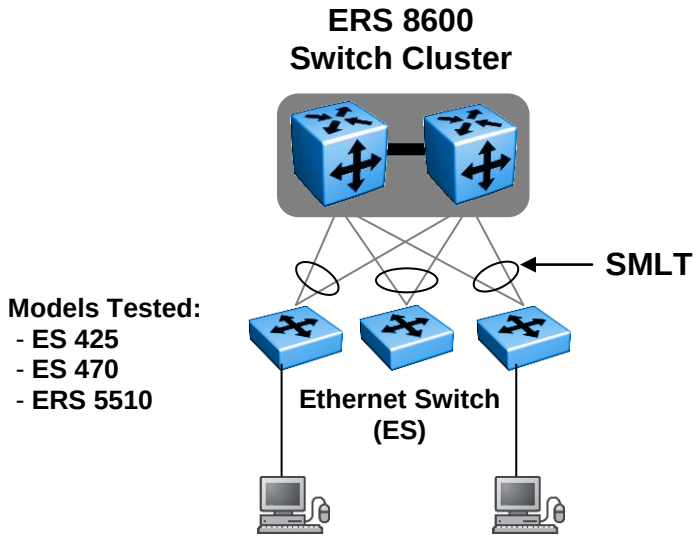



**Figure 1 High Level Network Topology**

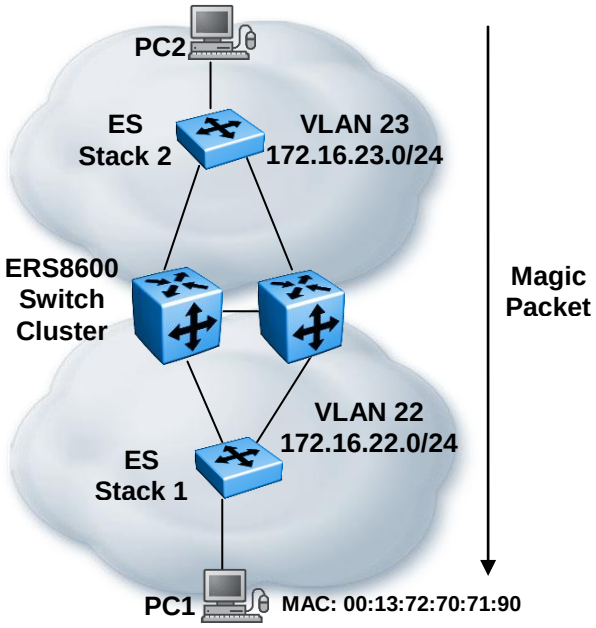


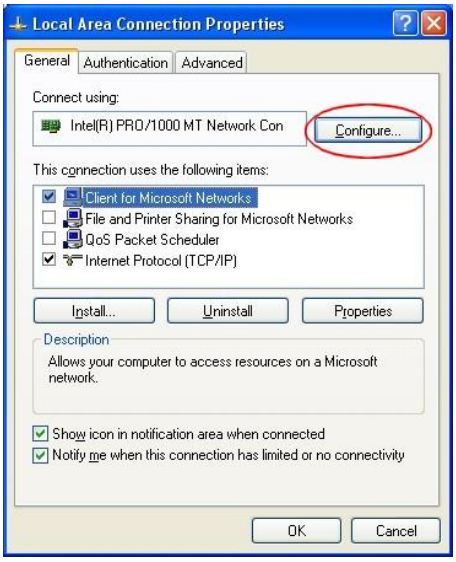

**Figure 2 Detailed Network Topology**

## 2.2 PC Configuration

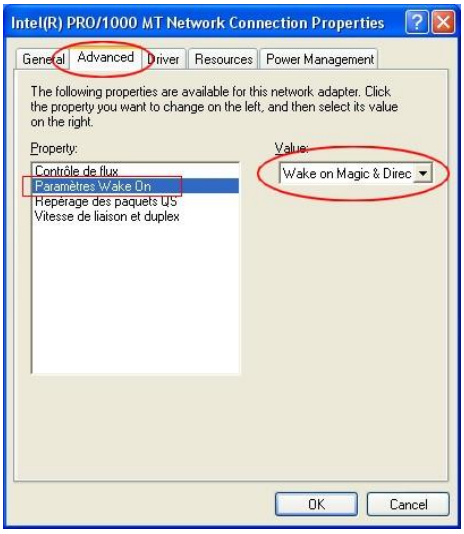
Configure the network interface on the PC by going to

Control Panel → Network and Internet Connections → Network Connections.

At this point, right click on the network adapter to be configured and select **Properties**. The following screen will appear - Click Configure:




Go to the Advanced Tab and enable Wake on LAN



# 3. Wake on LAN: No 802.1x Authentication

The first scenario tested used the WOL capability on the Avaya switching infrastructure without any type of end user authentication (namely 802.1x).

The following details the configuration of the network and PC's:

- All port-based VLANs were used on the ES stacks and the ERS 8600 Switch Cluster
- PC1 is connected to port 2/20 on ES Stack 1
- Port 2/20 is configured in port-based VLAN 22
- PC2 is connected to port 1/10 on ES Stack 2
- Port 1/10 is configured in port-based VLAN 23
- PC2 is used to wake up PC1 – in order to easily test WOL a small piece of software is installed on PC2. There are several freeware programs available on the web. For this test, Matcode software (http://www.matcode.com/wol.htm) was used.

Matcode Specific Usage

**Usage:** MC-WOL XX:XX:XX:XX:XX:XX [/p <Password>] [/a <IP Address>]

XX:XX:XX:XX:XX:XX is the MAC address of the PC to wake up

IP Address is only required if PC is on a different Layer 2 domain

IP Address is the broadcast address for the destination VLAN (subnet)

To wake up PC1 (00:13:72:70:71:90) from PC2 on the same Layer 2 VLAN:

C:\> mc-wol 00:13:72:70:71:90

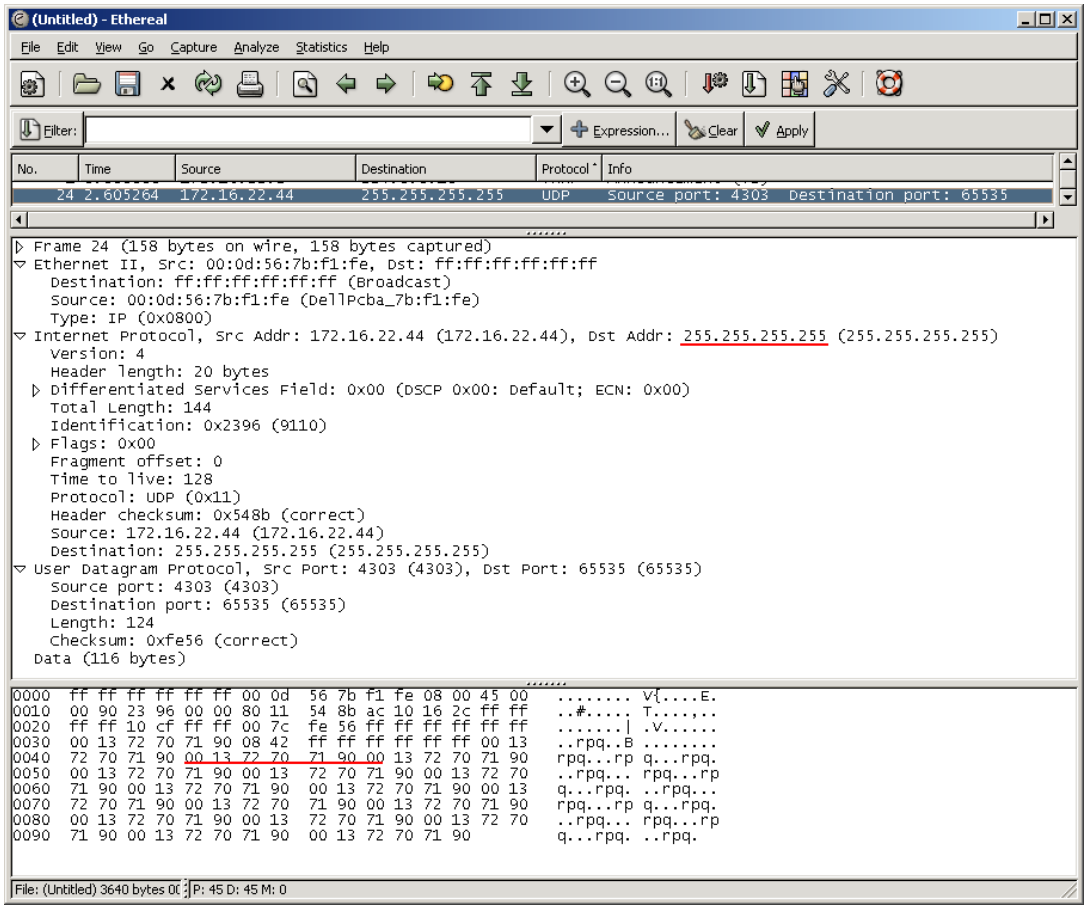
```
Ethernet adapter Local Area Connection:

        Connection-specific DNS Suffix  . :
        IP Address. . . . . . . . . . . . : 172.16.22.44
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        Default Gateway . . . . . . . . . : 172.16.22.254

C:\>mc-wol 00:13:72:70:71:90

WakeOnLAN v1.0 Copyright (c)2001, MATCODE Software.
Web: http://www.matcode.com
Author: Vitaly Evseenko, ve@matcode.com
Sending "Magic Packet" to 00:13:72:70:71:90 - Success!
```

**Ethereal capture:**



To wake up PC1 (00:13:72:70:71:90) from PC2 on a different Layer 2 VLAN:

C:\> mc-wol 00:13:72:70:71:90 /a 172.16.22.255

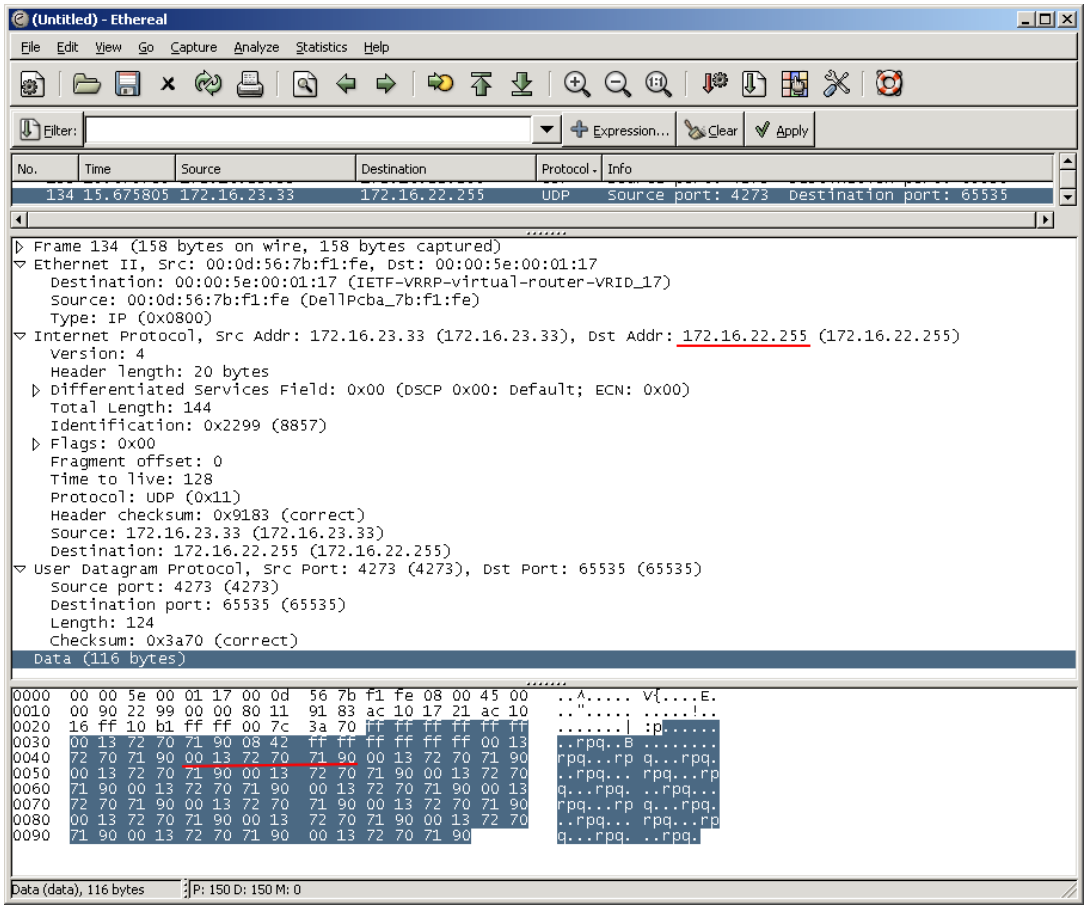
```
Ethernet adapter Local Area Connection:

        Connection-specific DNS Suffix  . : belab.europe.nortel.com
        IP Address. . . . . . . . . . . . : 172.16.23.33
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        Default Gateway . . . . . . . . . : 172.16.23.1

C:\>mc-wol 00:13:72:70:71:90 /a 172.16.22.255

WakeOnLAN v1.0 Copyright (c)2001, MATCODE Software.
Web: http://www.matcode.com
Author: Vitaly Evseenko, ve@matcode.com
Sending "Magic Packet" to 00:13:72:70:71:90 - Success!
```

**Ethereal capture:**



# 4. Wake on LAN: 802.1x Authentication

Wake on LAN and 802.1x authentication are mutually compatible only if the sleeping workstation is able to receive the magic packet. When an Ethernet switch port is configured with 802.1x enabled, traffic to and from the PC is dropped until the PC is authenticated. This could be a problem for WoL, as the magic packet would normally be dropped by the Ethernet switch before it ever reached the intended PC.

The Ethernet Switch 470, Ethernet Switch 425, and Ethernet Routing Switch 5500 series have a feature (traffic-control) that allows traffic from the network to the workstation even when the authentication process is not yet done.

From the CLI

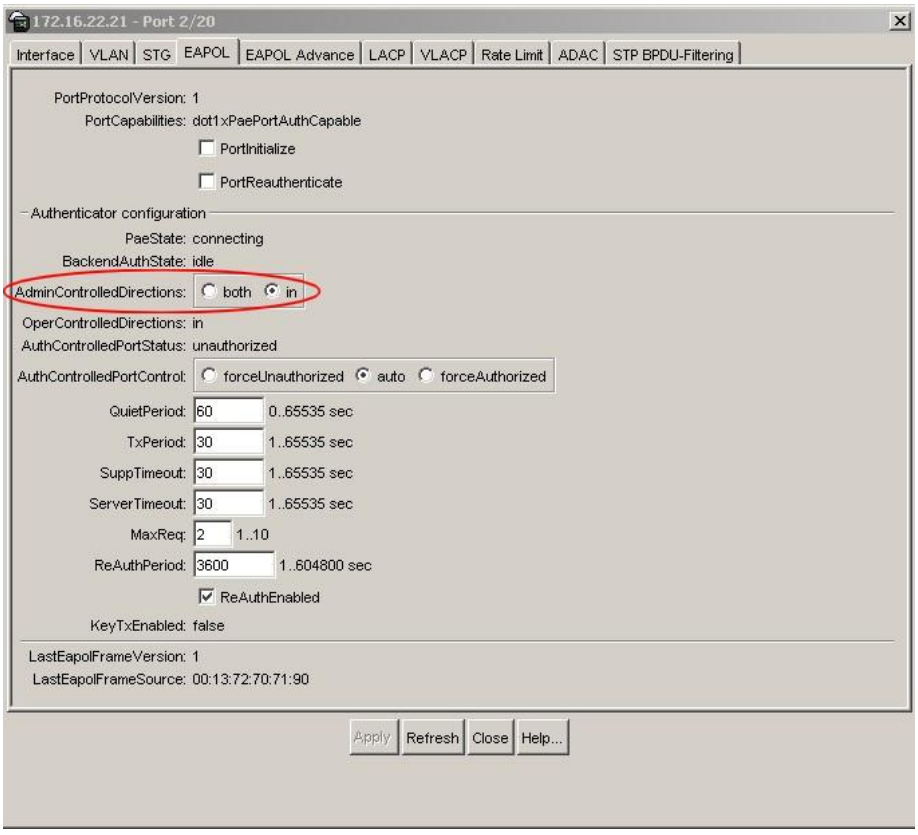
(config-if)#eapol traffic-control [port <portlist>] [in] [in-out]

| | |
|---|---|
| port | Specifies the port or list of ports to configure for EAPOL |
| in | Incoming traffic is blocked on EAP authentication failure |
| in-out | Incoming and outgoing traffic blocked on EAP authentication failure |

In this context, incoming traffic refers to the traffic coming from the PC into the Ethernet switch port. In order for the WOL magic packet to be passed to the PC while the port has 802.1x enabled, the switch port must be configured as follows:

(config-if)#eapol traffic-control 2/20 in

**From Java Device Manager (JDM):**



## 4.1 Caveats with 802.1x and Wake on LAN

802.1x authentication is supported in several different modes on the Avaya Ethernet switches.

- Single Host Single Authentication (SHSA) – ES 425, ES 470, ERS 5500
- Multiple Host Multiple Authentication (MHMA) – ES 470, ERS 5500
- Multiple Host Single Authentication (MHSA) – ES 470, ERS 5500

With SHSA it is possible use dynamic VLAN assignment whereby the Ethernet switch port is potentially moved to a different VLAN based on the user authentication. In the case where this feature is used, it is impossible to know which VLAN the end user PC port will be assigned to after successful authentication.

The PVID (Port Vlan Identifier) of the Ethernet switch port configured for 802.1x authentication is the VLAN of latest authentication, therefore it is impossible to know for sure the PVID of a port where a PC is shutdown. Also note that when the Ethernet switch is rebooted, the PVID of a port configured for 802.1x authentication is automatically set to VLAN 1.

It is recommended not to combine Wake on LAN with 802.1x when using dynamic VLAN assignment.

None of the multiple host methods support dynamic VLAN assignment and therefore are not subject to these restrictions.

# 5. Software Baseline

ES 470

- Software Release 3.6.3.04
- Firmware Release 3.6.0.1

ERS5510

- Software Release 5.0.0.011
- Firmware Release 4.2.0.11

ES425

- Software Release 3.5.0.06
- Firmware Release 3.5.0.2

ERS 8600

- Software Release 3.7.4.0

PC

- Windows XP

Matcode

- Version 1.0

# 6. Reference Documentation

White Paper: Wake on LAN Technology, Philip Lieberman, Lieberman Software Corporation, July 11, 2002 http://www.liebsoft.com/index.cfm/whitepapers/Wake_On_LAN

Wikipedia, Wake on LAN, http://en.wikipedia.org/wiki/Wake-on-LAN

Ethernet Routing Switch 5500 Series: Configuring and Managing Security, NN47200-501 (217463-B), May 31, 2006

Configuring and Managing Security Avaya Ethernet Switches 460 and 470 Software Release 3.6, 217104-A, June 2005

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