AVAYA

Avaya Solution & Interoperability Test Lab

Sample Configuration for using Link Layer Discovery Protocol (LLDP) with Cisco Catalyst 4500 or 3750 Switches for VLAN assignment to Avaya 4600 Series IP Telephones – Issue 1.0

Abstract

These Application Notes describe the steps for configuring the Cisco Catalyst 4503 and 3750 Ethernet switch to use the Network Policy Type Length Value (TLV) within the Link Layer Discovery Protocol Media Endpoint Devices (LLDP-MED) to assign VLAN information to Avaya 4600 Series IP Telephones.

1. Introduction

These Application Notes describe a sample configuration for using Link Layer Discovery Protocol (LLDP) to provision VLAN assignment for Avaya 4600 Series IP Telephones. LLDP or 802.1AB is an IEEE standard designed for the discovery of directly attached adjacent network devices such as Ethernet switches, Router, and other LLDP capable devices such as Avaya IP Telephones. LLDP advertisements are encapsulated in LLDP Data Units (LLDPDU) in the format of Type Length Value or TLV for short. The IEEE 802.1AB specification defines different types of TLVs – Standard and Optional. LLDP capable devices must support the advertisement of Standard TLVs such as Chassis ID, Port ID, and Time to Live TLVs. The same LLDP capable device may also include Network Policy, IEEE 802.3 (MAC/PHY Configuration/Status) and other Vendor specific optional TLVs as part of its LLDP advertisement. Starting with firmware release version 2.9, Avaya 4600 Series IP Telephone enhanced its LLDP support to include the use of the Network Policy TLV as a means to accept VLAN assignment in addition to using vendor specific TLVs. This applies to the H.323 software release for Avaya 4601+, 4602+, 4610, 4620SW, 4621SW, 4622SW, and 4625SW IP Telephones.

2. Overview

The sample network outlined in these Application Notes consists of two Cisco Catalyst switches, 4503 and 3750, serving as the connection point for the Avaya IP Telephones to connect into the network. The Ethernet switch port is configured to support 2 VLANs, one for voice and one for data. The voice VLAN supports Avaya IP Telephone traffic and the data VLAN supports PC traffic. LLDP is enabled on these Ethernet ports and are configured to advertise the voice VLAN ID using the Network Policy LLDP TLV.

Note: By default Cisco switches do not send out what Cisco term as LLDP-MED LLDPDU which includes the Network Policy TLV until an LLDP-MED packet is received by the switch port. The Network Policy TLV is used to advertise to any attached device what VLAN to use for sending traffic. Once the Cisco switch port receives a LLDP-MED packet from the attached device, the switch will then send only LLDP-MED LLDPDU going forward.
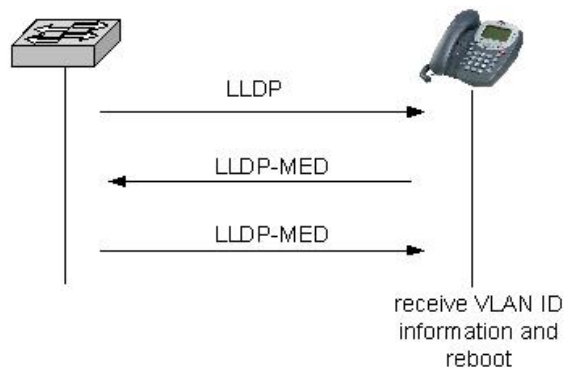
3. Configuration

Figure 1 illustrates the configuration used in these Application Notes. All Avaya IP Telephones are registered with Avaya Communication Manager connected to the Enterprise IP Network. All Avaya IP Telephones are assigned to the same IP network region within Avaya Communication Manager. VLAN information for Avaya IP Telephones is obtained through LLDP advertisement configured in the Cisco Catalyst switches.
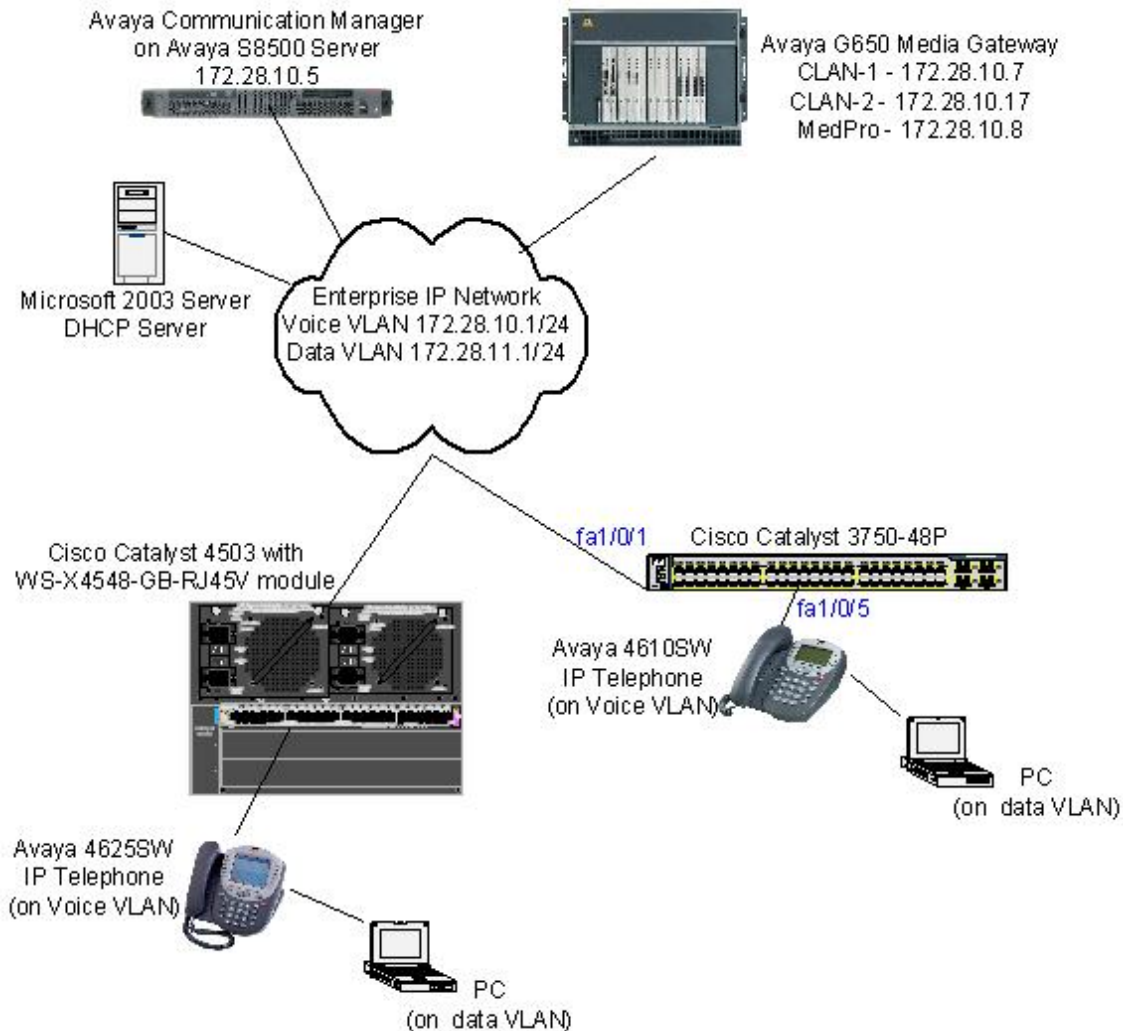
Figure 1: Sample Network Configuration

AL; Reviewed:
SPOC 12/05/2008

Solution & Interoperability Test Lab Application Notes
©2008 Avaya Inc. All Rights Reserved.

3 of 11
CSCO_LLDP-MED

4. Equipment and Software Validated

The following equipment and software/firmware were used for the sample configuration:

DEVICE DESCRIPTION	VERSION TESTED
Avaya Communication Manager with Avaya S8500 Server Avaya G650 Gateway	R015x.01.0.414.3
Avaya 4610SW IP Telephone (H.323)	2.9
Avaya 4625SW IP Telephone (H.323)	2.9
Cisco Catalyst 4503 with WS-X4548-GB-RJ45V module	IOS 12.2(46)SG
Cisco Catalyst 3750-48P	IOS 12.2(46)SE
Microsoft Windows running DHCP Server	2003 Server Enterprise Edition 5.2.3790.1830

5. Configure Cisco Catalyst switches

This section describes the configuration for Cisco catalyst switches as shown in **Figure 1** using the Command Line Interface (CLI). Since the syntax for configuring either Catalyst 4503 and 3750 switches is the same, only the configuration for the 3750 is shown.

1. Log into the Cisco Catalyst switch and enter enable mode using appropriate credential.
2. Enter into configuration mode by typing "configure terminal".
3. Below is the configuration for the switch. Comments are highlighted in blue between #---# signs. The "switchport voice vlan 10" command will cause the LLDP-MED to advertise VLAN 10 in its Network Policy TLV to the Avaya IP Telephone.

```
# ---------- configure interface fa1/0/1 ------------------ #
# ---------- as a trunk port for VLAN 10 and 11 ----------- #
interface FastEthernet1/0/1
 switchport trunk encapsulation dot1q
 switchport trunk allowed vlan 10,11
 switchport mode trunk
!
# ---------- Globally enable LLDP ------------------------- #
lldp run
!
# ---------- configure interface fa1/0/5 ------------------ #
# ---------- with access VLAN 11 and --------------------- #
# ---------- with voice VLAN 10 -------------------------- #
interface FastEthernet1/0/5
 switchport access vlan 11
 switchport mode access
 switchport voice vlan 10
 spanning-tree portfast
!
```

6. Verification

The following steps may be used to verify the configuration:

1. Use the **show lldp traffic** command to verify LLDP traffic statistics.

```
interop#show lldp traffic

LLDP traffic statistics:
    Total frames out: 125653
    Total entries aged: 54
    Total frames in: 47255
    Total frames received in error: 0
    Total frames discarded: 1
    Total TLVs unrecognized: 283524
```

2. Use the **show lldp interface** command to verify the status of the interfaces.

```
interop#show lldp interface

FastEthernet1/0/1:
    Tx: enabled
    Rx: enabled
    Tx state: IDLE
    Rx state: WAIT FOR FRAME

FastEthernet1/0/5:
    Tx: enabled
    Rx: enabled
    Tx state: IDLE
    Rx state: WAIT FOR FRAME
```

3. Use the **show lldp neighbors detail** command to verify detail LLDP neighbor information.

```
interop#show lldp neighbors detail

Chassis id: 172.28.10.55
Port id: 0009.6e08.e6d5
Port Description - not advertised
System Name: AVE08E6D5
System Description - not advertised

Time remaining: 93 seconds
System Capabilities: B,T
Enabled Capabilities: B
Management Addresses:
    IP: 172.28.10.55
    OID:
        2B 06 01 04 01 FF 69 01 45 01 07
Auto Negotiation - supported, enabled
Physical media capabilities:
    Symm Pause(FD)
    Pause(FD)
    100base-TX(FD)
    100base-TX(HD)
    10base-T(FD)
    10base-T(HD)
Media Attachment Unit type: 16

MED Information:

    MED Codes:
          (NP) Network Policy, (LI) Location Identification
          (PS) Power Source Entity, (PD) Power Device
          (IN) Inventory

    H/W revision: 4610D01A
    F/W revision: b10d01b2_9.bin
    S/W revision: a10d01b2_9.bin
    Serial number: 05GM01024360
    Manufacturer: Avaya
    Model: 4610
    Capabilities: NP, IN
    Device type: Endpoint Class III
    Network Policy(Voice): VLAN 10, tagged, Layer-2 priority: 6,
DSCP: 46
    Power requirements - not advertised
----------------------------------------------

Total entries displayed: 1
```

7. Conclusion

These Application Notes have described the administration steps required to configure the Cisco Catalyst switch model 4503 and 3750 to use LLDP-MED advertisement to perform VLAN assignment for Avaya 4600 Series IP Telephones.

Although not directly service impacting, it was observed during testing that the Catalyst 4503 implementation of the PMD Auto-Negotiation portion of the IEEE 802.3 TLV differed from the Catalyst 3750 implementation as described in Appendix A. The Catalyst 4503 implementation causes the Physical Media Capability portion of the LLDP neighbor detail displayed for the Avaya IP Telephone to become incorrect. Depending on how this TLV is used within Cisco switches, it may cause trap message to be generated.

8. Additional References

Product documentation for Avaya products may be found at http://support.avaya.com

[1] *Administrator Guide for Avaya Communication Manager*, Doc # 03-300509, Issue 4.0, Release 5.0, January 2008
[2] *Avaya Communication Manager Advanced Administration Quick Reference*, Doc # 03-300364, Issue 4, Release 5.0, January 2008
[3] *Administration for Network Connectivity for Avaya Communication Manager,* Doc # 555-233-504, Issue 13, January 2008
[4] *Avaya IP Telephony Implementation Guide*, May 1, 2006

Product documentation for Cisco products may be found at http://www.cisco.com

[5] *Catalyst 4500 Series Switch Cisco IOS Command Reference*, Release 12.2(46)SG, Text Part Number:OL-16005-01

[6] IEEE Standards Interpretation for IEEE Std 802.1AB^TM-2005, IEEE Standard for Local and Metropolitan Area Networks-Station and Media Access Control Connectivity Discovery, March 2008
http://standards.ieee.org/reading/ieee/interp/802.1AB.html

9. Appendix A – LLDP neighbor outputs

The physical media capabilities shown between the Catalyst 3750 and 4503 for the same Avaya IP Telephone are different. The physical media capabilities shown on the 4503 are incorrect. This is due to the fact that the Catalyst 4503 is mis-interpreting the PMD Auto-Negotiation portion of IEEE 802.3 TLV. For additional information regarding this TLV, please reference IEEE document [5].

9.1. Catalyst 3750 LLDP output

```
Chassis id: 172.28.10.51
Port id: 0004.0def.6d4b
Port Description - not advertised
System Name: AVAEF6D4B
System Description - not advertised

Time remaining: 116 seconds
System Capabilities: B,T
Enabled Capabilities: B,T
Management Addresses:
    IP: 172.28.10.51
    OID:
        2B 06 01 04 01 FF 69 01 45 01 0D
Auto Negotiation - supported, enabled
Physical media capabilities:
    Symm Pause(FD)
    Pause(FD)
    100base-TX(FD)
    100base-TX(HD)
    10base-T(FD)
    10base-T(HD)
Media Attachment Unit type: 16

MED Information:

    MED Codes:
            (NP) Network Policy, (LI) Location Identification
            (PS) Power Source Entity, (PD) Power Device
            (IN) Inventory

    H/W revision: 4625D01A
    F/W revision: b25d01a2_9.bin
    S/W revision: a25d01a2_9.bin
    Serial number: 061626500776
    Manufacturer: Avaya
    Model: 4625
    Capabilities: NP, IN
    Device type: Endpoint Class III
    Network Policy(Voice): VLAN 10, tagged, Layer-2 priority: 6,
DSCP: 46
    Power requirements - not advertised
```

9.2. Catalyst 4503 LLDP output

As shown in bold below, the Cisco Catalyst 4503 switch incorrectly interpreted the Physical media capabilities LLDP TLV of the phone as capable of supporting 100base-T2, Symm, Asym Pause (FD), 1000baseX(FD) and 1000baseT (HD).

```
Chassis id: 172.28.10.51
Port id: 0004.0def.6d4b
Port Description - not advertised
System Name: AVAEF6D4B
System Description - not advertised

Time remaining: 12 seconds
System Capabilities: B,T
Enabled Capabilities: B
Management Addresses:
    IP: 172.28.10.51
    OID:
        2B 06 01 04 01 FF 69 01 45 01 0D
Auto Negotiation - supported, enabled
Physical media capabilities:
    100base-TX(FD)
    100base-T2(FD)
    Symm Pause(FD)
    Symm, Asym Pause(FD)
    1000baseX(FD)
    1000baseT(HD)
Media Attachment Unit type: 16
Vlan ID: - not advertised

MED Information:

    MED Codes:
          (NP) Network Policy, (LI) Location Identification
          (PS) Power Source Entity, (PD) Power Device
          (IN) Inventory

    H/W revision: 4625D01A
    F/W revision: b25d01a2_9.bin
    S/W revision: a25d01a2_9.bin
    Serial number: 061626500776
    Manufacturer: Avaya
    Model: 4625
    Capabilities: NP, IN
    Device type: Endpoint Class III
    Network Policy(Voice): VLAN dot1p, tagged, Layer-2 priority: 6,
DSCP: 46
    Power requirements - not advertised
    Location - not advertised
```