



Avaya Solution & Interoperability Test Lab

Sample Configuration for using Link Layer Discovery Protocol (LLDP) with Cisco Catalyst 3750 Switches for VLAN assignment to Avaya one-X® 9600 and Avaya 1600 Series IP phones – Issue 1.0

Abstract

These Application Notes describe the steps for configuring Cisco Catalyst 3750E-24PD switches to assign VLAN information to Avaya one-X® 9600 and Avaya 1600 Series IP phones. The sample configuration uses the Network Policy Type Length Value (TLV) within the Link Layer Discovery Protocol Media Endpoint Devices (LLDP-MED) to assign VLAN information.

1. Introduction

These Application Notes describe a sample configuration for using Link Layer Discovery Protocol (LLDP) to provision VLAN assignment for Avaya one-X® 9600 and Avaya 1600 Series IP phones. 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 phones. 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. When the Avaya IP phone is powered up, the switch port of the phone is configured to receive frames with the LLDP group multicast destination address (01-80-C2-00-00-0E) on the Ethernet line. Please note that IEEE 802.1AB frames are not supported on the secondary Ethernet interface (PC port). The transmission of LLDP frames will not start until an LLDP frame is received.

2. Configuration

The sample network outlined in these Application Notes consists of a Cisco Catalyst 3750E-PD switch, serving as the connection point for the Avaya IP phones 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 phone 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 3750 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.

Figure 1 illustrates the configuration used in these Application Notes. All Avaya one-X® 9600 and 1600 Series H.323 phones are registered with Avaya Aura® Communication Manager while the Avaya one-X® 9601 SIP phone is registered with Avaya Aura® Session Manager connected to the Enterprise IP Network. VLAN information for Avaya IP phones is obtained through LLDP advertisement configured in the Cisco Catalyst 3750E-24PD switch.

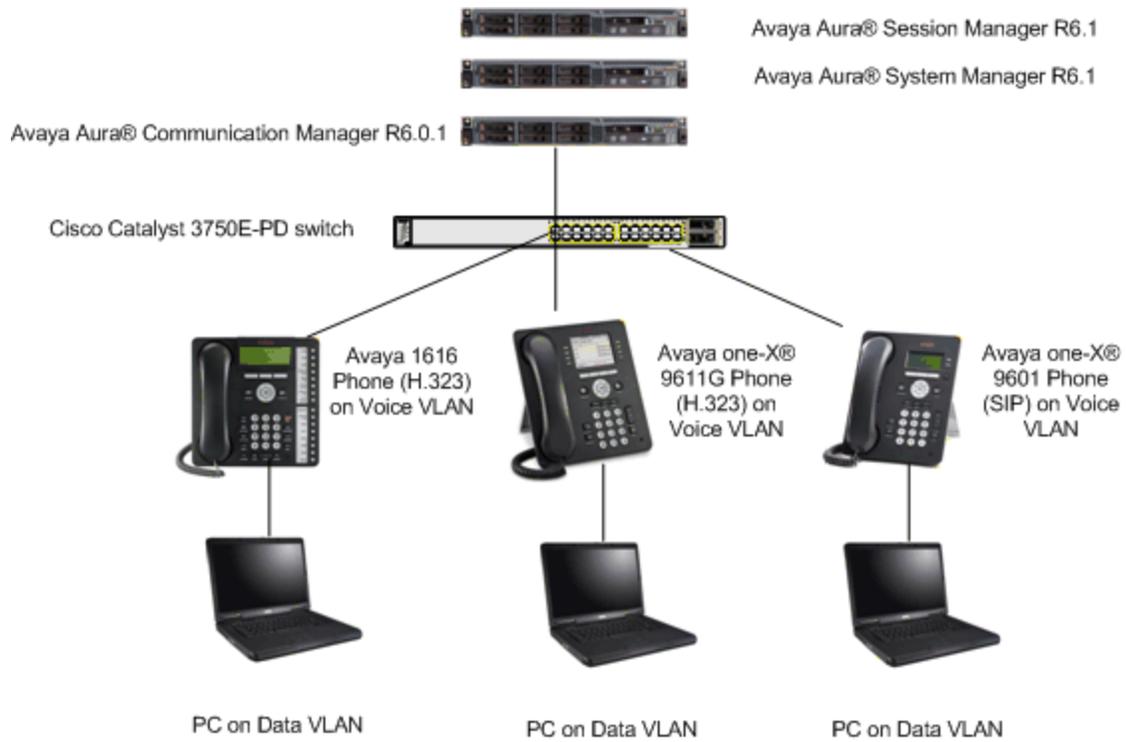


Figure 1: Avaya Interoperability Test Lab Reference Configuration

3. Equipment and Software Validated

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

Equipment	Software Version
Avaya S8800 Server	Avaya Aura® Communication Manager (GA) 6.0.1 – R016x.00.1.510.1 with patch 18599
Avaya S8800 Server	Avaya Aura® System Manager 6.1 6.1.0.0.7345-6.1.5.6
Avaya S8800 Server	Avaya Aura® Session Manager 6.1 6.1.1.0 – Build number 611023
Avaya one-X® 9601 Phone (SIP)	Avaya one-X® Deskphone SIP Release 6.1 Service Pack 2
Avaya one-X® 9611G Phone (H.323)	Avaya one-X® Deskphone H.323 Release 6.0 Service Pack 2
Avaya 1616 Phone (H.323)	Avaya 1600 Series Deskphone Release 1.300B (November 2010)
Cisco Catalyst 3750E-24PD	IOS 12.2(55)SE

4. Configure Cisco Catalyst switch

This section describes the configuration for Cisco catalyst switches as shown in **Figure 1** using the Command Line Interface (CLI).

1. Log into the Cisco Catalyst switch and enter enable mode using appropriate credentials.
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 phone.

```
# ----- Globally enable LLDP ----- #
lldp run
!
# ----- configure interface fa 0/5 ----- #
# ----- with access VLAN 11 and ----- #
# ----- with voice VLAN 10 ----- #
interface FastEthernet 0/5
switchport access vlan 11
switchport mode access
switchport voice vlan 10
spanning-tree portfast
!
```

5. 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: 10.0.0.11
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: 9601
  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
```

6. Conclusion

These Application Notes have described the administration steps required to configure the Cisco Catalyst 3750E-PD switch to use LLDP-MED advertisement to perform VLAN assignment for Avaya one-X® 9600 and 1600 series IP phones.

7. Additional References

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

- [1] *Avaya 1600 Series IP Deskphones Administrator Guide Release 1.3.x*, Doc # 16-601443, Issue 4, April 2010
- [2] *Avaya one-X™ Deskphone SIP Installation and Maintenance Guide Release 6.1 for 9601IP Deskphone*, Doc # 16-603843 Issue 1, December 2010
- [3] *Avaya one-X™ Deskphone SIP Administrator Guide Release 6.1*, Doc # 16-603838 Issue 1, December 2010

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

- [4] *Catalyst 3750 Software Configuration Guide, Release 12.2(55)SE*, August 2010
- [5] IEEE Standards Interpretation for IEEE Std 802.1AB™-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>

8. Appendix A – LLDP neighbor outputs

The physical media capabilities shown between the Catalyst 3750 for the same Avaya IP phone are different. 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
```

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