



Avaya Solution & Interoperability Test Lab

Configuring Link Layer Discovery Protocol on Avaya G250 and G350 Media Gateways and Extreme Networks BlackDiamond 8810 to Support Avaya IP Telephones - Issue 1.1

Abstract

The IEEE 802.1AB Link Layer Discovery Protocol (LLDP) enables devices to advertise capabilities, advertise media-specific configuration information and learn information about connected devices. LLDP is a vendor-neutral Layer 2 protocol and is positioned to replace proprietary protocols such as Cisco Discovery Protocol (CDP) and Nortel Discovery Protocol (NDP). Avaya IP telephones communicate with the connected switch to learn the voice VLAN through LLDP. These Application Notes provide the steps necessary to configure LLDP on Avaya G250 and G350 Media Gateways and the Extreme Networks BlackDiamond 8810 to support Avaya IP telephones.

1 Introduction

Prior to the availability of Link Layer Discovery Protocol (LLDP) support, Avaya IP telephones can obtain the voice VLAN from a DHCP server in the following way: When an Avaya IP telephone is initially reset, the telephone will send an untagged DHCP request. The DHCP server returns a DHCP offer on the untagged VLAN with an option string, instructing the IP telephone to enable 802.1Q tagging with the voice VLAN. The IP telephone receiving this reply releases the supplied IP address on the untagged VLAN and issues a new DHCP request on the voice VLAN.

With the support of LLDP in Avaya IP telephones, there is no longer a need to configure VLAN tagging via the DHCP server. Through LLDP, the phones communicate with the connected switch to learn the voice VLAN. LLDP is always enabled on the Avaya IP telephones. There is no configuration required to enable LLDP on the phones.

The IEEE 802.1AB standard defines a set of advertisement messages, called type-length-values (TLVs). Avaya IP telephones support TLV elements specified in IEEE 802.1AB-2005 and extensions. Refer to [1] for details of LLDP support in Avaya IP telephones.

Figure 1 shows the network diagram used in these Application Notes.

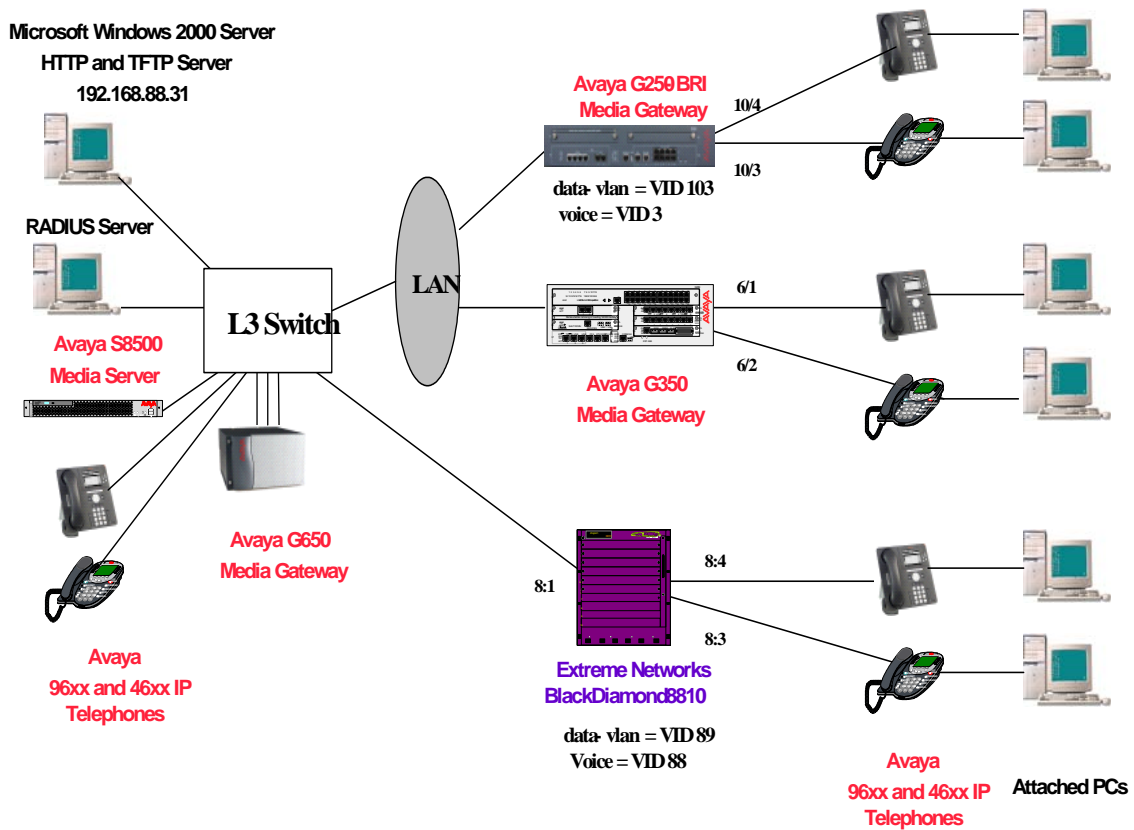


Figure 1 – LLDP Configuration for Avaya IP Telephones

2 Equipment and Software Validated

Table 1 below shows the versions verified in these Application Notes.

Equipment	Software
Avaya S8500 Media Server	Avaya Communication Manager R4.0 (R014x.00.0.722.0)
Avaya G650 Media Gateway IPSI (TN2312BP) C-LAN (TN799DP) MEDPRO (TN2302AP)	HW03 FW030 HW01 FW017 HW18 FW107
Avaya G250-BRI Media Gateway	26.21.0
Avaya G350 Media Gateway	26.21.0
Avaya 9610 IP Telephone	1.2 H.323 (1_20r19)
Avaya 9620 IP Telephone	1.2 H.323 (1_20r19)
Avaya 9630 IP Telephone	1.2 H.323 (1_20r19)
Avaya 9640 IP Telephone	1.2 H.323 (1_20r19)
Avaya 9650 IP Telephone	1.2 H.323 (1_20r19)
Avaya 4610SW IP Telephone	2.6 H.323
Avaya 4620SW IP Telephone	2.6 H.323
Avaya 4621SW IP Telephone	2.6 H.323
Avaya 4622SW IP Telephone	2.6 H.323
Avaya TFTP Server (for 4600 phones)	3.6.1
Extreme Networks BlackDiamond 8810 Module: G48P-41512	11.5.2.8 XOS
Apache HTTP Server (for 9600 phones)	2.0.54

Table 1: Equipment and Software Validated

3 Configurations

3.1 Configure LLDP on the Avaya G250-BRI Media Gateway

This section demonstrates the G250-BRI configuration. The same approach can be followed with Avaya G350, Avaya G250, and Avaya G250-DS1 Media Gateways.

The following screen shows the configuration for two VLANs on the G250-BRI. One VLAN is named “data-vlan” and the other is named “voice”. The “voice” VLAN is used by Avaya IP telephones and the “data-vlan” is used by attached PC’s. Note that the voice VLAN **must** be named “**voice**” in order for the IP telephone to use the voice VLAN via LLDP. The VLAN name of “**voice**” is not case sensitive for the IP telephones and any combination of upper/lower case letters can be used.

```
set vlan 3 name "voice"  
set vlan 103 name "data-vlan"
```

As shown in **Figure 1**, ports 10/3 and 10/4 are connected to the Avaya 4600 and 9600 IP telephones respectively. The following screen shows the configuration for the ports. VLAN 103 (data-vlan) is configured as the native VLAN on ports 10/3 and 10/4. VLAN 3 (voice) is configured as a static VLAN on ports 10/3 and 10/4. Ports 10/3 and 10/4 are also configured as dot1q trunk ports with the **vlan-binding-mode** set to the **bind-to-configured**.

```
set port vlan 103 10/3  
set port vlan 103 10/4  
set port static-vlan 10/3 3  
set port static-vlan 10/4 3  
set port vlan-binding-mode 10/3 bind-to-configured  
set port vlan-binding-mode 10/4 bind-to-configured  
set trunk 10/3 dot1q  
set trunk 10/4 dot1q
```

Use the command **show trunk <port#>** to display the trunk configuration. As shown below, ports 10/3 and 10/4 are associated with the VLAN IDs 3 and 103 in addition to the default VLAN 1. The default VLAN cannot be deleted.

```
G250-BRI-004(super)# show trunk 10/3-4
Port      Mode   Binding mode          Native vlan  Vlans allowed on trunk
-----
10/3     dot1q  bound to configured vlans  103        1,3,103

Port      Mode   Binding mode          Native vlan  Vlans allowed on trunk
-----
10/4     dot1q  bound to configured vlans  103        1,3,103
```

Use the command **set lldp system-control enable** to enable the LLDP agent globally. The global topology information of the G250 Media Gateway, including all mandatory TLVs, is now available to neighboring devices. To limit the delay for the phone to receive the dynamic LLDP advertisement, configure the LLDP transmit interval to be 5 seconds or less.

Use the command **set port lldp tlv <port #> enable all** to enable all the LLDP advertisements on the specified ports. Use the command **set port lldp tlv <port #> enable vlan-name <VLAN ID>** to enable the G250 Media Gateway to send VLAN name TLV on the specified ports. The VLAN name TLV includes both the VLAN ID and the VLAN name. When the phone detects “voice” as the VLAN name in the VLAN name TLV, the phone will use the associated VLAN ID as the phone’s voice VLAN tag.

If 802.1x is enabled on a port connected to an Avaya IP telephone, an additional command **set dot1x lldp tlv enable** must be entered in order for the Media Gateway to transmit the port LLDP information (VLAN name, etc) upon a successful 802.1x authentication. Refer to [2] for detailed 802.1x configuration on the Avaya G250 and G350 Media Gateways.

```
set lldp system-control enable
set lldp tx-interval 5
set port lldp tlv 10/3 enable all
set port lldp tlv 10/4 enable all
set dot1x lldp tlv enable
set port lldp tlv 10/3 enable vlan-name 3
set port lldp tlv 10/4 enable vlan-name 3
```

3.2 Configure LLDP Protocol on the Extreme Networks BlackDiamond

This section provides the LLDP configuration on the Extreme Networks BlackDiamond 8810 if 802.1x is not used for the Avaya IP telephones. Refer [3] for detailed configuration if 802.1x is used for the Avaya IP telephones.

The following screen shows the “data-vlan” configuration. The “data-vlan” is configured with VLAN ID 89. Ports 8:3 and 8:4 are connected to the Avaya 4600 and 9600 IP telephones and are configured with this untagged VLAN. The “data-vlan” is used by the attached PCs. Port 8:1 is connected to the L3 Switch and is configured with tagged VLAN 89.

```
create vlan "data-vlan"  
configure vlan data-vlan tag 89  
configure vlan data-vlan add ports 8:1 tagged  
configure vlan data-vlan add ports 8:3-4 untagged
```

The following screen shows the “Voice” VLAN configuration. The “Voice” VLAN is configured with VLAN ID 88. Ports 8:3 and 8:4 are configured with this tagged VLAN. Port 8:1 is connected to the L3 Switch and is also configured with this tagged VLAN. Note that the voice VLAN **must** be named to “**voice**” in order for the IP telephone to use the voice VLAN via LLDP. The VLAN name of “**voice**” is not case sensitive for the IP telephones and any combination of upper/lower case letters can be used (e.g. an upper case “V” is used in the VLAN name for these Application Notes as shown below).

```
create vlan "Voice"  
configure vlan Voice tag 88  
configure vlan Voice ipaddress 192.168.88.6 255.255.255.0  
enable ipforwarding vlan Voice  
configure vlan Voice add ports 8:1 tagged  
configure vlan Voice add ports 8:3-4 tagged
```

The following shows the LLDP configuration on the BlackDiamond 8810. The command **enable lldp ports <port #>** is used to enable transmitting and receiving of the LLDP on the specified ports. The command **configure lldp port <port #> advertise vendor-specific dot1 vlan-name vlan <vlan-name>** is used to advertise the configured VLAN name (as well as its VLAN ID) TLV. To limit the delay for the phone to receive the dynamic LLDP advertisement, configure the LLDP transmit interval to be 5 seconds or less.

```
enable lldp ports 8:3-4  
configure lldp port 8:3-4 advertise vendor-specific dot1 vlan-name vlan Voice  
configure lldp transmit-interval 5
```

4 Verification

4.1 Verify LLDP On the Avaya G250-BRI Media Gateway

Use the command **show lldp config** to verify that LLDP is globally enabled on the G250.

```
250-BRI-004(super)# show lldp config
```

```
Lldp Configuration
-----
Application status: enable
Tx interval: 5 seconds
Tx hold multiplier: 4 seconds
Tx delay: 2 seconds
Reinit delay: 2 seconds
```

Use the command **show port lldp config** to view the LLDP configuration. The LLDP TLVs shown include **System Name**, **System Description**, **System Capability**, **Management Address** and **PVID**.

```
G250-BRI-004(super)# show port lldp config
```

```
Port   Port   Port   System   System   System   Management
Number Status Description Name     Description Capability Address   PVID
-----
10/3   txAndRx enable  enable  enable  enable  enable  enable
10/4   txAndRx enable  enable  enable  enable  enable  enable
...
```

Use the command **show port lldp vlan-name config** to show the VLAN name TLV configuration. The following screen shows that ports 10/3 and 10/4 are configured to advertise the VLAN name TLV for VLAN ID 3. The VLAN name TLV for VLAN ID 3 includes both the VLAN ID 3 and the VLAN name “**voice**”.

```
G250-BRI-004(super)# show port lldp vlan-name config
```

```
Port   Transmitted VLAN-IDs
-----
10/3   3
10/4   3
...
```

4.2 Verify LLDP On the Extreme Networks BlackDiamond 8810

Use the command **show lldp detailed** to display detailed LLDP configuration. The following screen shows that ports 8:3 and 8:4 are enabled with LLDP for Tx and Rx modes. Note that VLAN Name flag “N” is enabled for the voice VLAN.

```
* BD-8810.36 # show lldp detailed
```

```
LLDP transmit interval      : 5 seconds
LLDP transmit hold multiplier : 4 (used TTL = 20 seconds)
LLDP transmit delay        : 2 seconds
LLDP SNMP notification interval : 5 seconds
LLDP reinitialize delay    : 2 seconds
LLDP-MED fast start repeat count : 3
```

LLDP Port Configuration:

Port	Rx Mode	Tx Mode	SNMP Notification	Optional LLDP	enabled 802.1	transmit 802.3	TLVs MED	AvEx
8:3	Enabled	Enabled	--	-----	--N	----	----	----
	VLAN: Voice			-----	--N	----	----	----
	VLAN: data-vlan			-----	---	----	----	----
8:4	Enabled	Enabled	--	-----	--N	----	----	----
	VLAN: Voice			-----	--N	----	----	----
	VLAN: data-vlan			-----	---	----	----	----

```

Notification: (L) lldpRemTablesChange, (M) lldpXMedTopologyChangeDetected
LLDP Flags   : (P) Port Description, (N) System Name, (D) System Description
               (C) System Capabilities, (M) Mgmt Address
802.1 Flags  : (P) Port VLAN ID, (p) Port & Protocol VLAN ID, (N) VLAN Name
802.3 Flags  : (M) MAC/PHY Configuration/Status, (P) Power via MDI
               (L) Link Aggregation, (F) Frame Size
MED Flags    : (C) MED Capabilities, (P) Network Policy,
               (L) Location Identification, (p) Extended Power-via-MDI
AvEx Flags   : (P) PoE Conservation Request, (C) Call Server, (F) File Server
               (Q) 802.1Q Framing

```


4.3 Verify the Avaya IP Telephone Operation

To verify that the IP telephone can transit from the untagged VLAN to the tagged voice VLAN via LLDP, reset the IP telephone to the factory default settings. Verify the IP telephone resets and uses the voice VLAN. Verify that the IP telephone can register to Avaya Communication Manager with the appropriate extension and password. Verify that calls can be made with acceptable voice quality.

Reset the IP telephone with the current configuration and verify that the telephone can register to Avaya Communication Manager with the appropriate extension and password. Verify that calls can be made with acceptable voice quality.

5 Conclusion

As illustrated in these Application Notes, LLDP can be used to configure VLAN tagging for Avaya IP telephones. The Avaya IP telephones can learn the voice VLAN from the Avaya G250 and G350 Media Gateways and Extreme Networks BlackDiamond 8810 via LLDP.

6 Reference

- [1] *802.1X Authentication, Link Layer Discovery Protocol (LLDP), LLDP-Media Endpoint Discovery, and Avaya IP Telephones*

http://support.avaya.com/elmodocs2/security/802_1x-LLDP.pdf

The following Application Notes can be found at <http://www.avaya.com/gcm/master-usa/en-us/resource/index.htm>.

- [2] *Configuring 802.1x Protocol On Avaya G250 and G350 Media Gateways For an Avaya IP Telephone With an Attached PC*
- [3] *Configuring Link Layer Discovery Protocol (LLDP) and 802.1x Protocol on Extreme Networks BlackDiamond 8810 for an Avaya IP Telephone with an Attached PC*

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