



Avaya Solution & Interoperability Test Lab

Application Notes for Avaya IP Office in a Converged VoIP and Data Network using Hewlett Packard Networking Switches configured with Link Layer Discovery Protocol (LLDP), Quality of Service (QoS), and Power over Ethernet (PoE) - Issue 1.0

Abstract

These Application Notes describe the configuration of a Voice over IP (VoIP) solution including an Avaya IP Office Telephony Infrastructure running in converged VoIP and data network built with HP Networking Ethernet switches. The Hewlett Packard Networking Switches were compliance-tested with Avaya IP Office and Avaya IP Office Voicemail Pro. Emphasis was placed on verifying interoperability with Link Layer Discovery Protocol, Layer2/Layer3 Quality of Service, and Power over Ethernet.

Information in these Application Notes has been obtained through DevConnect compliance testing and additional technical discussions. Testing was conducted via the DevConnect Program at the Avaya Solution and Interoperability Test Lab.

1. Introduction

These Application Notes describe the configuration of a Voice over IP (VoIP) solution including an Avaya IP Office Telephony Infrastructure running in a converged VoIP and data network built with HP Networking 5400zl, 3800, 2620, 2915, 3500, and 2910 Series Switches. Compliance testing verified methods for configuring Voice Virtual Local Area Network and Quality of Service (QoS), including IP Office Manager, and Link Layer Discovery Protocol for Media Endpoint Devices (LLDP-MED). Power over Ethernet (PoE) was also verified. Quality of Service (QoS) based on Layer 2 Priority (802.1p) and Layer 3 Differentiated Services (Diffserv) was implemented across the network to prioritize voice traffic over the LAN. The Avaya IP Telephones received QoS priority settings from Avaya IP Office and were enforced across the network by the HP Switches. Additionally QoS parameters were verified based on configuration settings via LLDP auto discovery. To verify proper QoS policies, VoIP traffic was given priority over data traffic, and tests were performed by over subscribing the LAN interfaces with low priority data traffic and verifying that acceptable voice quality was achieved when calls were routed over all of the LAN interfaces. PoE was also verified on the HP Networking switches.

2. General Test Approach and Test Results

The general test approach was to verify HP Networking Switch features through functionality, serviceability, and performance testing.

Functionality testing focused on configuration using LLDP, QoS and PoE. Serviceability included failure and recover of network interfaces through cable pulls while performance was verified by placing calls while the HP equipment was under network load.

DevConnect Compliance Testing is conducted jointly by Avaya and DevConnect members. The jointly-defined test plan focuses on exercising APIs and/or standards-based interfaces pertinent to the interoperability of the tested products and their functionalities. DevConnect Compliance Testing is not intended to substitute full product performance or feature testing performed by DevConnect members, nor is it to be construed as an endorsement by Avaya of the suitability or completeness of a DevConnect member's solution.

2.1. Interoperability Compliance Testing

The interoperability compliance testing included the following:

All test cases were performed manually.

- LAN connectivity between the Avaya and HP Networking products.
- Registration of Avaya endpoints with Avaya IP Office.
- VoIP calls, including, hold, transfer and conferencing.

- QoS for voice signaling and voice media received higher priority based on 802.1p and Differential Services Code Point settings.
- Configuration of QoS parameters using Avaya IP Office
- Auto discovery of QoS parameters using LLDP-MED
- Auto discovery of Voice VLAN using LLDP-MED
- IP Office Voicemail Pro voicemail and Message Waiting Indicator works properly.

Compliance testing focused on the QoS, VLAN, and PoE implementation in the Avaya/HP Networking configuration. Specifically, compliance testing verified that when the HP Networking switch interfaces were oversubscribed with low priority data traffic, the higher priority VoIP media and signaling traffic still got through and achieved good voice quality. Prioritization of voice traffic was achieved by implementing Layer 3 DiffServ-based QoS and Layer 2 priority (801.p). Voice and data traffic were segmented in the enterprise network using VLANs. Auto discovery of Voice VLAN, and QoS parameters, using LLDP were also verified along with the ability to power Avaya IP telephones via PoE.

2.2. Test Results

The test objectives listed in **Section 2.1** were verified. QoS and performance testing was verified by making voice calls while a traffic generator generated low priority data traffic to simulate a congested network. At the end of the performance test, it was verified that the network devices continued to operate successfully. Additionally tests were repeated using the configuration settings discovered via LLDP.

Serviceability testing was conducted to verify the ability of the Avaya/HP Networking VoIP solution to recover from adverse conditions, such as power cycling network devices and disconnecting cables between the LAN interfaces. In all cases, the ability to recover after the network normalized was verified.

All feature functionality, serviceability, and performance test cases passed. The HP Networking implementation prioritized VoIP traffic and yielded good voice quality without dropping any calls.

PoE parameters were verified using HP Networking show commands and fell within acceptable ranges.

All of the HP Networking products used in the compliance testing successfully passed.

2.3. Support

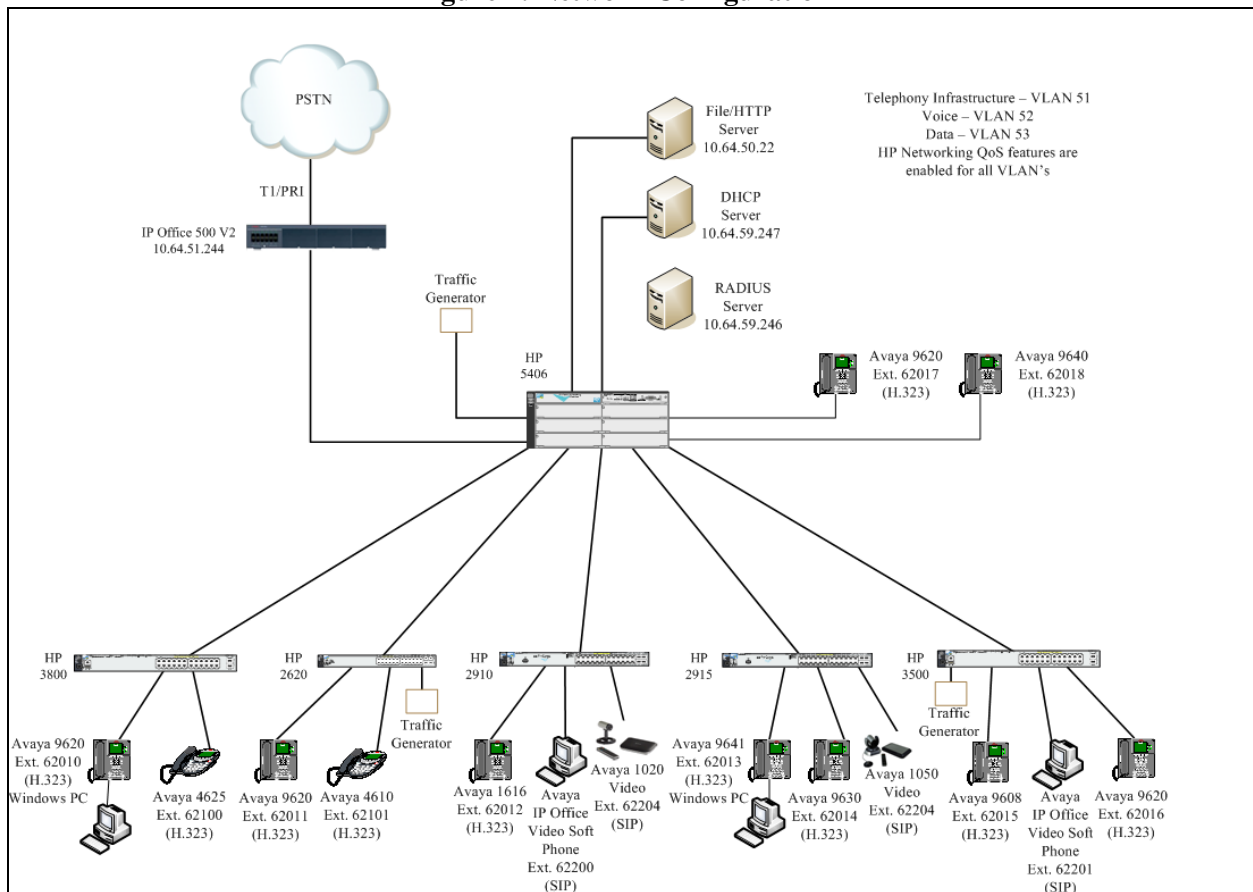
For technical support on HP Networking products, consult the following support pages by contacting HP Networking customer support at:

- Contact us: <http://h17007.www1.hp.com/us/en/contact>
- Website Support: <http://h17007.www1.hp.com/us/en/support/converter/index.aspx>
- Website Product Information: <http://h17007.www1.hp.com/us/en/index.aspx>

3. Reference Configuration

Figure 1 illustrates the configuration used for compliance testing. The network consisted of Avaya IP Office, and IP endpoints including, Avaya IP Telephones, Avaya IP Office Softphone, and Avaya Video Conferencing units. All Avaya components were connected to the HP Networking switches and voice and video traffic was carried across this infrastructure. Configuration settings for the endpoints were provided using IP Office Manager, LLDP-MED, and manually. To better manage the different traffic types and endpoint devices, the voice and data traffic were separated onto different VLANs. Additionally Avaya 1000 series Video Endpoints were placed into the Voice VLAN.

Figure 1: Network Configuration



4. Equipment and Software Validated

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

Equipment	Software/Firmware
<i>Avaya PBX Products</i>	
Avaya IP Office 500 V2	8.0(18)
<i>Avaya Messaging (Voice Mail) Products</i>	
Avaya IP Office Voicemail Pro	8.0(80018)
<i>Avaya Endpoints</i>	
Avaya 96xx Series IP Telephones	(H.323 3.1SP2)
Avaya 96x1 Series IP Telephones	(H.323 S6.010f)
Avaya 46xx Series IP Telephones	2.9.1
Avaya IP Office Softphone	3.2.3.15
Avaya 1020 Video Endpoint	4.8.3 (24)
Avaya 1050 Video Endpoint	4.8.3 (24)
<i>HP Networking Products</i>	
HP 5406 (family coverage for 54xx,82xx, 35xx)	https://h10145.www1.hp.com/downloads/SoftwareReleases.aspx?ProductNumber=J9532A K.15.07.0008
HP 3800 (family coverage for 3800 variants)	https://h10145.www1.hp.com/downloads/SoftwareReleases.aspx?ProductNumber=J9573A KA.15.03.3006
HP 2620 (family coverage for 2620 variants)	https://h10145.www1.hp.com/downloads/SoftwareReleases.aspx?ProductNumber=J9623A RA.15.06.0009
HP 2915 (family coverage for 2915 variants)	https://h10145.www1.hp.com/downloads/SoftwareReleases.aspx?ProductNumber=J9562A A.14.15
HP 2910(family coverage for 2910 variants)	https://h10145.www1.hp.com/downloads/SoftwareReleases.aspx?ProductNumber=J9145A W.14.70
HP 3500(family coverage for 3500 variants)	https://h10145.www1.hp.com/downloads/SoftwareReleases.aspx?ProductNumber=J9532A K.15.07.0008

5. Configure Avaya IP Office

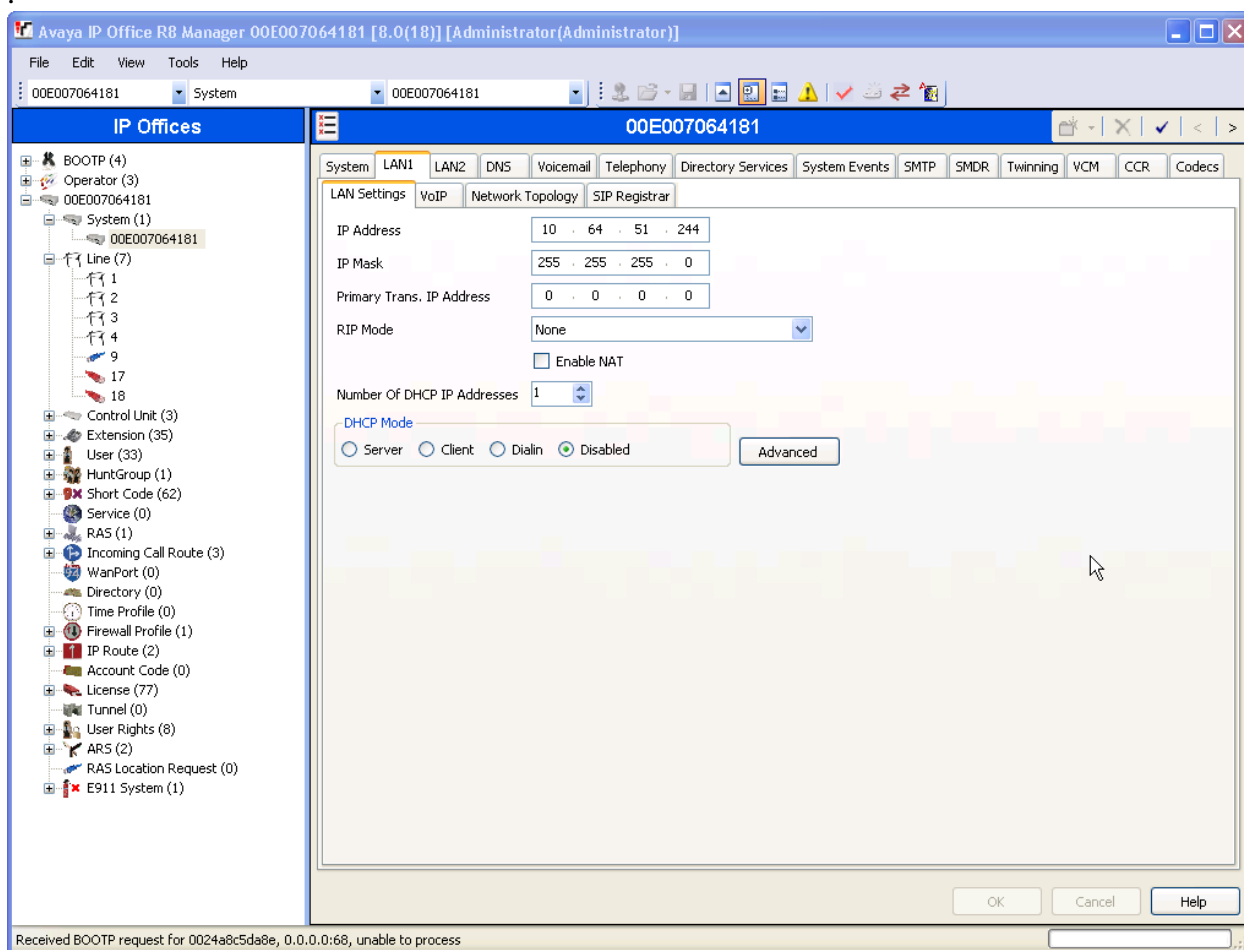
This section describes the steps required for IP Office to support the configuration in **Figure 1**. The following pages provide step-by-step instructions on how to administer parameters specific to the HP Networking solution only. The assumption is that the appropriate license and authentication files have been installed on the servers and that login and password credentials are available and that the reader has a basic understanding of the administration of IP Office. It is assumed that all other connections, e.g., to PSTN, to LAN, are configured and will not be covered in this document. The reader will need access to the IP Office Manager. For detailed information on the installation, maintenance, and configuration of IP Office, please refer to **Section 9 ([1])**.

5.1. Connect to IP Office using Manager

From a PC running the Avaya IP Office Manager application, select **Start** → **All Programs** → **IP Office** → **Manager** to launch the Manager application. Select the desired IP Office system and login with the appropriate credentials (not shown).

5.2. Disable DHCP server on Avaya IP Office.

From the Configuration Tree, click **System**. Select the **LAN1** tab. Set the **DHCP Mode** to **Disabled**. Click **OK** to continue

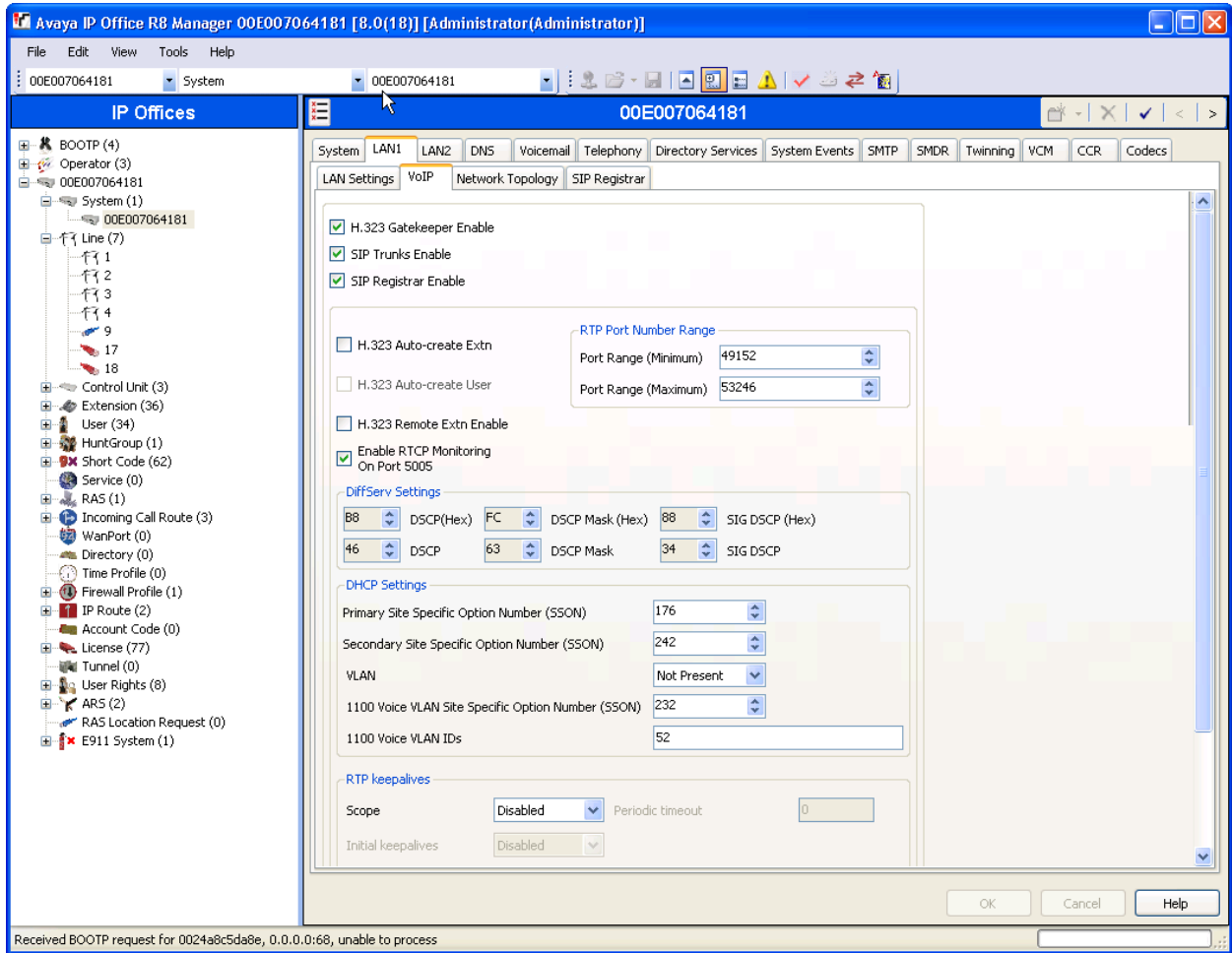


5.3. Configure QoS on Avaya IP Office.

To insure reliable delivery of latency sensitive voice and video traffic, QoS is utilized and should be implemented consistently throughout the entire network.

In order to prioritize voice and video traffic, the appropriate packets must be classified. The Avaya IP endpoints support both Layer 2 802.1.p priority and Layer 3 DiffServ.

The Avaya IP Telephones can get Differentiated Services information from the Avaya IP Office. This information will be utilized for QoS by the HP Networking Switches. In the Manager window, go to the Configuration Tree and click **System**. Select the **LAN1** tab then **VoIP**. Verify that the **DiffServ Settings** for **DSCP** and **SIG DSCP** are set to **46** and **34**, respectively.



6. Configure Layer 2 QoS for Avaya 96xx Telephones using the 46xxsettings.txt file.

Modify the following settings in the 46xxsettings.txt file for configuring the Voice VLAN and desired L2 QoS parameters for 96xx and 16xx Series SIP Telephones.

Note: By Default this file can be found on the Avaya Utility Server.


```

##### 802.1P/Q SETTINGS #####
##
## Voice VLAN Identifier
## VLAN identifier to be used by IP telephones. This
## parameter should only be set when IP telephones are to
## use a VLAN that is separate from the default data VLAN.
## If the VLAN identifier is to be configured via H.323
## signaling based on Avaya Communication Manager
## administration forms, it should not be set here.
## This parameter may also be changed via LLDP.
## Note : This setting is applicable for 1603 SIP phones also.
SET L2QVLAN 52
##
## Audio Priority Value
## Sets the layer 2 priority value for audio packets
## from the phone. (0-7)
## For H.323 phones, this parameter may also be
## changed from Communication Manager. For 96xx SIP
## phones, this parameter may also be changed via LLDP.
## Note : This setting is applicable for 1603 SIP phones also.
SET L2QAUD 6
##
## Signaling Priority Value
## Sets the layer 2 priority value for signaling
## protocol messages from the phone. (0-7)
## For H.323 phones, this parameter may also be
## changed from Communication Manager. For 96xx SIP
## phones, this parameter may also be changed via LLDP.
## Note : This setting is applicable for 1603 SIP phones also.
SET L2QSIG 6
##

```

Note: L3 QoS parameters are set by IP Office or by the Network Switch via LLDP-MED.

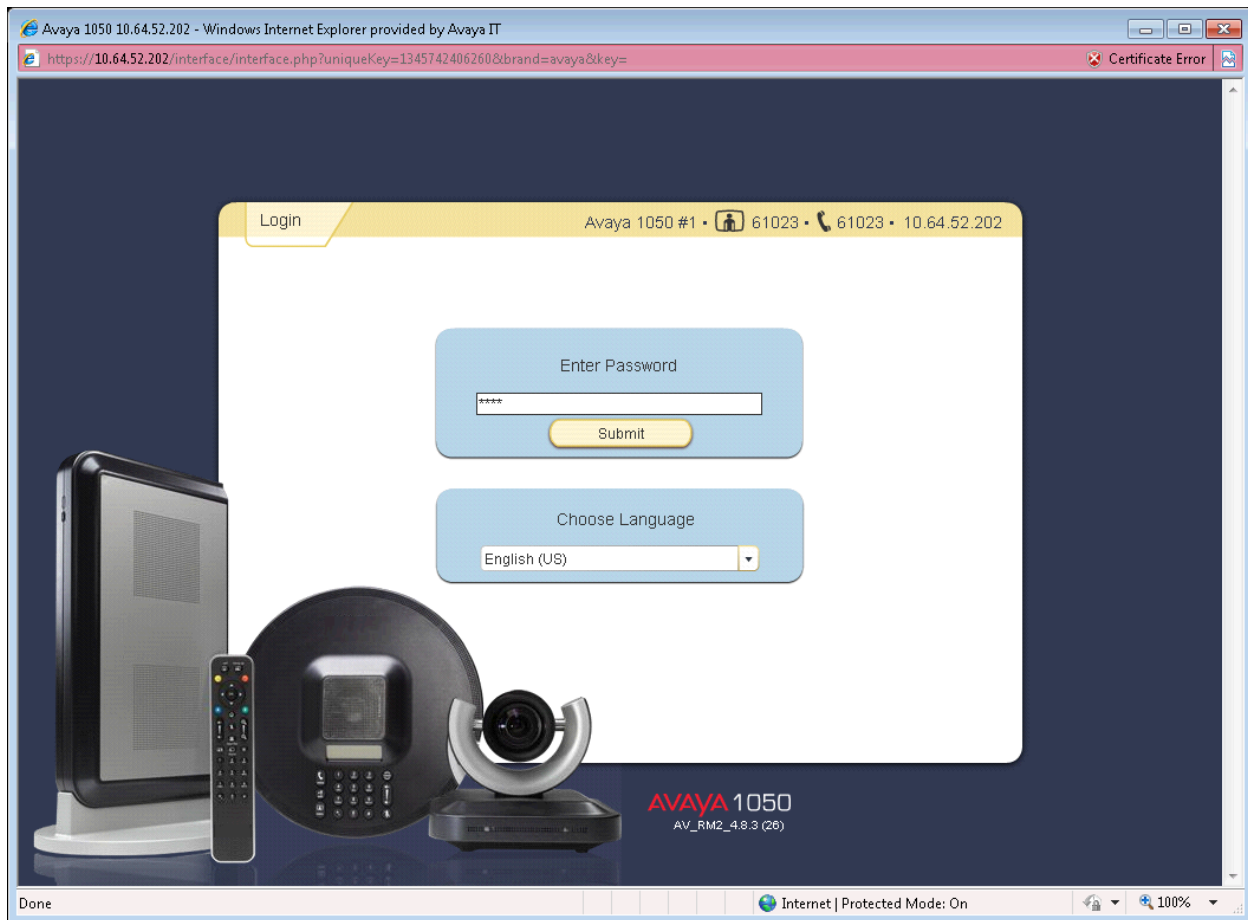
7. Configure Avaya IP Office Softphone.

Double-click the Avaya IP Office Softphone icon to start the application (not shown). Provide the proper login credentials for the Softphone Login and click the **Login** button.

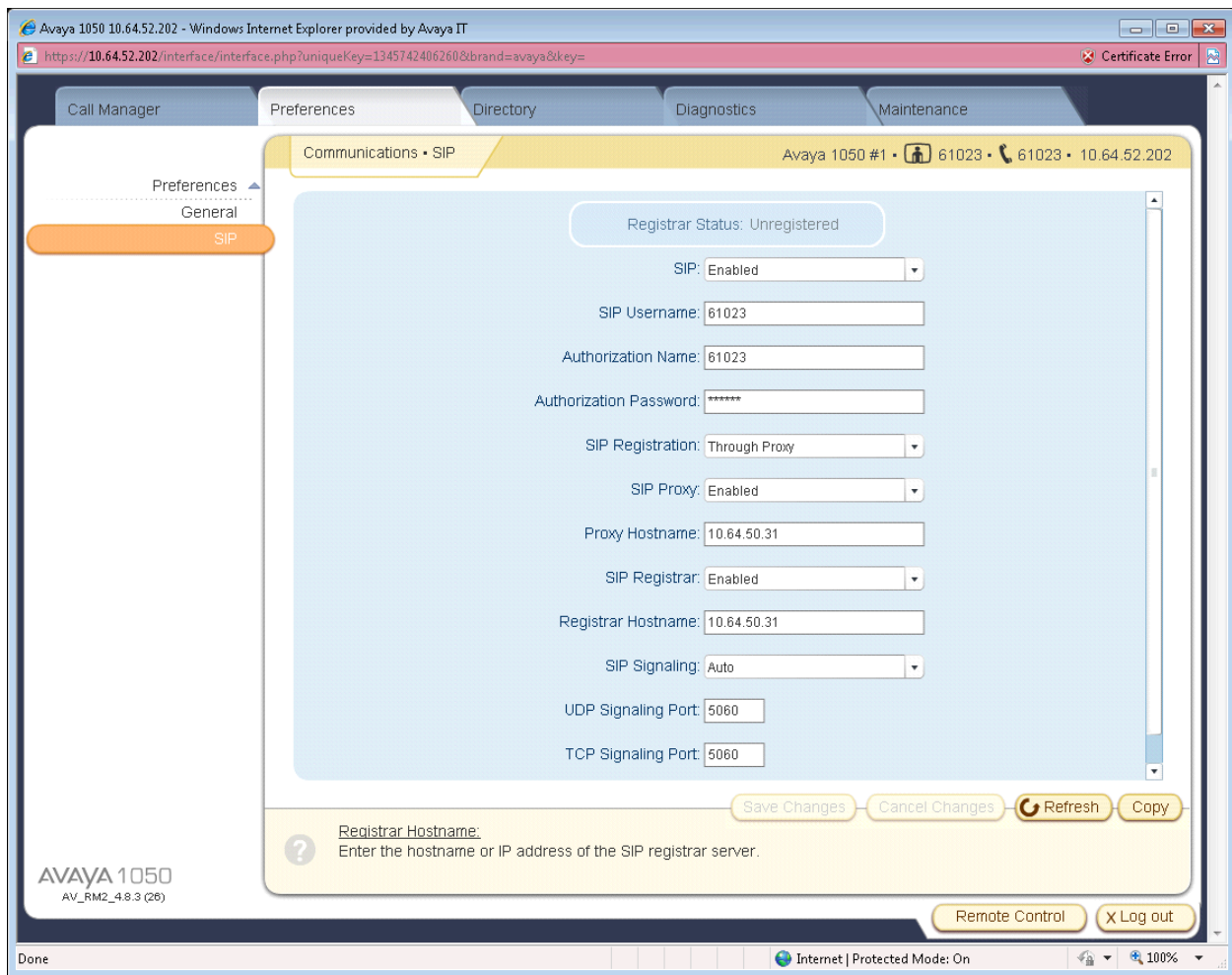
Note: IP Office Softphone does not have any configurable QoS parameters. QoS policies could be configured on the HP Networking switches to classify signaling and media packets for the softphone client. This configuration however was outside the scope of the compliance testing.

8. Configure QoS for Avaya 1000 series Video Conferencing Unit.

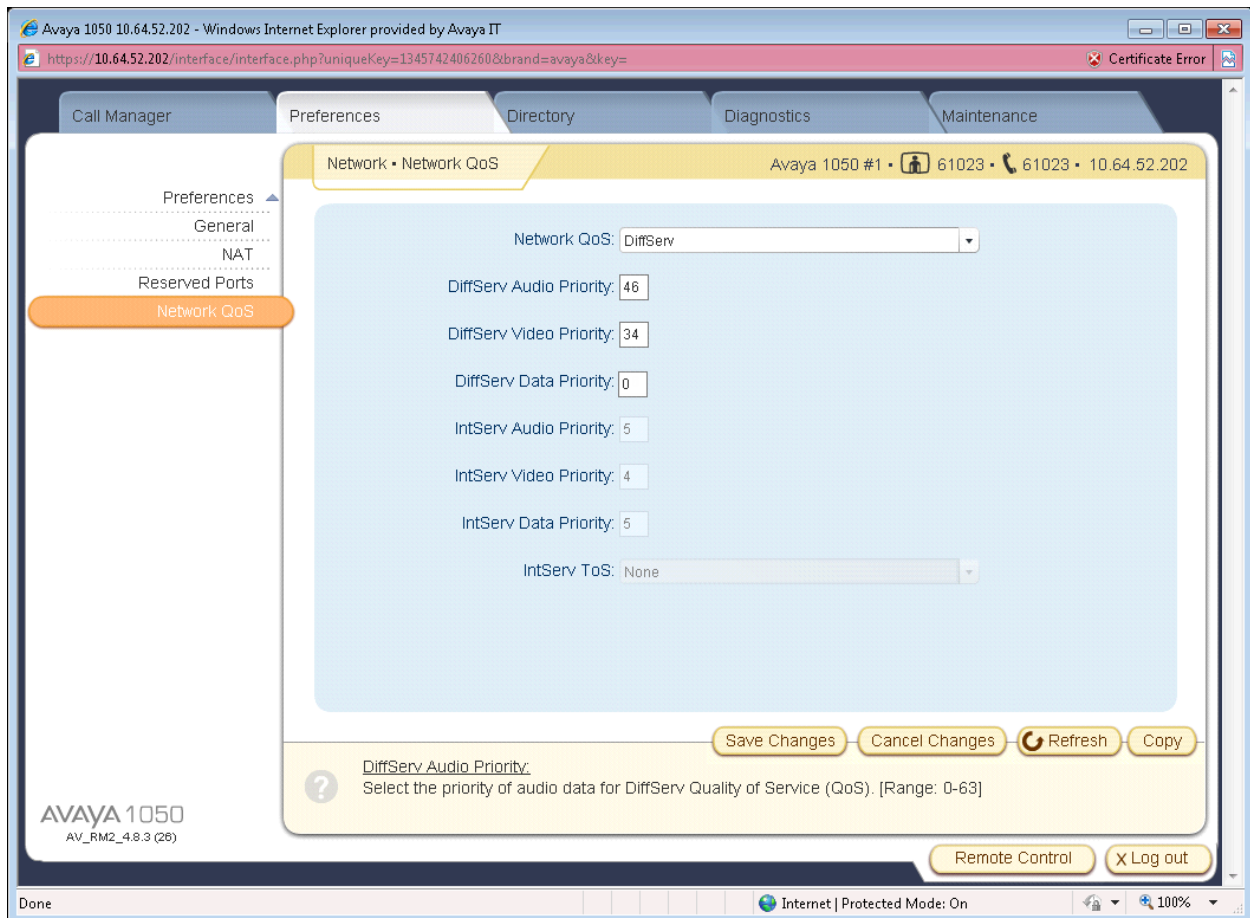
From a web browser enter the IP address of the Video Conferencing Unit (VCU) in the URL field to display the login page. Enter the proper login credentials and click the **Submit** button.



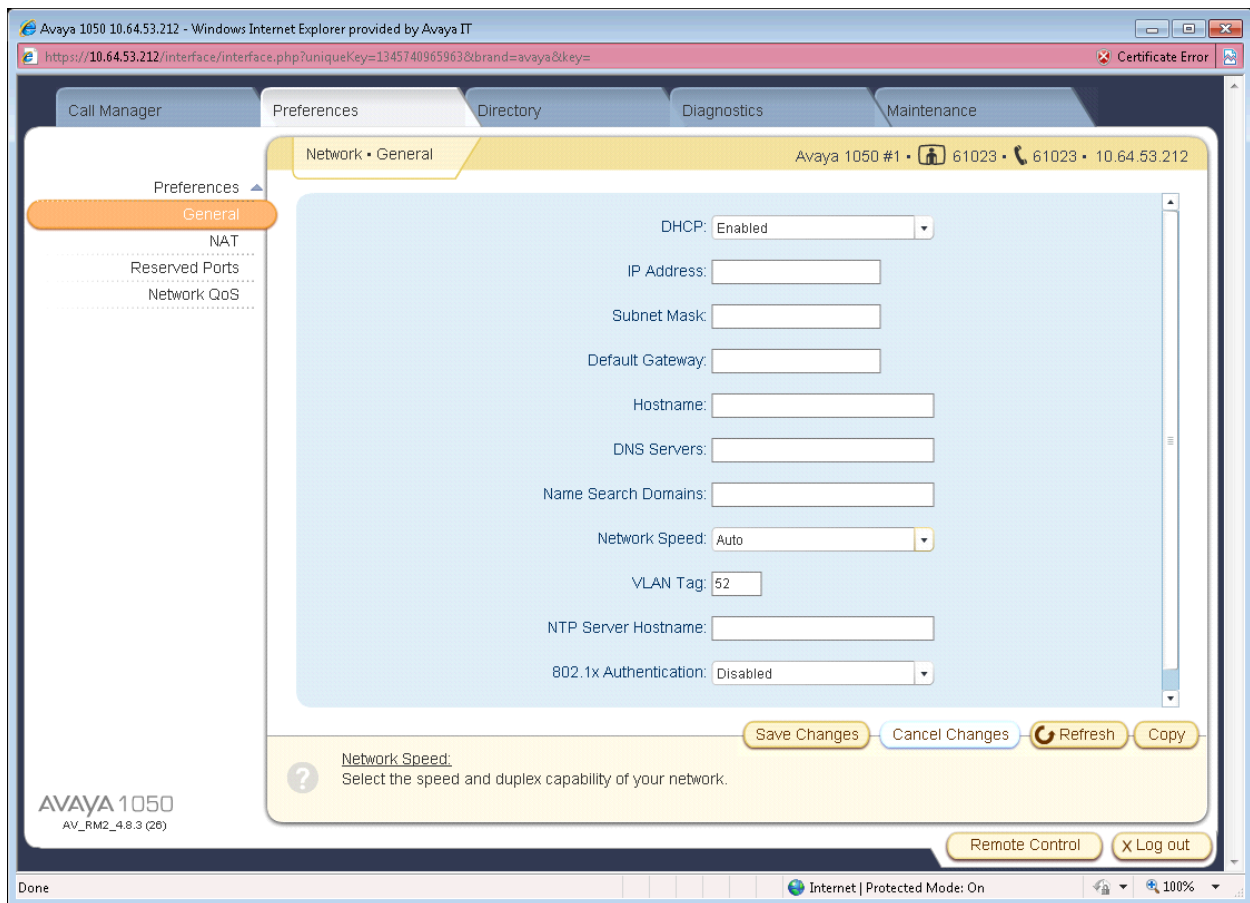
From the left pane of the **Preferences** tab, click **Communications**, and then **SIP** to display the following page. From this page select **Enabled** from the **SIP** dropdown box. Also enter the desired parameters for **SIP Username**, **Authorization Name**, and **Authorization Password**. For **SIP Registration** select **Through Proxy** and make sure **SIP Proxy** and **SIP Registrar** are both **Enabled**. For compliance testing IP Offices' IP Address was used for **Proxy** and **Registrar Hostname**. The remaining fields can be left at their default settings. Click the **Save Changes** button.



From the left pane of the **Preferences** tab, click **Network**, then **Network QoS** to display the following page. From this page select **DiffServ** from the **Network QoS** dropdown box. Also enter the desired parameters for **DiffServ Audio Priority**, **DiffServ Video Priority**, and **DiffServ Data Priority** and click the **Save Changes** button.



From the left pane click the **General** button to display the following page. From this page select **Enabled** from the **DHCP** dropdown box. Also enter the Voice VLAN ID in the **VLAN Tag** box and click the **Save Changes** button.



Note: After making these changes the Avaya VCU should reboot in to the Voce VLAN.

9. Configure the HP Networking 5406zl Core Switch

This section addresses how to configure the HP Networking 5406zl Switch for enforcing QoS policies.

To configure the HP Networking 5406zl Switch, connect a PC or laptop to the serial port of the switch. Run a terminal emulation program with the following configuration:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow Control: None

1. Use Telnet to connect to the HP Networking switch. The following prompt should be displayed.

```
HP-E5406zl#
```

2. Enable the following features on the HP Networking 5406zl Switch.
 - Enable routing.
 - Enable DSCP based QoS
 - Configure QoS map to be used by device-priority for Differentiated Services.
 - Set priority for the IP address of IP Office.
 - Save the running configuration to the startup configuration.

```
HP-E5406zl# configure  
HP-E5406zl# (config)# ip routing  
HP-E5406zl# (config)# qos type-of-service diff-services  
HP-E5406zl# (config)# qos dscp-map 101110 priority 6  
HP-E5406zl# (config)# qos device-priority 10.64.51.244 dscp 101110  
HP-E5406zl# (config)# write memory
```

3. Create and configure the telephony VLAN where all of the Avaya telephony infrastructure equipment is located.
 - Assign a VLAN ID for the telephony VLAN.
 - Assign a name for the telephony VLAN.
 - Assign an IP address for the telephony VLAN.
 - Assign ports to the telephony VLAN.

```
HP-E5406zl# configure
HP-E5406zl(config)# vlan 51
HP-E5406zl(vlan-51)# name Telephony_Infrastructure_IPO
HP-E5406zl(vlan-51)# ip address 10.64.50.64/24
HP-E5406zl(vlan-51)# untagged A6
HP-E5406zl(vlan-51)# tagged A21
HP-E5406zl(vlan-51)# end
HP-E5406zl#
```

4. Create and configure the voice VLAN.
 - Assign a VLAN ID for the voice VLAN.
 - Assign a name for the voice VLAN.
 - Assign voice option.
 - Assign an IP address for the voice VLAN.
 - Set an IP helper address for DHCP.
 - Assign ports to the voice VLAN.

```
HP-E5406zl# configure
HP-E5406zl(config)# vlan 52
HP-E5406zl(vlan-52)# name Voice
HP-E5406zl(vlan-52)# ip address 10.64.52.1/24
HP-E5406zl(vlan-52)# ip helper-address 10.64.59.247
HP-E5406zl(vlan-52)# tagged A1-A5,A11-A13
HP-E5406zl(vlan-52)# end
HP-E5406zl#
```

5. Create and configure the data VLAN.

- Assign a VLAN ID for the data VLAN.
- Assign a name for the data VLAN.
- Assign an IP address for the data VLAN.
- Set an IP helper address for DHCP.
- Assign ports to the data VLAN.

```

HP-E5406zl# configure
HP-E5406zl(config)# vlan 53
HP-E5406zl(vlan-53)# ip address 10.64.53.1/24
HP-E5406zl(vlan-53)# ip helper-address 10.64.59.247
HP-E5406zl(vlan-53)# tagged A1-A5,A11-A13
HP-E5406zl(vlan-53)# end
HP-E5406zl#

```

6. Save the running configuration to the startup configuration.

```

HP-E5406zl# write memory
HP-E5406zl#

```

10. Configure HP Networking Distribution/Access Switches

This section addresses configuring the HP 3800, 2620, 2915, and 2910 switches to support the configuration shown in **Figure 1**.

Note: *The purpose of this compliance test was to validate interoperability with each HP switch. Since each of the distribution/access switches were configured the same way, only the HP 3800 configuration is shown. To configure the other switches shown in Figure 1, repeat the same configuration commands on each switch.*

To configure the switches, connect a PC or laptop to the serial port. Run a terminal emulation program with the following configuration:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow Control: None

7. Use Telnet to connect to the switch. The following prompt should be displayed.

```

HP Stack E3800#

```

1. Enable the following features on the HP Networking 3800 switch.
 - Enable DSCP based QoS
 - Configure QoS map to be used by device-priority for Differentiated Services.

- Set priority for the IP address of IP Office.
- Save the running configuration to the startup configuration.

```

HP Stack E3800# configure
HP Stack E3800# (config)# qos type-of-service diff-services
HP Stack E3800# (config)# qos dscp-map 101110 priority 6
HP Stack E3800# (config)# qos device-priority 10.64.51.244 dscp 101110
HP Stack E3800# (config)# end
HP Stack E3800# write memory
HP Stack E3800#

```

2. Create and configure the voice VLAN.

- Assign a VLAN ID for the voice VLAN.
- Assign a name for the voice VLAN.
- Assign an IP address for the voice VLAN.
- Assign ports to the voice VLAN.
- Set the vlan QoS priority for the Voice VLAN.

```

HP Stack E3800# configure
HP Stack E3800(config)# vlan 52
HP Stack E3800(vlan-52)# name Voice
HP Stack E3800(vlan-52)# ip address 10.64.52.1/24
HP Stack E3800(vlan-52)# tagged A1-A5,A11-A13
HP Stack E3800(vlan-52)# end
HP Stack E3800#

```

3. Create and configure the data VLAN.
 - Assign a VLAN ID for the data VLAN.
 - Assign a name for the data VLAN.
 - Assign an IP address for the data VLAN.
 - Assign ports to the data VLAN.

```
HP Stack E3800# configure
HP Stack E3800(config)# vlan 53
HP Stack E3800(vlan-53)# ip address 10.64.53.1/24
HP Stack E3800(vlan-53)# tagged A1-A5,A11-A13
HP Stack E3800(vlan-53)# end
HP Stack E3800#
```

4. Save the running configuration to the startup configuration.

```
HP Stack E3800# write memory
HP Stack E3800#
```

11. Configure the HP Networking 5406zl Core Switch with LLDP

LLDP or 802.1AB is an IEEE standard designed for the discovery of directly attached adjacent network devices such as Ethernet switches, routers. LLDP-MED or American National Standards Institute/Telecommunications Industry Association (ANSI/TIA) -1057 is a TIA standard that extends LLDP for the discovery and auto-configuration of directly attached LLDP-MED capable media endpoint devices such as the Avaya 9600 and 4600 Series 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 LLDP-MED (Network Policy, Inventory) IEEE 802.3 (MAC/PHY Configuration/Status) and other Vendor specific optional TLVs as part of its LLDP advertisement. The Avaya 9600 and 4600 Series IP Telephones supports the use of the Network Policy TLV as a means to auto discover voice VLAN and QoS assignment in addition to using vendor specific TLVs.

This section addresses how to configure the HP Networking 5406zl Switch for setting VLAN and QoS policies.

To configure the HP Networking 5406zl Switch, connect a PC or laptop to the serial port of the switch. Run a terminal emulation program with the following configuration:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1

- Flow Control: None

8. Use Telnet to connect to the HP Networking switch. The following prompt should be displayed.

```
HP-E5406zl#
```

9. Enable the following features on the HP Networking 5406zl Switch.

- Enable routing.
- Enable DSCP based QoS
- Configure QoS map to be used by device-priority for Differentiated Services.
- Set priority for the IP address of IP Office.
- Save the running configuration to the startup configuration.

```
HP-E5406zl# configure  
HP-E5406zl# (config)# ip routing  
HP-E5406zl# (config)# qos type-of-service diff-services  
HP-E5406zl# (config)# qos dscp-map 101110 priority 6  
HP-E5406zl# (config)# qos device-priority 10.64.51.244 dscp 101110  
HP-E5406zl# (config)# write memory
```

10. Create and configure the telephony VLAN where all of the Avaya telephony equipment is located.

- Assign a VLAN ID for the telephony VLAN.
- Assign a name for the telephony VLAN.
- Assign an IP address for the telephony VLAN.
- Assign ports to the telephony VLAN.
- Assign a QoS priority to the telephony VLAN.

```
HP-E5406zl# configure
HP-E5406zl(config)# vlan 51
HP-E5406zl(vlan-51)# name Telephony_Infrastructure_IPO
HP-E5406zl(vlan-51)# ip address 10.64.50.64/24
HP-E5406zl(vlan-51)# untagged A6
HP-E5406zl(vlan-51)# tagged A21
HP-E5406zl(vlan-51)# end
HP-E5406zl#
```

11. Create and configure the voice VLAN.

- Assign a VLAN ID for the voice VLAN.
- Assign a name for the voice VLAN.
- Assign voice option which enables LLDP-MED and voice VLAN auto configuration.
- Assign an IP address for the voice VLAN.
- Set an IP helper address for DHCP.
- Assign ports to the voice VLAN.
- Set the DSCP value to be sent to the Avaya Telephones via LLDP.

```
HP-E5406zl# configure
HP-E5406zl(config)# vlan 52
HP-E5406zl(vlan-52)# name Voice
HP-E5406zl(vlan-52)# voice
HP-E5406zl(vlan-52)# ip address 10.64.52.1/24
HP-E5406zl(vlan-52)# ip helper-address 10.64.59.247
HP-E5406zl(vlan-52)# tagged A1-A5,A11-A13
HP-E5406zl(vlan-52)# qos dscp 101110
HP-E5406zl(vlan-52)# end
HP-E5406zl#
```

12. Create and configure the data VLAN.

- Assign a VLAN ID for the data VLAN.
- Assign a name for the data VLAN.
- Assign an IP address for the data VLAN.
- Set an IP helper address for DHCP.
- Assign ports to the data VLAN.

```

HP-E5406zl# configure
HP-E5406zl(config)# vlan 53
HP-E5406zl(vlan-53)# name Data
HP-E5406zl(vlan-53)# ip address 10.64.53.1/24
HP-E5406zl(vlan-53)# ip helper-address 10.64.59.247
HP-E5406zl(vlan-53)# tagged A1-A5,A11-A13
HP-E5406zl(vlan-53)# end
HP-E5406zl#

```

13. Save the running configuration to the startup configuration.

```

HP-E5406zl# write memory
HP-E5406zl#

```

12. Configure HP Networking Distribution/Access Switches with LLDP

This section addresses configuring the HP Networking 3800, 2620, 2915, and 2910 switches to support the configuration shown in **Figure 1**.

Note: *The purpose of this compliance test was to validate interoperability with each HP switch. Since each of the distribution/access switches were configured the same way, only the HP 3800 configuration is shown. To configure the other switches shown in Figure 1, repeat the same configuration commands on each switch.*

To configure the switches, connect a PC or laptop to the serial port. Run a terminal emulation program with the following configuration:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow Control: None

14. Use Telnet to connect to the switch. The following prompt should be displayed.

```

HP Stack E3800#

```

5. Enable the following features on the HP 3800 switch.
 - Enable DSCP based QoS

- Configure QoS map to be used by device-priority for Differentiated Services.
- Set priority for the IP address of IP Office.
- Save the running configuration to the startup configuration.

```

HP Stack E3800# configure
HP Stack E3800# (config)# qos type-of-service diff-services
HP Stack E3800# (config)# qos dscp-map 101110 priority 6
HP Stack E3800# (config)# qos device-priority 10.64.51.244 dscp 101110
HP Stack E3800# (config)# end
HP Stack E3800# write memory
HP Stack E3800#

```

15. Create and configure the voice VLAN.

- Assign a VLAN ID for the voice VLAN.
- Assign a name for the voice VLAN.
- Assign voice option which enables LLDP-MED and voice VLAN auto configuration.
- Assign an IP address for the voice VLAN.
- Set an IP helper address for DHCP.
- Assign ports to the voice VLAN.
- Set the DSCP value to be sent to the Avaya Telephones via LLDP.

```

HP Stack E3800# configure
HP Stack E3800(config)# vlan 52
HP Stack E3800(vlan-52)# name Voice
HP Stack E3800(vlan-52)# voice
HP Stack E3800(vlan-52)# ip address 10.64.52.1/24
HP Stack E3800(vlan-52)# ip helper-address 10.64.59.247
HP Stack E3800(vlan-52)# tagged A1-A5,A11-A13
HP Stack E3800(vlan-52)# qos dscp 101110
HP Stack E3800(vlan-52)# end
HP Stack E3800#

```

6. Create and configure the data VLAN.
 - Assign a VLAN ID for the data VLAN.
 - Assign a name for the data VLAN.
 - Assign an IP address for the data VLAN.
 - Assign ports to the data VLAN.

```
HP Stack E3800# configure
HP Stack E3800(config)# vlan 53
HP-E5406zl(vlan-53)# name Data
HP Stack E3800(vlan-53)# ip address 10.64.53.1/24
HP Stack E3800(vlan-53)# tagged A1-A5,A11-A13
HP Stack E3800(vlan-53)# end
HP Stack E3800#
```

7. Save the running configuration to the startup configuration.

```
HP-E5406zl# write memory
HP-E5406zl#
```

13. Configure HP Networking Distribution/Access Switches with PoE

Power over Ethernet (PoE) allows both power and data to be simultaneously carried over standard Ethernet cables. PoE-enabled Ethernet switches can supply power directly to Ethernet devices, thereby simplifying installation and removing the need for separate power supplies for those devices. The IEEE 802.3af-2003 standard defines the mechanisms for Power Sourcing Equipment (PSE), such as PoE-enabled Ethernet switches, to detect, classify, and supply up to 15.4W of power per port to Powered Devices (PDs), such as PoE-enabled IP telephones. In the compliance-tested configuration described in these Application Notes, the HP Networking Switches were configured to supply inline PoE to Avaya PDs. The HP Networking Switches support the IEEE 802.3at-2009 standard for Power over Ethernet Plus (PoE+), which can provide up to 30 W per port.

The default configuration for the HP Networking switches has PoE/PoE+ enabled. If modifications are required or PoE must be disabled, please refer to the HP Networking Switch manuals for more information.

14. Verification Steps

14.1. Verify QoS

The following steps may be used to verify the configuration:

- From the HP switch Command Line Interface (CLI), enter the command **show qos device-priority** to verify the QoS configuration for packets being sent to and from the Avaya Telephony Infrastructure devices.

```
HP-E5406z1# show qos device-priority
```

```
Device priorities
```

Device Address	Apply rule	DSCP	Priority
10.64.51.244	DSCP	101110	6

- From the HP switch CLI, enter the command **show qos vlan-priority** to verify the QoS configuration for the Voice VLAN.

```
HP-E5406z1# show qos vlan-priority
```

```
VLAN priorities
```

VLAN ID	Apply rule	DSCP	Priority
1	No-override		No-override
50	No-override		No-override
51	No-override		No-override
52	Priority		6
53	No-override		No-override
54	No-override		No-override

- From the HP switch CLI, enter the command **show qos dscp-map** to verify the DSCP QoS policy mapping.

HP-E5406z1# show qos dscp-map

DSCP -> 802.p priority mappings

NOTE: 'qos type-of-service diff-services' must be configured before DSCP is honored on inbound traffic.

DSCP CodePoint	DSCP Value	802.1p tag	DSCP Policy name
000000	0	0	cs0
000001	1	No-override	
000010	2	No-override	
000011	3	No-override	
000100	4	No-override	
000101	5	No-override	
000110	6	No-override	
000111	7	No-override	
001000	8	1	cs1
001001	9	No-override	
001010	10	1	af11
001011	11	No-override	
001100	12	1	af12
001101	13	No-override	
001110	14	2	af13
001111	15	No-override	
010000	16	2	cs2
010001	17	No-override	
010010	18	0	af21
010011	19	No-override	
010100	20	0	af22
010101	21	No-override	
010110	22	3	af23
010111	23	No-override	
011000	24	3	cs3
011001	25	No-override	
011010	26	4	af31
011011	27	No-override	
011100	28	4	af32
011101	29	No-override	
011110	30	5	af33
011111	31	No-override	
100000	32	4	cs4
100001	33	No-override	
100010	34	6	af41
100011	35	No-override	
100100	36	6	af42
100101	37	No-override	
100110	38	7	af43
100111	39	No-override	
101000	40	5	cs5
101001	41	No-override	
101010	42	No-override	
101011	43	No-override	
101100	44	No-override	
101101	45	No-override	
101110	46	7	ef
101111	47	No-override	
110000	48	6	cs6
110001	49	No-override	
110010	50	No-override	
110011	51	No-override	
110100	52	No-override	
110101	53	No-override	
110110	54	No-override	

- During the compliance testing wireshark was used to capture packets and verify the proper setting for L2/L2 QoS parameters.

14.2. Verify LLDP

Use the **show lldp info remote-device** command to display the list of devices that are discovered by the HP Networking switches via LLDP.

```
HP-E5406z1# show lldp info remote-device
```

LLDP Remote Devices Information

LocalPort	ChassisId	PortId	PortDescr	SysName
A1	b4 99 ba 54 76 8b	48	1/48	HP Stack E3800
A2	00 16 35 b6 30 c0	24	24	HP-E3500yl-24G
A3	00 23 47 51 bb 40	48	48	HP Networking
A4	f0 62 81 d1 85 10	10	10	HP Networking
A5	10 1f 74 a7 92 e0	26	26	HP-E2620-24-PoEP
A11	10.64.52.131	00 ...		AVAEC520A
A12	10.64.52.143	00 ...		AVTC4F4BE
A14	cc f9 54 26 f0 60	115...		
A21	00 1b 4f d9 14 00	00 ...		

Use the **show lldp info remote-device <port>** command to display more specific details about an individual device.

Hint: This command is also useful for debugging voice vlan and QoS issues, since it shows the actual vlan and QoS settings as advertised by the IP phone.

```
HP-E5406z1# show lldp info remote-device A12
```

```
LLDP Remote Device Information Detail
```

```
Local Port      : A12  
ChassisType    : network-address  
ChassisId      : 10.64.52.143  
PortType       : mac-...  
PortId         : 00 07 3b c4 f4 be  
SysName        : AVTC4F4BE  
System Descr   :  
PortDescr      :  
Pvid           :
```

```
System Capabilities Supported : bridge, telephone  
System Capabilities Enabled   : bridge, telephone
```

```
Remote Management Address
```

```
Type      : ipv4  
Address   : 10.64.52.143
```

```
MED Information Detail
```

```
EndpointClass      :Class3  
Media Policy Vlan id :52  
Media Policy Priority :6  
Media Policy Dscp   :46  
Media Policy Tagged :True  
Poe Device Type     :PD  
Power Requested     :5.3 W  
Power Source         :From PSE  
Power Priority       :High
```

14.3. Verify PoE

Use the **show power-over-ethernet** command to display general PoE information.

```

HP-E5406z1# show power-over-ethernet

Status and Counters - System Power Status

Pre-standard Detect      : Off
System Power Status     : No redundancy
PoE Power Status        : No redundancy

Chassis power-over-ethernet:

Total Available Power   : 273 W
Total Failover Power    : 0 W
Total Redundancy Power  : 0 W
Total used Power        : 9 W +/- 6W
Total Remaining Power   : 264 W

Internal Power
  1 273W/POE /Connected.
  2 Not Connected.

External Power
  EPS1 /Not Connected.
  EPS2 /Not Connected.

```

Use the **show power-over-ethernet brief a12** command to display brief info about the power on a specific port. The example below displays power information for a port connected to an Avaya 96xx Telephone.

```

HP-E5406z1# show power-over-ethernet brief a12

Status and Counters - Port Power Status

PoE   | Power Power   Alloc Alloc Actual Configured  Detection  Power
Port  | Enable Priority By   Power Power  Type      Status     Class
-----+-----
A12   | Yes   low    usage 17 W  4.3 W                Delivering  2

```

Use the **show power-over-ethernet a12** command to display detailed info about the power on a specific port.

```
HP-E5406z1# show power-over-ethernet a12

Status and Counters - Port Power Status for port A12

Power Enable      : Yes
Priority          : low
AllocateBy       : usage
Detection Status : Delivering
Over Current Cnt : 0
Power Denied Cnt : 1
Voltage          : 50.7 V
Power            : 4.3 W

LLDP Detect      : enabled
Configured Type :
Value           : 17 W
Power Class     : 2
MPS Absent Cnt  : 0
Short Cnt       : 0
Current         : 87 mA
```

15. Conclusion

These Application Notes describe a compliance-tested configuration comprised of Avaya IP Office Telephony Infrastructure connected to HP Networking Switches. The HP Networking Switches enforced L2/L3 QoS parameters that were configured via IP Office Manager, settings files, and LLDP. Additionally HP Networking Switches provided Power over Ethernet for the Avaya Telephones. Prioritization of VoIP traffic and good voice quality was successfully achieved in the Avaya/HP Networking configuration described in **Figure 1**. HP Networking successfully passed the compliance test..

16. Additional References

The documents referenced below were used for additional support and configuration information.

The following Avaya product documentation can be found at <http://support.avaya.com>.

- [1] *IP Office Manager, December 2011, Release 10.0, Document Number 15-601011, Issue 27m.*
- [2] *Avaya 1010 and 1020 User and Administrator Guide, May 2011*
- [3] *Avaya 1030, 1040, and 1050 Video Conferencing Systems User and Administrator Guide, February, 2011*

Product information for the HP Networking Switches may be found at <http://h17007.www1.hp.com/us/en/library/index.aspx>

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