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Application Notes for HP ProCurve Switches connected to an Avaya Telephony Infrastructure using Avaya IP Office in a Converged VoIP and Data Network - Issue 1.0

Abstract

These Application Notes describe the configuration of a Voice over IP (VoIP) solution consisting of HP ProCurve 5400zl, 3500yl, 2910 and 2610 Series Switches with an Avaya Telephony Infrastructure using Avaya IP Office in a Converged VoIP and Data Network. Emphasis was placed on verifying the prioritization of VoIP traffic and voice quality in a converged VoIP and Data network scenario.

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.

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1. Introduction

These Application Notes describe the configuration of a Voice over IP (VoIP) solution using ProCurve 5400, 3500, 2910 and 2610 Series Switches by HP with an Avaya Telephony Infrastructure consisting of Avaya IP Office and Avaya IP telephones. Compliance testing emphasis was placed on verifying the prioritization of VoIP traffic and voice quality in a converged VoIP and Data network scenario. 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 get QoS priority settings from Avaya IP Office and are enforced in the network by the ProCurve Switches. The VoIP traffic was given priority over data traffic, 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. Compliance testing included testing QoS, throughput, link aggregation, rapid spanning tree, load balancing, Open Shortest Path First (OSPF), and Direct IP Media connectivity while using G.711 and G.729 codecs.

1.1. Interoperability Compliance Testing

Interoperability compliance testing covered feature functionality, serviceability, and performance testing.

QoS testing verified that when the ProCurve Switch interfaces are over subscribed 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 (802.1p). Voice and data traffic were segmented in the enterprise network using VLANs. At the end of the performance test, it was verified that the network devices continued to operate successfully.

The telephony features verified to operate correctly included attended/unattended transfer, conference call participation, conference call add/drop, multiple call appearances, caller ID operation, call forwarding unconditional, call forwarding on busy, call Park, call pick-up, bridged call appearances, voicemail, Message Waiting Indicator (MWI), and hold and return from hold.

Serviceability testing was conducted to verify the ability of the Avaya/ProCurve 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.

1.2. Support

For technical support on ProCurve products, consult the support pages at:
http://www.procurve.com/customercare/support/manuals/index.htm

2. Reference Configuration

The configuration in **Figure 1** shows a single site converged VoIP and data network with multiple closets and labs configured with link aggregation, rapid spanning tree, load balancing and OSPF.

For compliance testing, a centralized corporate DHCP server was used. To better manage the different traffic types, the voice and data traffic were separated onto different VLANs.

2.1. Control Room

The control room consisted of a ProCurve 5406zl Switch, Avaya IP Office, one Avaya 1616 IP Telephone running Avaya one-X Deskphone Value Edition on VLAN Voice1, one Avaya 5610SW IP Telephone on VLAN Voice1, Avaya IP Office Manager running on a HP Proliant Server and one Corporate DHCP/File server. The corporate site provided a DHCP/File server for assigning IP network parameters and to download settings to the Avaya IP telephones. The ProCurve 5406zl Switch supplied Power over Ethernet (PoE) power for the Avaya IP telephones and was configured to support link aggregation, rapid spanning tree, load balancing, VLANs, enforce QoS policies, and OSPF with the peer ProCurve switches.

2.2. Lab-A

Lab-A consisted of a ProCurve 3500yl-PWR Switch, one Avaya 1616 IP Telephone running Avaya one-X Deskphone Value Edition on VLAN Voice2, one Avaya 5610SW IP Telephone on VLAN Voice2 and a PC on Datavlan2. The ProCurve 3500yl-PWR Switch supplied PoE power for the Avaya IP telephones and was configured to support link aggregation, rapid spanning tree, load balancing, VLANs, enforce QoS policies, and OSPF with the peer ProCurve switches.

2.3. Closet-A

Closet-A consisted of a ProCurve 2910al Switch, one Avaya 1603 IP Telephone running Avaya one-X Deskphone Value Edition on VLAN Voice1, one Avaya 5610SW IP Telephone on VLAN Voice1 on VLAN Voice1 and a PC on VLAN Datavlan1. The ProCurve 2910al Switch supplied PoE power for the Avaya IP telephones and was configured to support link aggregation, rapid spanning tree, enforce QoS policies, and load balancing.

2.4. Closet-B

Closet-B consisted of a ProCurve 2610-24-PWR Switch, one Avaya 1603 IP Telephone running Avaya one-X Deskphone Value Edition on VLAN Voice1, one Avaya 5610SW IP Telephone on VLAN Voice1 on VLAN Voice1 and a PC on VLAN Datavlan1. The ProCurve 2610-24-PWR Switch supplied PoE power for the Avaya IP telephones and was configured to support link aggregation, rapid spanning tree and enforce QoS policies.
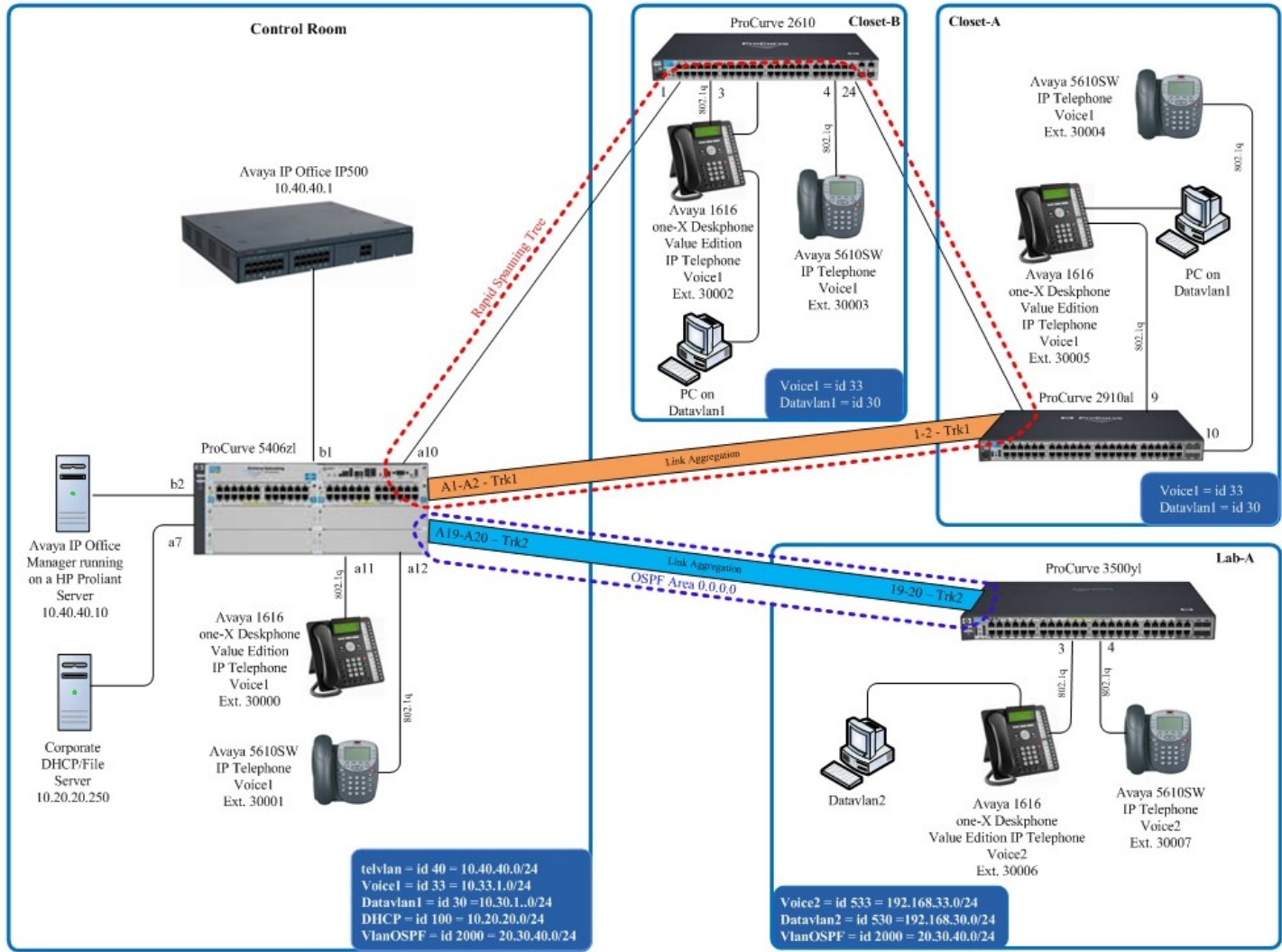
Figure 1: Avaya/ProCurve Network Diagram

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3. Equipment and Software Validated

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

Equipment	Software/Firmware
Avaya PBX Products	
Avaya IP Office (IP500)	4.2 (14)
Avaya IP Office Manager (running on HP Proliant Server)	6.2 (14)
Avaya Telephony Sets	
Avaya 1600 Series IP Telephones	Avaya one-X Deskphone Value Edition 1.020
Avaya 5600 Series IP Telephones	8.016
Avaya 2410 Digital Telephone	5.0
ProCurve Products	
ProCurve 5406zl by HP with J8705A module and RJ45 (J8177C Transceiver)	FW-K.14.09
ProCurve 3500yl-24-PWR by HP	FW-K.14.09
ProCurve 2910al by HP	W.14.28
ProCurve 2610-24-PWR by HP	R.11.25
HP Proliant Server	Microsoft Windows 2003 Server (Running Avaya IP Office Manager)
MS Products	
PC	Microsoft Windows 2003 Server (File/DHCP Service)

4. Avaya IP Office Settings

This section was included to verify that Avaya IP Office was configured correctly. Except where stated, the parameters in all steps are the default settings and are supplied for reference. For all other provisioning information such as provisioning of the trunks, call coverage, extensions, and voice mail, please refer to the Avaya IP Office product documentation in **Section 12**.
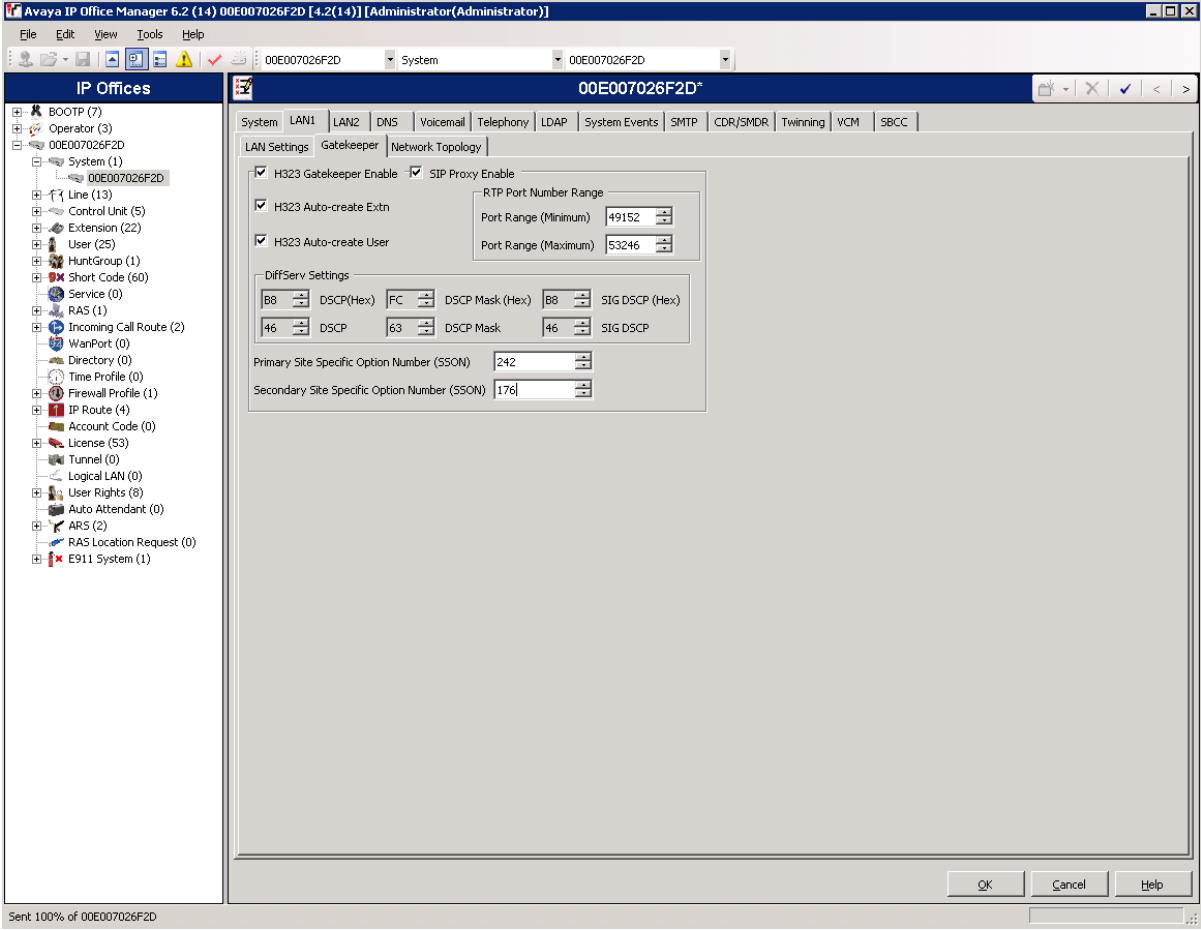
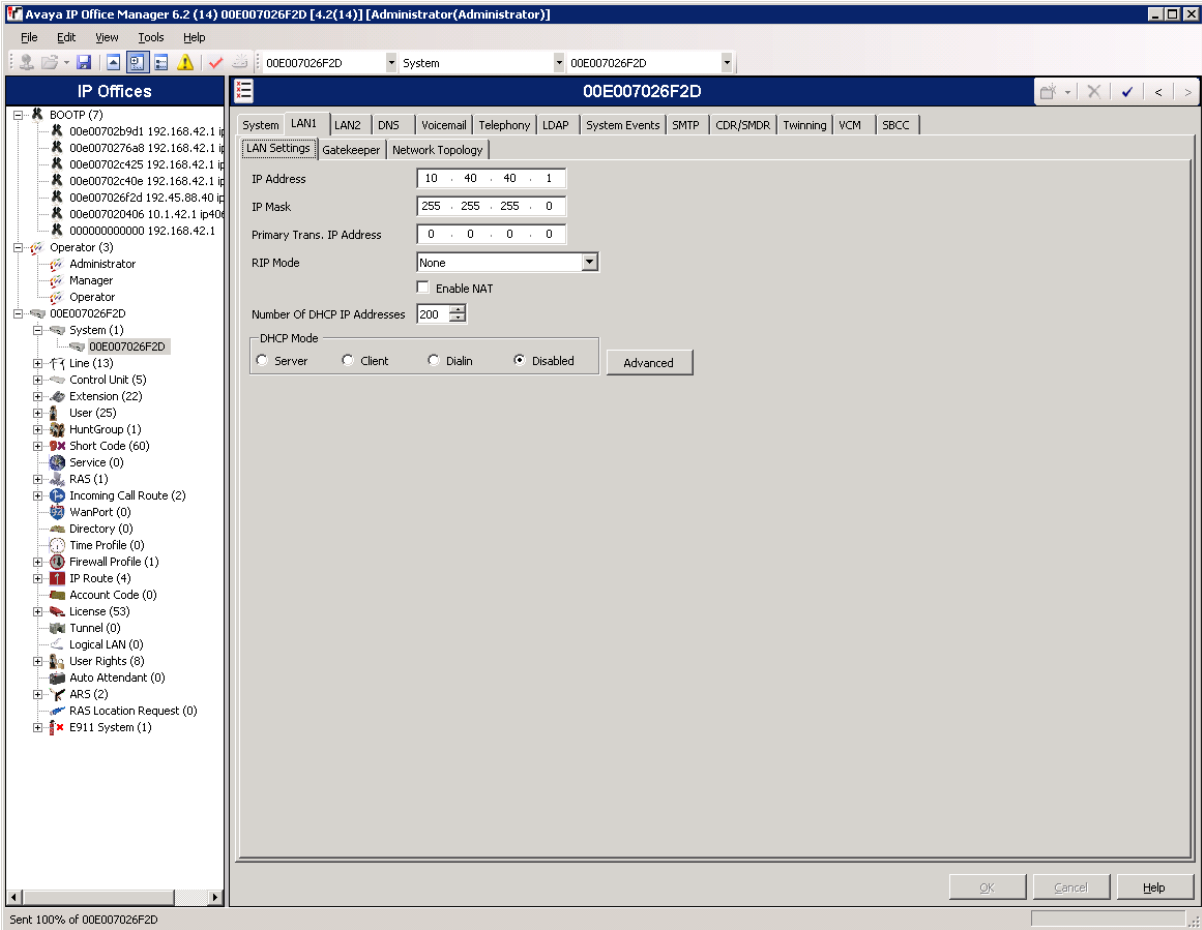| Step	Description
1.	Avaya IP Office is configured via the Avaya IP Office Manager program. Log into the Avaya IP Office Manager PC and select **Start → Programs → IP Office → Manager** to launch the Avaya IP Office Manager application. Log into the Avaya IP Office Manager application using the appropriate credentials.

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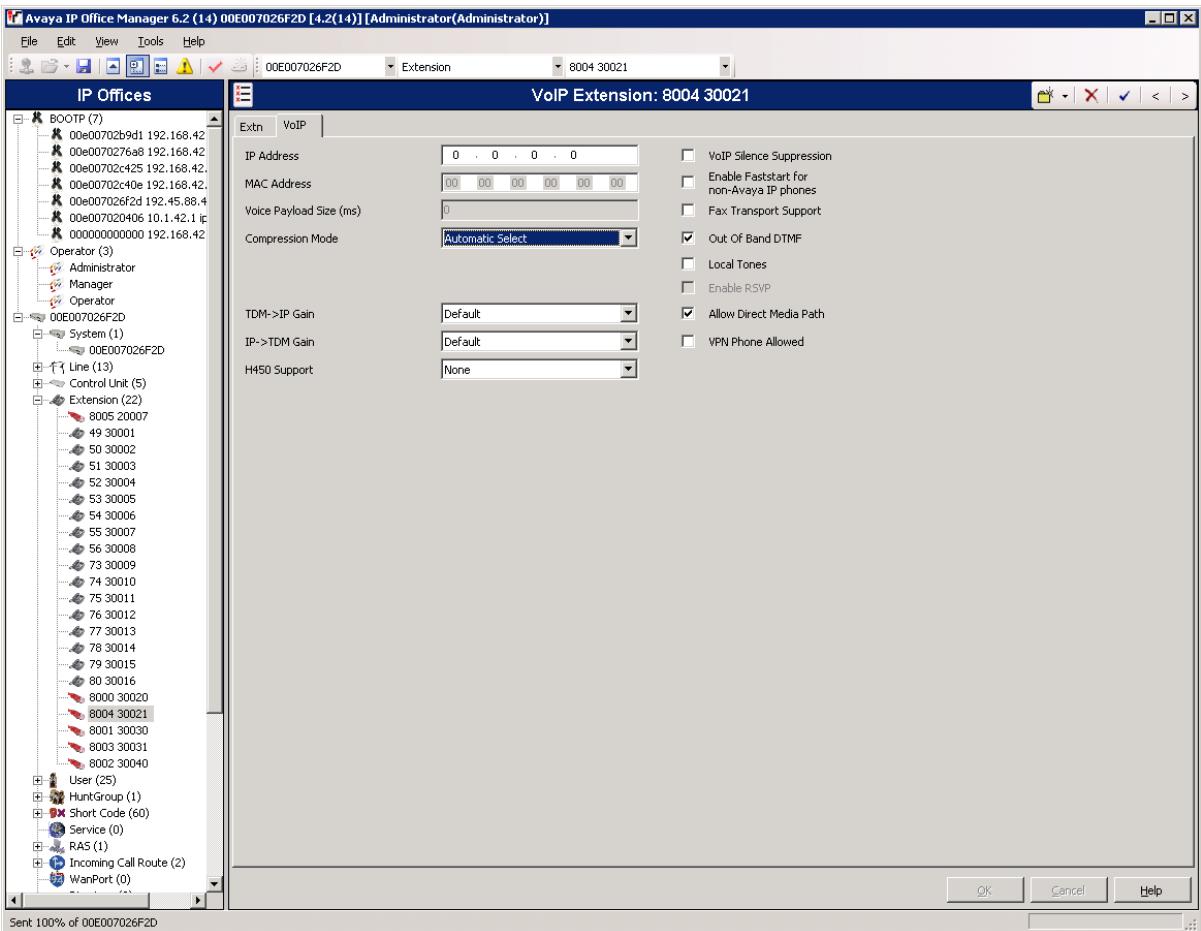| Step	Description
2.	Avaya IP Office Manager Window. The main Avaya IP Office Manager window appears. The following steps refer to the Configuration Tree, which is in the left pane of the window.

Step	Description
3.	Verify H323 Gatekeeper information.
	The Avaya IP Telephones will get Differentiated Services information from the Avaya IP Office. In the Manager window, go to the Configuration Tree and click **System**, select the **LAN1** tab, then select the **Gatekeeper** tab. Verify that the **DiffServ Settings** for **DSCP** and **SIG DSCP** are set to **46** and **46,** respectively.

Step	Description
4.	Disable DHCP server on Avaya IP Office. Select the **LAN Settings** tab. Set the **DHCP Mode** to **Disabled**. Click **OK** to continue.

Step	Description
5.	Verify Direct Media Path. From the Configuration Tree, select **Extension**. Click on the IP telephone extension to verify. Select the **VoIP** tab. Verify that **Allow Direct Media Path** is checked. Click **OK** to continue. The changes must be saved before they will take effect, click to the ![save] tab to save the configuration.

5. Configure the ProCurve 5406zl Switch

This section addresses how to configure the ProCurve 5406zl Switch. The ProCurve 5406zl Switch is used as the core Layer 2/Layer 3 router, enforces QoS policies and supports link aggregation, OSPF and spanning tree.

To configure the ProCurve 5406zl Switch, connect a PC or laptop to the serial port of the ProCurve 5406zl 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. Log into the ProCurve 5406zl Switch using the appropriate Login ID and Password.

```
Login:
Password:
ProCurve Switch 5406zl#
```

2. Enable the following features on the ProCurve 5406zl Switch.
   - Enable routing.
   - Enable spanning tree
   - Make the ProCurve 5406zl Switch the root bridge.
   - Enable QoS type-of-service
   - Set router IP
   - Assign priority 6 to DSCP CodePoint 101110
   - Assign a QoS value to ARP
   - Assign a QoS value for IP Office
   - Create trunks trk1 and trk2 using link aggregation protocol. Trunk trk1 goes to the ProCurve 2910al Switch and trunk trk2 goes to the ProCurve 3500yl-24G-PWR Switch.
   - Save the running configuration to the startup configuration.

```
ProCurve Switch 5406zl# configure
ProCurve Switch 5406zl(config)# ip routing
ProCurve Switch 5406zl(config)# spanning-tree
ProCurve Switch 5406zl(config)# spanning-tree priority 1
ProCurve Switch 5406zl(config)# qos type-of-service diff-services
ProCurve Switch 5406zl(config)# ip router-id 20.30.40.1
ProCurve Switch 5406zl(config)# qos dscp-map 101110 priority 6
ProCurve Switch 5406zl(config)# qos protocol ARP priority 4
ProCurve Switch 5406zl(config)# qos device-priority 10.40.40.1 dscp 101110
ProCurve Switch 5406zl(config)# trunk a1-a2 trk1 lacp
ProCurve Switch 5406zl(config)# trunk a19-a20 trk2 lacp
ProCurve Switch 5406zl(config)# write memory
```

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

```
ProCurve Switch 5406zl# configure
ProCurve Switch 5406zl(config)# vlan 2000
ProCurve Switch 5406zl (vlan-2000)# vlan 2000 name VlanOSPF
ProCurve Switch 5406zl (vlan-2000)# ip address 20.30.40.1/24
ProCurve Switch 5406zl (vlan-2000)# qos dscp 101110
ProCurve Switch 5406zl (vlan-2000)# tagged trk2
ProCurve Switch 5406zl (vlan-2000)# exit
```

4. Enable OSPF routing and set VLAN 2000 to ospf area 0.

```
ProCurve Switch 5406zl# configure
ProCurve Switch 5406zl(config)# router ospf
ProCurve Switch 5406zl(ospf)# area 0
ProCurve Switch 5406zl(ospf)# redistribute connected
ProCurve Switch 5406zl(ospf)# vlan 2000
ProCurve Switch 5406zl (vlan-2000)# ip ospf area 0
ProCurve Switch 5406zl (vlan-2000)# exit
```

5. Create and configure the telephony VLAN where all of the Avaya telephony equipment will run.
   - 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.

```
ProCurve Switch 5406zl# configure
ProCurve Switch 5406zl(config)# vlan 40
ProCurve Switch 5406zl (vlan-40)#vlan 40 name telvlan
ProCurve Switch 5406zl (vlan-40)#ip address 10.40.40.254/24
ProCurve Switch 5406zl (vlan-40)# untagged b1-b2
ProCurve Switch 5406zl (vlan-40)# exit
```

6. Create and configure the voice VLAN that will run between the control room and closets.
   - Assign a VLAN ID for the voice VLAN.
   - Assign a name for the voice VLAN.
   - Assign an IP address for the voice VLAN.
   - Set an IP helper address for DHCP.
   - Assign ports to the voice VLAN.

```
ProCurve Switch 5406zl# configure
ProCurve Switch 5406zl(config)# vlan 33
ProCurve Switch 5406zl (vlan-33)#vlan 33 name Voice1
ProCurve Switch 5406zl (vlan-33)#ip address 10.33.1.254/24
ProCurve Switch 5406zl (vlan-33)# ip helper-address 10.20.20.250
ProCurve Switch 5406zl (vlan-33)# tagged a10-a12,trk1
ProCurve Switch 5406zl (vlan-33)# exit
```

7. Create and configure the data VLAN that will run between the control room and closets.
   - 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.

```
ProCurve Switch 5406zl# configure
ProCurve Switch 5406zl(config)# vlan 30
ProCurve Switch 5406zl (vlan-30)# vlan 30 name Datavlan1
ProCurve Switch 5406zl (vlan-30)# ip address 10.30.1.254/24
ProCurve Switch 5406zl (vlan-30)# ip helper-address 10.20.20.250
ProCurve Switch 5406zl (vlan-30)# tagged a10,trk1
ProCurve Switch 5406zl (vlan-30)# untagged a11-a12
ProCurve Switch 5406zl (vlan-30)# exit
```

8. Create and configure the VLAN that where the DHCP/File server runs.
    - Assign a VLAN ID for the DHCP/File VLAN
    - Assign a name for the DHCP/File VLAN
    - Assign an IP address for the DHCP/File VLAN
    - Assign ports to the DHCP/File VLAN

```
ProCurve Switch 5406zl# configure
ProCurve Switch 5406zl(config)# vlan 100
ProCurve Switch 5406zl (vlan-2)#vlan 100 name DHCP
ProCurve Switch 5406zl (vlan-2)#ip address 10.20.20.254/24
ProCurve Switch 5406zl (vlan-2)# tagged a21
ProCurve Switch 5406zl (vlan-2)# exit
```

9. Save the running configuration to the startup configuration.

```
ProCurve Switch 5406zl# configure
ProCurve Switch 5406zl(config)# write memory
```

6. Configure Lab-A ProCurve 3500yl-24G-PWR Switch

This section addresses configuring the ProCurve 3500yl-24G-PWR Switch. The ProCurve 3500yl-24G-PWR Switch is used as the Lab-A Layer 2/ Layer 3 router, enforces QoS policies, and supports link aggregation, OSPF and spanning tree.

To configure the ProCurve 3500yl-24G-PWR Switch, connect a PC or laptop to the serial port of the ProCurve 3500yl-24G-PWR 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. Log into ProCurve 3500yl-24G-PWR Switch using the appropriate Login ID and Password.

```
Login:
Password:
ProCurve Switch 3500yl-24G-PWR#
```

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2. Enable the following features on the ProCurve 3500yl-24G-PWR Switch.
   - Enable routing.
   - Enable spanning tree
   - Enable QoS type-of-service
   - Set router IP
   - Assign priority 6 to DSCP CodePoint 101110
   - Assign a QoS value to ARP
   - Assign a QoS value for IP Office
   - Enable DHCP snooping.
   - Create trunk trk2. Trunk trk2 goes to ProCurve 5406zl Switch.
   - Save the running configuration to the startup configuration.

```
ProCurve Switch 3500yl-24G-PWR# configure
ProCurve Switch 3500yl-24G-PWR(config)# ip routing
ProCurve Switch 3500yl-24G-PWR(config)# spanning-tree
ProCurve Switch 3500yl-24G-PWR(config)# qos type-of-service diff-services
ProCurve Switch 3500yl-24G-PWR(config)# ip router-id 20.30.40.2
ProCurve Switch 3500yl-24G-PWR(config)# qos dscp-map 101110 priority 6
ProCurve Switch 3500yl-24G-PWR(config)# qos protocol ARP priority 4
ProCurve Switch 3500yl-24G-PWR(config)# qos device-priority 10.40.40.1 dscp 101110
ProCurve Switch 3500yl-24G-PWR(config)# dhcp-snooping authorized-server 10.20.20.250
ProCurve Switch 3500yl-24G-PWR(config)# trunk 19-20 trk2 lacp
ProCurve Switch 3500yl-24G-PWR(config)# write memory
```

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

```
ProCurve Switch 3500yl-24G-PWR# configure
ProCurve Switch 3500yl-24G-PWR(config)# vlan 2000
ProCurve Switch 3500yl-24G-PWR (vlan-2000)# vlan 2000 name VlanOSPF
ProCurve Switch 3500yl-24G-PWR (vlan-2000)# ip address 20.30.40.2/24
ProCurve Switch 3500yl-24G-PWR (vlan-2000)# qos dscp 101110
ProCurve Switch 3500yl-24G-PWR (vlan-2000)# tagged trk2
ProCurve Switch 3500yl-24G-PWR (vlan-2000)# exit
```

4. Enable OSPF routing and set VLAN 2000 to ospf area 0.

```
ProCurve Switch 3500yl-24G-PWR# configure
ProCurve Switch 3500yl-24G-PWR(config)# router ospf
ProCurve Switch 3500yl-24G-PWR(ospf)# area 0
ProCurve Switch 3500yl-24G-PWR(ospf)# redistribute connected
ProCurve Switch 3500yl-24G-PWR(ospf)# vlan 2000
ProCurve Switch 3500yl-24G-PWR (vlan-2000)# ip ospf area 0
ProCurve Switch 3500yl-24G-PWR (vlan-2000)#exit
```

5. Create and configure the voice VLAN that will run in Lab-A.
   - Assign a VLAN ID for the voice VLAN.
   - Assign a name for the voice VLAN.
   - Assign an IP address for the voice VLAN.
   - Set an IP helper address for DHCP.
   - Assign ports to the voice VLAN.

```
ProCurve Switch 3500yl-24G-PWR# configure
ProCurve Switch 3500yl-24G-PWR(config)# vlan 533
ProCurve Switch 3500yl-24G-PWR (vlan-533)# vlan 533 name Voice2
ProCurve Switch 3500yl-24G-PWR (vlan-533)# ip address 192.168.33.254/24
ProCurve Switch 3500yl-24G-PWR (vlan-533)# ip helper-address 10.20.20.250
ProCurve Switch 3500yl-24G-PWR (vlan-533)# tagged 3-4
ProCurve Switch 3500yl-24G-PWR (vlan-533)# exit
```

6. Create and configure the data VLAN that will run in Lab-A.
   - 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.

```
ProCurve Switch 3500yl-24G-PWR# configure
ProCurve Switch 3500yl-24G-PWR(config)# vlan 30
ProCurve Switch 3500yl-24G-PWR (vlan-30)#vlan 30 name Datavlan2
ProCurve Switch 3500yl-24G-PWR (vlan-30)#ip address 192.168.30.254/24
ProCurve Switch 3500yl-24G-PWR (vlan-30)# ip helper-address 10.20.20.250
ProCurve Switch 3500yl-24G-PWR (vlan-30)# untagged 3-4
ProCurve Switch 3500yl-24G-PWR (vlan-30)# exit
```

7. Save the running configuration to the startup configuration.

```
ProCurve Switch 3500yl-24G-PWR# configure
ProCurve Switch 3500yl-24G-PWR(config)# write memory
```

7. Configure Closet-A ProCurve 2910al Switch

This section addresses configuring the Closet-A ProCurve 2910al Switch. The ProCurve 2910al Switch was used as an edge switch to supply PoE power, support VLANs and to enforce QoS policies.

To configure the ProCurve 2910al Switch, connect a PC or laptop to the serial port of the 2910al. 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. Log into ProCurve 2910al Switch using the appropriate Login ID and Password.

```
Login:
Password:
ProCurve 2910al-48G-PoE Switch#
```

2. Enable the following features on the ProCurve 2910al Switch.

   - Enable spanning tree
   - Enable QoS type-of-service
   - Assign priority 6 to DSCP CodePoint 101110
   - Assign a QoS value to ARP
   - Assign a QoS value for IP Office
   - Create trunk trk1 using link aggregation. Trunk trk1 goes to the ProCurve 5406zl Switch.

```
ProCurve 2910al-48G-PoE Switch# configure
ProCurve 2910al-48G-PoE Switch# (config)# spanning-tree
ProCurve 2910al-48G-PoE Switch# (config)# qos type-of-service diff-services
ProCurve 2910al-48G-PoE Switch# (config)# qos dscp-map 101110 priority 6
ProCurve 2910al-48G-PoE Switch# (config)# qos protocol ARP priority 4
ProCurve 2910al-48G-PoE Switch# (config)# qos device-priority 10.40.40.1 dscp 101110
ProCurve 2910al-48G-PoE Switch# (config)# trunk 1-2 trk1 lacp
```

3. Create and configure the voice VLAN that runs between the control room and the closet A.

   - Assign a VLAN ID for the voice VLAN.
   - Assign a name for the voice VLAN.
   - Assign ports to the voice VLAN.

```
ProCurve 2910al-48G-PoE Switch(config)# vlan 33
ProCurve 2910al-48G-PoE Switch(vlan-33)# vlan 33 name Voice1
ProCurve 2910al-48G-PoE Switch(vlan-33)# tagged 9-10,44,trk1
ProCurve 2910al-48G-PoE Switch(vlan-33)# exit
```

4. Create and configure the data VLAN that runs between the control room and the closet A.
   - Assign a VLAN ID for the data VLAN.
   - Assign a name for the data VLAN.
   - Assign ports to the data VLAN.

```
ProCurve 2910al-48G-PoE Switch(# configure
ProCurve 2910al-48G-PoE Switch(config)# vlan 30
ProCurve 2910al-48G-PoE Switch(vlan-30)# vlan 30 name Datavlan1
ProCurve 2910al-48G-PoE Switch(vlan-30)# untagged 9-10
ProCurve 2910al-48G-PoE Switch(vlan-30)# tagged 44,trk1
ProCurve 2910al-48G-PoE Switch(vlan-30)# exit
```

5. Save the running configuration to the startup configuration.

> ProCurve 2910al-48G-PoE Switch# **write memory**

8. Configure Closet-B ProCurve 2610-24-PWR Switch

This section addresses configuring the ProCurve 2610-24-PWR Switch. The ProCurve 2610-24-PWR Switch is used as an edge switch to supply PoE power, support VLANs and to enforce QoS policies.

To configure the ProCurve 2610-24-PWR Switch, connect a PC or laptop to the serial port of the ProCurve 2610-24-PWR 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. Log into the ProCurve 2610-24-PWR Switch using the appropriate Login ID and Password.

> Login:
> Password:
> ProCurve Switch 2610-24-PWR#

2. Enable the following features on the ProCurve 2610-24-PWR Switch.

- Enable spanning tree
- Enable QoS type-of-service
- Assign priority 6 to DSCP CodePoint 101110
- Assign a QoS value for IP Office

> ProCurve Switch 2610-24-PWR# **configure**
> ProCurve Switch 2610-24-PWR(config)# **spanning-tree**
> ProCurve Switch 2610-24-PWR(config)# **qos type-of-service diff-services**
> ProCurve Switch 2610-24-PWR(config)# **qos dscp-map 101110 priority 6**
> ProCurve Switch 2610-24-PWR(config)# **qos device-priority 10.30.30.1 dscp 101110**

3. Create and configure the voice VLAN that runs between the control room and the closet B.

- Assign a VLAN ID for the voice VLAN.
- Assign a name for the voice VLAN.
- Assign ports to the voice VLAN.

```
ProCurve Switch 2610-24-PWR(config)# vlan 33
ProCurve Switch 2610-24-PWR(vlan-33)# vlan 33 name Voice1
ProCurve Switch 2610-24-PWR(vlan-33)# tagged 1,3-4,24
ProCurve Switch 2610-24-PWR(vlan-33)# exit
```

4. Create and configure the data VLAN that runs between the control room and the closets B.
- Assign a VLAN ID for the data VLAN.
- Assign a name for the data VLAN.
- Assign ports to the data VLAN.

```
ProCurve Switch 2610-24-PWR# configure
ProCurve Switch 2610-24-PWR(config)# vlan 30
ProCurve Switch 2610-24-PWR(vlan-30)# vlan 30 name Datavlan1
ProCurve Switch 2610-24-PWR(vlan-30)# untagged 3,4
ProCurve Switch 2610-24-PWR(vlan-30)# tagged 1,24
ProCurve Switch 2610-24-PWR(vlan-30)# exit
```

5. Save the running configuration to the startup configuration.

```
ProCurve Switch 2610-24-PWR# write memory
```

9. General Test Approach and Test Results

9.1. Test Approach

All feature functionality test cases were performed manually. The general test approach entailed verifying the following:

- LAN connectivity between the Avaya and ProCurve products
- Registration of Avaya telephones with Avaya IP Office
- Verification of the DHCP relay configuration
- VoIP calls over Layer 2 and Layer 3 connections
  Inter-office calls using G.711 mu-law & G.729 codecs
- Verifying that QoS directed the voice signaling and voice media to the higher priority egress queue based on the packets' DSCP value.
- Verifying voicemail and MWI work properly.
- Features Tested: attended/unattended transfer, conference call participation, conference call add/drop, multiple call appearances, caller ID operation, call forwarding unconditional, call forwarding on busy, call Park, call pick-up, bridged call appearances

The performance tests were performed by over subscribing the lines with low priority data and verifying that the prioritization of VoIP traffic and voice was achieved when calls are routed over all of the LAN interfaces.

9.2. Test Results

All feature functionality, serviceability, and performance test cases passed. The ProCurve implementation did prioritization of VoIP traffic and yielded good voice quality with no calls being lost. The Avaya/ProCurve solution was successfully verified through performance and serviceability testing.

10. Verification Steps

This section provides the steps for verifying end-to-end network connectivity and QoS in the field from the perspective of the ProCurve 5406zl Switch. In general, the verification steps include:

- Verify the DHCP relay is functioning by confirming that the all IP telephones from all locations receive their IP addresses from the DHCP server connected to the ProCurve 5406zl Switch.

- Place calls between Labs and Closets for each Avaya IP Telephone.

11. Conclusion

These Application Notes describe the configuration steps for integrating ProCurve Switches with an Avaya telephony infrastructure. For the configuration described in these Application Notes, the ProCurve switches were responsible for enforcing QoS using Layer 3 Differentiated Services and Layer 2 (802.1p) as well as link aggregation, rapid spanning tree, load balancing and OSPF. Avaya IP Office delivered the voice traffic to the routers for transmission over the LAN together with data traffic. Prioritization of VoIP traffic and good voice quality was successfully achieved in the Avaya/ProCurve configuration described herein.

12. Additional References

This section references the Avaya documentation relevant to these Application Notes. The following Avaya product documentation is available at http://support.avaya.com

[1] *Avaya IP Office 4.2 Installation Manual,* Document Number 15-601042
[2] *Avaya IP Office 4.2 Embedded Voicemail User Guide*, Document Number 15-601067
[3] *Avaya IP Office 4.2 Phone Manager User Guide,* Document Number 15-600988
[4] *Avaya IP Office 4.2 Manager 6.2,* Document # 16-601443
[5] *Deskphone Value Edition 1600 Series IP Telephones Installation and Maintenance Guide,* Document # 16-601443

The HP product documentation can be found at: http://www.hp.com/rnd/support/manuals

[6] *Command Line Interface Reference Guide for the ProCurve Series 3500yl, 6200yl, 5400zl, and 8212zl Switches*
[7] *Management and Configuration Guide for the ProCurve Series 3500yl, 6200yl, 5400zl, and 8200zl Switches*
[8] *Management and Configuration Guide for the ProCurve Series 2910 Switches*
[9] *Management and Configuration Guide for the ProCurve Series 2610 Switches*

13. Change History

Issue	Date	Reason
1.0	7/20/2009	Initial issue