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Avaya Solution & Interoperability Test Lab

Application Notes for ProCurve 5400zl, 3500yl and 2600 Series Switches by HP connected to Avaya Distributed 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 using ProCurve 5400zl, 3500yl and 2600 Series Switches by HP connected to Avaya Distributed Office. The ProCurve 5406zl, 3500yl-24G, 2610-24-PWR and 2626-24-PWR Switches were compliance-tested with Avaya Distributed Office with emphasis 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.

1. Introduction

These Application Notes describe the configuration of a Voice over IP (VoIP) solution using The ProCurve 5400, 3500 and 2600 Series Switches by HP connected to Avaya Distributed Office. 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 Distributed Office and are enforced in the network by the ProCurve Switches. To verify 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 verifying QoS, throughput, link aggregation, rapid spanning tree, load balancing and Open Shortest Path First (OSPF).

1.1. ProCurve Switch 5400zl/3500yl Series Switch

The ProCurve Switch 5400zl series includes a 6-slot and a 12-slot chassis and the ProCurve Switch 3500yl series includes 24-port and 48-port stackables. The foundation for all these switches is a purpose-built, programmable ProVision ASIC that allows networking features, such as QoS and security, to be implemented in a scalable yet granular fashion. The ProCurve Switch 5400zl/3500yl series have options for a variety of Gigabit Ethernet (GigE) interfaces, integrated Power over Ethernet (PoE) on all 10/100/1000Base-T ports, and 10-GigE capability. The ProCurve Switch 5400zl/3500yl series are IEEE 802.3af compliant for PoE and provide up to 15.4 Watts per port. A redundant external power supply is also available as an accessory.

1.2. ProCurve Switch 2600 Series Switch

The ProCurve Switch 2600 series is a collection of stackable, multi-layer, managed switches with 48, 24, or 8 auto-sensing 10/100 ports and dual-personality ports for 10/100/1000 or mini gigabit interface converter (GBIC) connectivity. The ProCurve Switch 2600 series is IEEE 802.3af compliant for PoE and provide up to 15.4 Watts per port. A redundant external power supply is also available as an accessory.

2. Hardware 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 Distributed Office, one Avaya 9630 IP Telephone running Avaya one-X Deskphone SIP, one Avaya 1616 IP Telephone running Avaya one-X Value Edition 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 for the Avaya IP Telephones and was configured to support link aggregation, rapid spanning tree, load balancing and OSPF.

2.2. Lab-A

Lab-A consisted of a ProCurve 3500yl-24G Switch, one Avaya 9630 IP Telephone running Avaya one-X Deskphone SIP and one Avaya 1608 IP Telephone running Avaya one-X Value Edition on VLAN Voice2 and a PC on Datavlan2. The ProCurve 3500yl-24G Switch supplied PoE power for the Avaya IP Telephones and was configured to support link aggregation, rapid spanning tree, load balancing and OSPF.

2.3. Closet-A

Closet-A consisted of a ProCurve Switch 2626-24-PWR Switch as an edge switch. It was configured to support VLANs, enforce QoS policies and rapid spanning tree.

2.4. Closet-B

Closet-B consisted of a ProCurve 2610-24-PWR Switch, one Avaya 1608 IP Telephone running Avaya one-X Value Edition on VLAN Voice1,one Avaya 9620 IP Telephone running Avaya one-X Deskphone SIP 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 load balancing.
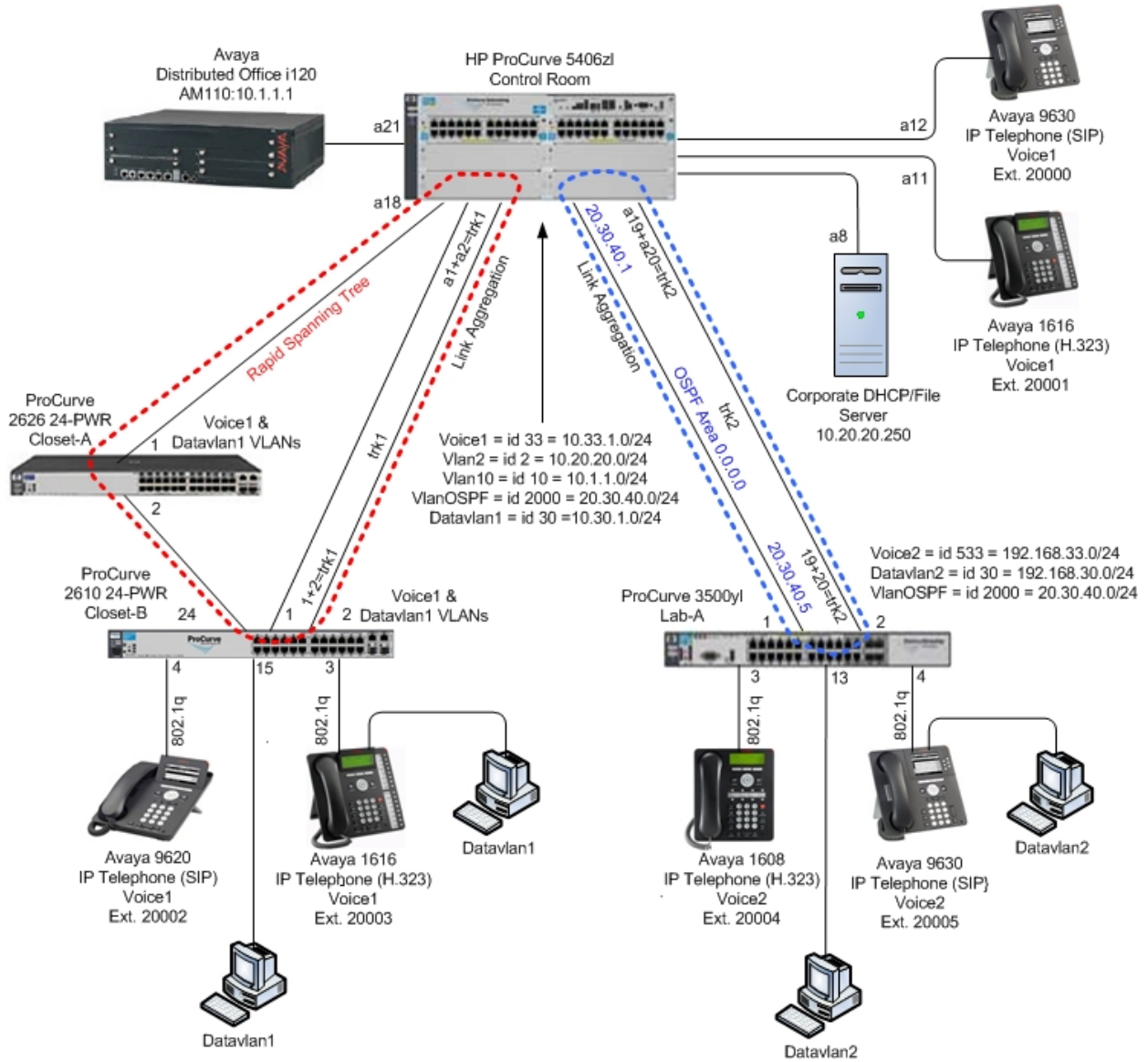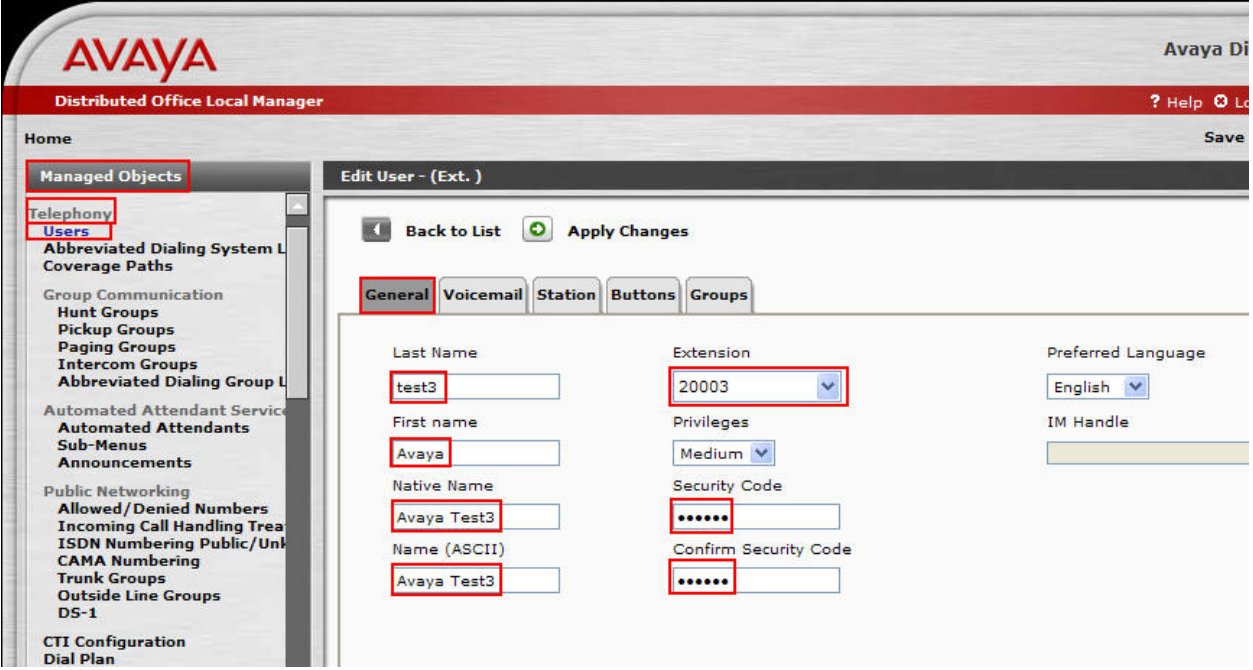
Figure 1: Network Configuration
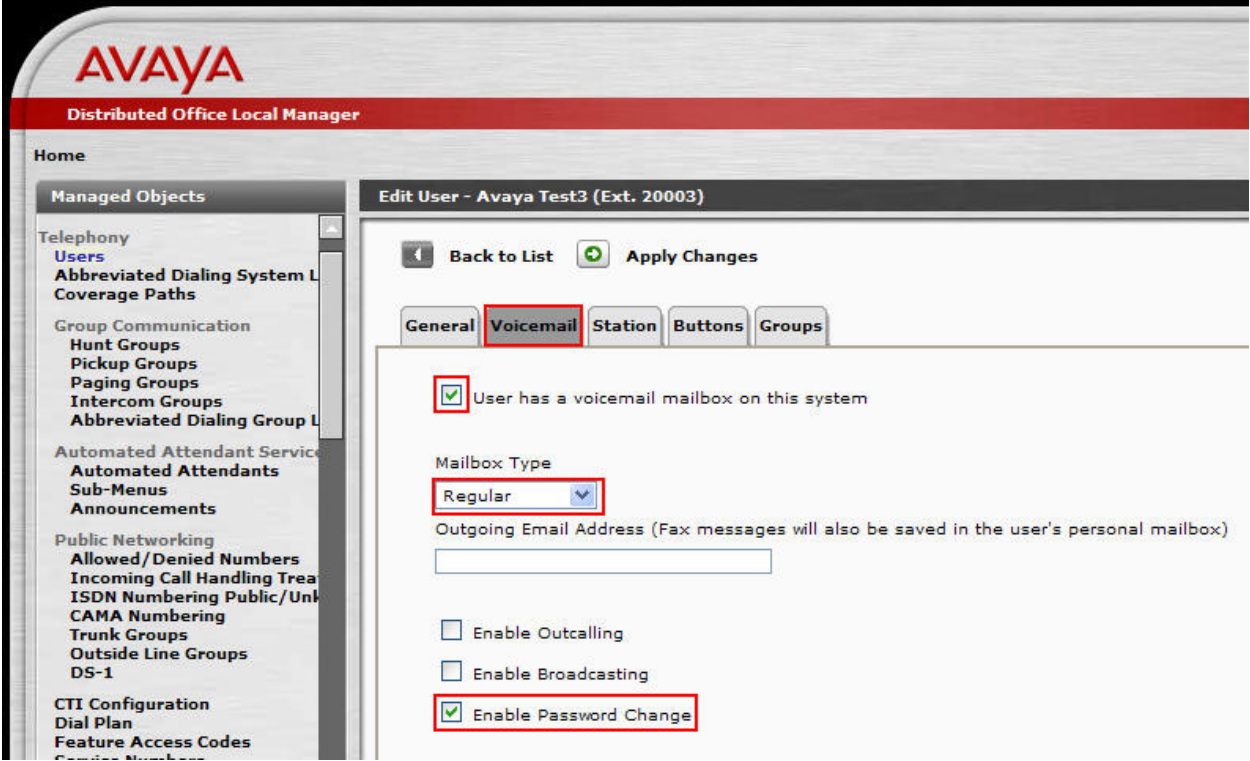
3. Equipment and Software Validated

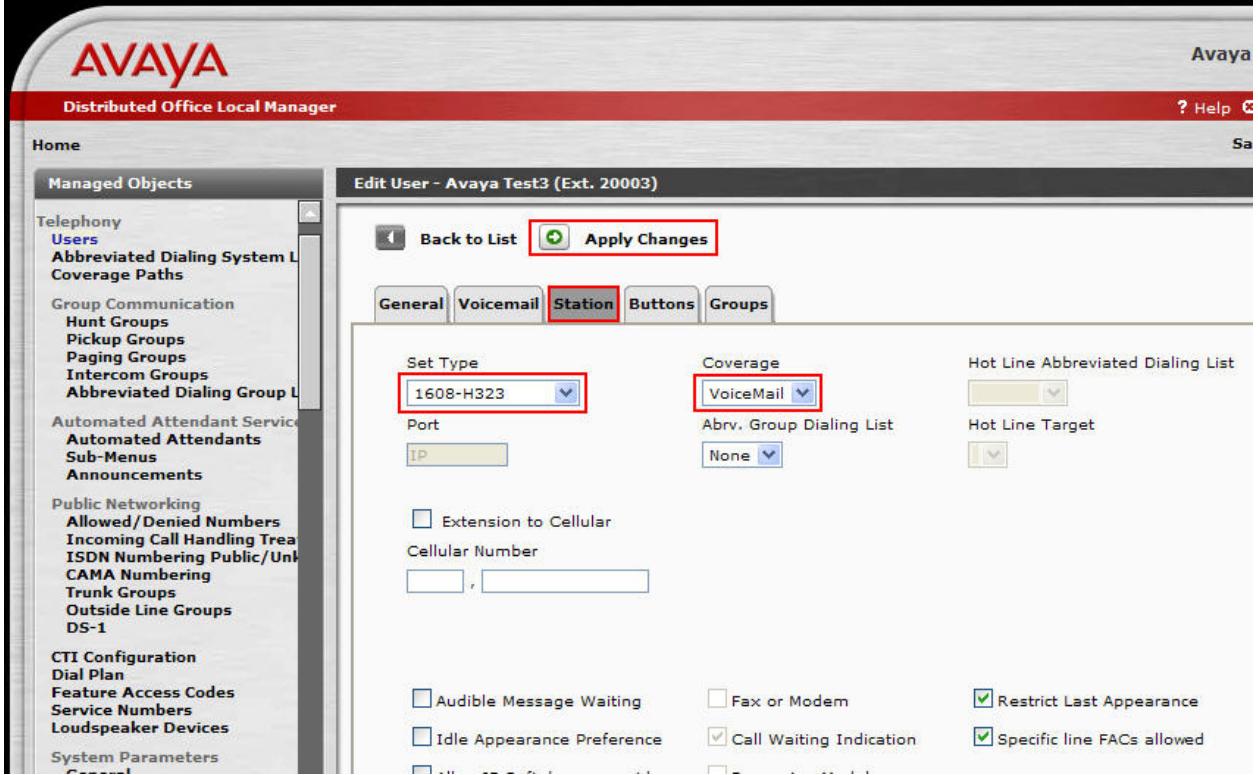The following equipment and software/firmware were used for the sample configuration provided:

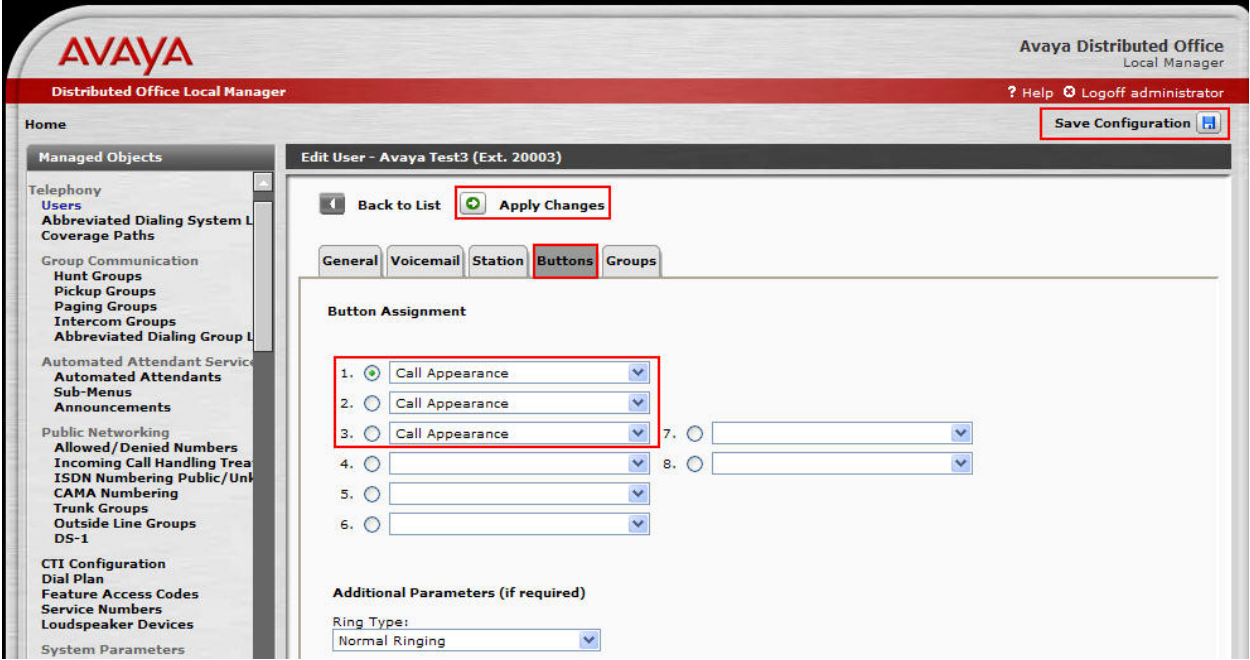| Equipment	Software/Firmware
Avaya Distributed Office i120	i120 sw.27.17.1
Avaya Distributed Office AM110	DO AM110 1.1.1_41.03
Avaya 9600 Series IP Telephones	Avaya one-X Deskphone SIP 2.0.3 (SIP)
Avaya 1600 Series IP Telephones	Avaya one-X Value Edition 1.23 (H.323)
ProCurve 5406zl by HP with J8705A module and RJ45 (J8177C Transceiver)	FW-K.13.09
ProCurve 3500yl-24-PWR by HP	FW-K.13.09
ProCurve 2610-24-PWR by HP	FW-H.11.07
ProCurve 2626-24-PWR by HP	FW-H.10.50

4. Avaya Distributed Office Configuration

Avaya Distributed Office is administered via a web interface. In the sample network the Avaya Distributed Office was assigned the IP address 10.1.1.1 and the URL http://10.1.1.1 was used to access the administration interface. For information on how to access and setup a factory default system, refer to **Section 9** [**1**].

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ProCurve-ADO

Step	Description
1.	Navigate to the **Edit User** window by clicking **Managed Object→Telephony→Users**. Enter the values displayed below and then click **Apply Changes**. **Last Name**, **First name** and **Native Name** can be any descriptive text that identifies this user. **Name (ASCII)** may be populated with the same information that is entered in **Native Name**. Enter the **Security Code** and **Confirm Security Code information**. Use the drop-down list for **Extension** and select any available extension. The remaining parameters were left at the default values.

Step	Description
2.	Navigate to the **Voicemail** tab by clicking **Voicemail**. Check the **User has a voicemail mailbox on this system** and **Enable Password Change** check boxes. Use the drop-down list for **Mailbox Type** to select "Regular". Press the **Station** tab to continue.

Step	Description
3.	Navigate to the **Station** tab by clicking **Station**. Use the drop-down list for **Set Type** to select "1608-H323" and use the drop-down list for **Coverage** to select "VoiceMail". The remaining parameters were left at the default values. Press the **Buttons** tab to continue.

Step	Description
4.	Use the drop list for **Button Assignment 1 – 3** and select "Call Appearance". The remaining parameters were left at the default values. Click **Apply Changes** and then click **Save Configuration**. Note the user may receive a message indicating the system is busy if **Save Configuration** is clicked immediately after **Apply Changes**. If that occurs, simply click **Save Configuration** after one or two minutes.
5.	Repeat Steps 1 thru 4 for each Avaya IP Telephone.

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 and make the ProCurve 5406zl Switch the root bridge.
   - Enable QoS for Differentiated Services.
   - Create trunks trk1 and trk2 using link aggregation protocol. Trunk trk1 goes to the ProCurve 2610-24-PWR Switch and trunk trk2 goes to the ProCurve 3500yl-24G-PWR Switch.
   - Set priority for the IP address of Avaya Distributed Office.
   - 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 dscp-map 101110 priority 6
ProCurve Switch 5406zl(config)# trunk a1-a2 trk1 lacp
ProCurve Switch 5406zl(config)# trunk a19-a20 trk2 lacp
ProCurve Switch 5406zl(config)# qos device-priority 10.1.1.1 dscp 101110
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 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)# untagged 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.
   - Assign a QoS priority to the telephony VLAN.

```
ProCurve Switch 5406zl# configure
ProCurve Switch 5406zl(config)# vlan 10
ProCurve Switch 5406zl (vlan-10)#vlan 10 name vlan10
ProCurve Switch 5406zl (vlan-10)#ip address 10.1.1.254/24
ProCurve Switch 5406zl (vlan-10)# untagged a21
ProCurve Switch 5406zl (vlan-10)# qos priority 6
ProCurve Switch 5406zl (vlan-10)# 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 voice option.
   - 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)# voice
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 a11-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 trk1
ProCurve Switch 5406zl (vlan-30)# exit
```

8. Create and configure the VLAN 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 2
ProCurve Switch 5406zl (vlan-2)#vlan 2 name vlan2
ProCurve Switch 5406zl (vlan-2)#ip address 10.20.20.254/24
ProCurve Switch 5406zl (vlan-2)# untagged a8
ProCurve Switch 5406zl (vlan-2)# exit
```

9. Set priority for telephony ports.

- Set the port QoS priority of Avaya Distributed Office to 6

```
ProCurve Switch 5406zl# configure
ProCurve Switch 5406zl(config)# interface a21
ProCurve Switch 5406zl(eth-A21)# qos priority 6
ProCurve Switch 5406zl(eth-A21)# exit
```

10. 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#
```

2. Enable the following features on the ProCurve 3500yl-24G-PWR Switch.
    - Enable Routing.
    - Enable spanning-tree.
    - Enable DHCP snooping.
    - Save the running configuration to the startup configuration.
    - Reboot the ProCurve 5406zl Switch.
    - Enable QoS for Differentiated Services.

- Create trunk trk1. Trunk trk1 goes to ProCurve 5406zl Switch.
- Set priority for the IP address of Avaya Distributed Office.

```
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)# dhcp-snooping authorized-server 10.20.20.250
ProCurve Switch 3500yl-24G-PWR(config)# write memory
ProCurve Switch 3500yl-24G-PWR(config)# boot

<Log back into the ProCurve Switch 3500yl-24G-PWR Switch after the reboot>

ProCurve Switch 3500yl-24G-PWR# configure
ProCurve Switch 3500yl-24G-PWR(config)# qos type-of-service diff-services
ProCurve Switch 3500yl-24G-PWR(config)# trunk 19-20 trk2 lacp
ProCurve Switch 3500yl-24G-PWR(config)# qos device-priority 10.1.1.1 dscp 101110
```

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 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 20.30.40.5/24
ProCurve Switch 3500yl-24G-PWR (vlan-2000)# untagged 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.
   - Make vlan Voice2.
   - 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)# voice
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 3-4,13
ProCurve Switch 3500yl-24G-PWR (vlan-30)# exit
```

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 2626-24-PWR Switch

This section addresses configuring the Closet-A ProCurve 2626-24-PWR Switch. The ProCurve 2626-24-PWR Switch was used as an edge switch to supply PoE power, support VLANs and to enforce QoS policies.

To configure the ProCurve 2626-24-PWR Switch, connect a PC or laptop to the serial port of the 2626-24-PWR. 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 2626-24-PWR Switch using the appropriate Login ID and Password.

```
Login:
Password:
ProCurve Switch 2626-PWR#
```

2. Enable the following features on the ProCurve 2626-24-PWR Switch.

- Enable spanning tree.
- Set DSCP map setting for priority 6.

```
ProCurve Switch 2626-PWR# configure
ProCurve Switch 2626-PWR# spanning-tree
ProCurve Switch 2626-PWR# qos dscp-map 101110 priority 6
```

3. Create and configure the voice VLAN that will run between the control room and the closets.

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

```
ProCurve Switch 2626-PWR (config)# vlan 33
ProCurve Switch 2626-PWR (vlan-33)#vlan 33 name Voice1
ProCurve Switch 2626-PWR (vlan-33)# tagged 1-2
ProCurve Switch 2626-PWR (vlan-33)# qos priority 6
ProCurve Switch 2626-PWR (vlan-33)# exit
```

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

```
ProCurve Switch 2626-PWR# configure
ProCurve Switch 2626-PWR(config)# vlan 30
ProCurve Switch 2626-PWR (vlan-30)# vlan 30 name Datavlan1
ProCurve Switch 2626-PWR (vlan-30)# tagged 1-2
ProCurve Switch 2626-PWR (vlan-30)# exit
```

5. Write the running-config to startup-config

```
ProCurve Switch 2626-PWR# configure
ProCurve Switch 2626-PWR(config)# 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, link aggregation 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.
    - Set DSCP map setting for priority 6.
    - Set QoS type of service.
    - Create trunk trk1 using link aggregation. Trunk trk1 goes to the ProCurve 5406zl Switch.

```
ProCurve Switch 2610-24-PWR# configure
ProCurve Switch 2610-24-PWR#  spanning-tree
ProCurve Switch 2610-24-PWR# qos dscp-map 101110 priority 6
ProCurve Switch 2610-24-PWR(config)# qos type-of-service diff-services
ProCurve Switch 2610-24-PWR(config)# trunk 1-2 trk1 lacp
```

3. Create and configure the voice VLAN that will run between the control room and the closets.

    - Assign a VLAN ID for the voice VLAN.
    - Assign a name for the voice VLAN.
    - Assign ports to the voice VLAN.
    - Assign a QoS priority 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 3,4,24,trk1
ProCurve Switch 2610-24-PWR(vlan-33)# qos priority 6
ProCurve Switch 2610-24-PWR(vlan-33)# exit
```

4. Create and configure the data VLAN that will run between the control room and the closets.
    - 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 3,4,15
ProCurve Switch 2610-24-PWR(vlan-30)# tagged 24,trk1
ProCurve Switch 2610-24-PWR(vlan-30)# exit
```

5. Save the running configuration to the startup configuration.

```
ProCurve Switch 2610-24-PWR# configure
ProCurve Switch 2610-24-PWR(config)# write memory
```

9. Interoperability Compliance Testing

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

Feature functionality testing focused on the QoS and VLAN implementation in the Avaya/ProCurve configuration. Specifically, compliance 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 (801.p). Voice and data traffic were segmented in the enterprise network using VLANs.

QoS and performance testing was verified by making voice calls while a traffic generator generated low priority data traffic to simulate a converged network. At the end of the performance test, it was verified that the network devices continued to operate successfully.

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.

9.1. General 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 equipment.
- Registration of Avaya H.323 IP Telephones with Avaya Distributed Office.
- Registration of Avaya SIP IP Telephones with Avaya Distributed Office.
- Verification of the DHCP relay configuration.
- VoIP calls over Layer 2 and Layer 3 connections.
- Calls using conferencing, and sending low priority data traffic over the LAN.
- Verifying that QoS directed the voice signaling and voice media to the higher priority egress queue based on the packet's DSCP value.
- Verifying that voicemail and MWI work properly.

The performance tests were performed by over subscribing the lines with low priority data and verifying that VoIP traffic was prioritized and that good voice quality was achieved when calls were routed over all of the LAN interfaces.
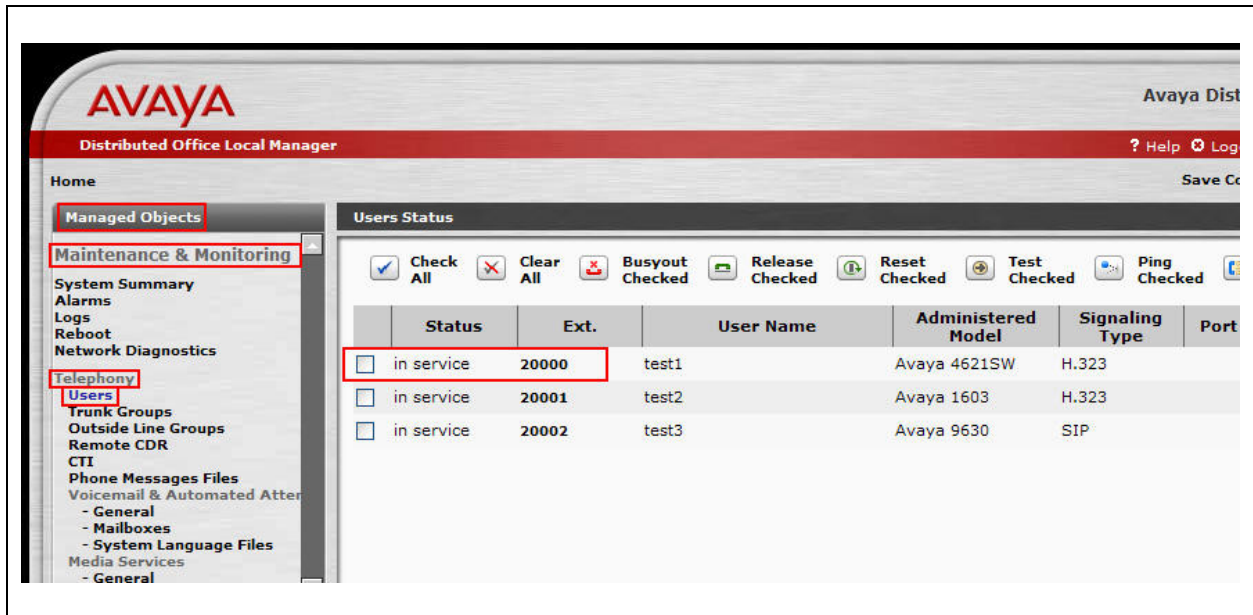
9.2. Test Results

All feature functionality, serviceability, and performance test cases passed. The ProCurve implementation did prioritize VoIP traffic and yielded good voice quality with no calls being lost. The stability of 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.

- Check that the Avaya IP telephones have successfully registered with Avaya Distributed Office. Log into Avaya Distributed Office using the appropriate credentials, select **Managed Objects → Maintenance & Monitoring → Telephony → Users,** look for **in service**.

11. Conclusion

These Application Notes describe the configuration steps required 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 Diffserv and 802.1p as well as link aggregation, rapid spanning tree, load balancing and OSPF. Avaya Distributed 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

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] *Avaya Distributed Office i20 Installation Quick Start*, May 2007 Issue 1, Document Number 03-602289.
[2] *Command Reference Release, Document Number*: 882-10034 Rev 1.
[3] *Configuration Guide, Document Number*: 882-20034 Rev 2.
[4] *Avaya one-X Deskphone Value Edition 1600 Series IP Telephones Installation and Maintenance Guide Release 1*, Document # 16-601443.
[5] *Avaya one-X Deskphone SIP for 9600 Series IP Telephones Installation and Maintenance Guide Release 2.0,* Document Number 16-601943.

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

[7] *Command Line Interface Reference Guide for ProCurve 5400zl/3500yl* (K.13.XX).
[8] *Management and Configuration Guide for the ProCurve Switch 2600 Series,* Switch 2600-PWR Series, Switch) (Entire Manual).

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