



**Application Notes for ProCurve 5400zl, 3500yl and 2600 Series Switches by HP connected to an 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 using ProCurve 5400zl, 3500yl and 2600 Series Switches by HP connected to an Avaya IP Office. The ProCurve 5406zl, 3500yl-24G-PWR and 2626-PWR Switches were compliance-tested with Avaya IP Office. Emphasis was placed on verifying voice quality in a converged VoIP and Data network scenario. Information in these Application Notes has been obtained through compliance testing and additional technical discussions. Testing was conducted via the *DeveloperConnection* 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 ProCurve 5400zl, 3500yl and 2600 Series Switches by HP connected to an Avaya IP Office. Compliance testing emphasis was placed on verifying voice quality in a converged VoIP and Data network scenario. Quality of Service (QoS) based on 802.1p (Layer 2 Priority) 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. Tests were performed by oversubscribing the LAN interfaces with low priority data and verifying that voice quality was achieved when calls were routed over all of the LAN interfaces. Compliance testing included QoS, throughput, link aggregation, rapid spanning tree, load balancing, Open Shortest Path First (OSPF), Direct Media and the G.711 & G.729 codecs.

## 1.1. ProCurve Switch 5400zl/3500yl Series

The 5400zl series include a 6-slot and a 12-slot chassis and the 3500yl series include 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. ProCurve Switch 5400zl/3500yl Series have options for a variety of Gigabit interfaces, integrated Power over Ethernet (PoE) on all 10/100/1000Base-T ports, and 10-GbE capability. The ProCurve Switch 5400zl/3500yl series are IEEE 802.3af compliant for Power over Ethernet 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

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-GBIC (gigabit interface converter) connectivity. The ProCurve Switch 2650-PWR, 2626-PWR, and 2600-8-PWR are IEEE 802.3af compliant for Power over Ethernet 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, the DHCP server function on Avaya IP Office was disabled and 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 consists of a ProCurve 5406zl, Avaya IP Office 406V2 with one Avaya 2400 Series Digital Telephone, one Avaya 5600 Series IP Telephone, one Avaya 4600 Series IP Telephone, Avaya IP Office Manager, two ProCurve 2626-PWR switches, one ProCurve 3500yl switch and one Corporate DHCP/TFTP Server. The corporate site provides a DHCP server for assigning IP network parameters to the Avaya IP Telephones. The ProCurve 5406zl switch will supply PoE for the Avaya IP Telephones as well as link aggregation, rapid spanning tree, load balancing and OSPF.

## **2.2. Closet A**

Closet A consists of a ProCurve 3500yl-PWR switch, two Avaya 4600 Series IP Telephones on VLAN Voice3 and a PC on Datavlan2. The ProCurve 3500yl-PWR will supply PoE power for the Avaya IP Telephones as well as link aggregation, rapid spanning tree, load balancing and OSPF.

## **2.3. Closet B**

Closet B consists of a ProCurve 2626-PWR switch, one Avaya 5600 Series IP Telephone, one Avaya 4600 Series IP Telephone on VLAN Voice1 and a PC on Datavlan1. The ProCurve 2626-PWR will supply PoE for the Avaya IP Telephones as well as link aggregation, rapid spanning tree and load balancing.

## **2.4. Lab A**

Lab A consists of a ProCurve Switch 2626-PWR as an edge switch. As an edge switch, it must be configured for the Layer 2 infrastructure (VLANs) and to enforce QoS policies. The ProCurve 2626-PWR is running rapid spanning tree.

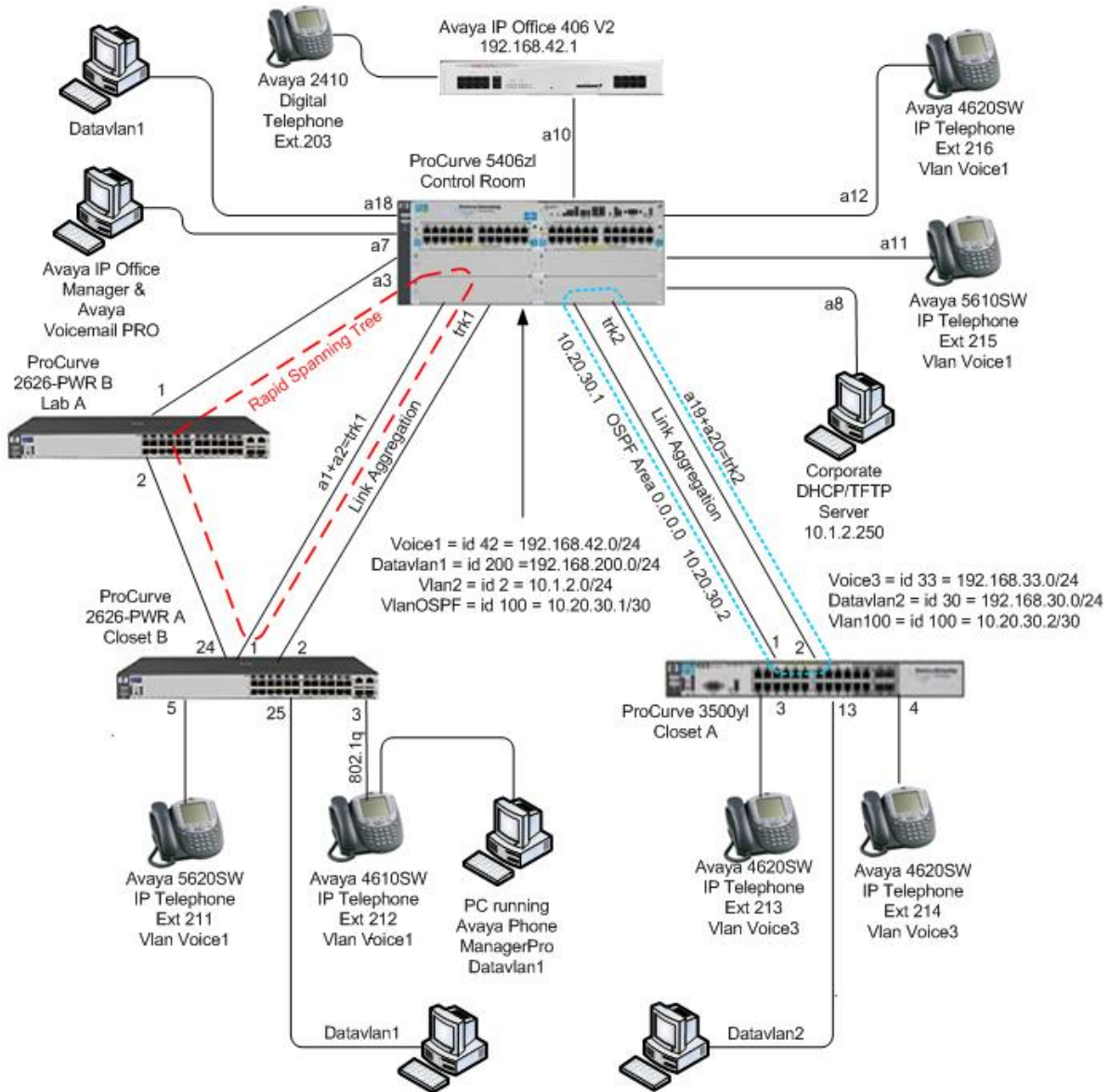


Figure 1: Network Configuration

### 3. Equipment and Software Validated

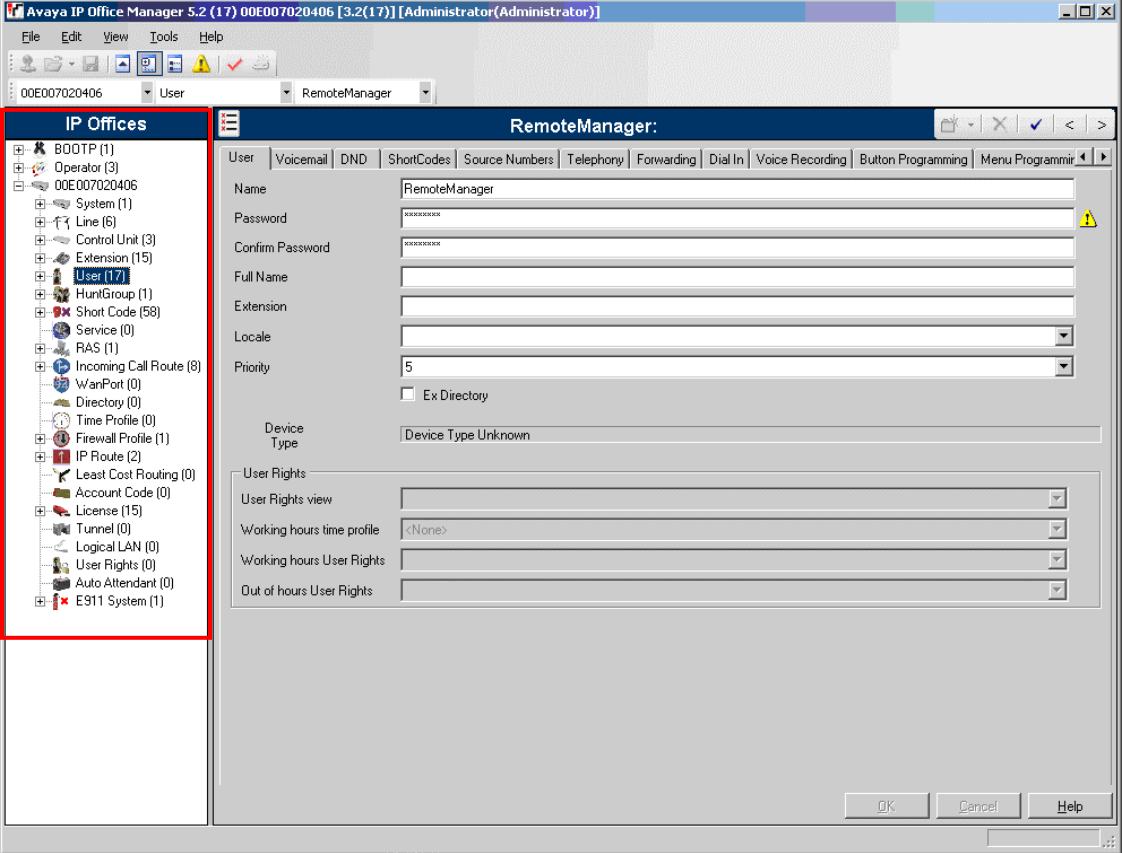
The following equipment and software/firmware were used for the sample configuration provided:

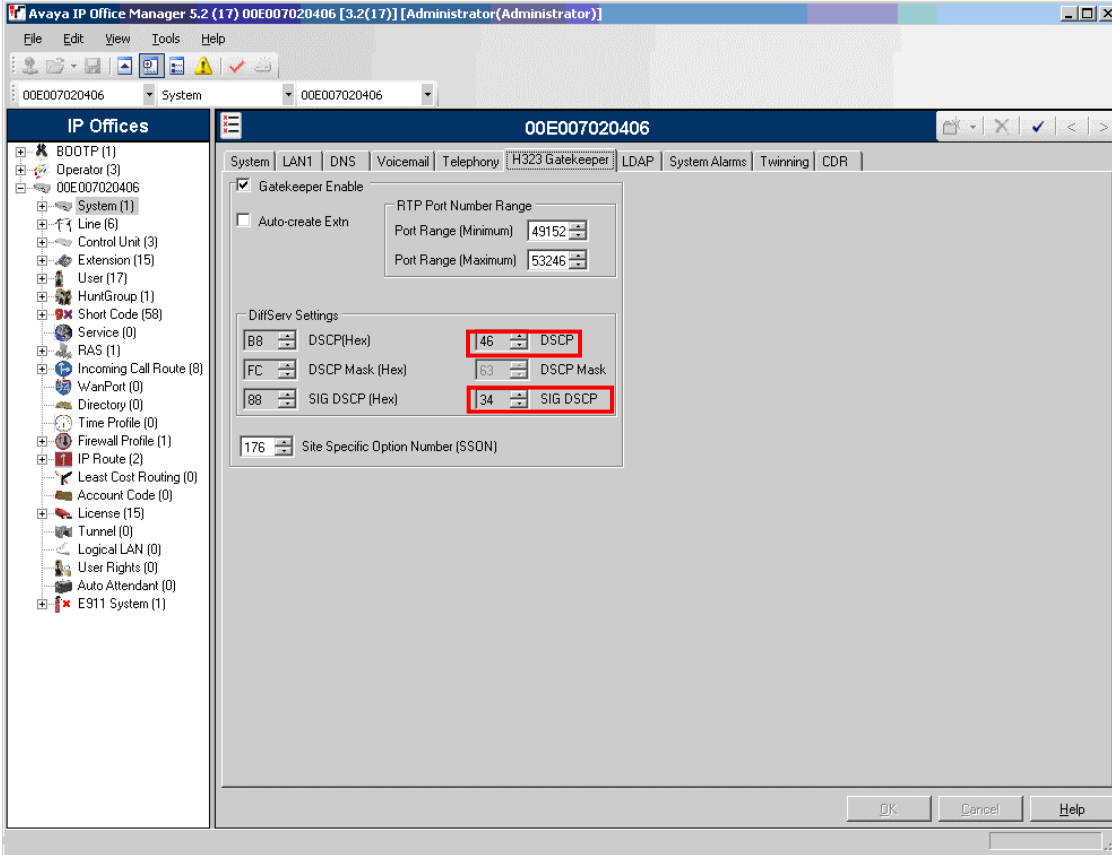
Equipment	Software/Firmware
Avaya IP Office IP406V2	3.2(17)
Avaya 4620SW IP Telephones	2.6
Avaya 4610SW IP Telephones	2.6
Avaya 5620SW Telephones	2.3
Avaya 5610SW Telephones	2.3
Avaya 2410SW Digital Telephone	N/A
Avaya IP Office Manager	3.2(17)
Avaya IP Office Phone Manager Pro	3.2.15
ProCurve 5406zl by HP	FW-H.08.98
ProCurve 3500yl-PWR by HP	FW-K.11.41
ProCurve 2626-PWR by HP	FW-K.11.41

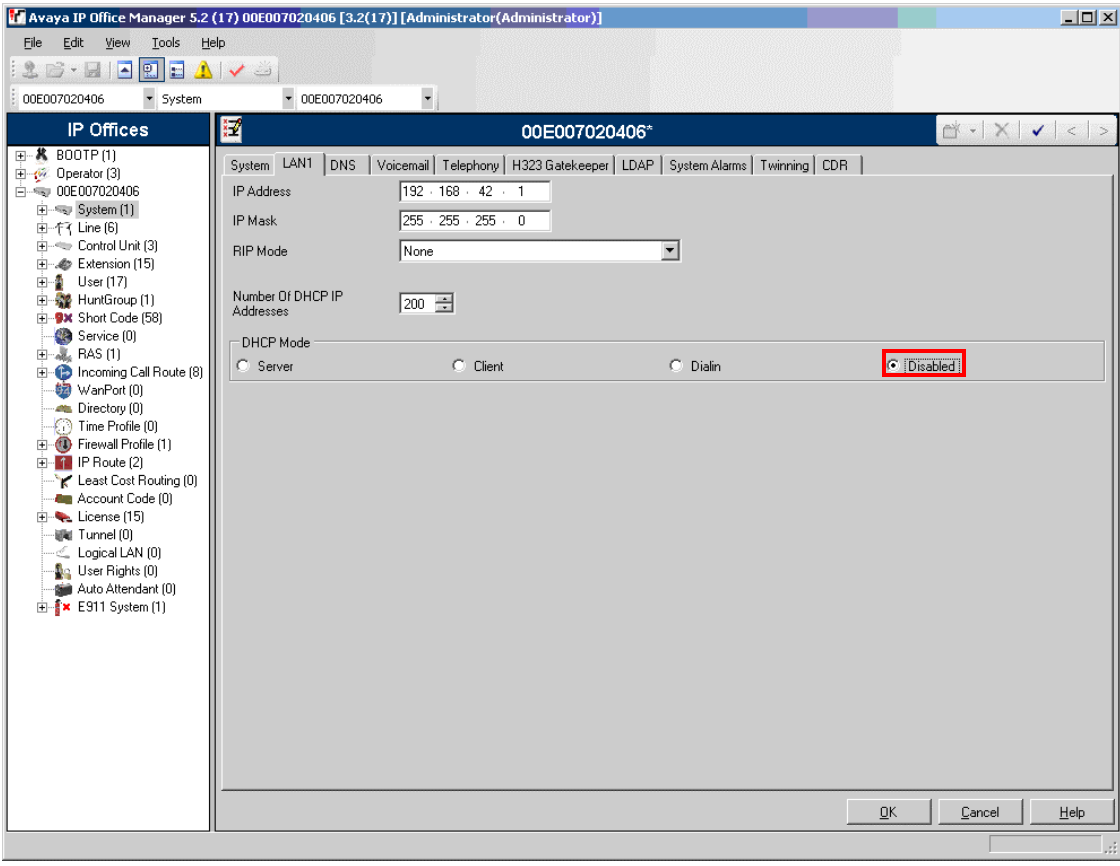
### 4. Avaya IP Office Settings

This Section was included to verify that Avaya IP Office was configured correctly. ProCurve specific configuration is not required on Avaya IP Office to support this solution. 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, and extensions, please refer to the Avaya IP Office product documentation.

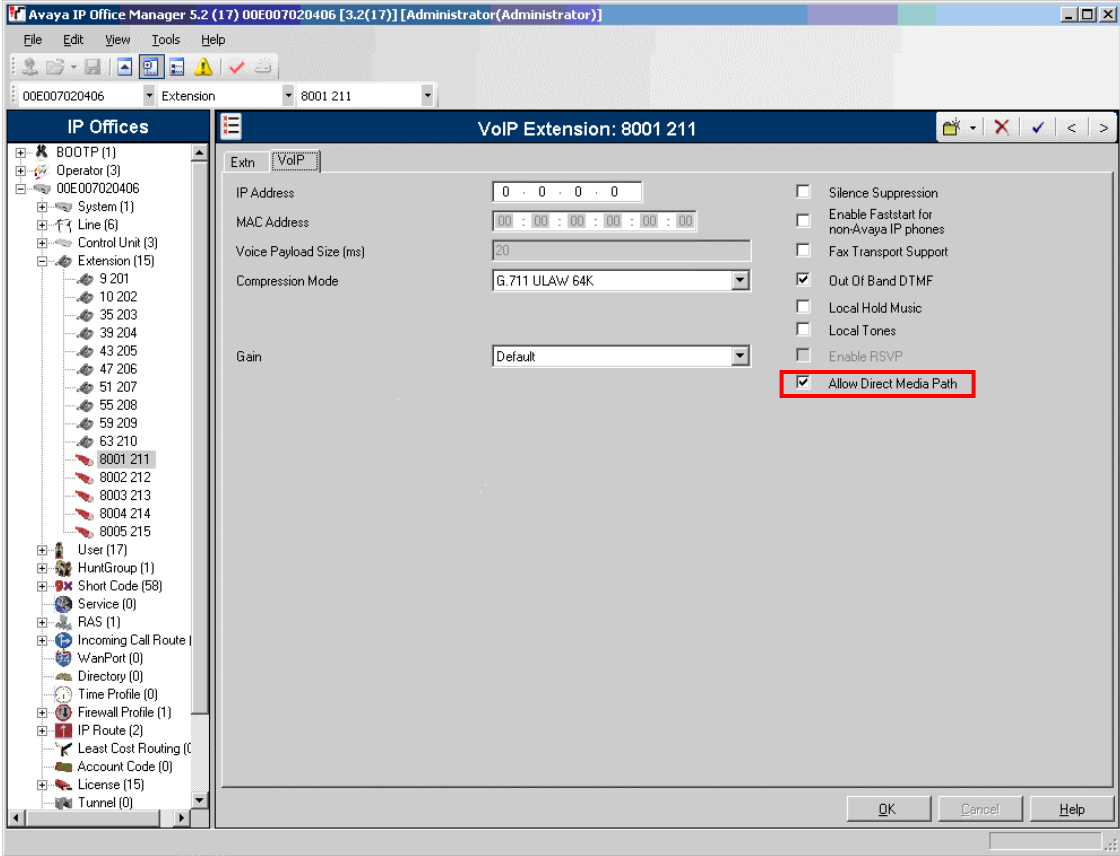
Log into the PC running IP Office Manager and go to **Start** → **Programs** → **IP Office** → **Manager** to launch the Manager application. Log into the Manager application using the appropriate credentials. In the Manager window that appears, select **File** → **Open** to search for IP Offices in the network.

Step	Description
1.	<p>IP Office Manager window.</p> <p>The main IP Office Manager window appears. The following steps refer to the Configuration Tree which is in the left pane of the window and under the heading <b>IP Offices</b>.</p> 

Step	Description
2.	<p>Verify Gatekeeper information.</p> <p>The Avaya IP Telephones will get Differentiated Services information from the Avaya IP Office. This information will be utilized for QoS by the ProCurve Switch. In the Manager window, go to the Configuration Tree and double-click <b>System</b>. Select the <b>H323 Gatekeeper</b> tab. Verify that the <b>DiffServ Settings</b> for <b>DSCP</b> and <b>SIG DSCP</b> are set to <b>46</b> and <b>34</b>, respectively.</p>  <p>The screenshot shows the Avaya IP Office Manager 5.2 (17) interface. The left-hand Configuration Tree is expanded to 'System (1)'. The main window displays the 'H323 Gatekeeper' configuration page. Under the 'DiffServ Settings' section, the following values are visible and highlighted with red boxes:</p> <ul style="list-style-type: none"> <li>DSCP(Hex): 46</li> <li>DSCP Mask (Hex): 63</li> <li>SIG DSCP (Hex): 34</li> <li>Site Specific Option Number (SSDN): 176</li> </ul>

Step	Description
3.	<p>Disable DHCP server on Avaya IP Office.            From the Configuration Tree, double-click <b>System</b>. Select the <b>LAN1</b> tab. Set the <b>DHCP Mode</b> to <b>Disabled</b>. Click <b>OK</b> to continue.</p>  <p>The screenshot shows the Avaya IP Office Manager 5.2 (17) interface. The left pane displays the Configuration Tree with 'System (1)' selected under the '00E007020406' node. The right pane shows the configuration for 'System (1)' under the 'LAN1' tab. The 'DHCP Mode' section has three radio buttons: 'Server', 'Client', and 'Disabled'. The 'Disabled' radio button is selected and highlighted with a red box. Other fields include IP Address (192.168.42.1), IP Mask (255.255.255.0), RIP Mode (None), and Number Of DHCP IP Addresses (200). The 'OK', 'Cancel', and 'Help' buttons are visible at the bottom right.</p>



Step	Description
4.	<p>Verify Direct Media Path.</p> <p>From the Configuration Tree, select <b>Extensions</b>. Double-click on the IP telephone extension to check. Select the <b>VoIP</b> tab. Verify that <b>Allow Direct Media Path</b> is checked. Click <b>OK</b> to continue</p>  <p>The screenshot shows the Avaya IP Office Manager 5.2 interface. The left pane displays the 'IP Offices' configuration tree, with 'Extension (15)' expanded to show a list of extensions, including '8001 211'. The right pane shows the configuration for 'VoIP Extension: 8001 211'. The 'VoIP' tab is selected. The 'Allow Direct Media Path' checkbox is checked and highlighted with a red box. Other settings include IP Address (0.0.0.0), MAC Address (00:00:00:00:00:00), Voice Payload Size (20), Compression Mode (G.711 ULAW/64K), and Gain (Default). Other options like Silence Suppression, Enable Faststart for non-Avaya IP phones, Fax Transport Support, Out Of Band DTMF, Local Hold Music, Local Tones, and Enable RSVP are unchecked.</p>

## 5. Configuration of the ProCurve 5406zl switch

This section addresses how to configure the ProCurve 5406zl Switch. The 5406zl will be used as the core router and will run Layer 2 and Layer 3, enforce QoS policies as well as Link Aggregation, OSPF and spanning tree.

### 1. Log into ProCurve 5406zl Switch.

Connect to the ProCurve 5406zl Switch. Log in using the appropriate Login ID and Password.

Login:

Password:

ProCurve Switch 5406zl#

### 2. Enable Routing on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# ip routing
```

### 3. Enable spanning tree and make the ProCurve 5406zl Switch the root bridge.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# spanning-tree  
ProCurve Switch 5406zl(config)# spanning-tree priority 1
```

### 4. Enable QoS for Differentiated Services on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# qos type-of-service diff-services
```

### 5. Create trunks 1 and 2 (Link Aggregation) on the ProCurve 5406zl Switch. Trunk trk1 goes to ProCurve 2626-PWR Switch (A) and trunk trk2 goes to the 3500yl-24G-PWR Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# trunk a1-a2 trk1 lacp  
ProCurve Switch 5406zl(config)# trunk a19-a20 trk2 lacp
```

### 6. Create and configure VLAN vlanOSPF on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# vlan 100 name vlanOSPF
```

7. Assign ports to VLAN vlanOSPF on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# vlan 100  
ProCurve Switch 5406zl (vlan-100)# tagged trk2
```

8. Assign an IP address VLAN vlanOSPF on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# vlan 100  
ProCurve Switch 5406zl (vlan-100)#ip address 10.20.30.1/30
```

9. Enable OSPF routing and set VLAN 100 to ospf area 0 on the ProCurve 5406zl Switch.

```
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 100  
ProCurve Switch 5406zl (vlan-100)# ip ospf area 0
```

10. Create and configure VLAN Voice1 on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# vlan 42 name Voice1
```

11. Assign an IP address and DHCP helper-address to VLAN Voice1 on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# vlan 42  
ProCurve Switch 5406zl (vlan-42)#ip address 192.168.42.254/24  
ProCurve Switch 5406zl (vlan-42)# ip helper-address 10.1.2.250
```

12. Assign ports to VLAN Voice1 on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# vlan 42  
ProCurve Switch 5406zl (vlan-42)# untagged a7,a10-a12  
ProCurve Switch 5406zl (vlan-42)# tagged a3,trk1
```

13. Create and configure VLAN Datavlan1 on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# vlan 200 name Datavlan1
```

14. Assign an IP address and DHCP helper-address to VLAN Datavlan1 on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# vlan 200  
ProCurve Switch 5406zl (vlan-30)#ip address 192.168.200.254/24  
ProCurve Switch 5406zl (vlan-30)# ip helper-address 10.1.2.250
```

15. Assign ports to VLAN Datavlan1 on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# vlan 200  
ProCurve Switch 5406zl (vlan-200)# untagged a18  
ProCurve Switch 5406zl (vlan-200)# tagged a3,trk1
```

16. Create and configure VLAN vlan2 on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# vlan 2 name vlan2
```

17. Assign an IP address to VLAN vlan2 on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# vlan 2  
ProCurve Switch 5406zl (vlan-2)#ip address 10.1.2.254/24
```

18. Assign ports to VLAN vlan2 on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# vlan 2  
ProCurve Switch 5406zl (vlan-2)# untagged a8  
ProCurve Switch 5406zl (vlan-2)# qos priority 6
```

19. Set all ports assigned to datavlan1 as edge-ports on the ProCurve 5406zl Switch.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# spanning-tree a18 edge-port
```

20. Set priority to the IP Office IP address.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# qos device-priority 192.168.42.1 dscp 100010
```

21. Set the port of the IP Office to priority of 6.

```
ProCurve Switch 5406zl# configure  
ProCurve Switch 5406zl(config)# int a10  
ProCurve Switch 5406zl(eth-A10)# qos priority 6
```

22. Save the configuration by writing the running configuration to the startup configuration.

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

## 6. Configuration of the ProCurve 3500yl-24G-PWR Switch

This section addresses configuring the ProCurve 3500yl-24G-PWR Switch. The 3500yl-24G-PWR will be used as one of the edge switches and will run Layer 2 and Layer 3, enforce QoS policies as well as Link Aggregation, OSPF and spanning tree.

1. Log into ProCurve 3500yl-24G-PWR Switch.

```
Connect to the ProCurve 3500yl-24G-PWR Switch. Log in using the appropriate  
Login ID and Password.
```

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

2. Enable Routing.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# ip routing
```

3. Enable spanning tree on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)#spanning-tree
```

4. Enable QoS on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)#qos type-of-service diff-services
```

5. Create a trunk on ports 1 and 2 (Link Aggregation) on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# trunk 1,2 trk1 lacp
```

6. Create and configure VLAN vlanOSPF on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# vlan 100 name vlanOSPF
```

7. Assign ports to VLAN vlanOSPF on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# vlan 100  
ProCurve Switch 3500yl-24G-PWR (vlan-100)# tagged trk1
```

8. Assign an IP address to VLAN vlanOSPF on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# vlan 100  
ProCurve Switch 3500yl-24G-PWR (vlan-100) ip address 10.20.30.2/30
```

9. Enable OSPF routing and set VLAN 100 to ospf area 0 on the ProCurve 3500yl-24G-PWR Switch.

```
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 100  
ProCurve Switch 3500yl-24G-PWR (vlan-100)# ip ospf area 0
```

10. Create and configure VLAN Voice3 on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# vlan 33 name Voice3
```

11. Assign an IP address and DHCP helper-address to VLAN Voice3 on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# vlan 33  
ProCurve Switch 3500yl-24G-PWR (vlan-33)#ip address 192.168.33.254/24  
ProCurve Switch 3500yl-24G-PWR (vlan-33)# ip helper-address 10.1.2.250
```

12. Enable 802.1p priority 6 for Voice3 on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# vlan 33  
ProCurve Switch 3500yl-24G-PWR (vlan-33)# qos priority 6
```

13. Assign ports to VLAN Voice3 on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# vlan 33  
ProCurve Switch 3500yl-24G-PWR (vlan-33)# untagged 3-4
```

14. Create and configure VLAN Datavlan2 on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# vlan 30 name Datavlan2
```

15. Assign an IP address and DHCP helper-address to VLAN Datavlan2 on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# vlan 30  
ProCurve Switch 3500yl-24G-PWR (vlan-30)#ip address 192.168.30.254/24  
ProCurve Switch 3500yl-24G-PWR (vlan-30)# ip helper-address 10.1.2.250
```

16. Assign ports to VLAN Datavlan2 on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# vlan 30  
ProCurve Switch 3500yl-24G-PWR (vlan-30)# untagged 13
```

17. Set all ports assigned to datavlan2 as edge-ports on the ProCurve 3500yl-24G-PWR Switch.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# spanning-tree 13 edge-port
```

18. Set priority to the IP Office IP address.

```
ProCurve Switch 3500yl-24G-PWR# configure  
ProCurve Switch 3500yl-24G-PWR(config)# qos device-priority 192.168.42.1 dscp 100010
```

19. Save the configuration by writing the running configuration to the startup configuration.

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

## 7. Configuration of the ProCurve 2626-PWR Switch (A)

This section addresses configuring the ProCurve 2626-PWR Switch. The ProCurve 2626-PWR Switch is used as an edge switch to supply PoE on VLAN Voice1. As an edge switch, it must be configured for the Layer 2 infrastructure (VLANs) and to enforce QoS policies.

1. Log into ProCurve 2626-PWR Switch (A).

```
Connect to the ProCurve 2626-PWR Switch. Log in using the appropriate  
Login ID and Password.
```

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

2. Enable spanning tree on the ProCurve 2626-PWR Switch (A).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# spanning-tree
```

3. Enable QoS on the ProCurve 2626-PWR Switch (A).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# qos type-of-service diff-services
```

4. Enable DSCP map to priority 6 on the ProCurve 2626-PWR Switch (A).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# qos dscp-map 100010 priority 6
```

5. Create trunks 1 and 2 (Link Aggregation) on the ProCurve 2626-PWR Switch (A).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# trunk 1-2 trk1 lacp
```

6. Create and configure VLAN Voice1 on the ProCurve 2626-PWR Switch (A).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# vlan 42 name Voice1
```



7. Assign ports to VLAN Voice1 on the ProCurve 2626-PWR Switch (A).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# vlan 42  
ProCurve Switch 2626-PWR (vlan-42)# untagged 5  
ProCurve Switch 2626-PWR (vlan-42)# tagged 3,24,trk1
```

8. Enable 802.1p priority 6 for Voice1 on the ProCurve 2626-PWR Switch (A).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# vlan 42  
ProCurve Switch 2626-PWR (vlan-42)# qos priority 6
```

9. Create and configure VLAN Datavlan1 on the ProCurve 2626-PWR Switch (A).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# vlan 200 name Datavlan1
```

10. Assign ports to VLAN Datavlan1 on the ProCurve 2626-PWR Switch (A).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# vlan 200  
ProCurve Switch 2626-PWR (vlan-200)# untagged 3,25  
ProCurve Switch 2626-PWR (vlan-200)# tagged 24,trk1
```

11. Save the configuration by writing the running configuration to the startup configuration on the ProCurve 2626-PWR Switch (A).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# write memory
```

## 8. Configuration of the ProCurve 2626-PWR switch (B)

This section addresses configuring the ProCurve 2626-PWR Switch (Lab A). The ProCurve 2626-PWR Switch is used as an edge switch to supply PoE and as an edge switch, it must be configured for the Layer 2 infrastructure (VLANs) and to enforce QoS policies.

1. Log into ProCurve 2626-PWR Switch (B).

Connect to the ProCurve 2626-PWR Switch. Log in using the appropriate Login ID and Password.

Login:

Password:

ProCurve Switch 2626-PWR#

2. Enable spanning tree on the ProCurve 2626-PWR Switch (B).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# spanning-tree
```

3. Enable DSCP map to priority 6 on the ProCurve 2626-PWR Switch (B).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# qos dscp-map 100010 priority 6
```

4. Create and configure VLAN Voice1 on the ProCurve 2626-PWR Switch (B).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# vlan 42 name Voice1
```

5. Assign ports to VLAN Voice1 on the ProCurve 2626-PWR Switch (B).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# vlan 42  
ProCurve Switch 2626-PWR (vlan-42)# tagged 1,2
```

6. Enable 802.1p priority 6 for Voice1 on the ProCurve 2626-PWR Switch (B).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# vlan 42  
ProCurve Switch 2626-PWR (vlan-42)# qos priority 6
```

7. Create and configure VLAN Datavlan1 on the ProCurve 2626-PWR Switch (B).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# vlan 200 name Datavlan1
```

8. Assign ports to VLAN Datavlan1 on the ProCurve 2626-PWR Switch (B).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-PWR(config)# vlan 200  
ProCurve Switch 2626-PWR (vlan-200)# tagged 1,2
```

9. Save the configuration by writing the running configuration to the startup configuration on the ProCurve 2626-PWR Switch (B).

```
ProCurve Switch 2626-PWR# configure  
ProCurve Switch 2626-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 oversubscribed with low priority data traffic the higher priority VoIP media and signaling traffic still gets through and good voice quality is achieved. 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.

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 testing verified the ability to recover after the network normalized.

### 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 products
- Registration of Avaya IP 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, 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 packets' DSCP value

The performance tests were performed by over subscribing the lines with low priority data and verifying that good voice quality 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 yielded good voice quality and no calls were 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:

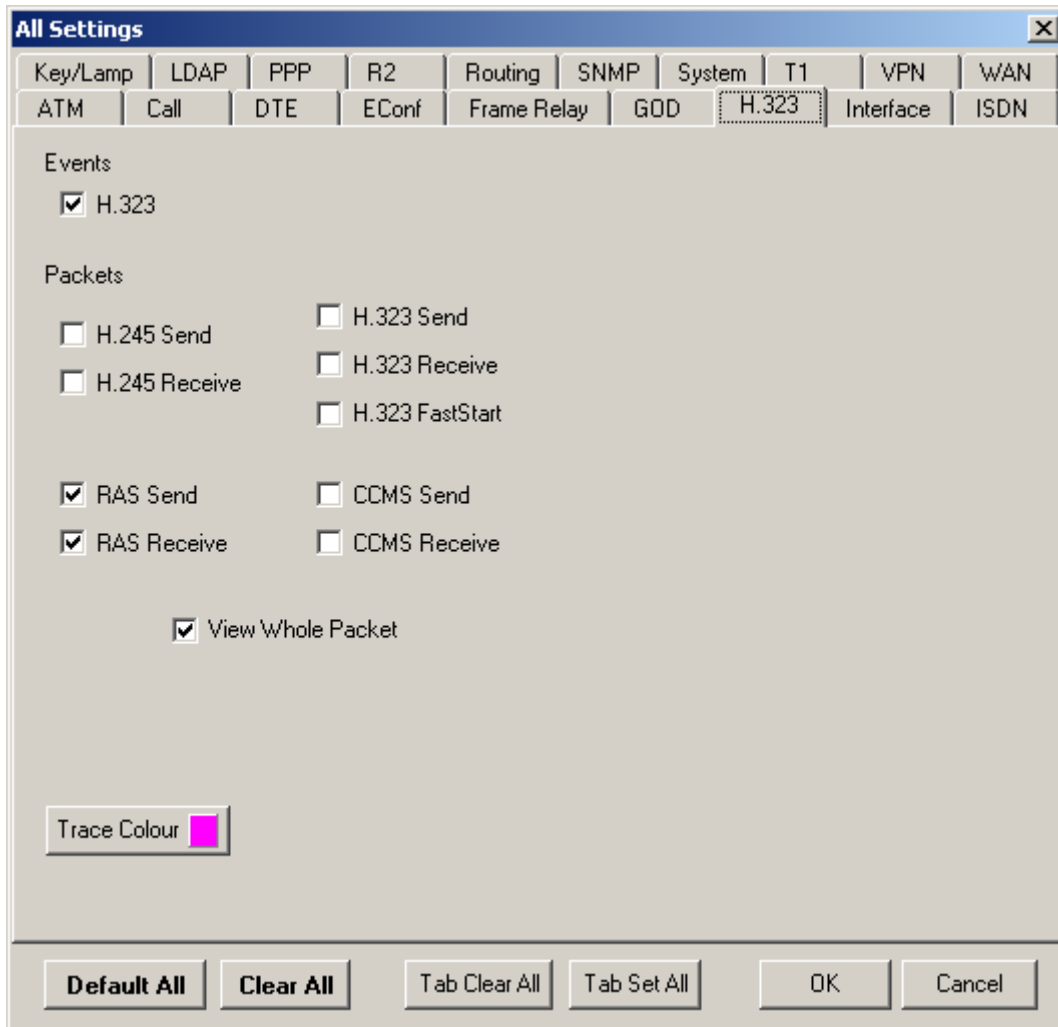
1. Verify the DHCP relay on the ProCurve switches is functioning by confirming that the IP Telephones receive their IP addresses from the DHCP server connected to the ProCurve 5406zl.
2. Check that the Avaya IP Telephones have successfully registered using the IP Office **System Monitor**. See Section 11.1.
3. Place internal and external calls between the Digital telephone and IP telephones at each site.

## 11. Troubleshooting

### 11.1. Avaya IP Office Troubleshooting

Troubleshooting can be done on the IP Office via the IP Office System Monitor application. Log into the IP Office Monitor PC and select **Start** → **Programs** → **IP Office** → **Monitor** to launch the IP Office System Monitor application. Log into the application using the appropriate credentials.

To see the registration messages going to and from IP Office, select **Trace Options** under the **Filters Menu**. Select the **H.323** tab and configure as illustrated below. Click the **OK** button.



## 11.2. Miscellaneous Troubleshooting

1. If the voice quality is poor, check Sections 5, 6, 7 and 8 for QoS options.
2. If any of the ProCurve switches are unable to communicate with any of the aforementioned IP devices and interfaces, check the VLAN configuration, routing and status of the Ethernet and LAN interfaces.

## 12. Conclusion

These Application Notes describe the configuration steps required for integrating ProCurve Switches into a small office Avaya IP Office 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. The Avaya IP Office delivered the voice traffic to the routers for transmission over the LAN together with data traffic. Good voice quality was successfully achieved in the Avaya/ProCurve configuration described herein.

## 13. Additional References

This section references the Avaya and HP product documentation that are relevant to these Application Notes.

The Avaya product documentation can be found at:

<http://support.avaya.com>

The HP product documentation can be found at:

<http://www.hp.com/rnd/support/manuals>

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