



## **Avaya Solution & Interoperability Test Lab**

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# **Application Notes for Extreme Networks Switches with Avaya IP Office and Avaya IP Telephones 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 Extreme Networks BlackDiamond 8800 Series, Summit X650 Series, Summit X460 Series and Summit X450 Series switches with Avaya IP Office and Avaya IP Telephones 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.

# 1. Introduction

These Application Notes describe the configuration of a Voice over IP (VoIP) solution consisting of Extreme Networks BlackDiamond 8800 Series, Summit X650 Series, Summit X460 Series and Summit X450 Series switches with an Avaya IP Office and Avaya IP Telephones 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.

## 2. General Test Approach and Test Results

The general test approach was to configure a Voice over IP (VoIP) solution consisting of Extreme Networks BlackDiamond 8800 Series, Summit X650 Series, Summit X460 Series and Summit X450 Series switches with Avaya IP Office and Avaya IP Telephones with emphasis placed on voice quality. The configuration (shown in **Figure 1**) was used to exercise the features and functionality listed in **Section 2.1**.

### 2.1. Interoperability Compliance Testing

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

Compliance testing emphasis was placed on verifying the prioritization of VoIP traffic and voice quality in a converged VoIP and data network scenario.

#### Feature functionality tested:

- QoS - Layer 3 DiffServ-based QoS and Layer 2 priority (802.1p)
- Open Shortest Path First (OSPF)
- Load balancing
- VLANs
- Rapid Spanning Tree
- DHCP relay

### **The telephony features verified to operate correctly included:**

- Attended/Unattended transfer
- Conference call add/drop/participation
- Multiple call appearances
- Caller ID operation
- Call forwarding
- Call Park,/Call pick-up
- Bridged call appearances
- Voicemail using Avaya Voicemail Pro
- Message Waiting Indicator (MWI)
- Hold/Return from hold
- Direct IP Media (Shuffling)
- G.711 and G.729 codecs

### **Serviceability testing:**

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

## **2.2. Test Results**

All feature functionality, serviceability, and performance test cases described in **Section 2.1** passed. VoIP traffic and voice features worked properly while traversing Extreme Networks BlackDiamond 8800 Series, Summit X650 Series, Summit X460 Series and Summit X450 Series switches.

## **2.3. Support**

For technical support on Extreme Networks products, consult the support pages at <http://www.extremenetworks.com> or contact the Extreme Networks at: 800-998-2408.

### 3. Reference Configuration

The network diagram shown in **Figure 1** illustrates the network environment used for the compliance test.

**The Avaya and Extreme components used to create the Control Room included:**

- Avaya IP Office 500
- Avaya IP Office Manager running on a PC
- Communication Manager Messaging
- Avaya 96x1 Series IP Telephone (H.323)
- Avaya 1600 Series IP Telephone (H.323)
- Avaya 2410 Digital Telephone
- Extreme Networks Summit X650-24t
- Extreme Summit X450e-24p
- DHCP/HTTP/TFTP Server

**The Avaya and Extreme components used to create Lab-A included:**

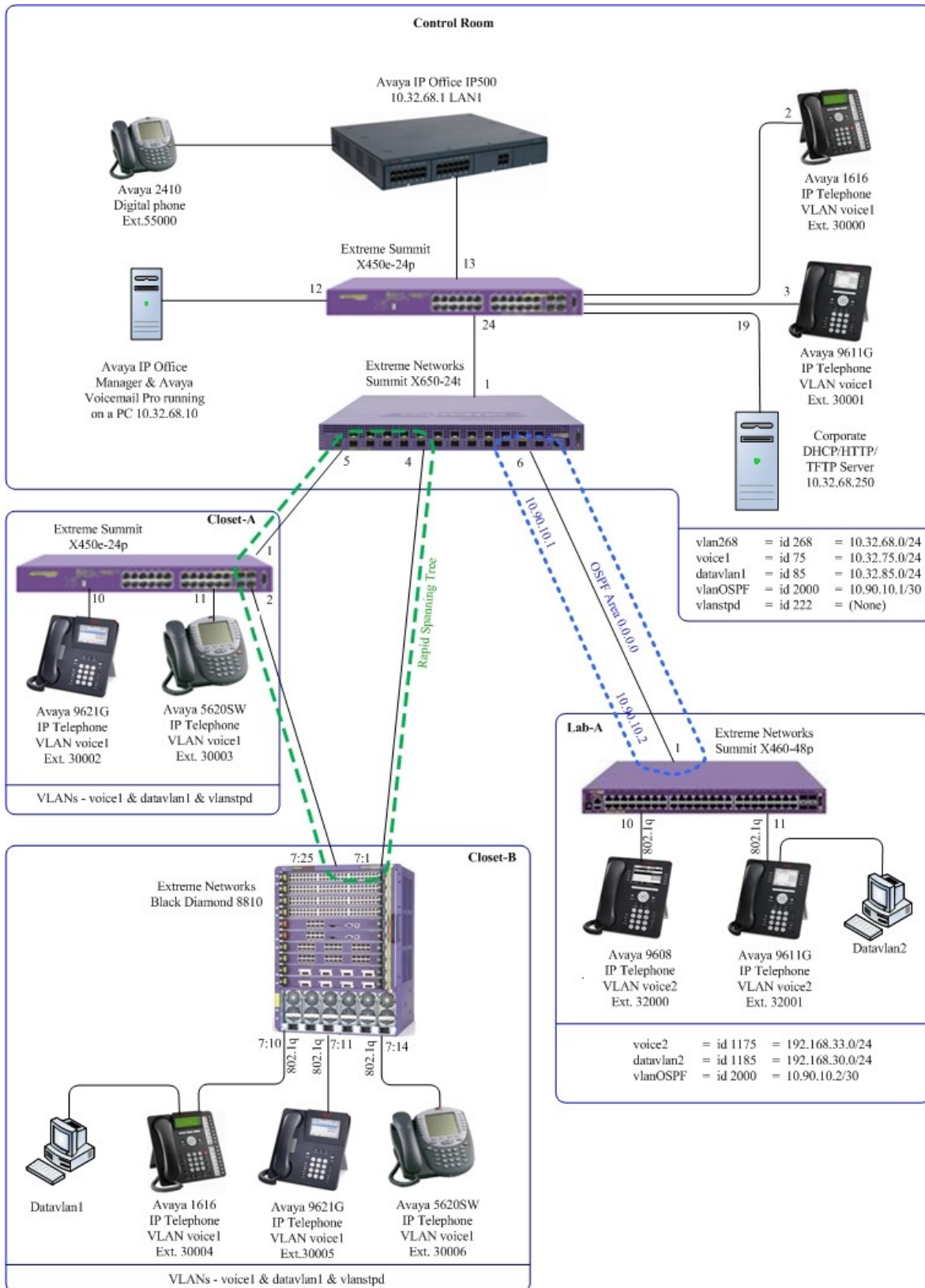
- Avaya 9600 Series IP Telephone (H.323)
- Avaya 96x1 Series IP Telephone (H.323)
- Extreme Summit X460-48p
- PC connected to the Avaya 9600 Series IP telephone switch port

**The Avaya and Extreme components used to create Closet-A included:**

- Avaya 96x1 Series IP Telephone (H.323)
- Avaya 5600 Series IP Telephone (H.323)
- Extreme Summit X450e-24p

**The Avaya and Extreme components used to create Closet-B included:**

- Avaya 96x1 Series IP Telephone (H.323)
- Avaya 1600 Series IP Telephone (H.323)
- Avaya 5600 Series IP Telephone (H.323)
- Extreme Black Diamond 8810
- PC connected to the Avaya 1600 Series IP Telephone switch port



**Figure 1: Avaya IP Telephony Network traversing Extreme Networks enterprise Solution**

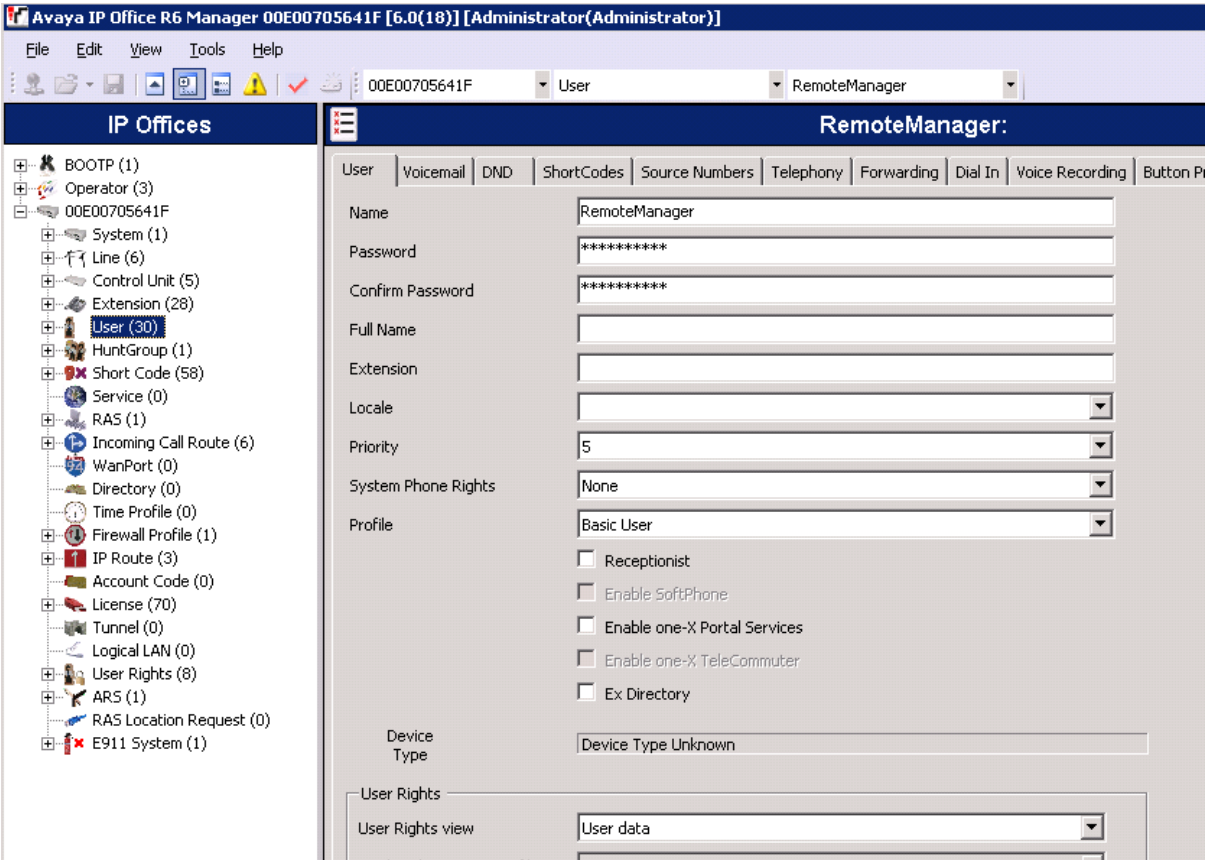
## 4. Equipment and Software Validated

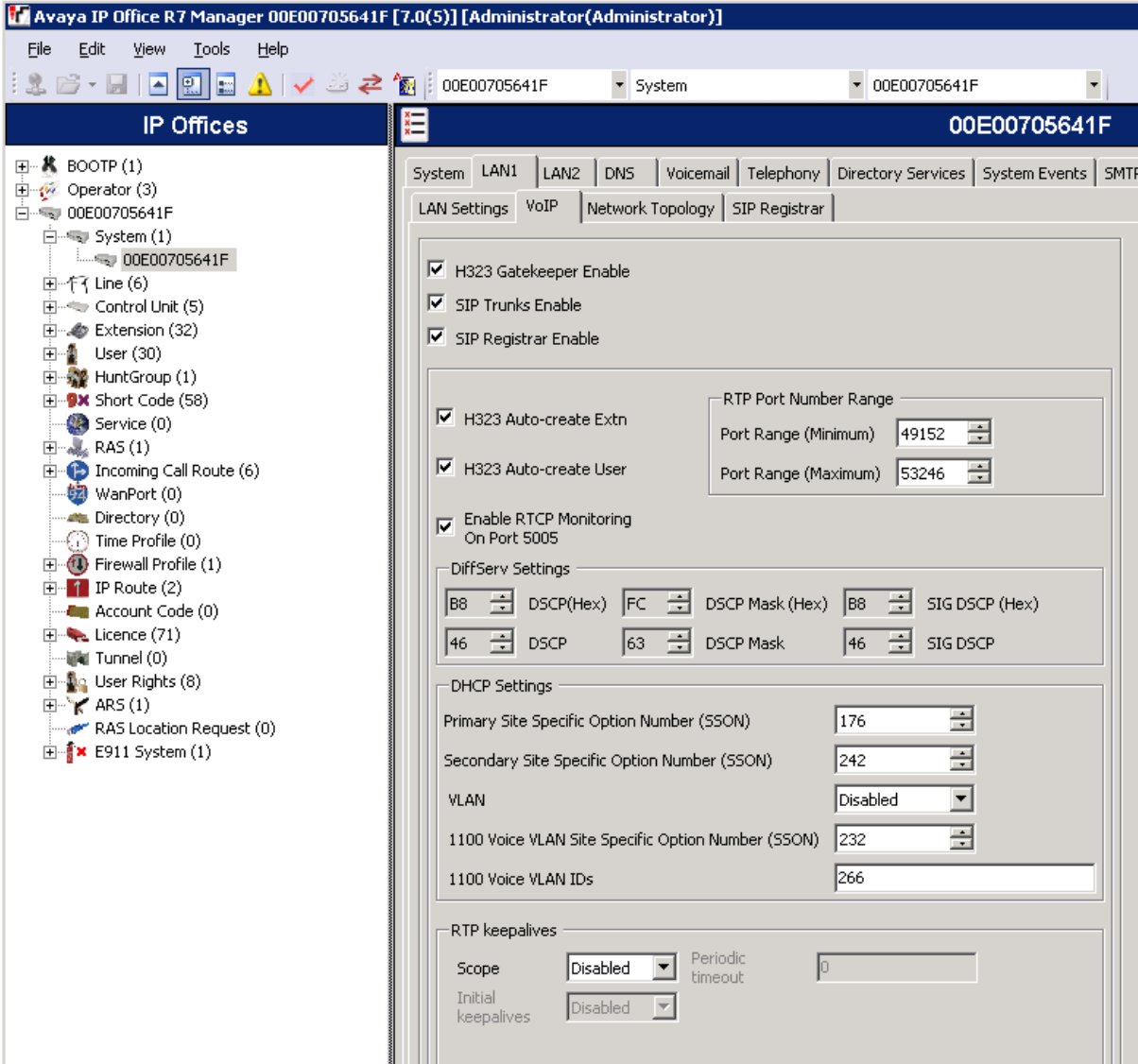
The following equipment and software/firmware were used for the sample configuration provided:

Equipment	Software/Firmware
<i>Avaya PBX Products</i>	
Avaya IP Office 500	7.0 (5)
Avaya IP Office Manager	7.0 (5)
<i>Avaya Messaging (Voice Mail) Products</i>	
Avaya Voicemail Pro	7.0 (17)
<i>Avaya Telephony Sets</i>	
Avaya 1600 Series IP Telephone (H.323)	1.3
Avaya 5600 Series IP Telephones	8.016
Avaya 9600 Series IP Telephones	3.110b
Avaya 96x1 Series IP Telephones	6.0
Avaya 2410 Digital Telephone	NA
<i>Extreme Networks Products</i>	
Extreme Networks Summit X650-24t	ExtremeXOS 12.5.1.6
Extreme Networks BlackDiamond 8810 with -8500-MSM-24 management module -8500-G48T-e 48-port 10/100/1000BASE-T RJ-45 module with optional PoE installed	ExtremeXOS 12.5.1.6
Extreme Networks Summit X460-48p	ExtremeXOS 12.5.1.6
Extreme Networks Summit X450e-24p	ExtremeXOS 12.5.1.6
<i>MS Products</i>	
DHCP/HTTP/TFTP Server	Microsoft Windows 2003 Server

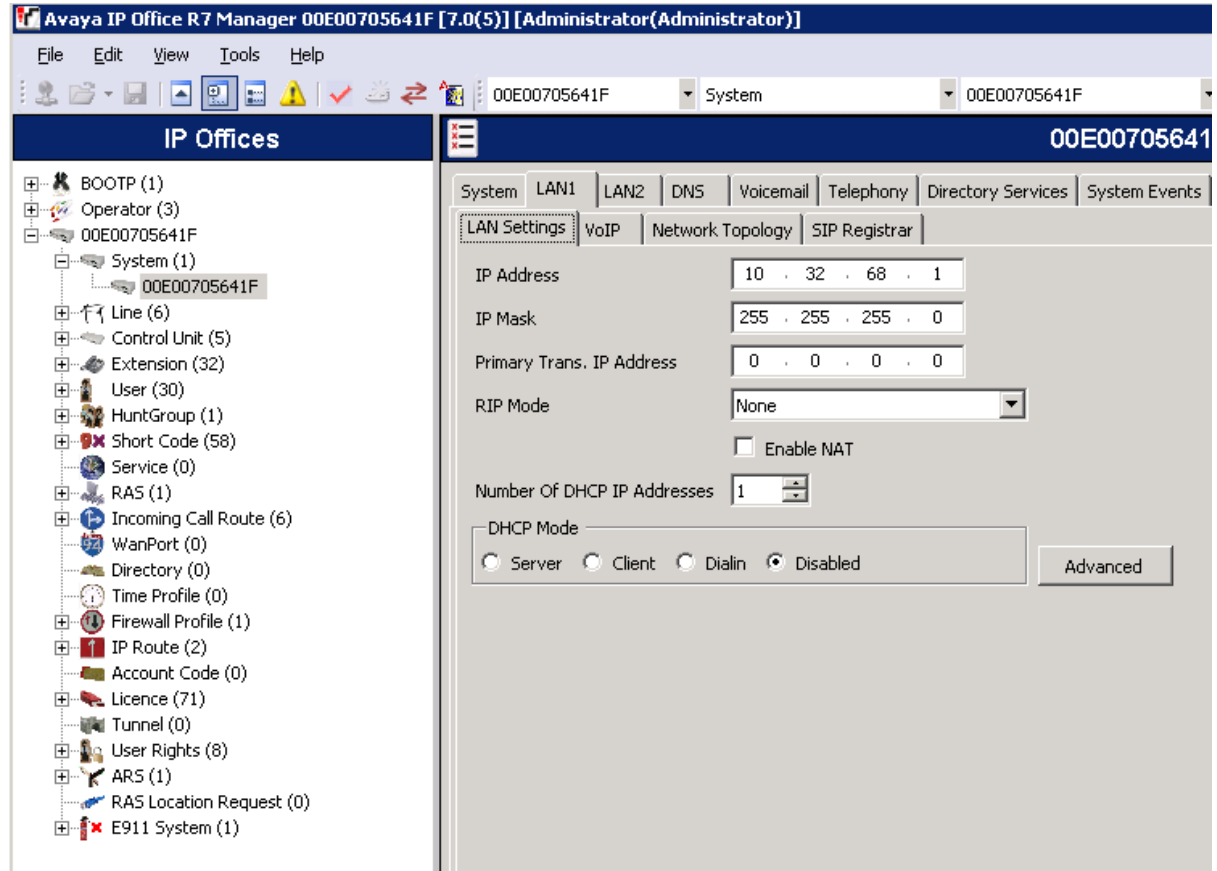
## 5. Avaya IP Office Settings


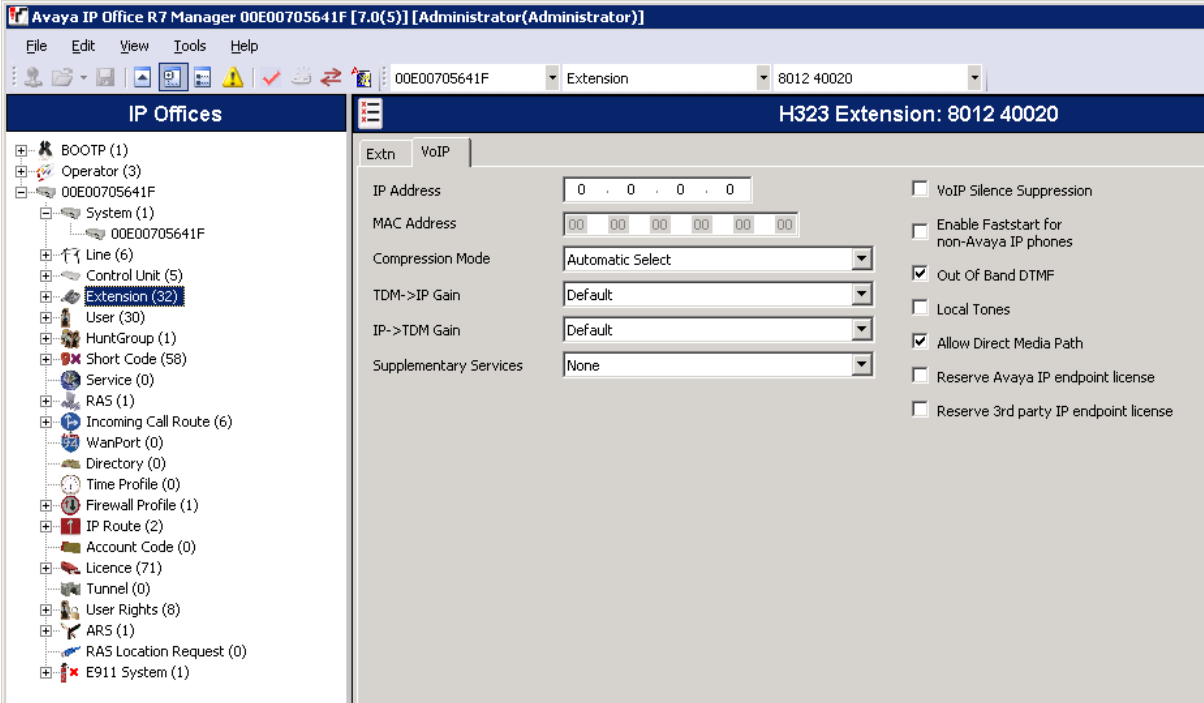
This section was included to verify that Avaya IP Office was configured correctly. Except where stated, the parameters in all steps are the default settings and are supplied for reference. For all other provisioning information such as provisioning of the trunks, call coverage, extensions, and voice mail, please refer to the Avaya IP Office product documentation in **Section 10**.

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 <b>Start</b> → <b>Programs</b> → <b>IP Office</b> → <b>Manager</b> to launch the Avaya IP Office Manager application. Log into the Avaya IP Office Manager application using the appropriate credentials.
2.	<p>Avaya IP Office Manager Window.</p> <p>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.</p> 

Step	Description
3.	<p>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 <b>System</b>, select the <b>LAN1</b> tab, then select the <b>VoIP</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>46</b>, respectively.</p>  <p>The screenshot shows the Avaya IP Office R7 Manager interface. The left pane displays the Configuration Tree with 'System' selected under '00E00705641F'. The right pane shows the 'LAN1' configuration for 'VoIP'. Under 'DiffServ Settings', the 'DSCP' is set to 46 and 'SIG DSCP' is also set to 46. Other settings like 'H323 Gatekeeper Enable', 'SIP Trunks Enable', and 'SIP Registrar Enable' are checked. The 'RTP Port Number Range' is set from 49152 to 53246. 'DHCP Settings' include SSON values of 176 and 242, and 'RTP keepalives' are set to 'Disabled'.</p>



Step	Description
4.	<p>Disable DHCP server on Avaya IP Office.</p> <p>Select the <b>LAN Settings</b> tab. Set the <b>DHCP Mode</b> to <b>Disabled</b>. Click <b>OK</b> to continue (not shown).</p>
 <p>The screenshot displays the Avaya IP Office R7 Manager interface. The title bar reads "Avaya IP Office R7 Manager 00E00705641F [7.0(5)] [Administrator/Administrator]". The main window is divided into a left-hand tree view and a right-hand configuration pane. The tree view shows a hierarchy starting with "IP Offices", followed by "BOOTP (1)", "Operator (3)", and "00E00705641F". Under "00E00705641F", there is a "System (1)" folder, which is expanded to show "00E00705641F". Below this are various system components like "Line (6)", "Control Unit (5)", "Extension (32)", "User (30)", "HuntGroup (1)", "Short Code (58)", "Service (0)", "RAS (1)", "Incoming Call Route (6)", "WanPort (0)", "Directory (0)", "Time Profile (0)", "Firewall Profile (1)", "IP Route (2)", "Account Code (0)", "Licence (71)", "Tunnel (0)", "User Rights (8)", "ARS (1)", "RAS Location Request (0)", and "E911 System (1)".</p> <p>The right-hand pane shows the configuration for the selected system. It has tabs for "System", "LAN1", "LAN2", "DNS", "Voicemail", "Telephony", "Directory Services", and "System Events". The "LAN Settings" tab is active. Within this tab, there are sub-tabs for "LAN Settings", "VoIP", "Network Topology", and "SIP Registrar". The "LAN Settings" sub-tab is selected, showing the following configuration:</p> <ul style="list-style-type: none"> <li>IP Address: 10 . 32 . 68 . 1</li> <li>IP Mask: 255 . 255 . 255 . 0</li> <li>Primary Trans. IP Address: 0 . 0 . 0 . 0</li> <li>RIP Mode: None (dropdown menu)</li> <li><input type="checkbox"/> Enable NAT</li> <li>Number Of DHCP IP Addresses: 1 (spin box)</li> <li>DHCP Mode: <input type="radio"/> Server <input type="radio"/> Client <input type="radio"/> Dialin <input checked="" type="radio"/> Disabled</li> <li>Advanced button</li> </ul>	

Step	Description
5.	<p>Verify Direct Media Path.</p> <p>From the Configuration Tree, select <b>Extension</b>. Click on the IP telephone extension to verify. Select the <b>VoIP</b> tab. Verify that <b>Allow Direct Media Path</b> is checked. Click <b>OK</b> to continue. The changes must be saved before they will take effect, click the  icon to save the configuration.</p>  <p>The screenshot shows the Avaya IP Office R7 Manager interface. The title bar reads 'Avaya IP Office R7 Manager 00E00705641F [7.0(5)] [Administrator/Administrator]'. The main window is divided into two panes. The left pane, titled 'IP Offices', shows a tree view of the system configuration. The right pane, titled 'H323 Extension: 8012 40020', shows the configuration for the selected extension. The 'VoIP' tab is selected, and the 'Allow Direct Media Path' checkbox is checked. Other configuration options include IP Address (0.0.0.0), MAC Address (00 00 00 00 00 00), Compression Mode (Automatic Select), TDM-&gt;IP Gain (Default), IP-&gt;TDM Gain (Default), and Supplementary Services (None). Other checkboxes include VoIP Silence Suppression, Enable Faststart for non-Avaya IP phones, Out Of Band DTMF, Local Tones, Reserve Avaya IP endpoint license, and Reserve 3rd party IP endpoint license.</p>

## 6. Configuration Control Room Extreme Summit X650-24t

This section addresses how to configure the Extreme X650-24t Switch. The X650-24t Switch will be used as the core router and will perform Layer 2 and Layer 3 forwarding, enforce QoS policies, run OSPF and rapid spanning tree.

1. Log into the Extreme X650-24t Switch.

Connect to the Extreme X650-24t Switch. Log in using the appropriate Login ID and Password.

Login:

Password:

X650-24t #

2. Remove all ports from the native VLAN Default.

X650-24t # **configure Default delete ports all**

3. Create and configure QoS profile qp7
  - Create QoS profile qp7
  - Configure dot1p type.
  - Configure diffserv examination code-point for qp7
  - Configure diffserv replacement priority for code-point 46
  - Enable diffserv examination on port 6 to enforce L3 QoS

X650-24t # **create qosprofile qp7**

X650-24t # **configure dot1p type 6 qosprofile QP7**

X650-24t # **configure diffserv examination code-point 46 qosprofile QP7**

X650-24t # **configure diffserv replacement priority 6 code-point 46**

X650-24t # **enable diffserv examination port 6**

4. Create and configure the OSPF VLAN that is present in the control room and Lab A.
  - Create the name for the OSPF VLAN.
  - Assign a VLAN ID for the OSPF VLAN.
  - Assign an IP address for the OSPF VLAN.
  - Enable ipforwarding for the OSPF VLAN.
  - Assign ports to the OSPF VLAN.

```
X650-24t # create vlan vlanOSPF  
X650-24t # configure vlan vlanOSPF tag 2000  
X650-24t # configure vlan vlanOSPF ipaddress 10.90.10.1 255.255.255.252  
X650-24t # enable ipforwarding vlan vlanOSPF  
X650-24t # configure vlan vlanOSPF add ports 6 untagged
```

5. Create and configure the telephony VLAN where the Avaya telephony equipment will run.
  - Create Vlan name.
  - Assign a VLAN ID for the telephony VLAN.
  - Assign an IP address for the telephony VLAN.
  - Enable ipforwarding for the telephony VLAN.
  - Assign ports to the telephony VLAN.

```
X650-24t # create vlan vlan268  
X650-24t # configure vlan vlan268 tag 268  
X650-24t # configure vlan vlan268 ipaddress 10.32.68.254 255.255.255.0  
X650-24t # enable ipforwarding vlan vlan268  
X650-24t # configure vlan vlan268 add ports 1 tagged
```

6. Create and configure the voice VLAN that is present in the control room and closets.
  - Create the name for the voice VLAN.
  - Assign a VLAN ID for the voice VLAN.
  - Assign an IP address for the voice VLAN.
  - Enable ipforwarding for the voice VLAN.
  - Assign ports to the voice VLAN.

```
X650-24t # create vlan voice1  
X650-24t # configure vlan voice1 tag 75  
X650-24t # configure vlan voice1 ipaddress 10.32.75.254 255.255.255.0  
X650-24t # enable ipforwarding vlan voice1  
X650-24t # configure vlan voice1 add ports 1, 4-5 tagged
```

7. Create and configure the data VLAN that is present in the control room and closets.
  - Create the name for the data VLAN.
  - Assign a VLAN ID for the data VLAN.
  - Assign an IP address for the data VLAN.
  - Enable ipforwarding for the data VLAN.
  - Assign ports to the voice VLAN.

```
X650-24t # create vlan datavlan1
X650-24t # configure vlan datavlan1 tag 85
X650-24t # configure vlan datavlan1 ipaddress 10.32.85.254 255.255.255.0
X650-24t # enable ipforwarding vlan datavlan1
X650-24t # configure vlan datavlan1 add ports 1,4-5 tagged
```

8. Create and configure the vlanstpd VLAN that is present in the control room and closets for rapid spanning tree.
  - Create the name for the vlanstpd VLAN.
  - Assign a VLAN ID for the vlanstpd VLAN.
  - Assign ports to the vlanstpd VLAN.

```
X650-24t # create vlan vlanstpd
X650-24t # configure vlan vlanstpd tag 222
X650-24t # configure vlan vlanstpd add ports 1,4-5 untagged
```

9. Create and configure the Access list to give priority to the voice VLAN traffic when communicating to IP Office.

From the X650-24t : CLI enter: **vi SMPRI.pol**

From the open vi session, enter the following information:

```
entry voice1 {
  if {
    source-address 10.32.75.0/24;
    destination-address 10.32.68.1/32;
  } then {
    permit;
    qosprofile qp7;
    replace-dscp;
    replace-dot1p;
  }
}
```

10. Enable the access list, **SMPRI.pol**, created in **step 9**.

```
X650-24t # config access-list SMPRI vlan voice1
```

11. Configure Rapid Spanning Tree and add ports to stpd s0.

- Configure stpd mode
- Add VLANs to stpd
- Add ports to stpd
- Assign VLAN tag to stpd
- Enable stpd

```
X650-24t # configure stpd s0 mode dot1w  
X650-24t # configure stpd s0 priority 0  
X650-24t # configure stpd s0 add voice1  
X650-24t # configure stpd s0 add datavlan1  
X650-24t # configure stpd s0 add voice1 ports 1,4-5  
X650-24t # configure stpd s0 add datavlan1 ports 1,4-5  
X650-24t # configure stpd s0 tag 222  
X650-24t # enable stpd s0 ports 1,4-5  
X650-24t # enable stpd s0
```

12. Enable OSPF

- Assign router ID
- Configure OSPF area
- Enable direct cost
- Enable OSPF

```
X650-24t # configure ospf routerid 10.90.10.1  
X650-24t # configure ospf add vlan vlanOSPF area 0.0.0.0  
X650-24t # enable ospf export direct cost 2 type ase-type-2  
X650-24t # enable ospf
```

13. Enable DHCP/bootprelay relay.

- Enable bootprelay
- Assign a bootprelay server.

```
X650-24t # enable bootprelay  
X650-24t # configure bootprelay add 10.32.68.250
```

14. Save the configuration

```
X650-24t # save
```

## 7. Configure the Extreme X450e-24p switch for Control Room

This section addresses configuring the Extreme Summit X450e-24p Switch (Control Room). The Extreme Summit X450e-24p Switch will be configured as a Layer 2 switch, enforce QoS policies and run rapid spanning tree.

1. Log into the Extreme Summit X450e-24p Switch (Control Room)

Connect to the Extreme Summit X450e-24p Switch. Log in using the appropriate Login ID and Password.

Login:

Password:

X450e-24p CR: #

2. Remove all ports from the native VLAN Default.

X450e-24p CR: # **configure Default delete ports all**

3. Create and configure QoS profile qp7
  - Create QoS profile qp7
  - Configure dot1p type.
  - Configure diffserv examination code-point for qp7
  - Configure diffserv replacement priority for code-point 46

X450e-24p CR: # **create qosprofile qp7**

X450e-24p CR: # **configure dot1p type 6 qosprofile QP7**

X450e-24p CR: # **configure diffserv examination code-point 46 qosprofile QP7**

X450e-24p CR: # **configure diffserv replacement priority 6 code-point 46**

4. Configure QoS and dot1p replacement for port13.

```
X450e-24p CR: # enable dot1p replacement port 13  
X450e-24p CR: # configure ports 13 qosprofile qp7
```

5. Create and configure the voice VLAN that is present in the control room and closets.
  - Create the name for the voice VLAN.
  - Assign a VLAN ID for the voice VLAN.
  - Assign ports to the voice VLAN.

```
X450e-24p CR: # create vlan voice1  
X450e-24p CR: # configure vlan voice1 tag 75  
X450e-24p CR: # configure vlan voice1 add ports 2-3,24 tagged
```

6. Create and configure the data VLAN that is present in the control room and closets.
  - Create the name for the data VLAN.
  - Assign a VLAN ID for the data VLAN.
  - Assign ports to the data VLAN.

```
X450e-24p CR: # create vlan datavlan1  
X450e-24p CR: # configure vlan datavlan1 tag 85  
X450e-24p CR: # configure vlan datavlan1 add ports 24 tagged  
X450e-24p CR: # configure vlan datavlan1 add ports 2-3 untagged
```

7. Create and configure the telephony VLAN that is present in the control room X450e-24p and the control room X650-24t.
  - Create the name for the telephony VLAN.
  - Assign a VLAN ID for the telephony VLAN.
  - Assign ports to the telephony VLAN.

```
X450e-24p CR: # create vlan vlan268  
X450e-24p CR: # configure vlan vlan268 tag 268  
X450e-24p CR: # configure vlan vlan268 add ports 24 tagged  
X450e-24p CR: # configure vlan vlan268 add ports 12-13 untagged
```



8. Create and configure the vlanstpd VLAN that is present in the control room and closets to support rapid spanning tree.
  - Create the name for the vlanstpd VLAN.
  - Assign a VLAN ID for the vlanstpd VLAN.
  - Assign ports to the vlanstpd VLAN.

```
X450e-24p CR: # create vlan vlanstpd  
X450e-24p CR: # configure vlan vlanstpd tag 222  
X450e-24p CR: # configure vlan vlanstpd add ports 24 untagged
```

9. Create and configure the Access list to give priority to the voice VLAN traffic when communicating to IP Office.

```
From the X450e-24p CR: CLI enter: vi SMPRI.pol
```

From the open vi session, enter the following information:

```
entry voice1 {  
  if {  
    source-address 10.32.75.0/24;  
    destination-address 10.32.68.1/32;  
  } then {  
    permit;  
    qosprofile qp7;  
    replace-dscp;  
    replace-dot1p;  
  }  
}
```

10. Enable the access list, **SMPRI.pol**, created in **step 9**.

```
X450e-24p CR:: # config access-list SMPRI vlan voice1
```

11. Configure Rapid Spanning Tree and add ports to stpd s0.

- Configure stpd mode
- Add VLANs to stpd
- Add ports to stpd
- Assign VLAN tag to stpd
- Enable stpd

```
X450e-24p CR: # configure stpd s0 mode dot1w  
X450e-24p CR: # configure stpd s0 priority 8192  
X450e-24p CR: # configure stpd s0 add voice1  
X450e-24p CR: # configure stpd s0 add datavlan1  
X450e-24p CR: # configure stpd s0 add voice1 ports 24  
X450e-24p CR: # configure stpd s0 add datavlan1 ports 24  
X450e-24p CR: # configure stpd s0 tag 222  
X450e-24p CR: # enable stpd s0 ports 24  
X450e-24p CR: # enable stpd s0
```

12. Save configuration

```
X450e-24p CR: # save
```

## 8. Configure the Extreme BlackDiamond 8810 switch for Closet B

This section addresses configuring the Extreme BlackDiamond 8810 switch for Closet B. The BlackDiamond 8810 switch will be configured as a Layer 2 switch, enforce QoS policies, run rapid spanning tree and supply PoE to the Avaya IP Telephones.

1. Log into the Extreme BlackDiamond 8810 switch for Closet B.

Connect to the BlackDiamond 8810 switch. Log in using the appropriate Login ID and Password.

Login:

Password:

BD-8810: #

2. Remove all ports from the native VLAN Default.

```
BD-8810: # configure Default delete ports all
```

3. Create and configure QoS profile qp7
  - Create QoS profile qp7
  - Configure dot1p type.
  - Configure diffserv examination code-point for qp7
  - Configure diffserv replacement priority for code-point 46

```
BD-8810: # create qosprofile qp7
```

```
BD-8810: # configure dot1p type 6 qosprofile QP7
```

```
BD-8810: # configure diffserv examination code-point 46 qosprofile QP7
```

```
BD-8810: # configure diffserv replacement priority 6 code-point 46
```

4. Create and configure the voice VLAN that is present in the control room and closets.
  - Create the name for the voice VLAN.
  - Assign a VLAN ID for the voice VLAN.
  - Assign ports to the voice VLAN.

```
BD-8810: # create vlan voice1  
BD-8810: # configure vlan voice1 tag 75  
BD-8810: # configure vlan voice1 add ports 7:1, 7:10-14, 7:25 tagged
```

5. Create and configure the data VLAN that will is present in the control room and closets.
  - Create the name for the data VLAN.
  - Assign a VLAN ID for the data VLAN.
  - Assign ports to the data VLAN.

```
BD-8810: # create vlan datavlan1  
BD-8810: # configure vlan datavlan1 tag 85  
BD-8810: # configure vlan datavlan1 add ports 7:1, 7:25 tagged  
BD-8810: # configure vlan datavlan1 add ports 10-14 untagged
```

6. Create and configure the vlanstpd VLAN that is present in the control room and closets to support rapid spanning tree.
  - Create the name for the vlanstpd VLAN.
  - Assign a VLAN ID for the vlanstpd VLAN.
  - Assign ports to the vlanstpd VLAN.

```
BD-8810: # create vlan vlanstpd  
BD-8810: # configure vlan vlanstpd tag 222  
BD-8810: # configure vlan vlanstpd add ports 7:1, 7:25 untagged
```

7. Create and configure the Access list to give priority to the voice VLAN traffic when communicating to IP Office.

From the 8810 CLI enter: **vi SMPRI.pol**

From the open vi session, enter the following information:

```
entry voice1 {  
  if {  
    source-address 10.32.75.0/24;  
    destination-address 10.32.68.1/32;  
  } then {  
    permit;  
    qosprofile qp7;  
    replace-dscp;  
    replace-dot1p;  
  }  
}
```

8. Enable the access list, **SMPRI.pol**, created in **step 7**.

```
BD-8810: # config access-list SMPRI vlan voice1
```

9. Configure Rapid Spanning Tree and add ports to stpd s0.
  - Configure stpd mode
  - Add VLANs to stpd
  - Add ports to stpd
  - Assign VLAN tag to stpd
  - Enable stpd

```
BD-8810: # configure stpd s0 mode dot1w  
BD-8810: # configure stpd s0 priority 4096  
BD-8810: # configure stpd s0 add voice1  
BD-8810: # configure stpd s0 add datavlan1  
BD-8810: # configure stpd s0 add voice1 ports 7:1, 7:25  
BD-8810: # configure stpd s0 add datavlan1 ports 7:1, 7:25  
BD-8810: # configure stpd s0 tag 222  
BD-8810: # enable stpd s0 ports 7:1, 7:25  
BD-8810: # enable stpd s0
```

10. Save the configuration

```
BD-8810: # save
```

## 9. Configure the Extreme X450e-24p Switch for Closet A

This section addresses configuring the Extreme Summit X450e-24p Switch (Closet A). The Extreme Summit X450e-24p Switch will be configured as a Layer 2 switch, enforce QoS policies, run rapid spanning tree and supply PoE to the Avaya IP Telephones.

1. Log into the Extreme Summit X450e-24p Switch for Closet A.

Connect to the Extreme Summit X450e-24p Switch. Log in using the appropriate Login ID and Password.

Login:

Password:

X450e-24p: #

2. Remove all ports from the native VLAN Default.

```
X450e-24p # configure Default delete ports all
```

3. Create and configure QoS profile qp7

- Create QoS profile qp7
- Configure dot1p type.
- Configure diffserv examination code-point for qp7
- Configure diffserv replacement priority for code-point 46

```
X450e-24p # create qosprofile qp7
```

```
X450e-24p # configure dot1p type 6 qosprofile QP7
```

```
X450e-24p # configure diffserv examination code-point 46 qosprofile QP7
```

```
X450e-24p # configure diffserv replacement priority 6 code-point 46
```

4. Create and configure the voice VLAN that is present in the control room and closets.
  - Create the name for the voice VLAN.
  - Assign a VLAN ID for the voice VLAN.
  - Assign ports to the voice VLAN.

```
X450e-24p: # create vlan voice1  
X450e-24p: # configure vlan voice1 tag 75  
X450e-24p: # configure vlan voice1 add ports 1-2, 10-11 tagged
```

5. Create and configure the data VLAN that is present in the control room and closets.
  - Create the name for the data VLAN.
  - Assign a VLAN ID for the data VLAN.
  - Assign ports to the data VLAN.

```
X450e-24p: # create vlan datavlan1  
X450e-24p: # configure vlan datavlan1 tag 85  
X450e-24p: # configure vlan datavlan1 add ports 1-2 tagged  
X450e-24p: # configure vlan datavlan1 add ports 10-11 untagged
```

6. Create and configure the vlanstpd VLAN that is present in the control room and closets to support rapid spanning tree.
  - Create the name for the vlanstpd VLAN.
  - Assign a VLAN ID for the vlanstpd VLAN.
  - Assign ports to the vlanstpd VLAN.

```
X450e-24p: # create vlan vlanstpd  
X450e-24p: # configure vlan vlanstpd tag 222  
X450e-24p: # configure vlan vlanstpd add ports 1-2 untagged
```

7. Create and configure the Access list to give priority to the voice VLAN traffic when communicating to IP Office.

From the X450e-24p CLI enter: **vi SMPRI.pol**

From the open vi session, enter the following information:

```
entry voice1 {  
  if {  
    source-address 10.32.75.0/24;  
    destination-address 10.32.68.1/32;  
  } then {  
    permit;  
    qosprofile qp7;  
    replace-dscp;  
    replace-dot1p;  
  }  
}
```

8. Enable the access list, **SMPRI.pol**, created in **step 8**.

```
X450e-24p: # config access-list SMPRI vlan voice1
```

9. Configure Rapid Spanning Tree and add ports to stpd s0.

```
X450e-24p: # configure stpd s0 mode dot1w  
X450e-24p: # configure stpd s0 priority 40960  
X450e-24p: # configure stpd s0 add Voice1  
X450e-24p: # configure stpd s0 add Datavlan1  
X450e-24p: # configure stpd s0 add Voice1 ports 1,2  
X450e-24p: # configure stpd s0 add Datavlan1 ports 1,2  
X450e-24p: # configure stpd s0 tag 222  
X450e-24p: # enable stpd s0 ports 1,2  
X450e-24p: # enable stpd s0
```

10. Save the configuration

```
X450e-24p: # save
```



## 10. Configuration Control Room Extreme Summit X460-48p

This section addresses how to configure the Extreme X460-48p switch. The X460-48p switch will be used as a secondary router and will perform Layer 2 and Layer 3 forwarding, enforce QoS policies and run OSPF.

1. Log into the Extreme X460-48p switch.

Connect to the Extreme X460-48p switch. Log in using the appropriate Login ID and Password.

Login:

Password:

X460-48p #

2. Remove all ports from the native VLAN Default.

```
X460-48p # configure Default delete ports all
```

3. Create and configure QoS profile qp7
  - Create QoS profile qp7
  - Configure dot1p type.
  - Configure diffserv examination code-point for qp7
  - Configure diffserv replacement priority for code-point 46
  - Enable diffserv examination on port 1 to enforce L3 QoS

```
X460-48p # create qosprofile qp7
```

```
X460-48p # configure dot1p type 6 qosprofile QP7
```

```
X460-48p # configure diffserv examination code-point 46 qosprofile QP7
```

```
X460-48p # configure diffserv replacement priority 6 code-point 46
```

```
X460-48p # enable diffserv examination port 1
```

4. Create and configure the OSPF VLAN that is present in the control room and Lab A.
  - Create the name for the OSPF VLAN.
  - Assign a VLAN ID for the OSPF VLAN.
  - Assign an IP address for the OSPF VLAN.
  - Enable ipforwarding for the OSPF VLAN.
  - Assign ports to the OSPF VLAN.

```
X460-48p # create vlan vlanOSPF  
X460-48p # configure vlan vlanOSPF tag 2000  
X460-48p # configure vlan vlanOSPF ipaddress 10.90.10.2 255.255.255.252  
X460-48p # enable ipforwarding vlan vlanOSPF  
X460-48p # configure vlan vlanOSPF add ports 1 untagged
```

5. Create and configure the voice VLAN that is present in Lab A.
  - Create the name for the voice VLAN.
  - Assign a VLAN ID for the voice VLAN.
  - Assign an IP address for the voice VLAN.
  - Enable ipforwarding for the voice VLAN.
  - Assign ports to the voice VLAN.

```
X460-48p # create vlan voice2  
X460-48p # configure vlan voice2 tag 1133  
X460-48p # configure vlan voice2 ipaddress 192.168.33.254 255.255.255.0  
X460-48p # enable ipforwarding vlan voice2  
X460-48p # configure vlan voice2 add ports 10-11 tagged
```

6. Create and configure the data VLAN that is present in Lab A.
  - Create the name for the data VLAN.
  - Assign a VLAN ID for the data VLAN.
  - Assign an IP address for the data VLAN.
  - Enable ipforwarding for the data VLAN.
  - Assign ports to the voice VLAN.

```
X460-48p # create vlan datavlan2  
X460-48p # configure vlan datavlan2 tag 1130  
X460-48p # configure vlan datavlan2 ipaddress 192.168.30.254 255.255.255.0  
X460-48p # enable ipforwarding vlan datavlan2  
X460-48p t.avino@verizon.net# configure vlan datavlan2 add ports 10-11 untagged
```

7. Create and configure the Access list to give priority to the voice VLAN traffic when communicating to IP Office.

From the X460-48p CLI enter: **vi SMPRI.pol**

From the open vi session, enter the following information:

```
entry voice2 {  
  if {  
    source-address 192.168.33.0/24;  
    destination-address 10.32.68.1/32;  
  } then {  
    permit;  
    qosprofile qp7;  
    replace-dscp;  
    replace-dot1p;  
  }  
}
```

8. Enable the access list, **SMPRI.pol**, created in **step 7**.

```
X460-48p # config access-list SMPRI vlan voice2
```

9. Enable OSPF
  - Assign router ID
  - Configure OSFP area
  - Enable direct cost
  - Enable OSPF

```
X460-48p # configure ospf routerid 10.90.10.2  
X460-48p # configure ospf add vlan vlanOSPF area 0.0.0.0  
X460-48p # enable ospf export direct cost 2 type ase-type-2  
X460-48p # enable ospf
```

10. Enable DHCP/bootprelay relay.
  - Enable bootprelay
  - Assign a bootprelay server.

```
X460-48p # enable bootprelay  
X460-48p # configure bootprelay add 10.32.68.250
```

## 11. Save the configuration

```
X460-48p # save
```

## 11. Verification Steps

This section provides the steps for verifying end-to-end network connectivity and QoS. In general, the verification steps include:

- Place calls between all the Avaya IP Telephones.
- Place calls between the Avaya 2410 Digital Telephone and the Avaya IP Telephones.
- Verify DHCP relay is functioning by confirming that the Avaya IP Telephones received their IP addresses from the DHCP server.

## 12. Conclusion

These Application Notes describe the configuration steps for integrating Extreme Networks BlackDiamond 8800 Series, Summit X650 Series, Summit X460 Series and Summit X450 Series switches with an Avaya telephony infrastructure. For the configuration described in these Application Notes, the Extreme Networks switches were responsible for enforcing QoS using Layer 3 Differentiated Services and Layer 2 (802.1p), rapid spanning tree, and OSPF. Prioritization of VoIP traffic and good voice quality was successfully achieved in the Avaya/Extreme configuration described herein.

## 13. References

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

- [1] *IP Office Installation*, Document number 15-601042
- [2] *IP Office Manager*, Document number 15-601011
- [3] *Avaya one-X® Deskphone Edition for 9600 Series IP Telephones Installation and Maintenance Guide*, Release 3.1, Document Number 16-300694.
- [4] *Avaya one-X® Deskphone H.323 Installation and Maintenance Guide, for 9608, 9611G, 9621G, and 9641G Deskphones, Release 6.1*, Document number 16-603603
- [5] *Avaya 1600 Series IP Deskphones Installation and Maintenance Guide*, Release 1.3.x
- [6] *Avaya Voicemail Pro: Administration Manual*, Document number 15-601063

The following product documentation is provided by Extreme Networks. For additional product and company information, visit <http://www.extremenetworks.com>

- [7] ExtremeXOS® Concepts Guide Software Version 12.5.2 Part number: 100377-00 Rev. 02
- [8] ExtremeXOS® Command Reference Guide Software Version 12.5.2 Part number: 100376-00 Rev. 02

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