



Avaya Solution & Interoperability Test Lab

Application Notes for Extreme Networks Switches with an Avaya Telephony Infrastructure including Avaya Aura® Communication Manager, Avaya Aura® Session Manager and Avaya IP Telephones - 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 an Avaya Telephony Infrastructure using Avaya Aura® Communication Manager, Avaya Aura® Session Manager 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 Telephony Infrastructure using Avaya Aura® Communication Manager, Avaya Aura® Session Manager 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 an Avaya Telephony Infrastructure using Avaya Aura® Communication Manager, Avaya Aura® Session Manager 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 Aura™ Communication Manager Messaging
- 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 **Figure1** illustrates the network environment used for the compliance test.

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

- Avaya S8300D Server running Avaya Aura® Communication Manager & Avaya Aura® Communication Manager Messaging
- Avaya S8800 Server running Avaya Aura® Session Manager
- Avaya S8800 Server running Avaya Aura® System Manager
- Avaya G450 Media Gateway
- Avaya Modular Messaging Server (MAS) and (MSS)
- Avaya 9600-Series IP telephone (H.323)
- Avaya A175 Desktop Video Device (SIP)
- 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 9600-Series IP telephone (SIP)
- 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 9600-Series IP telephone (H.323)
- Avaya 9600-Series IP telephone (SIP)
- Extreme Summit X450e-24p

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

- Avaya A175 Desktop Video Device (SIP)
- Avaya 9600-Series IP telephone (H.323)
- Avaya 9600-Series IP telephone (SIP)
- Extreme Black Diamond 8810
- PC connected to the Avaya 9600-Series IP telephone switch port

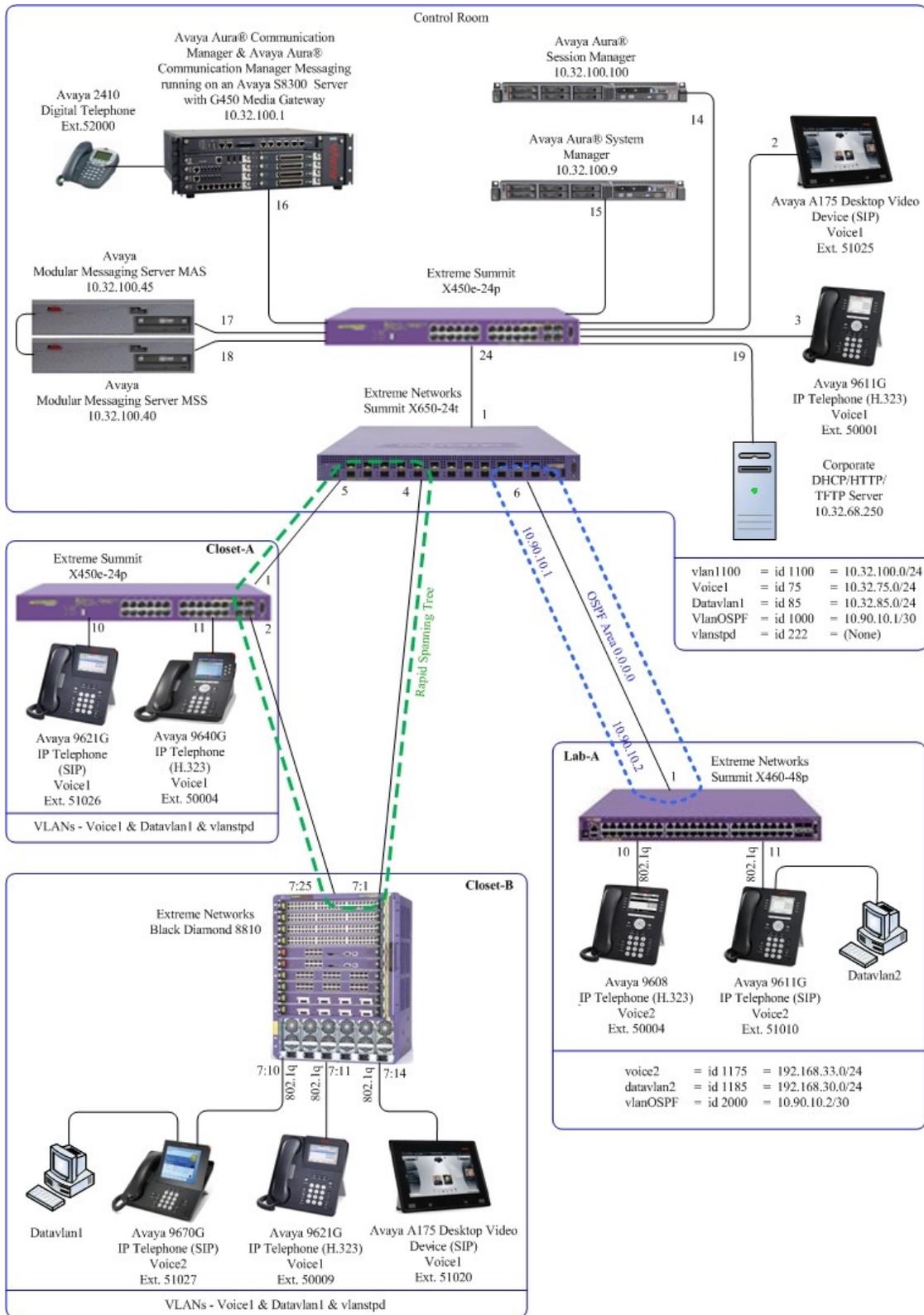


Figure 1: Avaya IP Telephony Network traversing Extreme Networks enterprise Solution

4. Equipment and Software Validated

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

Equipment	Software/Firmware
Avaya S8300D Server running Avaya Aura® Communication Manager	Avaya Aura® Communication Manager 6.0.1
Avaya G450 Media Gateway	
MGP	30 .13 .2
MM712 DCP Media Module	HW9
Avaya S8800 Server	Avaya Aura® Session Manager (6.1)
Avaya S8800 Server	Avaya Aura® System Manager (6.1)
Avaya A175 Desktop Video Device	Software Release 1.0.2 for the Avaya A175 Desktop Video Device with the Avaya Flare® Experience
Avaya 96x1 Series IP Telephone	Avaya one-X® Deskphone SIP (6.1)
Avaya 96x1 Series IP Telephone	Avaya one-X® Deskphone H.323 (6.0)
Avaya 9600 Series IP Telephone	Avaya one-X® Deskphone SIP (2.6)
Avaya 9600 Series IP Telephone	Avaya one-X® Deskphone H.323 (3.1)
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

5. Configure Communication Manager

There is no configuration requirement on Avaya Aura® Communication Manager, Avaya Aura® Session Manager or Avaya IP telephones to support this. It is assumed that all Avaya Aura® Telephony components and appropriate licenses and authentication files have been configured already, e.g., trunks, dial plans, etc, and will not be covered in this document. For detailed information on the installation, maintenance, and configuration of Communication Manager and Session Manager, please reference items in **Section 13**. **Section 5.1** below is supplied for reference only; no special configuration is required.

5.1. Verify QoS

IP networks were originally designed to carry data on a best-effort delivery basis, which meant that all traffic had equal priority and an equal chance of being delivered in a timely manner. As a result, all traffic had an equal chance of being dropped when congestion occurred. QoS is now utilized to prioritize VoIP traffic and should be implemented throughout the entire network.

In order to achieve prioritization of VoIP traffic, the VoIP traffic must be classified. The Avaya Aura® telephony infrastructure supports both IEEE 802.1p and DiffServ.

The DiffServ and 802.1p/Q values configured here will be downloaded to the Avaya H.323 IP Telephones via Communication Manager. Avaya SIP IP Telephones will get QoS settings by downloading the 46xxsettings file from the HTTP server. For more information on QoS settings refer to **Section 13**.

On **Page 1** of the **change ip-network-region** form, verify the Differentiated Services Code Points. The Differentiated Services Code Point for **Call Control PHB Value** and **Audio PHB Value** are **46** and the **Call Control 802.1p Priority** and **Audio 802.1p Priority** are set to **6**.

```
change ip-network-region 1                                     Page 1 of 20
                                                                IP NETWORK REGION
  Region: 1
Location:      Authoritative Domain: dev4.com
  Name: Main
MEDIA PARAMETERS                                           Intra-region IP-IP Direct Audio: yes
  Codec Set: 1                                             Inter-region IP-IP Direct Audio: yes
  UDP Port Min: 2048                                       IP Audio Hairpinning? n
  UDP Port Max: 3329
DIFFSERV/TOS PARAMETERS
Call Control PHB Value: 46
Audio PHB Value: 46
  Video PHB Value: 26
802.1P/Q PARAMETERS
Call Control 802.1p Priority: 6
Audio 802.1p Priority: 6
  Video 802.1p Priority: 5
                                                                AUDIO RESOURCE RESERVATION PARAMETERS
H.323 IP ENDPOINTS                                         RSVP Enabled? n
  H.323 Link Bounce Recovery? y
  Idle Traffic Interval (sec): 20
  Keep-Alive Interval (sec): 5
  Keep-Alive Count: 5
```

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 QoS profile qp5
 - Create QoS profile qp5
 - Configure dot1p type.
 - Configure diffserv examination code-point for qp5
 - Configure diffserv replacement priority for code-point 26

```
X650-24t # create qosprofile qp5  
X650-24t # configure dot1p type 5 qosprofile QP5  
X650-24t # configure diffserv examination code-point 26 qosprofile QP5  
X650-24t # configure diffserv replacement priority 5 code-point 26
```

5. 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
```

6. 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 vlan1100  
X650-24t # configure vlan vlan1100 tag 1100  
X650-24t # configure vlan vlan1100 ipaddress 10.32.100.254 255.255.255.0  
X650-24t # enable ipforwarding vlan vlan1100  
X650-24t # configure vlan vlan1100 add ports 1 tagged
```

7. 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
```

8. 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 data 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
```

9. 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
```

10. Create and configure the Access list to give priority to the voice VLAN traffic when communicating to Session Manager.

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 10.32.100.100/32;
  } then {
    permit;
    qosprofile qp7;
    replace-dscp;
    replace-dot1p;
  }
}
```

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

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

12. 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
```

13. 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
```

14. Enable DHCP/bootprelay relay.

- Enable bootprelay
- Assign a bootprelay server.

```
X650-24t # enable bootprelay  
X650-24t # configure bootprelay add 10.32.100.250
```

15. 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. Create and configure QoS profile qp5

- Create QoS profile qp5
- Configure dot1p type.
- configure diffserv examination code-point for qp5
- configure diffserv replacement priority for code-point 26

X450e-24p CR: # **create qosprofile qp5**

X450e-24p CR: # **configure dot1p type 5 qosprofile QP5**

X450e-24p CR: # **configure diffserv examination code-point 26 qosprofile QP7**

X450e-24p CR: # **configure diffserv replacement priority 5 code-point 26**

5. Configure QoS and dot1p replacement for ports 14 & 16.

X450e-24p CR: # **enable dot1p replacement port 14**

X450e-24p CR: # **configure ports 14 qosprofile qp7**

X450e-24p CR: # **enable dot1p replacement port 16**

X450e-24p CR: # **configure ports 16 qosprofile qp7**

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 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
```

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 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
```

8. 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 vlan1100
X450e-24p CR: # configure vlan vlan1100 tag 1100
X450e-24p CR: # configure vlan vlan1100 add ports 24 tagged
X450e-24p CR: # configure vlan vlan1100 add ports 14-19 untagged
```

9. 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.

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

10. Create and configure the Access list to give priority to the voice VLAN traffic when communicating to Session Manager.

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 10.32.100.100/32;
  } then {
    permit;
    qosprofile qp7;
    replace-dscp;
    replace-dot1p;
  }
}
```

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

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

12. 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
```

13. Save the 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 run Layer 2 VLANs, 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 QoS profile qp5
 - Create QoS profile qp5
 - Configure dot1p type.
 - configure diffserv examination code-point for qp5
 - configure diffserv replacement priority for code-point 26

```
BD-8810: # create qosprofile qp5  
BD-8810: # configure dot1p type 5 qosprofile QP5  
BD-8810: # configure diffserv examination code-point 26 qosprofile QP5  
BD-8810: # configure diffserv replacement priority 5 code-point 26
```

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.

```
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
```

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.

```
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
```

7. 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.

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

8. Create and configure the Access list to give priority to the voice VLAN traffic when communicating to Session Manager.

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 10.32.100.100/32;  
  } then {  
    permit;  
    qosprofile qp7;  
    replace-dscp;  
    replace-dot1p;  
  }  
}
```

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

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

10. 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
```

11. 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 run Layer 2 VLANs, 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 QoS profile qp5

- Create QoS profile qp5
- Configure dot1p type.
- configure diffserv examination code-point for qp5
- configure diffserv replacement priority for code-point 26

```
X450e-24p: # create qosprofile qp5
```

```
X450e-24p: # configure dot1p type 5 qosprofile QP5
```

```
X450e-24p: # configure diffserv examination code-point 26 qosprofile QP5
```

```
X450e-24p: # configure diffserv replacement priority 5 code-point 26
```

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

6. 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.

```
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
```

7. 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.

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

8. Create and configure the Access list to give priority to the voice VLAN traffic when communicating to Session Manager.

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 10.32.100.100/32;  
  } then {  
    permit;  
    qosprofile qp7;  
    replace-dscp;  
    replace-dot1p;  
  }  
}
```

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

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

10. 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
```

11. 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 QoS profile qp5
 - Create QoS profile qp5
 - Configure dot1p type.
 - Configure diffserv examination code-point for qp5
 - Configure diffserv replacement priority for code-point 26

```
X460-48p # create qosprofile qp5  
X460-48p # configure dot1p type 5 qosprofile QP5  
X460-48p # configure diffserv examination code-point 26 qosprofile QP5  
X460-48p # configure diffserv replacement priority 5 code-point 26
```

5. 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
```

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.

```
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
```

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 data 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 # configure vlan datavlan2 add ports 10-11 untagged
```

8. Create and configure the Access list to give priority to the voice VLAN traffic when communicating to Session Manager.

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 10.32.100.100/32;  
  } then {  
    permit;  
    qosprofile qp7;  
    replace-dscp;  
    replace-dot1p;  
  }  
}
```

9. Enable the access list, **SMPRI.pol**, created in **step 5**.

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

10. 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
```

11. Enable DHCP/bootprelay relay.

- Enable bootprelay
- Assign a bootprelay server.

```
X460-48p # enable bootprelay  
X460-48p # configure bootprelay add 10.32.100.250
```

12. 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 the all 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.
- From the Avaya Aura® System Manager web administration interface, verify that all remote endpoints are registered with Avaya Aura® Session Manager. To view, navigate to **Elements → Session Manager → System Status → User Registrations**.
- Verify that the Avaya IP endpoints have successfully registered with Communication Manager by typing the **list registered-ip-stations** command on the SAT.

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] *Installing and Configuring Avaya Aura® System Platform*, Release 6, June 2010.
- [2] *Administering Avaya Aura® System Platform*, Release 6, June 2010.
- [3] *Installing and Upgrading Avaya Aura® System Manager*, **November 2010**
- [4] *Administering Avaya Aura® System Manager*, **November 2010**
- [5] *Installing and Configuring Avaya Aura® Session Manager*, **April 2011, Document Number 03-603473**
- [6] *Administering Avaya Aura® Session Manager*, **November 2010, Document Number 03-603324**
- [7] *Administering Avaya Aura® Communication Manager*, May 2009, Document Number 03-300509.
- [8] *Avaya Aura® Communication Manager Feature Description and Implementation*, May 2009, Document Number 555-245-205.
- [9] *Avaya one-X Deskphone Edition for 9600 Series IP Telephones Administrator Guide*, November 2009, Document Number 16-300698.
- [10] *Avaya one-X Deskphone Edition for 9600 Series IP Telephones Administrator Guide Release 3.0*, Document Number 16-300698.
- [11] *Avaya one-X Deskphone SIP for 9600 Series IP Telephones Administrator Guide, Release 2.0*, Document Number 16-601944.
- [12] *Modular Messaging, Release 5.0 with the Avaya MSS Messaging Application Server (MAS) Administration Guide*, January 2009.
- [13] *Avaya Aura® Communication Manager Messaging Installation and Initial Configuration*.

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