



Avaya Solution & Interoperability Test Lab

**Application Notes for Extreme Networks Summit X450e-24p Switch with Avaya Communication Manager and Avaya IP Telephones in a Converged VoIP and Data Network
- Issue 1.0**

Abstract

These Application Notes describe a sample configuration of a Voice over IP (VoIP) solution using an Extreme Networks Summit X450e-24p Switch with Avaya Communication Manager and Avaya IP Telephones in a Converged VoIP and Data Network. The Extreme Summit X450e-24p Switch was compliance-tested with Avaya Communication Manager and Avaya IP Telephones with emphasis 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 an Extreme Summit X450e-24p Switch connected to Avaya Communication Manager and Avaya IP Telephones in a Converged VoIP and Data Network. The Extreme Summit X450e-24p Switch was compliance-tested with Avaya Communication Manager and Avaya IP Telephones with emphasis placed on verifying voice quality in a converged VoIP and data network scenario. QoS (Quality of Service) 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 Communication Manager. These QoS settings are enforced in the network by the Extreme switches. Tests were performed by oversubscribing the LAN interfaces with low priority data and verifying that good voice quality was achieved when calls were routed over all LAN interfaces. Compliance testing included QoS, throughput, Ethernet Automatic Protection Switching (EAPS), rapid spanning tree (RSTP), Open Shortest Path First (OSPF), Direct Media and the G.711 and G.729 codecs.

1.1. Extreme X450e Series Switch

The Summit X450e Series have 24-port 10/100/1000BASE-T Power over Ethernet (PoE) and 4-port 1000BASE-X SFP. With tri-speed Gigabit Ethernet interface with inline power capability as well as optional dual 10 Gigabit Ethernet, the Summit X450e Series provide universal connectivity.

The Summit X450e Series have a non-blocking switching fabric and offers wire-speed Layer 2/Layer 3 switching for all ports with Quality of Service and security features such as hardware based Access Control Lists (ACLs). With its extensive Layer 2-4 intelligence, the Summit X450e Series meets a variety of requirements at the edge of the converged enterprise network as well as aggregation and small core.

The features supported by the Summit X450e Series include the following:

- 128 Gbps switch fabric bandwidth, 65 Mpps L2 and IPv4/IPv6 L3 packet forwarding rate
- Optional dual 10-gigabit Ethernet ports for redundant uplinks
- 9216 Byte maximum packet size (Jumbo Frame)
- 8 QoS queues/port
- 4096 VLANs (Port, IEEE 802.1Q, MAC-based)
- Hardware based ACLs

2. Hardware Configuration

2.1. Avaya Communication Manager and Extreme Summit X450e-24p Switch

The configuration in **Figure 1** shows a converged VoIP and Data network with multiple closets and labs configured with VLANs, rapid spanning tree and OSPF.

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

Note: EAPS was compliance-tested but is not part of this document.

2.2. Control Room

The control room consists of a BlackDiamond 8810 Switch, Avaya G700 Media Gateway with an Avaya S8300 Media Server running Avaya Communication Manager, one Avaya 2410 Digital Telephone, one Avaya 9620 one-X Deskphone Edition IP Telephone, one Avaya 4620SW IP Telephone, one PC on Datavlan1, and one DHCP/file Server. The DHCP server provides IP network parameters to the Avaya IP Telephones. The Extreme BlackDiamond 8810 Switch will also enforce QoS policies, run rapid spanning tree and OSPF.

2.3. Closet A

Closet A consists of an Extreme Summit X450e-24p Switch, two Avaya 4620SW IP Telephones on VLAN Voice3 and two PC's on VLAN Datavlan2. The Extreme Summit X450e-24p Switch will supply PoE for the Avaya IP Telephones, enforce QoS policies and run OSPF.

2.4. Closet B

Closet B consists of an Extreme Summit X450e-24p Switch, one Avaya 9630 one-X Deskphone Edition IP Telephone with SBM24 24-button Module on VLAN Voice1, one Avaya 9620 one-X Deskphone Edition IP Telephone and two PC's on VLAN Datavlan1. The Extreme Summit X450e-24p Switch will supply PoE for the Avaya IP Telephones, enforce QoS policies and run rapid spanning tree.

2.5. Lab A

Lab A consists of an Extreme Summit X450a-24t Switch and will run Layer 2 infrastructure (VLANs), rapid spanning tree and enforce QoS policies.

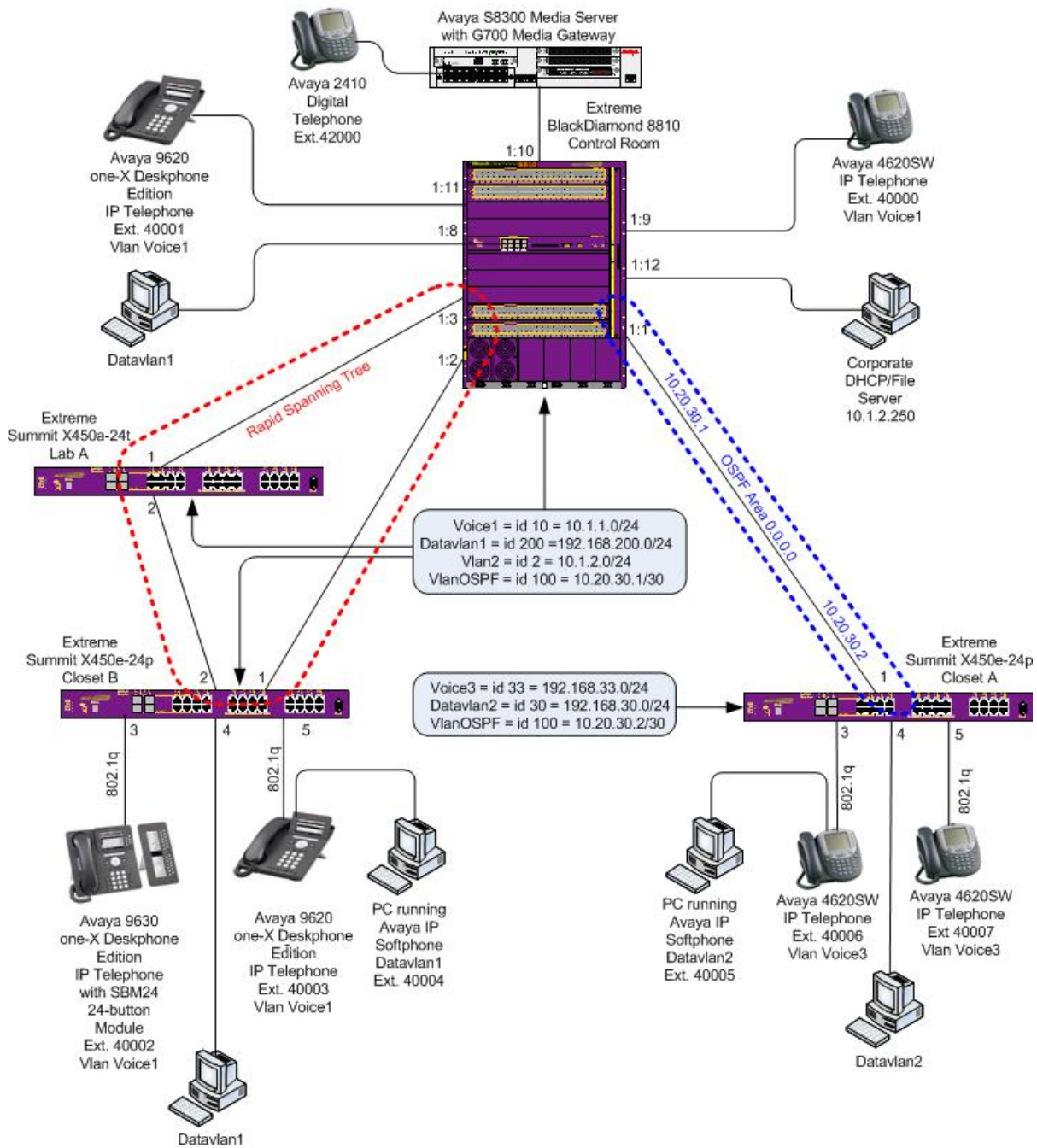


Figure 1: Network Configuration for Avaya Communication Manager and Extreme Summit X450e-24p Switch

3. Equipment and Software Validated

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

Equipment	Software/Firmware
Avaya S8300 Media Server	Avaya Communication Manager 3.1.2
Avaya G700 Media Gateway	25.28.0
Avaya 4620SW IP Telephones (H.323)	2.6
Avaya 9630 one-X Deskphone Edition IP Telephone with SBM24 24-button module (H.323)	1.1
Avaya 9620 one-X Deskphone Edition IP Telephone (H.323)	1.1
Avaya 2410 Digital Telephone	N/A
Extreme Summit X450e-24p Switch	ExtremeXOS 11.5.1.4 (FCS code)
Extreme Summit X450a-24t Switch	ExtremeXOS 11.5.1.4 (FCS code)
Extreme BlackDiamond 8810 Switch	ExtremeXOS 11.5.1.4 (FCS code)

4. Configure Avaya Communication Manager

This section shows the necessary steps in configuring Avaya Communication Manager. For detailed information on the installation, maintenance, and configuration of Avaya Communication Manager, please consult references [1], [2], [3] and [4]. The following steps describe the configuration of Avaya Communication Manager

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. To carry voice in this kind of network, QoS has to be implemented throughout the entire network.

In order to achieve good voice quality, the VoIP traffic must be classified. The Avaya S8300 Media Server, Avaya G700 Media Gateway and Avaya IP Telephones support both Layer 2 802.1p/Q priority and Layer 3 Differentiated Services. The Extreme Summit X450e-24p Switch can be configured to prioritize VoIP traffic based on these values.

All network components are in network region 1 for this sample configuration. The DiffServ and 802.1p/Q values that were configured will be downloaded to the Avaya IP Telephones.

Use the **change ip-network-region** command to change the **DIFFSERV/TOS PARAMETERS** and **802.1P/Q PARAMETERS** settings configured in Avaya Communication Manager. The **Call Control PHB Value** should be **46** and the **Audio PHB Value** should be **46**. The **Call Control 802.1P Priority** and **Audio 802.1P Priority** are set to **6**.

```

change ip-network-region 1                                     Page 1 of 19
                                     IP NETWORK REGION
Region: 1
Location:      Authoritative Domain: devcon.com
Name:
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? y
  UDP Port Max: 3027
DIFFSERV/TOS PARAMETERS      RTCP Reporting Enabled? y
  Call Control PHB Value: 46  RTCP MONITOR SERVER PARAMETERS
  Audio PHB Value: 46        Use Default Server Parameters? y
  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

```

5. Configuration of the Extreme BlackDiamond 8810 Switch for the Control Room

This section addresses how to configure the Extreme BlackDiamond 8810 Switch. The BlackDiamond 8810 Switch will run Layer 2 and Layer 3, enforce QoS policies, run OSPF and rapid spanning tree.

1. Log into the Extreme BlackDiamond 8810 Switch.

```

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

Login:
Password:
BlackDiamond-8810.1 #

```

2. Ensure the ports are not already configured. Use the **show port <port> info detail** command to check the current configuration for the port.

```

BlackDiamond-8810.1 # show port 1:1 info detail

Repeat for ports 1:2, 1:3, 1:8, 1:9, 1:10, 1:11, and 1:12.

```

3. If any of the ports are configured with VLAN information use the **configure vlan <VLAN NAME> delete ports <port>** command to delete it.

```
BlackDiamond-8810.1# configure vlan <VLAN NAME> delete ports <port>
```

4. Enable DiffServ examination on port 1:1.

```
BlackDiamond-8810.1 # enable diffserv examination ports 1:1
```

5. Create QoS profile qp7.

```
BlackDiamond-8810.1 # create qosprofile qp7
```

6. Assign DiffServ DSCP replacement value for qp7 to 46.

```
BlackDiamond-8810.1 # configure diffserv replacement qp7 code-point 46
```

7. Assign ports to the native VLAN Default.

```
BlackDiamond-8810.1 # configure Default add ports 1:2, 1:3
```

8. Create VLAN VlanOSPF.

```
BlackDiamond-8810.1 # create vlan VlanOSPF  
BlackDiamond-8810.1 # configure VlanOSPF tag 100
```

9. Add an IP address for VLAN VlanOSPF and enable IP forwarding.

Note: subnets/VLANs will not route unless IP forwarding is enabled for that VLAN.

```
BlackDiamond-8810.1 # configure VlanOSPF ipaddress 10.20.30.1/30  
BlackDiamond-8810.1 # enable ipforwarding VlanOSPF
```

10. Assign ports to VLAN VlanOSPF.

```
BlackDiamond-8810.1 # configure VlanOSPF add ports 1:1
```

11. Enable OSPF.

```
BlackDiamond-8810.1 # enable ospf
```

12. Configure OSPF for VlanOSPF.

```
BlackDiamond-8810.1 # configure ospf VlanOSPF area 0.0.0.0  
BlackDiamond-8810.1 # configure ospf add VlanOSPF area 0.0.0.0
```

13. Enable OSPF to forward information for directly connected interfaces.

```
BlackDiamond-8810.1 # enable ospf export direct cost 2 type ase-type-2
```

14. Create VLAN Voice1.

```
BlackDiamond-8810.1 # create vlan Voice1  
BlackDiamond-8810.1 # configure Voice1 tag 10
```

15. Add an IP address for VLAN Voice1 and enable IP forwarding.

```
BlackDiamond-8810.1 # configure Voice1 ipaddress 10.1.1.254/24  
BlackDiamond-8810.1 # enable ipforwarding Voice1
```

16. Assign ports to VLAN Voice1 for the interfaces.

```
BlackDiamond-8810.1 # configure Voice1 add ports 1:1, 1:2, 1:3, 1:9, 1:10, 1:11 tagged
```

17. Create VLAN Datavlan1.

```
BlackDiamond-8810.1 # create vlan Datavlan1  
BlackDiamond-8810.1 # configure Datavlan1 tag 200
```

18. Add Datavlan1 to QoS profile qp1 (best effort).

```
BlackDiamond-8810.1 # configure Datavlan1 qosprofile qp1
```

19. Add an IP address for VLAN Datavlan1 and enable IP forwarding.

```
BlackDiamond-8810.1 # configure Datavlan1 ipaddress 192.168.200.254/24  
BlackDiamond-8810.1 # enable ipforwarding Datavlan1
```

20. Assign ports to VLAN Datavlan1.

```
BlackDiamond-8810.1 # configure Datavlan1 add ports 1:2, 1:3 tagged  
BlackDiamond-8810.1 # configure Datavlan1 add ports 1:8
```

21. Create VLAN Vlan2.

```
BlackDiamond-8810.1 # create vlan Vlan2  
BlackDiamond-8810.1 # configure Vlan2 tag 2
```


22. Add an IP address for VLAN Vlan2 and enable IP forwarding.

```
BlackDiamond-8810.1 # configure Vlan2 ipaddress 10.1.2.1/24  
BlackDiamond-8810.1 # enable ipforwarding Vlan2
```

23. Assign ports to VLAN Vlan2.

```
BlackDiamond-8810.1 # configure Vlan2add ports 1:12
```

24. Configure Rapid Spanning Tree, make it the root switch and add ports to stpd s0.

```
BlackDiamond-8810.1 # configure stpd s0 mode dot1w  
BlackDiamond-8810.1 # configure stpd s0 priority 0  
BlackDiamond-8810.1 # configure stpd s0 add Voice1  
BlackDiamond-8810.1 # configure stpd s0 add Datavlan1  
BlackDiamond-8810.1 # configure stpd s0 add Voice1 ports 1:2, 1:3, 1:9, 1:10, 1:11  
BlackDiamond-8810.1 # configure stpd s0 add Datavlan1 ports 1:2, 1:3, 1:8
```

25. Enable DHCP relay.

```
BlackDiamond-8810.1 # enable bootprelay  
BlackDiamond-8810.1 # configure bootprelay add 10.1.2.250
```

26. Enable Rapid Spanning Tree.

```
BlackDiamond-8810.1 # enable stpd s0
```

27. Save the running configuration to the startup configuration.

```
BlackDiamond-8810.1 # save
```

6. Configuration of the Extreme Summit X450a-24t Switch for Lab A

This section addresses how to configure the Extreme Summit X450a-24t Switch for Lab A. The Summit X450a-24t Switch will run Layer 2 VLANs, enforce QoS policies, and run rapid spanning tree.

1. Log into the Extreme Summit X450a-24t Switch (Lab A)

Connect to the Extreme X450a-24t Switch. Log in using the appropriate Login ID and Password.

Login:

Password:

X450a-24t.1 #

2. Ensure the ports are not already configured. Use the **show port <port> info detail** command to check the current configuration for the port.

X450a-24t.1 # **show port 1 info detail**

Repeat for port 2.

3. If any of the ports are configured with VLAN information use the **configure vlan <VLAN NAME> delete ports <port>** command to delete it.

X450a-24t.1# **configure vlan <VLAN NAME> delete ports <port>**

4. Create QoS profile qp7.

X450a-24t.1 # **create qosprofile qp7**

5. Assign ports to the native VLAN Default.

X450a-24t.1 # **configure Default add ports 1, 2**

6. Create VLAN Voice1.

X450a-24t.1 # **create vlan Voice1**

X450a-24t.1 # **configure Voice1 tag 10**

7. Assign ports to VLAN Voice1 for the interfaces.

X450a-24t.1 # **configure Voice1 add ports 1, 2 tagged**

8. Create VLAN Datavlan1.

X450a-24t.1 # **create vlan Datavlan1**

X450a-24t.1 # **configure Datavlan1 tag 200**

9. Add Datavlan1 to QoS profile qp1 (best effort).

```
X450a-24t.1 # configure Datavlan1 qosprofile qp1
```

10. Assign ports to VLAN Datavlan1.

```
X450a-24t.1 # configure Datavlan1 add ports 1, 2 tagged
```

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

```
X450a-24t.1 # configure stpd s0 mode dot1w
X450a-24t.1 # configure stpd s0 add Voice1
X450a-24t.1 # configure stpd s0 add Datavlan1
X450a-24t.1 # configure stpd s0 add Voice1 ports 1, 2
X450a-24t.1 # configure stpd s0 add Datavlan1 ports 1, 2
```

12. Enable Rapid Spanning Tree.

```
X450a-24t.1 # enable stpd s0
```

13. Save the running configuration to the startup configuration.

```
X450a-24t.1 # save
```

7. Configuration of the Extreme Summit X450e-24p Switch for Closet A

This section addresses how to configure the Extreme Summit X450e-24p Switch. The Summit X450e-24p Switch will run Layer 2 and Layer 3, enforce QoS policies, run OSPF, and supply PoE to the Avaya IP Telephones.

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

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

```
Login:
```

```
Password:
```

```
X450e-24p.1 #
```

2. Ensure the ports are not already configured. Use the **show port <port> info detail** command to check the current configuration for the port.

```
X450e-24p.1 # show port 1 info detail
```

Repeat for ports 3, 4, and 5.

3. If any of the ports are configured with VLAN information use the **configure vlan <VLAN NAME> delete ports <port>** command to delete it.

```
X450e-24p.1# configure vlan <VLAN NAME> delete ports <port>
```

4. Enable DiffServ examination on port 1.

```
X450e-24p.1 # enable diffserv examination ports 1
```

5. Create QoS profile qp7.

```
X450e-24p.1 # create qosprofile qp7
```

6. Assign DiffServ DSCP replacement value for qp7 to 46.

```
X450e-24p.1 # configure diffserv replacement qp7 code-point 46
```

7. Create VLAN VlanOSPF.

```
X450e-24p.1 # create vlan VlanOSPF  
X450e-24p.1 # configure VlanOSPF tag 100
```

8. Add an IP address for VLAN VlanOSPF and enable IP forwarding.

```
X450e-24p.1 # configure VlanOSPF ipaddress 10.20.30.2/30  
X450e-24p.1 # enable ipforwarding VlanOSPF
```

9. Assign ports to VLAN VlanOSPF.

```
X450e-24p.1 # configure VlanOSPF add ports 1
```

10. Enable OSPF.

```
X450e-24p.1 # enable ospf
```

11. Configure OSPF for VlanOSPF.

```
X450e-24p.1 # configure ospf VlanOSPF area 0.0.0.0  
X450e-24p.1 # configure ospf add VlanOSPF area 0.0.0.0
```

12. Enable OSPF to forward information for directly connected interfaces.

```
X450e-24p.1 # enable ospf export direct cost 2 type ase-type-2
```

13. Create VLAN Voice3.

```
X450e-24p.1 # create vlan Voice3  
X450e-24p.1 # configure Voice3 tag 33
```

14. Add an IP address for VLAN Voice3 and enable IP forwarding.

```
X450e-24p.1 # configure Voice3 ipaddress 192.168.33.254/24  
X450e-24p.1 # enable ipforwarding Voice3
```

15. Assign ports to VLAN Voice3 for the interfaces.

```
X450e-24p.1 # configure Voice3 add ports 1, 3, 5 tagged
```

16. Create VLAN Datavlan2.

```
X450e-24p.1 # create vlan Datavlan2  
X450e-24p.1 # configure Datavlan2 tag 30
```

17. A Add Datavlan2 to QoS profile qp1 (best effort).

```
X450e-24p.1 # configure Datavlan2 qosprofile qp1
```

18. Add an IP address for VLAN Datavlan2 and enable IP forwarding.

```
X450e-24p.1 # configure Datavlan2 ipaddress 192.168.30.254/24  
X450e-24p.1 # enable ipforwarding Datavlan2
```

19. Assign ports to VLAN Datavlan2.

```
X450e-24p.1 # configure Datavlan2 add ports 3, 4
```

20. Enable DHCP relay.

```
X450e-24p.1 # enable bootprelay  
X450e-24p.1 # configure bootprelay add 10.1.2.250
```

21. Save the running configuration to the startup configuration.

```
X450e-24p:1 # save
```

8. Configure the Extreme Summit X450e-24p Switch for Closet B

This section addresses how to configure the Extreme Summit X450e-24p Switch (Closet B). 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-24pt Switch (Closet B).

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

Login:

Password:

```
X450e-24p:1 #
```

2. Ensure the ports are not already configured. Use the **show port <port> info detail** command to check the current configuration for the port.

```
X450e-24p:1 # show port 1 info detail
```

Repeat for ports 2, 3, 4, and 5.

3. If any of the ports are configured with VLAN information (including Default), use the **configure vlan <VLAN NAME> delete ports <port>** command to delete it.

```
X450e-24p:1 # configure vlan <VLAN NAME> delete ports <port>
```

4. Assign ports to the native VLAN Default.

```
X450e-24p:1 # configure Default add ports 1, 2
```

5. Create VLAN Voice1.

```
X450e-24p:1 # create vlan Voice1
```

```
X450e-24p:1 # configure Voice1 tag 10
```

6. Assign ports to VLAN Voice1 for the interfaces.

```
X450e-24p:1 # configure Voice1 add ports 1, 2, 3, 5 tagged
```

7. Create VLAN Datavlan1.

```
X450e-24p:1 # create vlan Datavlan1  
X450e-24p:1 # configure Datavlan1 tag 200
```

8. Add Datavlan1 to QoS profile qp1 (best effort).

```
X450e-24p:1 # configure Datavlan1 qosprofile qp1
```

9. Assign ports to VLAN Datavlan1.

```
X450e-24p:1 # configure Datavlan1 add ports 1, 2 tagged  
X450e-24p:1 # configure Datavlan1 add ports 4, 5
```

10. Configure Rapid Spanning Tree add ports to stpd s0.

```
X450e-24p:1 # configure stpd s0 mode dot1w  
X450e-24p:1 # configure stpd s0 add Voice1  
X450e-24p:1 # configure stpd s0 add Datavlan1  
X450e-24p:1 # configure stpd s0 add Voice1 ports 1, 2, 3, 5  
X450e-24p:1 # configure stpd s0 add Datavlan1 ports 1, 2, 4, 5
```

22. Enable DHCP relay.

```
X450e-24p:1 # enable bootprelay  
X450e-24p:1 # configure bootprelay add 10.1.2.250
```

11. Enable Rapid Spanning Tree.

```
X450e-24p:1 # enable stpd s0
```

12. Save the running configuration to the startup configuration.

```
X450e-24p:1 # save
```

9. Interoperability Compliance Testing

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

For feature functionality testing, emphasis was placed on verifying voice quality in a converged VoIP and data network scenario. Specifically, compliance testing verified that when the Extreme switch interfaces are oversubscribed with low priority data traffic, the higher priority VoIP media and signaling traffic still get through with good voice quality. Prioritization of voice traffic was achieved by implementing Layer 3 DiffServ and Layer 2 priority (802.1p) QoS. Voice and data traffic were segmented in the enterprise network using VLANs.

QoS and performance testing were verified by making voice calls while a traffic generator generated low priority data traffic. 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/Extreme VoIP solution to recover from adverse conditions, such as power cycling the Avaya G700 Media Gateway, Extreme Networks devices and disconnecting cables between the LAN interfaces. In all cases, the Avaya and Extreme Networks devices recovered without intervention.

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 Extreme products
- Registration of Avaya IP Telephones with Avaya Communication Manager
- 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, direct media, 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
- Interoperability of 802.1d rapid spanning tree
- Layer-2, Layer-3, port based and VLAN based Quality of Service

Note: EAPS was compliance tested but is not part of this document.

The performance tests were performed by oversubscribing the network interfaces with low priority data traffic and verifying that good voice quality was achieved when calls were made over the routed and switched interfaces.

9.2. Test Results

All feature functionality, serviceability, and performance test cases passed. The Extreme implementation yielded good voice quality. The stability of the Avaya/Extreme 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 Extreme BlackDiamond 8810 Switch. In general, the verification steps include:

- Verify that the DHCP relay on the Extreme switches is functioning by confirming that the Avaya IP Telephones receive their IP addresses from the DHCP server connected to the Extreme BlackDiamond 8810 Switch.
- Check that the Avaya IP Telephones have successfully registered with Avaya Communication Manager.
- Place calls between the Avaya 2410 Digital Telephone and Avaya IP Telephones.

11. Troubleshooting

11.1. Extreme Troubleshooting

- If the voice quality is poor, check sections 5, 6, 7 and 8 for QoS options.
- If any of the Extreme switches are unable to communicate with any of the aforementioned IP devices and interfaces:
 1. Check the VLAN configuration with the command **show vlan**
 2. Check routing with the command **show iproute**
 3. Check the status of the Ethernet and LAN interfaces with the command **show port <port> information detail**
 4. Check spanning tree with the command **show stpd s0**

12. Conclusion

These Application Notes describe the configuration steps required for integrating Extreme Switches into an Avaya Communication Manager infrastructure. For the configuration described in these Application Notes, the Extreme switches were responsible for enforcing QoS using Layer 3 Differentiated Services and Layer 2 (802.1p), rapid spanning tree (802.1d) and OSPF. Voice quality was successfully achieved in the Avaya/Extreme configuration described herein.

13. Additional References

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

Product documentation for Avaya products may be found at <http://support.avaya.com>.

- [1] *Administrator Guide for Avaya Communication Manager*, Doc # 03-300509, Issue 2.1, May 2006
- [2] *Avaya Communication Manager Advanced Administration Quick Reference*, Doc # 03-300364, Issue 2, June 2005
- [3] *Administration for Network Connectivity for Avaya Communication Manager*, Doc # 555-233-504, Issue 11, February 2006

[4] *Avaya IP Telephony Implementation Guide*, May 1, 2006

The Extreme product documentation can be found at:

<http://www.extremenetworks.com/products/summit-x450e.aspx>

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