



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

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# **Application Notes for Foundry Networks FastIron SuperX Switch, FastIron GS Switch and FastIron Edge Switch connected to Avaya Communication Manager, Avaya SIP Enablement Services and Avaya Modular Messaging - Issue 1.0**

### **Abstract**

These Application Notes describe the configuration of a Voice over IP (VoIP) solution using Foundry Networks FastIron SuperX Switch, Foundry Networks FastIron GS Switch and Foundry Networks FastIron Edge Switch connected to Avaya Communication Manager, Avaya SIP Enablement Services and Avaya Modular Messaging. 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 using Foundry Networks FastIron SuperX Switch, Foundry Networks FastIron GS Switch and Foundry Networks FastIron Edge Switch connected to Avaya Communication Manager, Avaya SIP Enablement Services (SES) and Avaya Modular Messaging. Compliance testing emphasis was placed on verifying the prioritization of VoIP traffic and voice quality in a converged VoIP and Data network scenario. Quality of Service (QoS) based on Layer 2 Priority (802.1p) and Layer 3 Differentiated Services (Diffserv) was implemented across the network to prioritize voice traffic over the LAN. The Avaya IP telephones get QoS priority settings from Avaya Communication Manager and are enforced in the network by the Foundry Networks Switches. To verify VoIP traffic was given priority over data traffic, tests were performed by over-subscribing the LAN interfaces with low priority data traffic and verifying that acceptable voice quality was achieved when calls were routed over all of the LAN interfaces. Compliance testing included testing QoS, throughput, link aggregation, rapid spanning tree, load balancing, Open Shortest Path First (OSPF), Direct IP Media connectivity and the G.711 and G.729 codecs.

## 2. Hardware Configuration

The configuration in **Figure 1** shows a single site converged VoIP and data network with multiple closets and labs configured with link aggregation, rapid spanning tree, load balancing and OSPF.

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

### 2.1. Control Room

The control room consisted of a Foundry Networks FastIron SuperX Switch, Avaya Communication Manager running on an Avaya S8300 Server with an Avaya G700 Media Gateway, Avaya SES, Avaya Modular Messaging, one Avaya 2400 Series Digital Telephone, one Avaya 9630G IP Telephone running Avaya one-X™ Deskphone Edition on VLAN Voice1, one Avaya 9620 IP Telephone running Avaya one-X Deskphone SIP on VLAN Voice1 and one Corporate DHCP/File server. The corporate site provided a DHCP/File server for assigning IP network parameters and to download settings to the Avaya IP telephones. The Foundry Networks FastIron SuperX Switch supplied Power over Ethernet (PoE) power for the Avaya IP telephones and was configured to support link aggregation, rapid spanning tree, load balancing, VLANs, enforce QoS policies, and OSPF with the peer Foundry Networks switches.

### 2.2. Lab-A

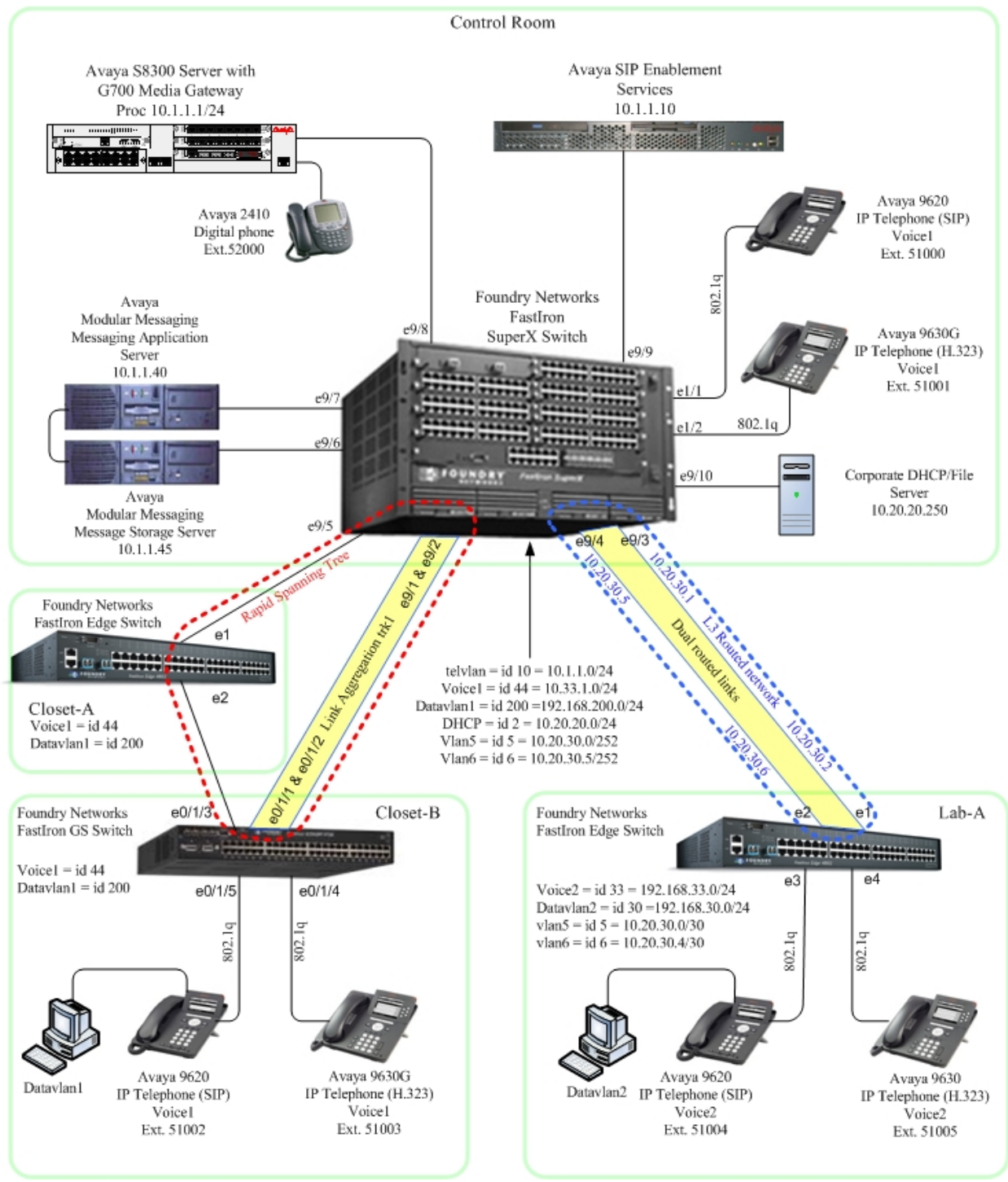
Lab-A consisted of a Foundry Networks FastIron Edge Switch, one Avaya 9630 IP Telephone running Avaya one-X Deskphone Edition and one Avaya 9620 IP Telephone running Avaya one-X Deskphone SIP on VLAN Voice2 and a PC on Datavlan2. The Foundry Networks FastIron Edge Switch supplied PoE power for the Avaya IP telephones and was configured to support link aggregation, rapid spanning tree, load balancing, VLANs, enforce QoS policies, and OSPF with the peer Foundry Networks switches.

### **2.3. Closet-A**

Closet-A consisted of a Foundry Networks FastIron Edge Switch. It was configured to support VLANs, rapid spanning tree and enforce QoS policies.

### **2.4. Closet-B**

Closet-B consisted of a Foundry Networks FastIron GS Switch, one Avaya 9620 IP Telephone running Avaya one-X Deskphone SIP and one Avaya 9630G IP Telephone running Avaya one-X Deskphone Edition on VLAN Voice1 and a PC on VLAN Datavlan1. The FastIron GS Switch supplied PoE power for the Avaya IP telephones and was configured to support link aggregation, rapid spanning tree, enforce QoS policies, and load balancing.



**Figure 1: Network Configuration**

### 3. Equipment and Software Validated

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

Equipment	Software/Firmware
Avaya S8300 Server	Avaya Communication Manager 4.0 (R14x.00.1.731.2)
Avaya G700 Media Gateway with MM712 DCP Media Module 8	26.31.0 FW 008
Avaya Modular Messaging - Messaging Application Server (MAS)	3.1
Avaya Modular Messaging - Message Storage Server (MSS)	3.1
Avaya SIP Enabled Services	4.0 (SES-4.0.0.0-033.6)
Avaya 9600 Series IP Telephones	Avaya one-X Deskphone SIP 1.0 (SIP)
Avaya 9600 Series IP Telephones	Avaya one-X Deskphone Edition 1.5 (H.323)
Avaya 2410 Digital Telephone	NA
Foundry Networks FastIron SuperX Switch	4.0
Foundry Networks FastIron GS Switch	4.0
Foundry Networks FastIron Edge Switch	4.0

### 4. Configure Avaya Communication Manager

This section shows the steps used to configure Avaya Communication Manager. For detailed information on the installation, maintenance, and configuration of Avaya Communication Manager, refer to [1].

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 S8300 Server, Avaya G700 Media Gateway, Avaya SIP Enablement Services and Avaya IP telephones support both 802.1p and DiffServ.

All network components are in network region 1 for this sample configuration. The DiffServ and 802.1p/Q values configured here will be downloaded to the Avaya H.323 IP Telephones via Avaya Communication Manager. Avaya SIP IP Telephones will get QoS setting by downloading the 46xxsettings file from the HTTP server. For more information on QoS settings please refer to [1].

Use the **change ip-network-region 1** command to change the DIFFSERV/TOS PARAMETERS and 802.1P/Q PARAMETERS settings configured in Avaya Communication Manager.

```
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
```

The Differentiated Services Code Point (DSCP) value of 46 will be used for both PHB values. DSCP 46 represents the traffic class of premium and the traffic type voice. Set the **Call Control PHB Value** to **46** and the **Audio PHB Value** to **46**. **Call Control 802.1p Priority** and **Audio 802.1p Priority** are set to **6**.

## 5. Configuration of the Foundry Networks FastIron SuperX Switch

This section addresses how to configure the Foundry FastIron SuperX Switch. The Foundry FastIron SuperX Switch was used as the core Layer 2/Layer 3 router and will enforce QoS policies support Link Aggregation, OSPF and spanning tree.

To configure the FastIron SuperX Switch, connect a PC or laptop to the serial port of the FastIron SuperX Switch. Run a terminal emulation program with the following configuration:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow Control: None

1. Log into Foundry FastIron SuperX Switch.

Connect to the Foundry FastIron SuperX Switch. Log in using the appropriate credentials.

Login:

Password:

FastIron SuperX Switch#

Enable the following features on the FastIron SuperX Switch.

- Enable spanning tree
- Create link aggregation trunk
- Enable QoS
- Set QoS Differentiated Services information
- Create QoS access lists
- Enable OSPF and set area
- Enable spanning-tree to ports
- Write the running configuration to the startup configuration

```
FastIron SuperX Switch # configure
FastIron SuperX Switch(config)# global-stp
FastIron SuperX Switch(config)# trunk ethe 9/1 to 9/2
FastIron SuperX Switch(config)# qos mechanism strict
FastIron SuperX Switch(config)# qos-tos map dscp-priority 26 46 to 7
FastIron SuperX Switch(config)# access-list 101 permit ip any any dscp-matching 46 dscp-
cos-mapping
FastIron SuperX Switch(config)# access-list 101 permit ip any any
FastIron SuperX Switch(config)# access-list 102 permit ip any any precedence critical
dscp-cos-mapping
FastIron SuperX Switch(config)# access-list 102 permit ip any any
FastIron SuperX Switch(config)# router ospf
FastIron SuperX Switch(config-ospf-router)# area 0.0.0.0 normal
FastIron SuperX Switch(config-ospf-router) exit
FastIron SuperX Switch(config)# interface ethernet 9/5
FastIron SuperX Switch(config-if-9/5)# spanning-tree 802-1w admin-pt2pt-mac
```

2. Write the running configuration to the startup configuration.

```
FastIron SuperX Switch(config)# write memory
```



3. Create, configure and enable the dual routed links to Lab-A.

- Assign a VLAN ID for interface 1
- Assign a name to interface 1
- Assign a port to vlan 5
- Enable spanning tree and assign priority 0
- Create interface and assign an IP address for interface 1
- Assign a VLAN ID for interface 2
- Assign a name to interface 2
- Assign a port to vlan 6
- Enable spanning tree and assign priority 0
- Create interface and assign an IP address for interface 2

```
FastIron SuperX Switch # configure
FastIron SuperX Switch(config)# vlan 5
FastIron SuperX Switch(config-vlan-5)# vlan 5 name vlan5
FastIron SuperX Switch(config-vlan-5)# untagged ethe 9/3
FastIron SuperX Switch(config-vlan-5)# spanning-tree rstp
FastIron SuperX Switch(config-vlan-5)# spanning-tree priority 0
FastIron SuperX Switch(config-vlan-5)# exit
FastIron SuperX Switch(config)# interface ethe 9/3
FastIron SuperX Switch(config-if-9/3)# ip address 10.20.30.1 255.255.255.252
FastIron SuperX Switch(config-if-9/3)# exit
FastIron SuperX Switch(config)# vlan 6
FastIron SuperX Switch(config-vlan-6)# vlan 6 name vlan6
FastIron SuperX Switch(config-vlan-6)# untagged ethe 9/4
FastIron SuperX Switch(config-vlan-6)# spanning-tree rstp
FastIron SuperX Switch(config-vlan-6)# spanning-tree priority 0
FastIron SuperX Switch(config-vlan-6)# exit
FastIron SuperX Switch(config)# interface ethe 9/4
FastIron SuperX Switch(config-if-9/4)# ip address 10.20.30.5 255.255.255.252
FastIron SuperX Switch(config-if-9/4)# exit
```

4. Create and configure the telephony VLAN that all of the Avaya telephony equipment will run on.

- Assign a VLAN ID for the telephony VLAN
- Assign a name for the telephony VLAN
- Assign ports to the telephony VLAN
- Enable spanning tree and assign priority 0
- Create the interface and assign an IP address for the telephony VLAN
- Add VLAN to access-group
- Add a helper-address for the telephony VLAN
- Add the VLAN to OSPF area 0

```
FastIron SuperX Switch # configure
FastIron SuperX Switch(config)# vlan 10
FastIron SuperX Switch(config-vlan-10)# vlan 10 name telvlan
FastIron SuperX Switch(config-vlan-10)# tagged ethe 9/1 to 9/2 ethe 9/5
FastIron SuperX Switch(config-vlan-10)# untagged ethe 9/6 to 9/9
FastIron SuperX Switch(config-vlan-10)# spanning-tree 802-1w
FastIron SuperX Switch(config-vlan-10)# spanning-tree 802-1w priority 0
FastIron SuperX Switch(config-vlan-10)# exit
FastIron SuperX Switch(config)# router-interface ve 10
FastIron SuperX Switch(config-vif-10) # ip address 10.1.1.254/24
FastIron SuperX Switch(config-vif-10) # ip access-group 101 in
FastIron SuperX Switch(config-vif-10) # ip helper-address 1 10.20.20.250
FastIron SuperX Switch(config-vif-10) # ip ospf area 0
FastIron SuperX Switch(config-vif-10) # exit
```

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

- Assign a VLAN ID for the voice VLAN
- Assign a name for the voice1 VLAN
- Enable spanning tree and assign priority 0
- Create the interface and assign an IP address for the voice1 VLAN
- Add VLAN to access-group
- Add a helper-address for the voice1 VLAN
- Add the VLAN to OSPF area 0
- Assign ports to the voice1 VLAN

```
FastIron SuperX Switch # configure
FastIron SuperX Switch(config)# vlan 44
FastIron SuperX Switch(config-vlan-44)# vlan 44 name voice1
FastIron SuperX Switch(config-vlan-44)# tagged ethe 1/1 to 1/2 ethe 9/1 to 9/2 ethe 9/5
FastIron SuperX Switch(config-vlan-44)# spanning-tree 802-1w
FastIron SuperX Switch(config-vlan-44)# spanning-tree 802-1w priority 0
FastIron SuperX Switch(config-vlan-44)# exit
FastIron SuperX Switch(config)# router-interface ve 44
FastIron SuperX Switch(config-vif-44) # ip address 10.33.1.254/24
FastIron SuperX Switch(config-vif-44) # ip access-group 101 in
FastIron SuperX Switch(config-vif-44) # ip helper-address 1 10.20.20.250
FastIron SuperX Switch(config-vif-44) # ip ospf area 0
FastIron SuperX Switch(config-vif-44) # exit
FastIron SuperX Switch(config)# interface ethernet 1/1
FastIron SuperX Switch(config-if-1/1) dual-mode 200
FastIron SuperX Switch(config-if-1/1) exit
FastIron SuperX Switch(config)# interface ethernet 1/2
FastIron SuperX Switch(config-if-1/2) dual-mode 200
FastIron SuperX Switch(config-if-1/2) exit
```

6. Create and configure the data VLAN that will run between the control room and closets.

- Assign a VLAN ID for the data1 VLAN
- Assign a name for the data1 VLAN
- Assign ports to the data VLAN
- Enable spanning tree and assign priority 0
- Create the interface and assign an IP address for the data VLAN
- Add a helper-address for the data VLAN
- Add the VLAN to OSPF area 0

```
FastIron SuperX Switch # configure
FastIron SuperX Switch(config)# vlan 200
FastIron SuperX Switch(config-vlan-200)# vlan 200 name datavlan1
FastIron SuperX Switch(config-vlan-200)# tagged ethe 1/1 to 1/2 ethe 9/1 to 9/2 ethe 9/5
FastIron SuperX Switch(config-vlan-200)# spanning-tree 802-1w
FastIron SuperX Switch(config-vlan-200)# spanning-tree 802-1w priority 0
FastIron SuperX Switch(config-vlan-200)# exit
FastIron SuperX Switch(config)# router-interface ve 200
FastIron SuperX Switch(config-vif-200) # ip address 192.168.200.254/24
FastIron SuperX Switch(config-vif-200) # ip helper-address 1 10.20.20.250
FastIron SuperX Switch(config-vif-200) # ip ospf area 0
FastIron SuperX Switch(config-vif-200) # exit
```

7. Create and configure the DHCP VLAN.

- Assign a VLAN ID for the DHCP VLAN
- Assign a name for the DHCP VLAN
- Assign ports to the DHCP VLAN
- Enable spanning tree and assign priority 0
- Create the interface and assign an IP address for the DHCP VLAN
- Add the VLAN to OSPF area 0

```
FastIron SuperX Switch # configure
FastIron SuperX Switch(config)# vlan 2
FastIron SuperX Switch(config-vlan-2)# vlan 2 name DHCP
FastIron SuperX Switch(config-vlan-2)# untagged ethe 1/11 ethe 1/24 ethe 9/10 to 9/11
FastIron SuperX Switch(config-vlan-2)# spanning-tree rstp
FastIron SuperX Switch(config-vlan-2)# spanning-tree priority 0
FastIron SuperX Switch(config-vlan-2)# exit
FastIron SuperX Switch(config)# router-interface ve 2
FastIron SuperX Switch(config-vif-2) # ip address 10.20.20.250/24
FastIron SuperX Switch(config-vif-2) # ip ospf area 0
FastIron SuperX Switch(config-vif-2) # exit
```

8. Write the running configuration to the startup configuration.

```
FastIron SuperX Switch(config)# write memory
```

## 6. Configure the Foundry Networks FastIron Edge Switch in Lab-A

This section addresses how to configure the Foundry FastIron Edge Switch. Foundry FastIron Edge Switch will enforce QoS policies support link aggregation, OSPF and spanning tree.

To configure the FastIron Edge Switch, connect a PC or laptop to the serial port of the FastIron Edge Switch. Run a terminal emulation program with the following configuration:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow Control: None

1. Log into Foundry FastIron Edge Switch.

Connect to the Foundry FastIron Edge Switch. Log in using the appropriate credentials.

Login:

Password:

FastIron Edge Switch#

2. Enable the following features on the FastIron Edge Switch.

- Enable spanning tree
- Enable QoS
- Set QoS Differentiated Services information
- Create QoS access list 101
- Enable OSPF and set area
- Write the running configuration to the startup configuration

```
FastIron Edge Switch # configure
FastIron Edge Switch(config)# global-stp
FastIron Edge Switch(config)# vlan 1
FastIron Edge Switch(config-vlan-1)# spanning-tree
FastIron Edge Switch(config-vlan-1)# spanning-tree rstp
FastIron Edge Switch(config-vlan-1)# exit
FastIron Edge Switch(config)# qos mechanism strict
FastIron Edge Switch(config)# qos-tos map dscp-priority 46 to 7
FastIron Edge Switch(config)# access-list 101 permit ip any any dscp-matching 46 dscp-
cos-mapping
FastIron Edge Switch(config)# access-list 101 permit ip any any
FastIron Edge Switch(config)# router ospf
FastIron Edge Switch(config-ospf-router)# area 0.0.0.0 normal
FastIron Edge Switch(config-ospf-router)# exit
```

3. Write the running configuration to the startup configuration.

```
FastIron Edge Switch(config)# write memory
```

4. Create, configure and enable the dual routed links to Control Room.

- Assign a VLAN ID for interface 1
- Assign a name to interface 1
- Assign a port to vlan 5
- Create interface and assign an IP address
- Disable spanning-tree for interface 1
- Assign a VLAN ID for interface 2
- Assign a name to interface 2
- Assign a port to vlan 6
- Create interface and assign an IP address
- Disable spanning-tree for interface 2

```
FastIron Edge Switch # configure
FastIron Edge Switch(config)# vlan 5
FastIron Edge Switch(config-vlan-5)# vlan 5 name vlan5
FastIron Edge Switch(config-vlan-5)# untagged ethe 1
FastIron Edge Switch(config-vlan-5)# exit
FastIron Edge Switch(config)# interface ethe 1
FastIron Edge Switch(config-if-1)# ip address 10.20.30.2 255.255.255.252
FastIron Edge Switch(config-if-1)# no spanning-tree
FastIron Edge Switch(config-if-1)# exit
FastIron Edge Switch(config)# vlan 6
FastIron Edge Switch(config-vlan-6)# vlan 6 name vlan6
FastIron Edge Switch(config-vlan-6)# untagged ethe 2
FastIron Edge Switch(config-vlan-6)# exit
FastIron Edge Switch(config)# interface ethe 2
FastIron Edge Switch(config-if-2)# ip address 10.20.30.6 255.255.255.252
FastIron Edge Switch(config-if-2)# no spanning-tree
FastIron Edge Switch(config-if-2)# exit
```

5. Create and configure the voice VLAN for Lab-A.

- Assign a VLAN ID for the voice VLAN
- Assign a name to the voice VLAN
- Assign ports to the voice VLAN
- Create the interface and assign an IP address for the voice VLAN
- Add a helper-address for the voice VLAN
- Add the vlan to OSPF area 0
- Enable dual mode trunking on ports 3 and 4

```
FastIron Edge Switch # configure
FastIron Edge Switch(config)# vlan 33
FastIron Edge Switch(config-vlan-33)# vlan 33 name voice2
FastIron Edge Switch(config-vlan-33)# tagged ethe 3 to 4
FastIron Edge Switch(config-vlan-33)# exit
FastIron Edge Switch(config)# router-interface ve 33
FastIron Edge Switch(config-vif-33) # ip address 192.168.33.254/24
FastIron Edge Switch(config-vif-33) # ip helper-address 1 10.20.20.250
FastIron Edge Switch(config-vif-33) # ip ospf area 0
FastIron Edge Switch(config-vif-33) # exit
FastIron Edge Switch(config)# interface ethernet 3
FastIron Edge Switch(config-if-3) dual-mode 30
FastIron Edge Switch(config-if-3) exit
FastIron Edge Switch(config)# interface ethernet 4
FastIron Edge Switch(config-if-4) dual-mode 30
FastIron Edge Switch(config-if-4) exit
```



6. Create and configure the data VLAN for Lab-A.

- Assign a VLAN ID for the data VLAN
- Assign a name to the data VLAN
- Assign ports to the data VLAN
- Create the interface and assign an IP address for the data VLAN
- Add a helper-address for the data VLAN
- Add the VLAN to OSPF area 0

```
FastIron Edge Switch # configure
FastIron Edge Switch(config)# vlan 30
FastIron Edge Switch(config-vlan-30)# vlan 30 name DataVlan2
FastIron Edge Switch(config-vlan-30)# tagged ethe 3 to 4
FastIron Edge Switch(config-vlan-30)# exit
FastIron Edge Switch(config)# router-interface ve 30
FastIron Edge Switch(config-vif-30) # ip address 192.168.30.254/24
FastIron Edge Switch(config-vif-30) # ip helper-address 1 10.20.20.250
FastIron Edge Switch(config-vif-30) # ip ospf area 0
FastIron Edge Switch(config-vif-30) # exit
```

7. Write the running configuration to the startup configuration

```
FastIron Edge Switch(config)# write memory
```

## 7. Configure the Foundry Networks FastIron GS Switch in Closet-B

This section addresses how to configure the Foundry FastIron GS Switch. Foundry FastIron GS Switch was used as the core Layer 2 switch and will enforce QoS policies support link aggregation and spanning tree.

To configure the FastIron GS Switch, connect a PC or laptop to the serial port of the FastIron GS Switch. Run a terminal emulation program with the following configuration:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow Control: None

1. Log into Foundry FastIron GS Switch.

Connect to the Foundry FastIron GS Switch. Log in using the appropriate credentials.

Login:

Password:

FastIron GS Switch#

2. Enable the following features on the FastIron GS Switch.

- Create link aggregation trunk
- Set port name
- Enable QoS
- Set QoS Differentiated Services information
- Create QoS access list 101
- Write the running-config to startup-config

FastIron GS Switch # **configure**

FastIron GS Switch(config)# **trunk ethe 0/1/1 to 0/1/2**

FastIron GS Switch(config)# **port-name to SuperX**

FastIron GS Switch(config) **qos mechanism strict**

FastIron GS Switch(config)# **qos-tos map dscp-priority 26 46 to 7**

FastIron GS Switch(config)# **access-list 101 permit ip any any dscp-matching 46 internal-priority-marking 7**

FastIron GS Switch(config)# **interface ethe 0/1/1**

FastIron GS Switch(config-if-0/1/1)# **access-list 101 permit ip any any**

FastIron GS Switch(config-if-0/1/1)# **write memory**

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

- Assign VLAN ID 44 for the voice VLAN
- Assign name to voice VLAN
- Enable spanning-tree
- Add VLAN 44 to access-group
- Assign ports to voice1 VLAN and enable in-line power
- Enable dual mode trunking on ports 3 and 4

```
FastIron GS Switch # configure
FastIron GS Switch(config)# vlan 44
FastIron GS Switch(config-vlan-44)# vlan 44 name voice1
FastIron GS Switch(config-vlan-44)# spanning-tree 802-1w
FastIron GS Switch(config-vlan-44)# tagged ethe 0/1/1 to 0/1/5
FastIron GS Switch(config-vlan-44)# exit
FastIron GS Switch(config)# interface ethernet 0/1/4
FastIron GS Switch(config-if-0/1/4) dual-mode 200
FastIron GS Switch(config-if-0/1/4) # ip access-group 101 in
FastIron GS Switch(config-if-0/1/4) inline power
FastIron GS Switch(config-if-0/1/4) trust dscp
FastIron GS Switch(config-if-0/1/4) no spanning-tree
FastIron GS Switch(config-if-0/1/4) exit
FastIron GS Switch(config)# interface ethernet 0/1/5
FastIron GS Switch(config-if-0/1/5) dual-mode 200
FastIron GS Switch(config-if-0/1/5) # ip access-group 101 in
FastIron GS Switch(config-if-0/1/5) inline power
FastIron GS Switch(config-if-0/1/5) trust dscp
FastIron GS Switch(config-if-0/1/5) no spanning-tree
FastIron GS Switch(config-if-0/1/5) exit
```

4. Create and configure the data VLAN that will run between the control room and closets.

- Assign a VLAN ID 200 for the data VLAN
- Assign name to data VLAN
- Assign ports to the data VLAN
- Enable spanning-tree

```
FastIron GS Switch # configure
FastIron GS Switch(config)# vlan 200
FastIron GS Switch(config-vlan-200)# vlan 200 name datavlan1
FastIron GS Switch(config-vlan-200)# tagged ethe 0/1/1 to 0/1/5
FastIron GS Switch(config-vlan-200)# untagged ethe 0/1/4 ethe 0/1/5
FastIron GS Switch(config-vlan-200)# spanning-tree 802-1w
FastIron GS Switch(config-vlan-200) # exit
```

5. Write the running configuration to the startup configuration

```
FastIron GS Switch(config)# write memory
```

## 8. Configure the Foundry Networks FastIron Edge Switch in Closet-A

This section addresses how to configure the Foundry FastIron Edge Switch. The Foundry FastIron Edge Switch will enforce QoS policies and spanning tree.

To configure the FastIron Edge Switch, connect a PC or laptop to the serial port of the FastIron Edge Switch. Run a terminal emulation program with the following configuration:

- Bits per second: 9600
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow Control: None

1. Log into Foundry FastIron Edge Switch.

```
Connect to the Foundry FastIron Edge Switch. Log in using the appropriate credentials.
```

```
Login:
Password:
FastIron Edge Switch#
```

2. Enable the following features on the FastIron Edge Switch.

- Enable spanning tree
- Enable QoS
- Set QoS Differentiated Services information
- Create QoS access list 101
- Write the running configuration to the startup configuration

```
FastIron Edge Switch # configure
FastIron Edge Switch(config)# spanning-tree
FastIron Edge Switch(config)# spanning-tree rstp
FastIron Edge Switch(config)# qos mechanism strict
FastIron Edge Switch(config)# qos-tos map dscp-priority 46 to 7
FastIron Edge Switch(config)# access-list 101 permit ip any any dscp-matching 46 dscp-
cos-mapping
```

3. Create and configure the voice VLAN for Closet-A.

- Assign a VLAN ID for the voice VLAN
- Assign a name to the voice VLAN
- Assign ports to the voice VLAN

```
FastIron Edge Switch # configure
FastIron Edge Switch(config)# vlan 44
FastIron Edge Switch(config-vlan-44)# vlan 44 name voice44
FastIron Edge Switch(config-vlan-44)# tagged ethe 1 to 2
FastIron Edge Switch(config-vlan-44)# exit
```

4. Create and configure the data VLAN for Closet-A

- Assign a VLAN ID for the data VLAN
- Assign a name to the data VLAN
- Assign ports to the data VLAN

```
FastIron Edge Switch # configure
FastIron Edge Switch(config)# vlan 200
FastIron Edge Switch(config-vlan-200)# vlan 200 name DataVlan1
FastIron Edge Switch(config-vlan-200)# tagged ethe 1 to 2
FastIron Edge Switch(config-vlan-200)# exit
```

## 5. Write the running configuration to the startup configuration

```
FastIron Edge Switch(config)# write memory
```

## 9. Interoperability Compliance Testing

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

Feature functionality testing focused on the QoS and VLAN implementation in the Avaya/Foundry configuration. Specifically, compliance testing verified that when the Foundry Networks Switch interfaces are over subscribed with low priority data traffic, the higher priority VoIP media and signaling traffic still got through and achieved good voice quality. Prioritization of voice traffic was achieved by implementing Layer 3 DiffServ-based QoS and Layer 2 priority (801.p). Voice and data traffic were segmented in the enterprise network using VLANs.

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

Serviceability testing was conducted to verify the ability of the Avaya/Foundry VoIP solution to recover from adverse conditions, such as power cycling network devices and disconnecting cables between the LAN interfaces. In all cases, the ability to recover after the network normalized was verified.

### 9.1. General Test Approach

All feature functionality test cases were performed manually. The general test approach entailed verifying the following:

- LAN connectivity between the Avaya and Foundry Networks products
- Registration of Avaya H.323 IP telephones with Avaya Communication Manager
- Registration of Avaya SIP IP telephones with Avaya SIP Enablement Services
- Verification of the DHCP relay configuration
- VoIP calls over Layer 2 and Layer 3 connections
- Inter-office calls using G.711 mu-law & G.729 codecs, conferencing, and sending low priority data traffic over the LAN.
- Verifying that QoS directed the voice signaling and voice media to the higher priority egress queue based on the packets' DSCP value.
- Verifying that Avaya Modular Messaging voicemail and MWI work properly.

The performance tests were performed by over subscribing the lines with low priority data and verifying that the prioritization of VoIP traffic and voice was achieved when calls are routed over all of the LAN interfaces.

## 9.2. Test Results

All feature functionality, serviceability, and performance test cases passed. The Foundry implementation did prioritization of VoIP traffic and yielded good voice quality with no calls being lost. The Avaya/Foundry Networks 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 Foundry Networks FastIron SuperX Switch. In general, the verification steps include:

1. Verify the DHCP relay on the Foundry Networks switches is functioning by confirming that the Avaya IP telephones receive their IP addresses from the DHCP server connected to the Foundry Networks FastIron SuperX Switch.
2. Check that the Avaya IP telephones have successfully registered with Avaya Communication Manager using the **list registered-station** command.
3. Place internal and external calls between the digital telephone and IP telephones at each site.

## 11. Conclusion

These Application Notes describe the configuration steps for integrating Foundry Network Switches with an Avaya telephony infrastructure. For the configuration described in these Application Notes, the Foundry Networks switches were responsible for enforcing QoS using Layer 3 Differentiated Services and Layer 2 (802.1p) as well as link aggregation, rapid spanning tree, load balancing and OSPF. Avaya Communication Manager delivered the voice traffic to the routers for transmission over the LAN together with data traffic. Prioritization of VoIP traffic and good voice quality was successfully achieved in the Avaya/Foundry configuration described herein.

## 12. Additional References

The following Avaya product documentation can be found at <http://support.avaya.com>.

- [1] *Administrator Guide for Avaya Communication Manager*, February 2007, Issue 3.1, Document Number 03-300509
- [2] *Installing and Administering SIP Enablement Services*, March 2007, Issue 2.1, Document Number 03-600768
- [3] *Avaya one-X Deskphone Edition for 9600 Series IP Telephones Administrator Guide*
- [4] *Messaging Application Server (MAS) Administration Guide Release 3.1*, February 2007

The Foundry Networks product documentation can be found at: <http://www.foundrynet.com/>.

[5] *Foundry FastIron Configuration Guide* with sections as follows:

- *FastIron X Series Compact Switches*
  - *FastIron Edge Switch X Series*
- *FastIron X Series Chassis*
  - *FastIron SuperX*
- *FastIron Layer 2 Compact Switches*
  - *FastIron GS*



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