



Avaya Solution & Interoperability Test Lab

**Application Notes for Enterasys Networks Matrix N5,
Enterasys Networks SecureStack C2 and Enterasys
Networks SecureStack B2 with Avaya IP Office - Issue 1.0**

Abstract

These Application Notes describe the procedure for Enterasys Networks Matrix N5, Enterasys Networks SecureStack C2 and Enterasys Networks SecureStack B2 switches to interoperate with Avaya IP Office in a converged network infrastructure. 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 a compliance-tested configuration utilizing Avaya IP Office, Avaya 4600 IP Telephones with Enterasys Networks Matrix N5, Enterasys Networks SecureStack C2 and Enterasys Networks SecureStack B2 switches.

The Enterasys Networks Matrix N5 is a modular five-slot chassis with an integrated Power over Ethernet (POE) shelf. The Matrix N5 leverages Enterasys' distributed architecture whereby the switching and control functions are embedded on each module. It supports Enterasys' next-generation modules called Distributed Forwarding Engines (DFEs). The DFEs couple wire-speed throughput with advanced intelligence to recognize and prioritize traffic flows automatically.

The SecureStack C2 supports IEEE standards for switching and provides QoS support for VoIP and real-time broadcast/multicast video. The Enterasys Networks SecureStack C2 switch model C2H124-48P used for compliance testing features 48 ports of non-blocking 10/100 Base-TX with PoE capability, four uplink ports supporting SFP (Small Form-factor Pluggable) GBICs and two integrated stacking ports.

The SecureStack B2 is an advanced Layer 2+ switch that supports IEEE standards for switching, provides QoS support for VoIP and video, and supports Layer 2/3/4 packet classification and marking based on a number of factors. The Enterasys Networks SecureStack B2 switch (model B2H124-48P) features 48 ports of 10/100 Base TX with PoE capability, four uplink ports supporting SFP (Small Form-factor Pluggable) GBICs and two integrated stacking ports.

The configuration in **Figure 1** shows a network consisting of the Avaya IP Office, Avaya 4600 IP Telephones, Infoblox DNSone and PCs connected to the Enterasys Networks Matrix N5, SecureStack C2 and SecureStack B2 switches. The Matrix N5 was used to provide Layer 3 routing. 802.1Q tagged trunks were used to uplink Layer 2 Virtual LAN (VLAN) traffic from the SecureStack C2 and SecureStack B2 switches to the Matrix N5's routing interfaces. See **Table 1** for detailed port configurations.

The tested configuration is shown in **Figure 1**.

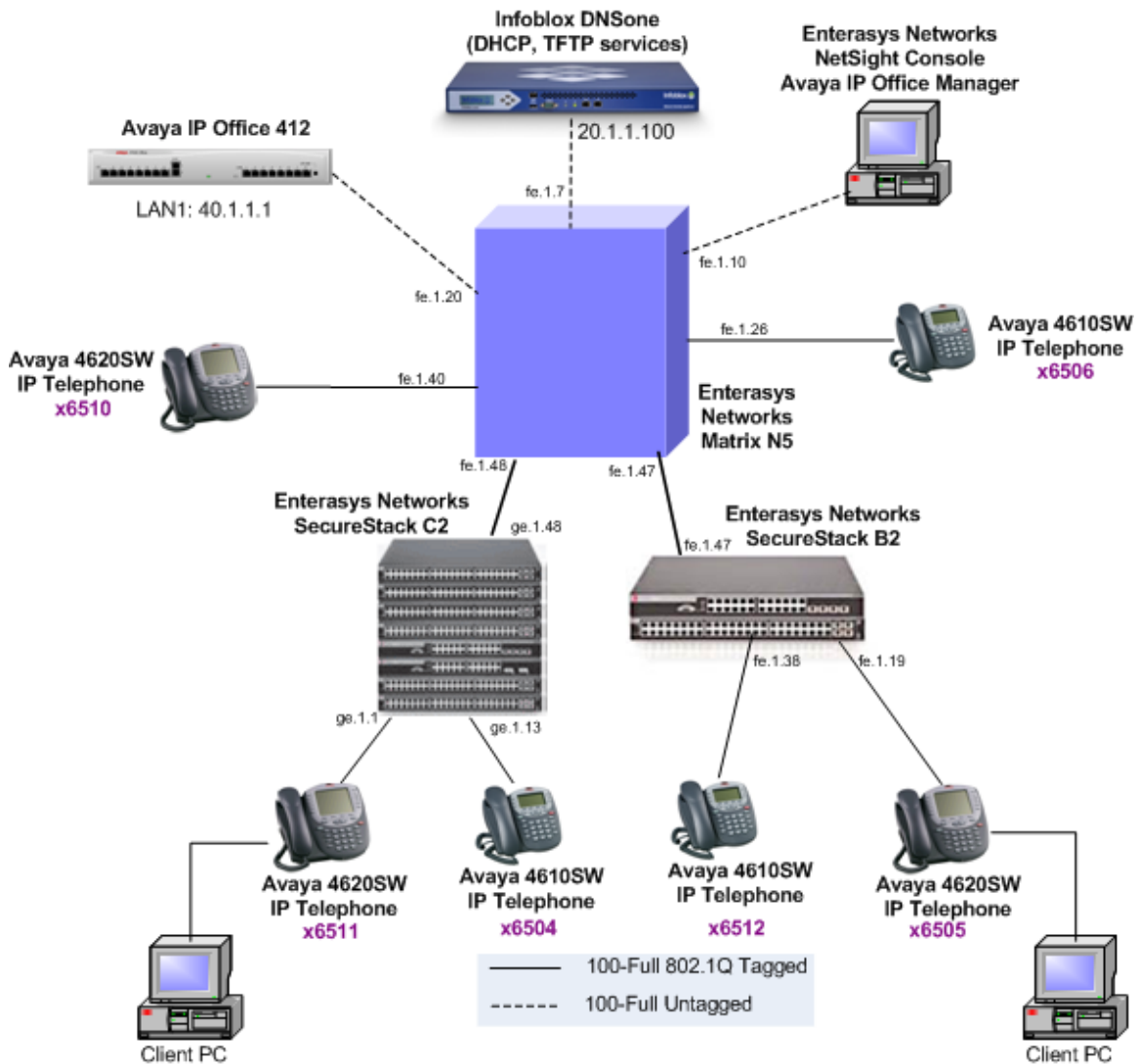


Figure 1 – Sample LAN Configuration

Device	Port	PVID	Port Priority	Static VLANs	IP Interface
Avaya IP Office 412	LAN1				40.1.1.1/24
Enterasys Networks NetSight Console & Avaya IP Office Manager PC	NIC				40.1.1.36/24
Infoblox DNSone	NIC				20.1.1.200/24
Enterasys Networks Matrix N5	fe.1.7	2			vlan2 – 20.1.1.254/24
Enterasys Networks Matrix N5	fe.1.10	2			vlan2 – 20.1.1.254/24

Device	Port	PVID	Port Priority	Static VLANs	IP Interface
Enterasys Networks Matrix N5	fe.1.20	4	6		vlan4 – 40.1.1.254/24
Enterasys Networks Matrix N5	fe.1.26			5 tag	vlan5 – 50.1.1.254/24
Enterasys Networks Matrix N5	fe.1.40			7 tag	vlan7 – 70.1.1.254/24
Enterasys Networks Matrix N5	fe.1.47			1 tag 2 tag 3 tag 4 tag 5 tag 6 tag 7 tag	vlan1 – 10.1.1.254/24 vlan2 – 20.1.1.254/24 vlan3 – 30.1.1.254/24 vlan4 – 40.1.1.254/24 vlan5 – 50.1.1.254/24 vlan6 – 60.1.1.254/24 vlan7 – 70.1.1.254/24
Enterasys Networks Matrix N5	fe.1.48			1 tag 2 tag 3 tag 4 tag 5 tag 6 tag 7 tag	vlan1 – 10.1.1.254/24 vlan2 – 20.1.1.254/24 vlan3 – 30.1.1.254/24 vlan4 – 40.1.1.254/24 vlan5 – 50.1.1.254/24 vlan6 – 60.1.1.254/24 vlan7 – 70.1.1.254/24
Enterasys Networks SecureStack C2	ge.1.1	1		6 tag	vlan1 – 10.1.1.254/24 vlan6 – 60.1.1.254/24
Enterasys Networks SecureStack C2	ge.1.13	3		4 tag	vlan3 – 30.1.1.254/24 vlan4 – 40.1.1.254/24
Enterasys Networks SecureStack C2	ge.1.48			1 tag 2 tag 3 tag 4 tag 5 tag 6 tag 7 tag	vlan1 – 10.1.1.254/24 vlan2 – 20.1.1.254/24 vlan3 – 30.1.1.254/24 vlan4 – 40.1.1.254/24 vlan5 – 50.1.1.254/24 vlan6 – 60.1.1.254/24 vlan7 – 70.1.1.254/24
Enterasys Networks SecureStack B2	fe.1.19	3		4 tag	vlan3 – 30.1.1.254/24 vlan4 – 40.1.1.254/24
Enterasys Networks SecureStack B2	fe.1.38	7			vlan7 – 70.1.1.254/24
Enterasys Networks SecureStack B2	ge.1.47			1 tag 2 tag 3 tag 4 tag 5 tag 6 tag 7 tag	vlan1 – 10.1.1.254/24 vlan2 – 20.1.1.254/24 vlan3 – 30.1.1.254/24 vlan4 – 40.1.1.254/24 vlan5 – 50.1.1.254/24 vlan6 – 60.1.1.254/24 vlan7 – 70.1.1.254/24

Table 1 – Connectivity Matrix

Table 2 shows the DHCP Option 176 string settings the Infoblox DNSOne DHCP server must provide for the Avaya 4600 IP Telephones to register with Avaya IP Office.

VLAN	Scope	Option 3 Router	Option 176 String (do not insert blanks in string)
VLAN1	10.1.1.0/24	10.1.1.254	L2Q=1,L2QVLAN=6
VLAN2	20.1.1.0/24	20.1.1.254	
VLAN3	30.1.1.0/24	30.1.1.254	L2Q=1,L2QVLAN=4
VLAN4	40.1.1.0/24	40.1.1.254	MCIPADD=40.1.1.1,MCPORT=1719,TFTPDIR=/ipoffice/,TFTPSRVR=20.1.1.100
VLAN5	50.1.1.0/24	50.1.1.254	MCIPADD=40.1.1.1,MCPORT=1719,TFTPDIR=/ipoffice/,TFTPSRVR=20.1.1.100
VLAN6	60.1.1.0/24	60.1.1.254	MCIPADD=40.1.1.1,MCPORT=1719,TFTPDIR=/ipoffice/,TFTPSRVR=20.1.1.100
VLAN7	70.1.1.0/24	70.1.1.254	MCIPADD=40.1.1.1,MCPORT=1719,TFTPDIR=/ipoffice/,TFTPSRVR=20.1.1.100

Table 2 – DHCP Option 176 by VLAN Information

2. Equipment and Software Validated

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

Equipment	Software/Firmware
Avaya IP Office 412	3.2(17)
Avaya IP400 Digital Module	3.2(17)
Avaya IP Office Manager	3.2(17)
Avaya 4600 Series IP Telephones	2.3
Enterasys Networks Matrix N5	05.14.04
Enterasys Networks SecureStack C2	03.01.52
Enterasys Networks SecureStack B2	01.01.41
Enterasys Networks NetSight Console	2.1
Infoblox DNSOne	3.2r1-1

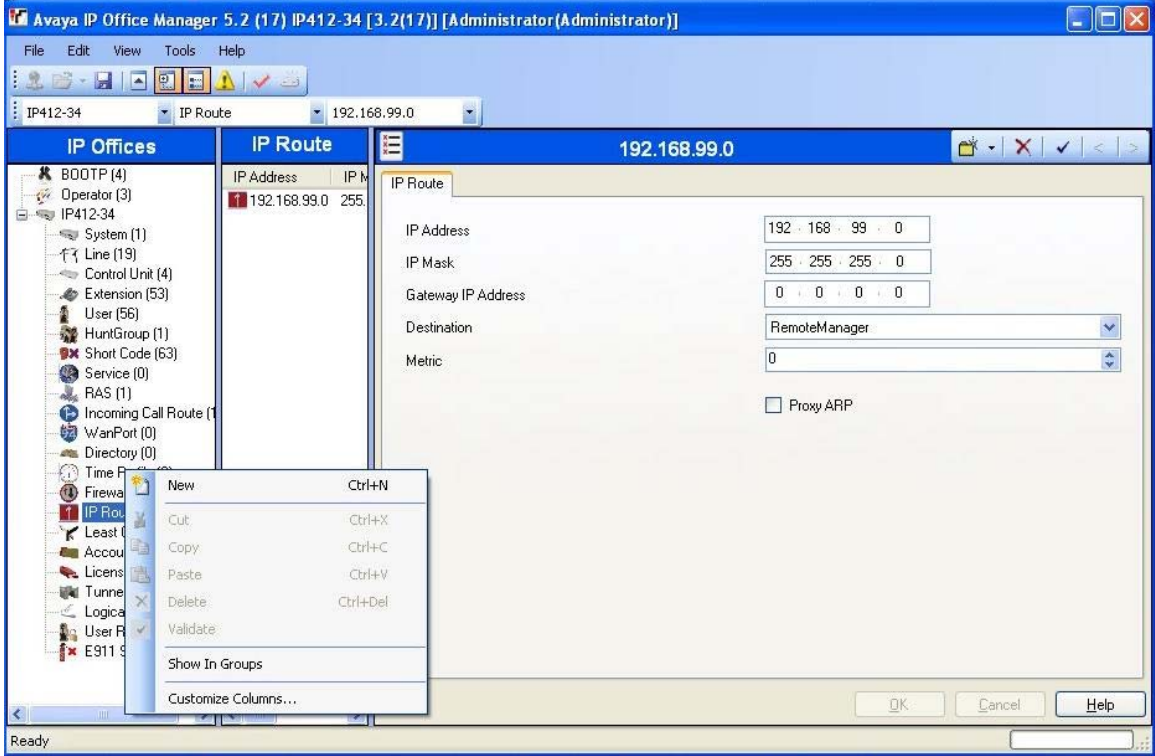
Table 3 – Equipment and Software / Firmware Versions Validated

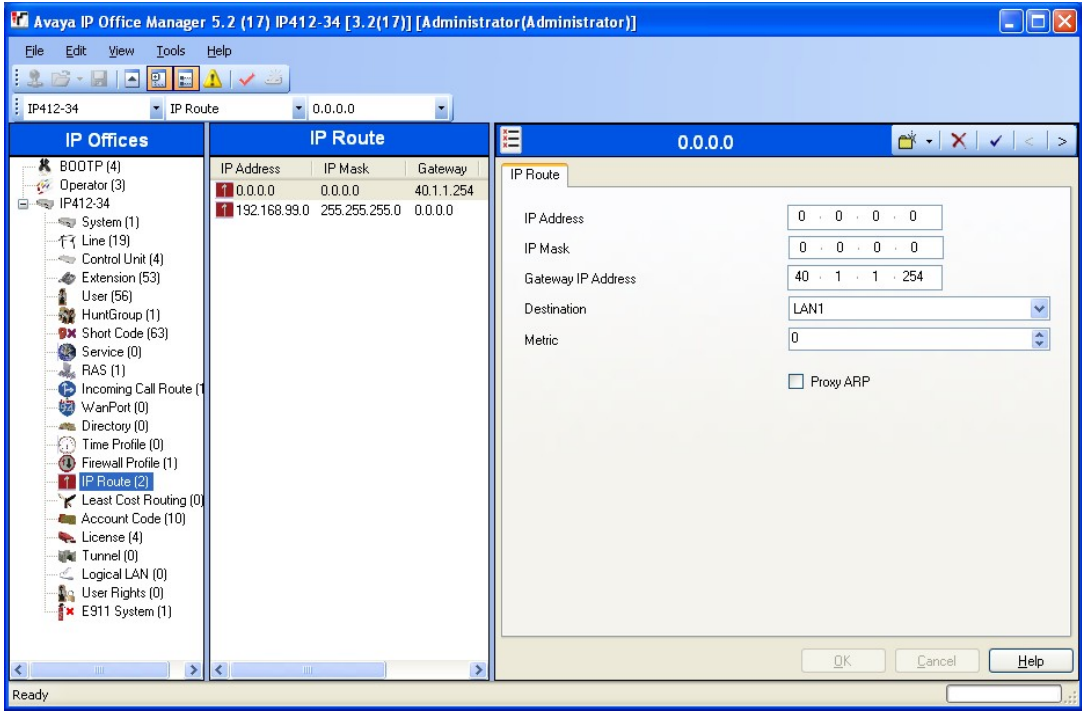
3. Configure Avaya IP Office

The information provided in this section describes the steps that are required for setting up Avaya IP Office for the configuration described in these Application Notes.

For all other provisioning information, please refer to the Avaya IP Office product documentation in reference [1].

Step	Description
1.	Log into the IP Office Manager PC and go to Start → Programs → IP Office → Manager to launch the Manager application.
2.	In the Manager window that appears, select File → Open to search for IP Office in the

Step	Description
	network.
3.	Log into IP Office using the appropriate login credentials to receive its configuration.
4.	<p>In the Manager window that appears, go to the left pane, right-click IP Route and select New in the menu popup that appears.</p>  <p>The screenshot shows the Avaya IP Office Manager 5.2 (17) interface. The title bar reads "Avaya IP Office Manager 5.2 (17) IP412-34 [3.2(17)] [Administrator/Administrator]". The main window is divided into three panes: "IP Offices", "IP Route", and "192.168.99.0". The "IP Offices" pane on the left contains a tree view with various system components. The "IP Route" pane in the middle shows a table with one entry: IP Address 192.168.99.0 and IP Mask 255.255.255.0. The "192.168.99.0" pane on the right shows configuration fields for IP Address, IP Mask, Gateway IP Address, Destination, and Metric. A context menu is open over the "IP Route" table, with the "New" option selected. The context menu includes options like "New", "Cut", "Copy", "Paste", "Delete", "Validate", "Show In Groups", and "Customize Columns...".</p>

Step	Description
5.	<p>In the right pane, set IP Address to <i>0.0.0.0</i>, set IP Mask to <i>0.0.0.0</i>, set Gateway IP Address to <i>40.1.1.254</i>, and select <i>LAN1</i> for Destination. Click OK. Note: This screen shot was taken after the OK button was clicked.</p> 
6.	<p>In the Manager window, select File → Save to send the new configuration back to the IP Office. Set the Reboot Mode to <i>Immediate</i> since the changes entered cannot be merged. Wait for the system to update. This completes configuration of Avaya IP Office.</p>

4. Configure Enterasys Networks Matrix N5 Switch

The Enterasys Networks Matrix N5 switch provides a web interface, a Command Line Interface (CLI) as well as the Enterasys Networks NetSight Console for administration. These Application Notes present administration via the CLI for configuring the Enterasys Networks Matrix N5 for this solution.

For all other provisioning information, please refer to Enterasys Networks product documentation in references [3], [4], and [5].

Step	Description
1.	<p>Create and assign tag values to applicable Virtual LANs (VLANs), assign IP interfaces to the VLANs and administer the target DHCP server for the DHCP relayed requests.</p> <pre>Matrix>Router1#config t</pre>

Step	Description
	<pre> Matrix>Router1(config-if)#interface vlan 1 Matrix>Router1(config-if(vlan1))#ip address 10.1.1.254 255.255.255.0 Matrix>Router1(config-if(vlan1))#ip helper-address 20.1.1.100 Matrix>Router1(config-if(vlan1))#no shutdown Matrix>Router1(config-if(vlan1))#exit Matrix>Router1(config-if)#interface vlan 2 Matrix>Router1(config-if(vlan2))#ip address 20.1.1.254 255.255.255.0 Matrix>Router1(config-if(vlan2))#ip helper-address 20.1.1.100 Matrix>Router1(config-if(vlan2))#no shutdown Matrix>Router1(config-if(vlan2))#exit Matrix>Router1(config-if)#interface vlan 3 Matrix>Router1(config-if(vlan3))#ip address 30.1.1.254 255.255.255.0 Matrix>Router1(config-if(vlan3))#ip helper-address 20.1.1.100 Matrix>Router1(config-if(vlan3))#no shutdown Matrix>Router1(config-if(vlan3))#exit Matrix>Router1(config-if)#interface vlan 4 Matrix>Router1(config-if(vlan4))#ip address 40.1.1.254 255.255.255.0 Matrix>Router1(config-if(vlan4))#ip helper-address 20.1.1.100 Matrix>Router1(config-if(vlan4))#no shutdown Matrix>Router1(config-if(vlan4))#exit Matrix>Router1(config-if)#interface vlan 5 Matrix>Router1(config-if(vlan5))#ip address 50.1.1.254 255.255.255.0 Matrix>Router1(config-if(vlan5))#ip helper-address 20.1.1.100 Matrix>Router1(config-if(vlan5))#no shutdown Matrix>Router1(config-if(vlan5))#exit Matrix>Router1(config-if)#interface vlan 6 Matrix>Router1(config-if(vlan6))#ip address 60.1.1.254 255.255.255.0 Matrix>Router1(config-if(vlan6))#ip helper-address 20.1.1.100 Matrix>Router1(config-if(vlan6))#no shutdown Matrix>Router1(config-if(vlan6))#exit Matrix>Router1(config-if)#interface vlan 7 Matrix>Router1(config-if(vlan7))#ip address 70.1.1.254 255.255.255.0 Matrix>Router1(config-if(vlan7))#ip helper-address 20.1.1.100 Matrix>Router1(config-if(vlan7))#no shutdown Matrix>Router1(config-if(vlan7))#exit Matrix>Router1(config-if)#exit </pre>
2.	<p>Configure interface information for the switch.</p> <pre> Matrix>Router1#set ip address 20.1.1.1 mask 255.255.255.0 Matrix>Router1#set ip route default 20.1.1.254 </pre>
3.	<p>Assign VLANs to ports for Infoblox DNSone, Enterasys Networks Netsight Console PC, and Avaya IP Office as listed in Table 1.</p> <pre> Matrix>Router1#clear vlan egress 1 fe.1.7;fe.1.10;fe.1.20;fe.1.26; fe.1.40 Matrix>Router1#set port vlan fe.1.7 2 Matrix>Router1#set port vlan fe.1.10 2 Matrix>Router1#set port vlan fe.1.20 4 Matrix>Router1#set vlan egress 2 fe.1.7;fe.1.10 untagged Matrix>Router1#set vlan egress 4 fe.1.20 untagged Matrix>Router1#set vlan dynamic egress 1 enable </pre>

Step	Description
4.	Statically assign the VLANs to ports connected to Avaya 4600 IP Telephones as listed in Table 1 . <pre>Matrix>Router1#set port vlan fe.1.26 5 Matrix>Router1#set port vlan fe.1.40 7 Matrix>Router1#set vlan egress 5 fe.1.26 tagged Matrix>Router1#set vlan egress 7 fe.1.40 tagged</pre>
5.	Statically assign VLANs to neighboring Secure Stack C2 port as listed in Table 1 . <pre>Matrix>Router1#set vlan egress 1 fe.1.48 tagged Matrix>Router1#set vlan egress 2 fe.1.48 tagged Matrix>Router1#set vlan egress 3 fe.1.48 tagged Matrix>Router1#set vlan egress 4 fe.1.48 tagged Matrix>Router1#set vlan egress 5 fe.1.48 tagged Matrix>Router1#set vlan egress 6 fe.1.48 tagged Matrix>Router1#set vlan egress 7 fe.1.48 tagged</pre>
6.	Statically assign VLANs to neighboring Secure Stack B2 port as listed in Table 1 . <pre>Matrix>Router1#set vlan egress 1 fe.1.47 tagged Matrix>Router1#set vlan egress 2 fe.1.47 tagged Matrix>Router1#set vlan egress 3 fe.1.47 tagged Matrix>Router1#set vlan egress 4 fe.1.47 tagged Matrix>Router1#set vlan egress 5 fe.1.47 tagged Matrix>Router1#set vlan egress 6 fe.1.47 tagged Matrix>Router1#set vlan egress 7 fe.1.47 tagged</pre>
7.	Configure Avaya IP Office port with priority 6 (high). <pre>Matrix>Router1#set port priority fe.1.20 6</pre>
8.	Save the configuration. This completes configuration of the Matrix N5. <pre>Matrix>Router1#show config outfile slot1/n5config</pre>

5. Configure Enterasys Networks SecureStack C2 Switch

The SecureStack C2 switch provides a web interface, a Command Line Interface (CLI) as well as the Enterasys Networks NetSight Console for administration. These Application Notes present administration via the CLI for configuring the SecureStack C2 for this solution.

For all other provisioning information, please refer to Enterasys Networks product documentation in references [3], [4], and [5].

Step	Description
1.	Create applicable Virtual LANs. <pre>C2 (su)->set vlan create 2 C2 (su)->set vlan create 3 C2 (su)->set vlan create 4 C2 (su)->set vlan create 5 C2 (su)->set vlan create 6 C2 (su)->set vlan create 7</pre>
2.	Configure interface information for the switch. <pre>C2 (su)->set ip address 20.1.1.3 mask 255.255.255.0 gateway 20.1.1.254</pre>

Step	Description
3.	Statically assign the VLANs to ports connected to Avaya 4600 IP Telephones as listed in Table 1 . C2 (su)-> clear vlan egress 1 ge.1.13 C2 (su)-> set port vlan ge.1.13 4 C2 (su)-> set vlan egress 6 ge.1.1 tagged C2 (su)-> set vlan egress 4 ge.1.13 tagged
4.	Statically assign VLANs to neighboring Matrix N5 port as listed in Table 1 . C2 (su)-> set vlan egress 1 ge.1.48 tagged C2 (su)-> set vlan egress 2 ge.1.48 tagged C2 (su)-> set vlan egress 3 ge.1.48 tagged C2 (su)-> set vlan egress 4 ge.1.48 tagged C2 (su)-> set vlan egress 5 ge.1.48 tagged C2 (su)-> set vlan egress 6 ge.1.48 tagged C2 (su)-> set vlan egress 7 ge.1.48 tagged
5.	Save the configuration. This completes configuration of the SecureStack C2. C2 (su)-> show config outfile configs/c2config

6. Configure Enterasys Networks SecureStack B2 Switch

The SecureStack B2 switch provides a web interface, a Command Line Interface (CLI) as well as the Enterasys Networks NetSight Console for administration. These Application Notes present administration via the CLI for configuring the SecureStack B2 for this solution.

For all other provisioning information, please refer to Enterasys Networks product documentation in references [3], [4], and [5].

Step	Description
1.	Create applicable Virtual LANs. B2 (su)-> set vlan create 2 B2 (su)-> set vlan create 3 B2 (su)-> set vlan create 4 B2 (su)-> set vlan create 5 B2 (su)-> set vlan create 6 B2 (su)-> set vlan create 7
2.	Configure interface information for the switch. B2 (su)-> set ip address 20.1.1.2 mask 255.255.255.0 gateway 20.1.1.254
3.	Statically assign the VLANs to ports connected to Avaya 4600 IP Telephones as listed in Table 1 . B2 (su)-> clear vlan egress 1 fe.1.19;fe.1.38 B2 (su)-> set port vlan fe.1.19 3 B2 (su)-> set port vlan fe.1.38 7 B2 (su)-> set vlan egress 4 fe.1.19 tagged B2 (su)-> set vlan egress 7 fe.1.38 untagged
4.	Enable GVRP (GARP VLAN Registration Protocol) to neighboring Matrix N5 switch. GVRP prunes trunk links so that only active VLANs will be sent across the trunk connection. B2 (su)-> set gvrp enable fe.1.47
5.	Save the configuration. This completes configuration of the SecureStack B2. B2 (su)-> show config outfile configs/b2config

7. Configure Infoblox DNSone (DHCP/TFTP Server)

The requirements for the DHCP server used in this configuration are to provide two scopes to support voice and data hosts on different VLANs simultaneously. For information on how to configure the Infoblox DNSone (20.1.1.100/24) to provide DHCP and TFTP services for this configuration, please refer to the Application Notes in reference [2]. A summary of the information required for the configuration in these Application Notes follows below.

The “DataEdge” scope includes the appropriate default gateway option 003 and custom option 176, which informs Avaya 4600 IP Telephones attempting to boot on native PVID 1 that the Avaya 4600 IP Telephones must tag on VLAN 6 and rediscover an appropriate IP address on the newly assigned voice VLAN.

```
Scope [10.1.1.0] DataEdge
  Address Pool
    Start Address = 10.1.1.120
    End Address = 10.1.1.130
    Option 003 Router = 10.1.1.254
    Option 176 IP Telephone = L2Q=1,L2QVLAN=6
```

The “VoiceEdge” scope includes the default gateway option 003 and the custom 176 option, which informs Avaya 4600 IP Telephones of the Avaya IP Office 412 Server, registration port and TFTP server IP address.

```
Scope [60.1.1.0] VoiceEdge
  Address Pool
    Start Address = 60.1.1.120
    End Address = 60.1.1.130
    Option 003 Router = 60.1.1.254
    Option 176 IP Telephone =
      MCIPADD=40.1.1.1,MCPORT=1719,TFTPDIR=/ipoffice/,TFTPSRVR=20.1.1.100
```

A similar arrangement was used for data VLAN 3 with voice VLAN 4. VLAN 5 and VLAN 7 are configured as VoiceEdge VLANs.

8. Interoperability Compliance Testing

The Interoperability Compliance Test included feature functionality and performance testing. Feature functionality testing examined the Enterasys Networks Matrix N5, SecureStack C2 and SecureStack B2 switches ability to forward Voice over IP (VoIP) signaling, audio and data without any impact on voice quality. Performance tests verified that the configuration remained stable under load.

8.1. General Test Approach

Feature functionality testing was performed manually. Calls were made between stations that were registered to Avaya IP Office. While calls were being made, a protocol analyzer was used to monitor call signaling and audio flows to ensure that proper QoS markers at Layer 2 and

Layer 3 were being relayed. Performance testing was done using a data traffic generator to stress the QoS functionality of the devices over a one-hour period.

8.2. Test Results

All feature functionality and performance test cases passed successfully. A one-hour test was conducted with UDP traffic saturating the 100 Mbps LAN link between the Matrix N5 switch and connected SecureStack C2 and B2 switches. Various calls were placed between phones without any call loss or voice quality degradation.

9. Verification Steps

- Verify connectivity from the SecureStack C2 and SecureStack B2 switches to the Matrix N5 using ping command.
- Verify that the Matrix N5 switch auto negotiates speed and duplex with Avaya IP Office.
- Verify that the IP Telephone tags on the voice VLAN based on Option 176 values.
- Verify that the IP Telephone successfully completes the registration process.
- Place IP-to-IP calls and verify audio quality.
- Place IP-to-Digital calls and verify audio quality.

10. Support

For technical support on the Enterasys Networks Matrix N5, Enterasys Networks SecureStack C2 and Enterasys Networks SecureStack B2 Switches, contact the Enterasys Networks Tech Support at 800-872-8440. Technical support email can be sent to support@enterasys.com.

11. Conclusion

These Application Notes describe administration steps, which allowed the Enterasys Networks Matrix N5, Enterasys Networks SecureStack C2, and Enterasys Networks SecureStack B2 switches to interoperate with Avaya IP Office for the purposes of providing basic network connectivity and Layer 2 Quality of Service (QoS) via 802.1p prioritization. Features and functionality were successfully validated.

12. Additional References

Available from Avaya:

[1] Avaya IP Office 3.2 Manager, 15-601011, Issue 18g (28th June 2006)

[2] Application Notes for Infoblox DNSone in an Avaya IP Office IP Telephony Infrastructure – Issue 1.0, March 2006

Available from Enterasys:

[3] Enterasys Networks Matrix N Standalone (NSA) Platinum Series Configuration Guide, Firmware Version 5.14.xx

[4] Enterasys Networks SecureStack C2 Configuration Guide, Firmware Version 3.01.xx

[5] Enterasys Networks SecureStack B2 Configuration Guide, Firmware Version 1.01.xx

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