



DEFENSE INFORMATION SYSTEMS AGENCY

P. O. BOX 4502
ARLINGTON, VIRGINIA 22204-4502

IN REPLY
REFER TO: Joint Interoperability Test Command (JTE)

30 Apr 10

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Brocade FastIron CX (FCX) Series with Release 7.0

References: (a) DoD Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2005
(b) CJCSI 6212.01E, "Interoperability and Supportability of Information Technology and National Security Systems," 15 December 2008
(c) through (e), see Enclosure 1

1. References (a) and (b) establish the Defense Information Systems Agency (DISA), Joint Interoperability Test Command (JITC), as the responsible organization for interoperability test certification.

2. The Brocade FCX648S-High Power over Ethernet (HPOE) with Release 7.0 is hereinafter referred to as the system under test (SUT). The SUT met the interface and functional requirements for an Assured Services Local Area Network (ASLAN) Layer 2 access switch as described in Reference (c). The SUT is certified as interoperable for joint use within the Defense Switched Network (DSN) with other ASLAN components listed on the Unified Capabilities (UC) Approved Products List (APL) with the following interfaces: 10000/1000 Base SX/LX and 10/100/1000 BaseT. Testing was conducted using test procedures derived from Reference (d). The following Brocade FXC systems employ the same software and similar hardware as the SUT: FCX 624S-HPOE, FCX 648S, FCX 624S, FCX 624S-F, FCX 648, and FXC 624. The JITC analysis determined these systems to be functionally identical to the SUT for interoperability certification purposes and they are also certified for joint use.

The SUT is certified to support DSN Assured Services over Internet Protocol. If a component meets the minimum requirements for deployment in an ASLAN, it also meets the lesser requirements for deployment in a non-ASLAN. Non-ASLANs are "commercial grade" and provide support to Command and Control (C2) (ROUTINE only calls), (C2(R)), or non-C2 voice subscribers. The SUT is certified for joint use deployment in a non-ASLAN for C2R and non-C2 traffic. When deployed in a non-ASLAN, the SUT may also be used to receive all levels of precedence, but is limited to supporting calls that are originated at ROUTINE precedence only. Non-ASLANs do not meet the availability or redundancy requirements for C2 or Special C2 users and therefore are not authorized to support precedence calls originated above ROUTINE.

Testing of the SUT did not include video services or data applications; however, simulated preferred data, best effort data, and video traffic was generated during testing to determine the SUT's ability to prioritize and properly queue voice media and signaling traffic. No other

configurations, features, or functions, except those cited within this document, are certified by the JITC. This certification expires upon changes that affect interoperability, but no later than three years from the date of Defense Information Assurance (IA)/Security Accreditation Working Group (DSAWG) accreditation.

3. This finding is based on interoperability testing conducted by JITC, review of the vendor's Letters of Compliance (LoC), and DSAWG accreditation. Interoperability testing was conducted by JITC at the Global Information Grid Network Test Facility, Fort Huachuca, Arizona, from 7 through 18 December 2009. Review of the vendor's LoC was completed on 20 January 2010. DSAWG granted accreditation on 9 March 2010 based on the security testing completed by DISA-led IA test teams and published in a separate report, Reference (e).

4. Table 1 provides the SUT's interface status. The SUT capability and functional requirements are listed in Table 2.

Table 1. SUT Interface Status

Interface	Applicability	CRs/FRs (See note 1.)	Status
	Access		Access
Network Management Interfaces for Layer 2 Access Switches			
EIA/TIA (Serial) 232	R	EIA/TIA-232	Met
IEEE 802.3i (10BaseT UTP)	C	1, 6-15, 18-28, 31, 32-36, 49	Not Tested ²
IEEE 802.3u (100BaseT UTP)	C	1, 6-15, 18-28, 31, 32-36, 49	Met
IEEE 802.3ab (1000BaseT UTP)	C	1, 6-15, 18-28, 31, 32-36, 49	Met
Uplink Interfaces for Layer 2 Access Switches			
IEEE 802.3u (100BaseT UTP)	R	1-15, 16, 18-24, 28-31, 40, 49	Met
IEEE 802.3u (100BaseFX)	C	1-6, 11, 16, 18-24, 28-31, 40-41, 49	Met
IEEE 802.3ab (1000BaseT UTP)	C	1-16, 18-24, 28-31, 40, 49	Met
IEEE 802.3z (1000BaseX Fiber)	C	1-5, 8-16, 18-24, 28-31, 40, 49	Met
IEEE 802.3ae (10GBaseX)	C	1-5, 8-16, 18, 19, 40-41, 49	Met
Access Interfaces for Layer 2 Access Switches			
IEEE 802.3i (10BASET UTP)	R	1-15, 18-24, 28-41, 49	Met
IEEE 802.3u (100BaseT UTP)	R	1-15, 18-24, 28-41, 49	Met
IEEE 802.3u (100BaseFX)	C	1-6, 11, 18-24, 28-31, 49	Met
IEEE 802.3ab (1000BaseT UTP)	C	1-15, 18-24, 28-41, 49	Met
IEEE 802.3z (1000BaseX Fiber)	C	1-6, 11, 18-24, 28-31, 49	Met
Generic Requirements for all Interfaces			
Generic Requirements not associated with specific interfaces	R	30-32, 35, 36, 40, 69-71	Met
DoD IPv6 Profile Requirements	R	UCR Section 5.3.5.5 (See note 3.)	Met
Security	R	UCR Sections 5.3.1.3.8, 5.3.1.5, 5.3.1.6, and 5.4 (See note 4.)	Met

Table 1. SUT Interface Status (continued)

NOTES:			
1	The SUT's specific capability and functional requirement ID numbers depicted in the CRs/FRs column can be cross-referenced in Table 2. These requirements are for the following Brocade FastIron switch models, which are certified in the Layer 2 access layer: <u>FCX 648S-HPOE</u> , FCX 624S-HPOE, FCX 648S, FCX 624S, FCX 624S-F, FCX 648, and FCX 624. The JITC tested the devices that are bolded and underlined. The other devices listed that are not bolded or underlined are in the same family series as the SUT were not tested; however, they utilize the same OS software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes. Although the <u>FCX 648S-HPOE</u> , FCX 624S-HPOE, FCX 648S, FCX 624S, and FCX 624S-F are stackable switches, the SUT was not tested in a stacked configuration. Therefore, none of the certified switches are certified in a stacked configuration.		
2	This interface is not offered by the SUT, and is not a required interface.		
3	IPv6 requirements are met by both testing and a vendor letter of compliance.		
4	Security testing is accomplished via DISA-led Information Assurance test teams and published in a separate report, Reference (e).		
LEGEND:			
802.3ab	1000BaseT Gbps Ethernet over twisted pair at 1 Gbps (125 Mbps)	EIA-232	Standard for defining the mechanical and electrical characteristics for connecting DTE and DCE data communications devices
802.3ae	10 Gbps Ethernet	F	fiber
802.3i	10BaseT Mbps over twisted pair	FCX	FastIron CX
802.3u	Standard for carrier sense multiple access with collision detection at 100 Mbps	FRs	Functional Requirements
802.3z	Gigabit Ethernet Standard	Gbps	Gigabits per second
1000BaseFX	1000 Mbps Ethernet over fiber	HPoE	Power over Ethernet
1000BaseT	1000 Mbps (Baseband Operation, Twisted Pair) Ethernet	ID	Identification
ASLAN	Assured Services Local Area Network	IEEE	Institute of Electrical and Electronics Engineers
C	Conditional	IPv6	Internet Protocol version 6
CRs	Capability Requirements	JITC	Joint Interoperability Test Command
DCE	Data Circuit-terminating Equipment	Mbps	Megabits per second
DISA	Defense Information Systems Agency	NA	Not Applicable
DoD	Department of Defense	OS	Operating System
DTE	Data Terminal Equipment	R	Required
EIA	Electronic Industries Alliance	S	stackable
		SUT	System Under Test
		TIA	Telecommunications Industry Association
		UCR	Unified Capabilities Requirements
		UTP	Unshielded Twisted Pair

Table 2. SUT Capability and Functional Requirements

ID	Requirement (See note.)	UCR Reference
1	ASLAN components can have no single point of failure for >96 users for C2 and Special C2 users. Non-ASLAN components can have a single point of failure for C2(R) and non-C2 users. (R)	5.3.1.2.1, 5.3.1.7.7
2	Non-blocking of any voice or video traffic at 50%. (R)	5.3.1.3
3	Maximum of 1 ms of jitter for all ASLAN components. (R)	5.3.1.3
4	Maximum of 0.02% packet loss for core and distribution layer components and 0.01% for access layer components. (R)	5.3.1.3
5	Maximum of 2 ms latency for core and distribution layer components and 2 ms for access layer components. (R)	5.3.1.3
6	100 Mbps IAW IEEE 802.3u and 1 Gbps IAW IEEE 802.3z for core and distribution layer components and 10 Mbps IAW IEEE 802.3i and 100 Mbps IAW IEEE 802.3u for access layer components. (R)	5.3.1.3.1
7	Force mode and auto-negotiation IAW IEEE 802.3, filtering IAW RFC 1812, and flow control IAW IEEE 802.3x. (R)	5.3.1.3.2
8	Auto-negotiation IAW IEEE 802.3. (R)	5.3.1.3.2
9	Force mode IAW IEEE 802.3. (R)	
10	Flow control IAW IEEE 802.3x. (R)	
11	Filtering IAW RFC 1812. (R)	
12	Link Aggregation IAW IEEE 802.3ad (output/egress ports only). (R)	
13	Spanning Tree Protocol IAW IEEE 802.1D. (R)	
14	Multiple Spanning Tree IAW IEEE 802.1s. (R)	
15	Rapid Reconfiguration of Spanning Tree IAW IEEE 802.1w. (R)	
16	LACP link Failover and Link Aggregation IAW IEEE 802.3ad uplink ports only). (R)	5.3.1.3.2, 5.3.1.7.7.1
17	Class of Service Marking: Layer 3 DSCPs IAW RFC 2474. (R) Layer 2 3-bit user priority field of the IEEE 802.1Q 2-byte TCI field. (C)	5.3.1.3.3
18	VLAN Capabilities IAW IEEE 802.1Q. (R)	5.3.1.3.4

Table 2. SUT Capability and Functional Requirements (continued)

ID	Requirement (See note.)	UCR Reference	
19	Protocols IAW DISR profile (IPv4 and IPv6). IPv4 (R: LAN Switch, Layer 2 Switch); IPv6 (R: LAN Switch, C: Layer 2 Switch). Note: Layer 2 switch is required to support only RFC 2460, 5095, 2464, and be able to queue packets based on DSCPs in accordance with RFC 2474.	5.3.1.3.5	
20	QoS Features	5.3.1.3.6	
21			Shall support minimum of 4 queues. (R)
22			Must be able to assign VLAN tagged packets to a queue. (R)
23			Support DSCP PHBs per RFCs 2474, 2494, 2597, 2598, and 3246. (R: LAN Switch). Note: Layer 2 switch is required to support RFC 2474 only.
24			Support a minimum of one of the following: Weighted Fair Queuing (WFQ) IAW RFC 3662, Priority Queuing (PQ) IAW RFC 1046, or Class-Based WFQ IAW RFC 3366. (R)
25	Must be able to assign a bandwidth or percent of traffic to any queue. (R)		
26	Network Monitoring	5.3.1.3.7	
27			SNMP IAW RFC's 1157, 2206, 3410, 3411, 3412, 3413 and 3414. (R)
27			SNMP traps IAW RFC1215. (R)
27	Remote monitoring IAW RFC1281 and Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model IAW RFC 3826. (R)		
28	Product Requirements Summary IAW UCR2008 Table 5.3.1-5. (R)	5.3.1.3.9	
29	E2E Performance (Voice)	5.3.1.4.1	
			No more than 5 ms Latency over any 5-minute period measured under congestion. (R)
			No more than 3 ms Jitter over any 5-minute period measured under congestion. (R)
30	E2E Performance (Video)	5.3.1.4.2	
			Packet loss not to exceed engineered (queuing) parameters over any 5-minute period under congestion. (R)
			No more than 30 ms Latency over any 5-minute period measured under congestion. (R)
31	E2E Performance (Data)	5.3.1.4.3	
			No more than 30 ms Jitter over any 5-minute period measured under congestion. (R)
			Packet loss not to exceed engineered (queuing) parameters over any 5-minute period under congestion. (R)
32	Configuration Control for ASLAN and Non-ASLAN. (R)	5.3.1.6.1	
33	Operational Controls for ASLAN and Non-ASLAN. (R)	5.3.1.6.2	
34	Performance Monitoring for ASLAN and Non-ASLAN. (R)	5.3.1.6.3	
35	Alarms for ASLAN and Non-ASLAN. (R)	5.3.1.6.4	
36	Reporting for ASLAN and Non-ASLAN. (R)	5.3.1.6.5	
37-43	Redundancy	5.3.1.7.7	
			Redundant Power Supplies. (Required on standalone redundant products.)
			Chassis Failover. (Required on standalone redundant products.)
			Switch Fabric Failover. (Required on standalone redundant products.)
			Non-LACP Link Failover.(R)
			Fiber Blade Failover. (R)
			Stack Failover. (C) (Required if the stack supports more than 96 users.)
CPU (routing engine) blade Failover. (R)			
49	Support IPv6 packets over Ethernet IAW RFC2464. (R)	5.3.5.4	
76	Engineering Requirements: Physical Media for ASLAN and Non-ASLAN. (R) (Site requirement)	5.3.1.7.1	
77	Battery Back up two hours for non-ASLAN components and eight hours for ASLAN components. (R) (Site requirement)	5.3.1.7.5	
78	Availability of 99.999 percent (Special C2), and 99.997 percent (C2) for ASLAN (R), and 99.9 percent (non-C2 and C2(R) for non-ASLAN. (R) (Site requirement)	5.3.1.7.6	
79	Port-Based Access Control IAW IEEE 802.1x (R)	5.3.1.3.2	
80	Secure methods for network configuration. SSH2 instead of Telnet and support RFCs 4251-4254. Must use HTTPS instead of http, and support RFCs 2660 and 2818 for ASLAN and Non-ASLAN. (R)	5.3.1.6	
81	Security (R)	5.3.1.3.8	
82	Must meet IA requirements IAW UCR 2008 Section 5.4 for ASLAN and non-ASLAN. (R)	5.3.1.5	

NOTE: All requirements are for core, distribution, and access layer components unless otherwise specified.

Table 2. SUT Capability and Functional Requirements (continued)

LEGEND:					
ASLAN	Assured Services Local Area Network	http	Hypertext Transfer Protocol	ms	millisecond
		HTTPS	Hyper Text Transfer Protocol, Secure	MTU	Maximum Transmission Unit
C2	Command and Control			PHB	Per Hop Behavior
C2(R)	Command and Control ROUTINE only	Gbps	Gigabits per second	PQ	Priority Queuing
		IA	Information Assurance	QoS	Quality of Service
CPU	Central Processing Unit	IAW	In Accordance with	RFC	Request for Comments
DHCP	Dynamic Host Configuration Protocol	ID	Identification	SNMP	Simple Network Management Protocol
		IEEE	Institute Of Electrical and Electronics Engineers	SSH2	Secure Shell Version 2
DISR	Department of Defense Information Technology Standards Registry	IPv4	Internet Protocol Version 4	SUT	System Under Test
		IPv6	Internet Protocol Version 6	TCI	Tag Control Information
DSCP	Differentiated Services Code Point	LACP	Link Aggregation Control Protocol	UCR	Unified Capabilities Requirements
		LAN	Local Area Network		
E2E	End to End	LS	LAN Switch	VLAN	Virtual Local Area Network
HMAC	Hash-based Message Authentication Code	Mbps	Megabits per second	WFQ	Weighted Fair Queuing

5. No detailed test report was developed in accordance with the Program Manager’s request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at <https://stp.fhu.disa.mil>. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at <http://jit.fhu.disa.mil> (NIPRNet), or <http://199.208.204.125> (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at <http://jitc.fhu.disa.mil/tssi>. Due to the sensitivity of the information, the Information Assurance Accreditation Package (IAAP) that contains the approved configuration and deployment guide must be requested directly through government civilian or uniformed military personnel from the Unified Capabilities Certification Office (UCCO), e-mail: ucco@disa.mil.

6. The JITC point of contact is Mr. Edward Mellon, DSN 879-5159, commercial (520) 538-5159, FAX DSN 879-4347, or e-mail to Edward.Mellon@disa.mil. The JITC’s mailing address is P.O. Box 12798, Fort Huachuca, AZ 85670-2798. The Tracking Number for the SUT is 0904209.

FOR THE COMMANDER:

2 Enclosures a/s


for RICHARD A. MEADOR
Chief
Battlespace Communications Portfolio

JITC Memo, JTE, Special Interoperability Test Certification of the Brocade FastIron CX (FCX) Series with Release 7.0

Distribution (electronic mail):

Joint Staff J-6

Joint Interoperability Test Command, Liaison, TE3/JT1

Office of Chief of Naval Operations, CNO N6F2

Headquarters U.S. Air Force, Office of Warfighting Integration & CIO, AF/XCIN (A6N)

Department of the Army, Office of the Secretary of the Army, DA-OSA CIO/G-6 ASA (ALT), SAIS-IOQ

U.S. Marine Corps MARCORSSYSCOM, SIAT, MJI Division I

DOT&E, Net-Centric Systems and Naval Warfare

U.S. Coast Guard, CG-64

Defense Intelligence Agency

National Security Agency, DT

Defense Information Systems Agency, TEMC

Office of Assistant Secretary of Defense (NII)/DOD CIO

U.S. Joint Forces Command, Net-Centric Integration, Communication, and Capabilities Division, J68

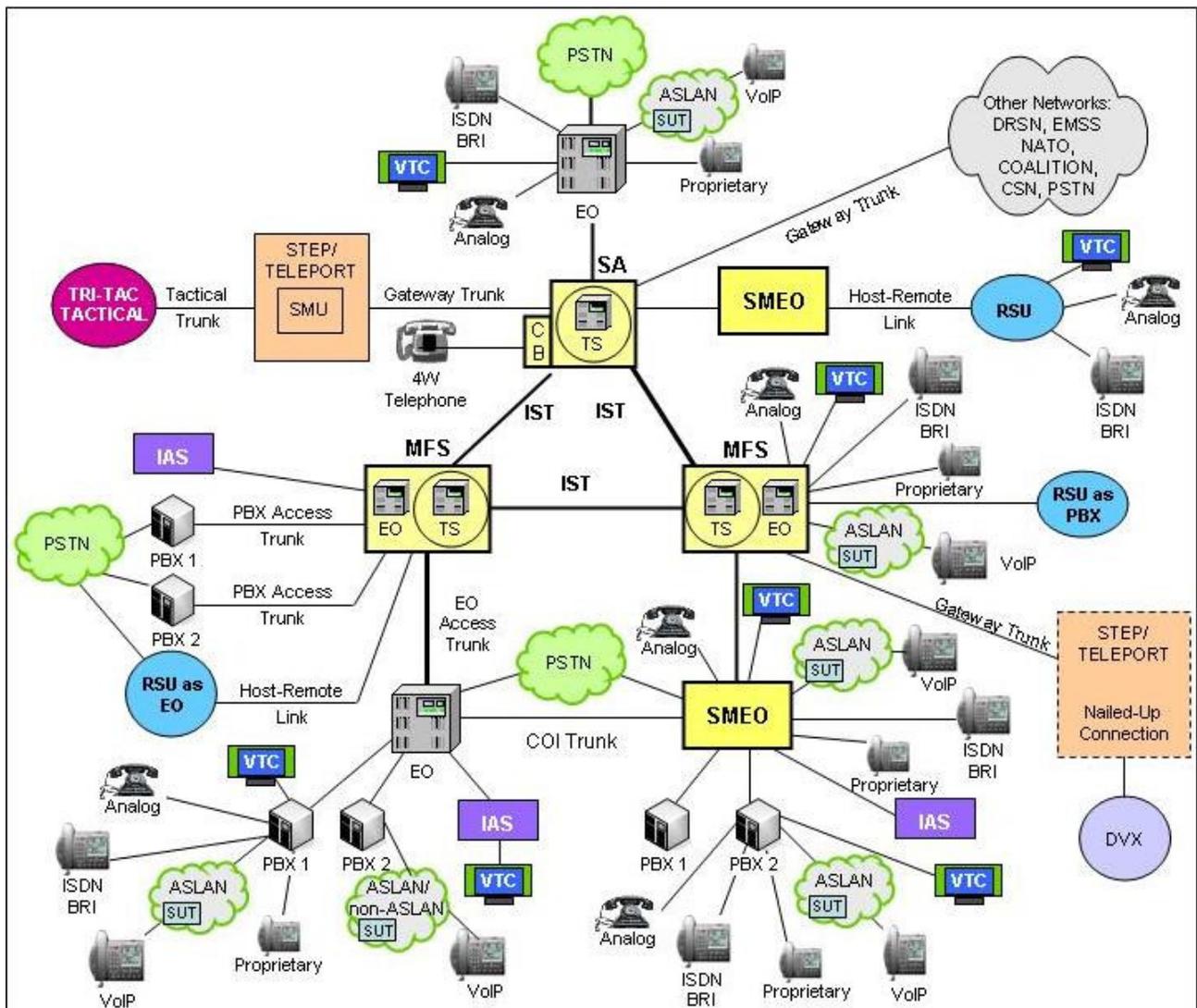
Defense Information Systems Agency, GS23

ADDITIONAL REFERENCES

- (c) Office of the Assistant Secretary of Defense, "Department of Defense Unified Capabilities Requirements 2008 Change 1," 22 January 2010
- (d) Joint Interoperability Test Command, "Defense Switched Network Generic Switch Test Plan (GSTP), Change 2," 2 October 2006
- (e) Joint Interoperability Test Command, "Information Assurance (IA) Assessment of Brocade FastIron (F)CX648S-High Power over Ethernet (HPoE) Release (Rel.) 7.0 (Tracking Number 0923905)," 4 March 2010

CERTIFICATION TESTING SUMMARY

- 1. SYSTEM TITLE.** Brocade FastIron CX (FCX) Series with Release 7.0; hereinafter referred to as the system under test (SUT).
- 2. PROPONENT.** Headquarters United States Army Information Systems Engineering Command (HQUSAISEC).
- 3. PROGRAM MANAGER.** Gary Kitsmiller, AMSEL-IE-IS, Building 53301 Arizona Street, Fort Huachuca, Arizona, 85613-5300, e-mail: gary.kitsmiller@us.army.mil.
- 4. TESTER.** Joint Interoperability Test Command (JITC), Fort Huachuca, Arizona.
- 5. SYSTEM UNDER TEST DESCRIPTION.** The SUT is used to transport voice signaling and media as part of an overall Voice over Internet Protocol (VoIP) system. The SUT provides availability, security, and Quality of Service (QoS) to meet the operational requirements of the network and Assured Services for the warfighter. The SUT is certified as a layer 2 access switch and is interoperable for joint use with other Assured Services Local Area Network (ASLAN) components listed on the Unified Capabilities (UC) Approved Products List (APL) with the following interfaces: 10000/1000 Base SX/LX and 10/100/1000 BaseT. The Brocade FCX648S-HPOE was the system tested; however the following Brocade FXC systems employ the same software and similar hardware as the SUT: FCX 624S-HPOE, FCX 648S, FCX 624S, FCX 624S-F, FCX 648, and FXC 624. The JITC analysis determined these systems to be functionally identical to the SUT for interoperability certification purposes.
- 6. OPERATIONAL ARCHITECTURE.** The Defense Switched Network (DSN) architecture is a two-level network hierarchy consisting of DSN backbone switches and Service/Agency installation switches. Service/Agency installation switches have been authorized to extend voice services over Internet Protocol (IP) infrastructures. The Unified Capabilities Requirements (UCR) operational DSN Architecture is depicted in Figure 2-1, which depicts the relationship of the ASLAN and non-ASLAN to the DSN switch types.



LEGEND:

- | | | | |
|-------|-------------------------------------|---|---|
| 4W | 4-Wire | NATO | North Atlantic Treaty Organization |
| ASLAN | Assured Services Local Area Network | PBX | Private Branch Exchange |
| BRI | Basic Rate Interface | PBX 1 | Private Branch Exchange 1 |
| CB | Channel Bank | PBX 2 | Private Branch Exchange 2 |
| COI | Community of Interest | PC | Personal Computer |
| CSN | Canadian Switch Network | PSTN | Public Switched Telephone Network |
| DRSN | Defense Red Switch Network | RSU | Remote Switching Unit |
| DSN | Defense Switched Network | SMEO | Small End Office |
| DVX | Deployable Voice Exchange | SMU | Switched Multiplex Unit |
| EMSS | Enhanced Mobile Satellite System | STEP | Standardized Tactical Entry Point |
| EO | End Office | TDM/P | Time Division Multiplex/Packetized |
| IAS | Integrated Access Switch | Tri-Tac | Tri-Service Tactical Communications Program |
| IP | Internet Protocol | TS | Tandem Switch |
| ISDN | Integrated Services Digital Network | VoIP | Voice over Internet Protocol |
| IST | Interswitch Trunk | VTC | Video Teleconferencing |
| MFS | Multifunction Switch |  | System Under Test |

Figure 2-1. DSN Architecture

7. REQUIRED SYSTEM INTERFACES. The SUT capability and functional requirements are listed in Table 2-1. These requirements are derived from the UCR 2008, Change 1, and verified through JITC testing and review of the vendor’s Letters of Compliance (LoC).

Table 2-1. SUT Capability and Functional Requirements

ID	Requirement (See note.)		UCR Reference
1	ASLAN components can have no single point of failure for >96 users for C2 and Special C2 users. Non-ASLAN components can have a single point of failure for C2(R) and non-C2 users. (R)		5.3.1.2.1, 5.3.1.7.7
2	Non-blocking of any voice or video traffic at 50%. (R)		5.3.1.3
3	Maximum of 1 ms of jitter for all ASLAN components. (R)		5.3.1.3
4	Maximum of 0.02% packet loss for core and distribution layer components and 0.01% for access layer components. (R)		5.3.1.3
5	Maximum of 2 ms latency for core and distribution layer components and 2 ms for access layer components. (R)		5.3.1.3
6	100 Mbps IAW IEEE 802.3u and 1 Gbps IAW IEEE 802.3z for core and distribution layer components and 10 Mbps IAW IEEE 802.3i and 100 Mbps IAW IEEE 802.3u for access layer components. (R)		5.3.1.3.1
7	Force mode and auto-negotiation IAW IEEE 802.3, filtering IAW RFC 1812, and flow control IAW IEEE 802.3x. (R)		5.3.1.3.2
8	Port Parameter Requirements	Auto-negotiation IAW IEEE 802.3. (R)	5.3.1.3.2
9		Force mode IAW IEEE 802.3. (R)	
10		Flow control IAW IEEE 802.3x. (R)	
11		Filtering IAW RFC 1812. (R)	
12		Link Aggregation IAW IEEE 802.3ad (output/egress ports only). (R)	
13		Spanning Tree Protocol IAW IEEE 802.1D. (R)	
14		Multiple Spanning Tree IAW IEEE 802.1s. (R)	
15		Rapid Reconfiguration of Spanning Tree IAW IEEE 802.1w. (R)	
16	LACP link Failover and Link Aggregation IAW IEEE 802.3ad uplink ports only). (R)		5.3.1.3.2, 5.3.1.7.7.1
17	Class of Service Marking: Layer 3 DSCPs IAW RFC 2474. (R) Layer 2 3-bit user priority field of the IEEE 802.1Q 2-byte TCI field. (C)		5.3.1.3.3
18	VLAN Capabilities IAW IEEE 802.1Q. (R)		5.3.1.3.4
19	Protocols IAW DISR profile (IPv4 and IPv6). IPv4 (R: LAN Switch, Layer 2 Switch): IPv6 (R: LAN Switch, C: Layer 2 Switch). Note: Layer 2 switch is required to support only RFC 2460, 5095, 2464, and be able to queue packets based on DSCPs in accordance with RFC 2474.		5.3.1.3.5
20	QoS Features	Shall support minimum of 4 queues. (R)	5.3.1.3.6
21		Must be able to assign VLAN tagged packets to a queue. (R)	
22		Support DSCP PHBs per RFCs 2474, 2494, 2597, 2598, and 3246. (R: LAN Switch). Note: Layer 2 switch is required to support RFC 2474 only.	
23		Support a minimum of one of the following: Weighted Fair Queuing (WFQ) IAW RFC 3662, Priority Queuing (PQ) IAW RFC 1046, or Class-Based WFQ IAW RFC 3366. (R)	
24		Must be able to assign a bandwidth or percent of traffic to any queue. (R)	
25	Network Monitoring	SNMP IAW RFC's 1157, 2206, 3410, 3411, 3412, 3413 and 3414. (R)	5.3.1.3.7
26		SNMP traps IAW RFC1215. (R)	
27		Remote monitoring IAW RFC1281 and Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model IAW RFC 3826. (R)	
28	Product Requirements Summary IAW UCR2008 Table 5.3.1-5. (R)		5.3.1.3.9
29	E2E Performance (Voice)	No more than 5 ms Latency over any 5-minute period measured under congestion. (R)	5.3.1.4.1
		No more than 3 ms Jitter over any 5-minute period measured under congestion. (R)	
		Packet loss not to exceed engineered (queuing) parameters over any 5-minute period under congestion. (R)	
30	E2E Performance (Video)	No more than 30 ms Latency over any 5-minute period measured under congestion. (R)	5.3.1.4.2
		No more than 30 ms Jitter over any 5-minute period measured under congestion. (R)	
		Packet loss not to exceed engineered (queuing) parameters over any 5-minute period under congestion. (R)	
31	E2E Performance (Data)	No more than 50 ms Latency over any 5-minute period measured under congestion	5.3.1.4.3
		Packet loss not to exceed engineered (queuing) parameters over any 5-minute period under congestion. (R)	

Table 2-1. SUT Capability and Functional Requirements (continued)

ID	Requirement (See note.)		UCR Reference	
32	LAN Network Management	Configuration Control for ASLAN and Non-ASLAN. (R)	5.3.1.6.1	
33		Operational Controls for ASLAN and Non-ASLAN. (R)	5.3.1.6.2	
34		Performance Monitoring for ASLAN and Non-ASLAN. (R)	5.3.1.6.3	
35		Alarms for ASLAN and Non-ASLAN. (R)	5.3.1.6.4	
36		Reporting for ASLAN and Non-ASLAN. (R)	5.3.1.6.5	
37	Redundancy	Redundant Power Supplies. (Required on standalone redundant products.)	5.3.1.7.7	
38		Chassis Failover. (Required on standalone redundant products.)		
39		Switch Fabric Failover. (Required on standalone redundant products.)		
40		Non-LACP Link Failover.(R)		
41		Fiber Blade Failover. (R)		
42		Stack Failover. (C) (Required if the stack supports more than 96 users.)		
43		CPU (routing engine) blade Failover. (R)		
49	Support IPv6 packets over Ethernet IAW RFC2464. (R)		5.3.5.4	
76	Site Requirements	Engineering Requirements: Physical Media for ASLAN and Non-ASLAN. (R) (Site requirement)	5.3.1.7.1	
77		Battery Back up two hours for non-ASLAN components and eight hours for ASLAN components. (R) (Site requirement)	5.3.1.7.5	
78		Availability of 99.999 percent (Special C2), and 99.997 percent (C2) for ASLAN (R), and 99.9 percent (non-C2 and C2(R) for non-ASLAN. (R) (Site requirement)	5.3.1.7.6	
79	IA Security requirements	Port-Based Access Control IAW IEEE 802.1x (R)	5.3.1.3.2	
80		Secure methods for network configuration. SSH2 instead of Telnet and support RFCs 4251-4254. Must use HTTPS instead of http, and support RFCs 2660 and 2818 for ASLAN and Non-ASLAN. (R)	5.3.1.6	
81		Security (R)		5.3.1.3.8
82		Must meet IA requirements IAW UCR 2008 Section 5.4 for ASLAN and non-ASLAN. (R)		5.3.1.5

NOTE: All requirements are for core, distribution, and access layer components unless otherwise specified.

LEGEND:

ASLAN	Assured Services Local Area Network	HTTPS	Hyper Text Transfer Protocol, Secure	MTU	Maximum Transmission Unit
C2	Command and Control	Gbps	Gigabits per second	PHB	Per Hop Behavior
C2(R)	Command and Control ROUTINE only	IA	Information Assurance	PQ	Priority Queuing
CPU	Central Processing Unit	IAW	In Accordance with	QoS	Quality of Service
DHCP	Dynamic Host Configuration Protocol	ID	Identification	RFC	Request for Comments
DISR		IEEE	Institute Of Electrical and Electronics Engineers	SNMP	Simple Network Management Protocol
DSCP	Differentiated Services Code Point	IPv4	Internet Protocol Version 4	SSH2	Secure Shell Version 2
E2E	End to End	IPv6	Internet Protocol Version 6	SUT	System Under Test
HMAC	Hash-based Message Authentication Code	LACP	Link Aggregation Control Protocol	TCI	Tag Control Information
http	Hypertext Transfer Protocol	LAN	Local Area Network	UCR	Unified Capabilities Requirements
		LS	LAN Switch	VLAN	Virtual Local Area Network
		Mbps	Megabits per second	WFQ	Weighted Fair Queuing
		ms	millisecond		

8. TEST NETWORK DESCRIPTION. The SUT was tested at JITC's Global Information Grid Network Test Facility in a manner and configuration similar to that of the DSN operational environment. A notional diagram of the SUT within an ASLAN VoIP architecture is depicted in Figure 2-2 and the Notional non-ASLAN VoIP architecture is depicted in Figure 2-3. The notional ASLAN and non-ASLAN combined VoIP architecture is depicted in Figure 2-4. The ASLAN test configuration used to test the SUT in a homogeneous network is depicted in Figure 2-5, and the heterogeneous test network configurations are depicted in Figures 2-6 and 2-7.

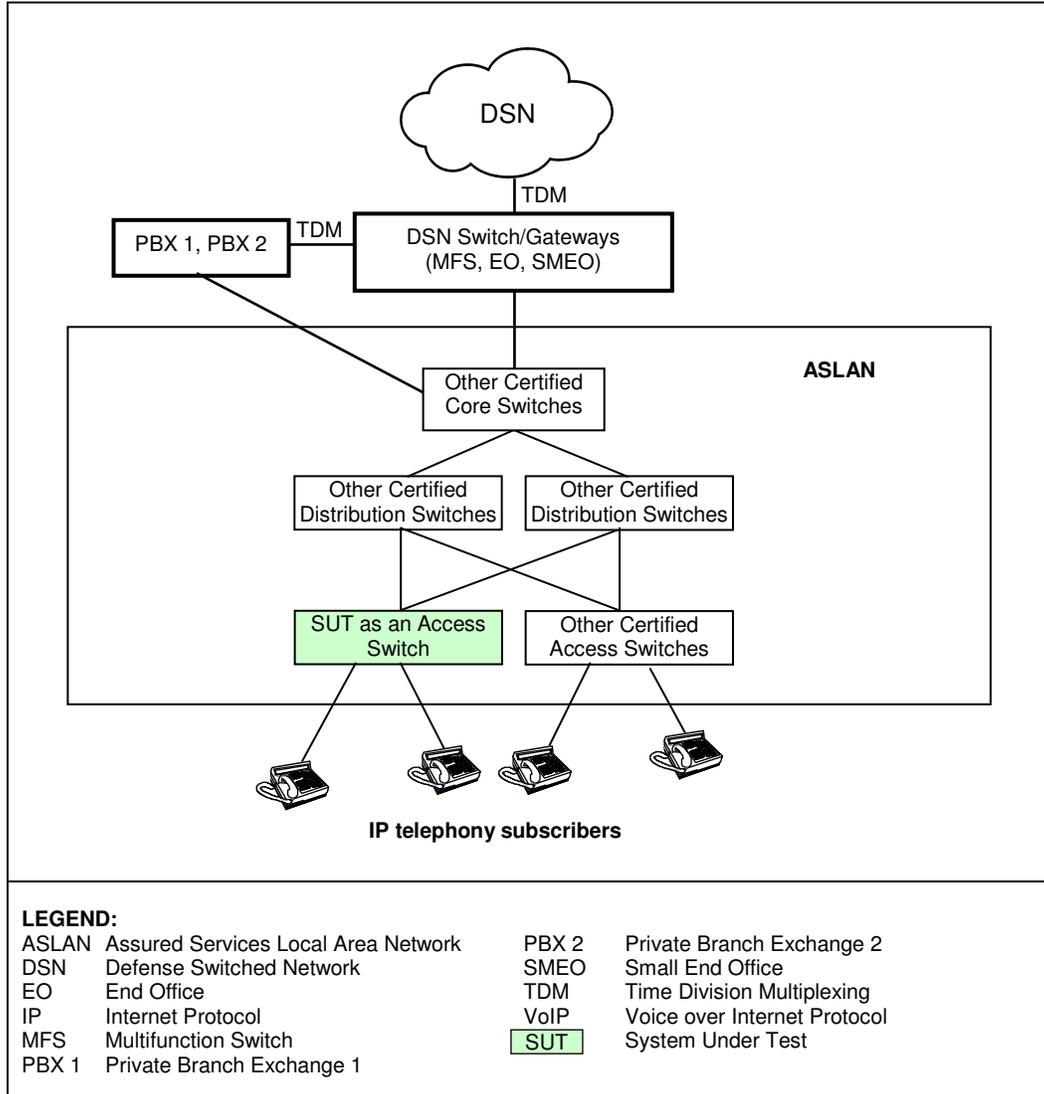


Figure 2-2. SUT Notional ASLAN VoIP Architecture

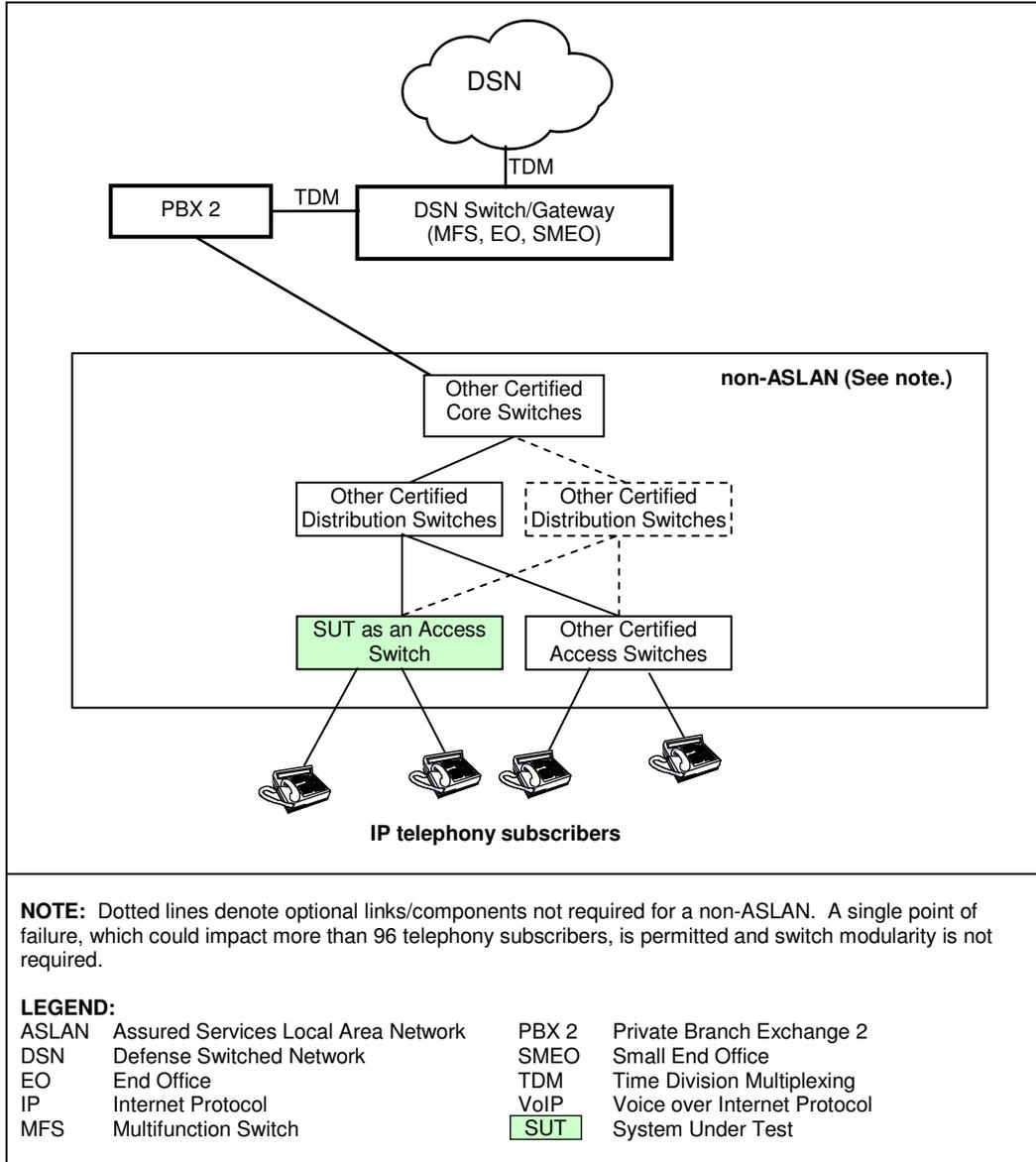


Figure 2-3. SUT Notional Non-ASLAN VoIP Architecture

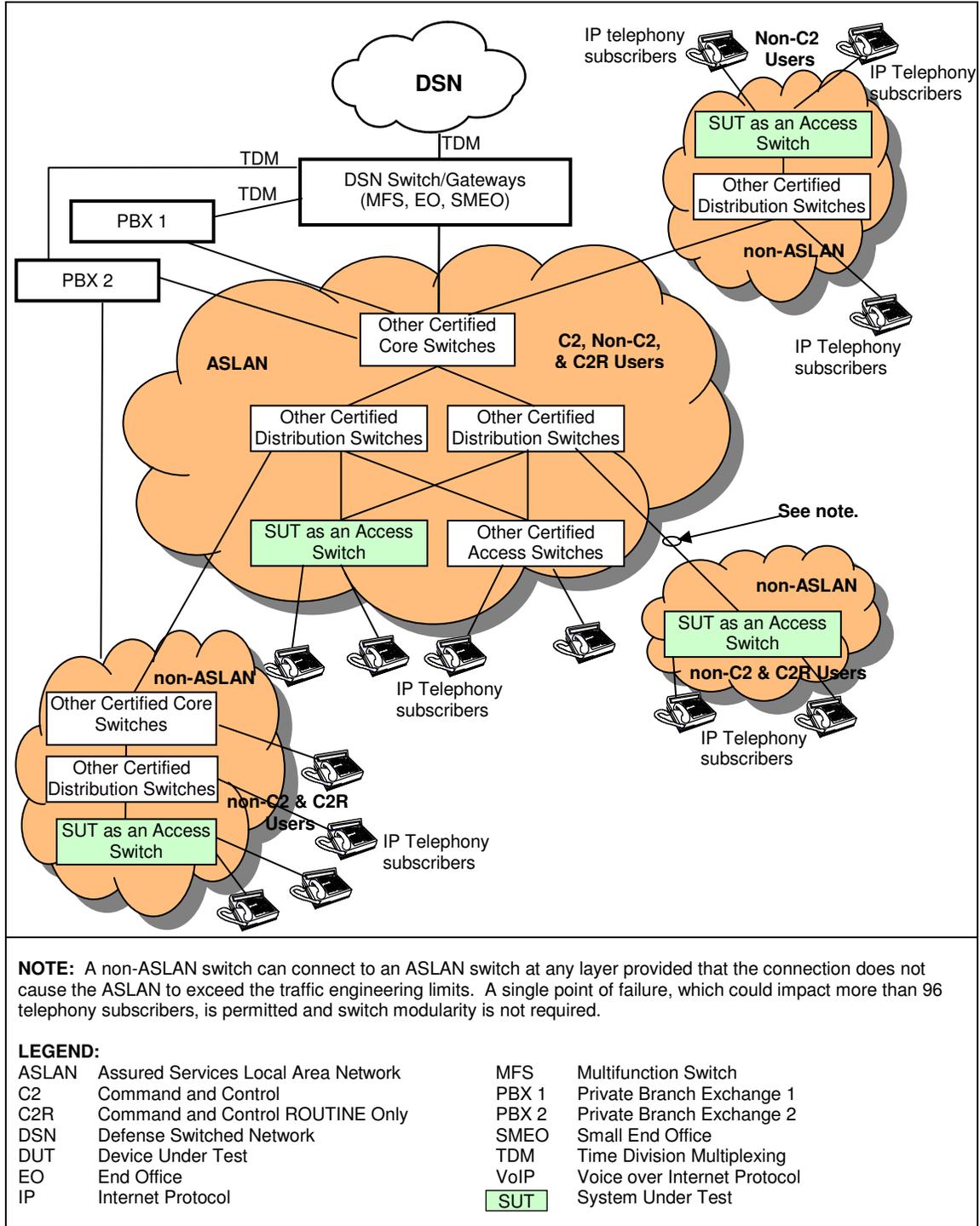


Figure 2-4. SUT Notional ASLAN and non-ASLAN Combined VoIP Architecture

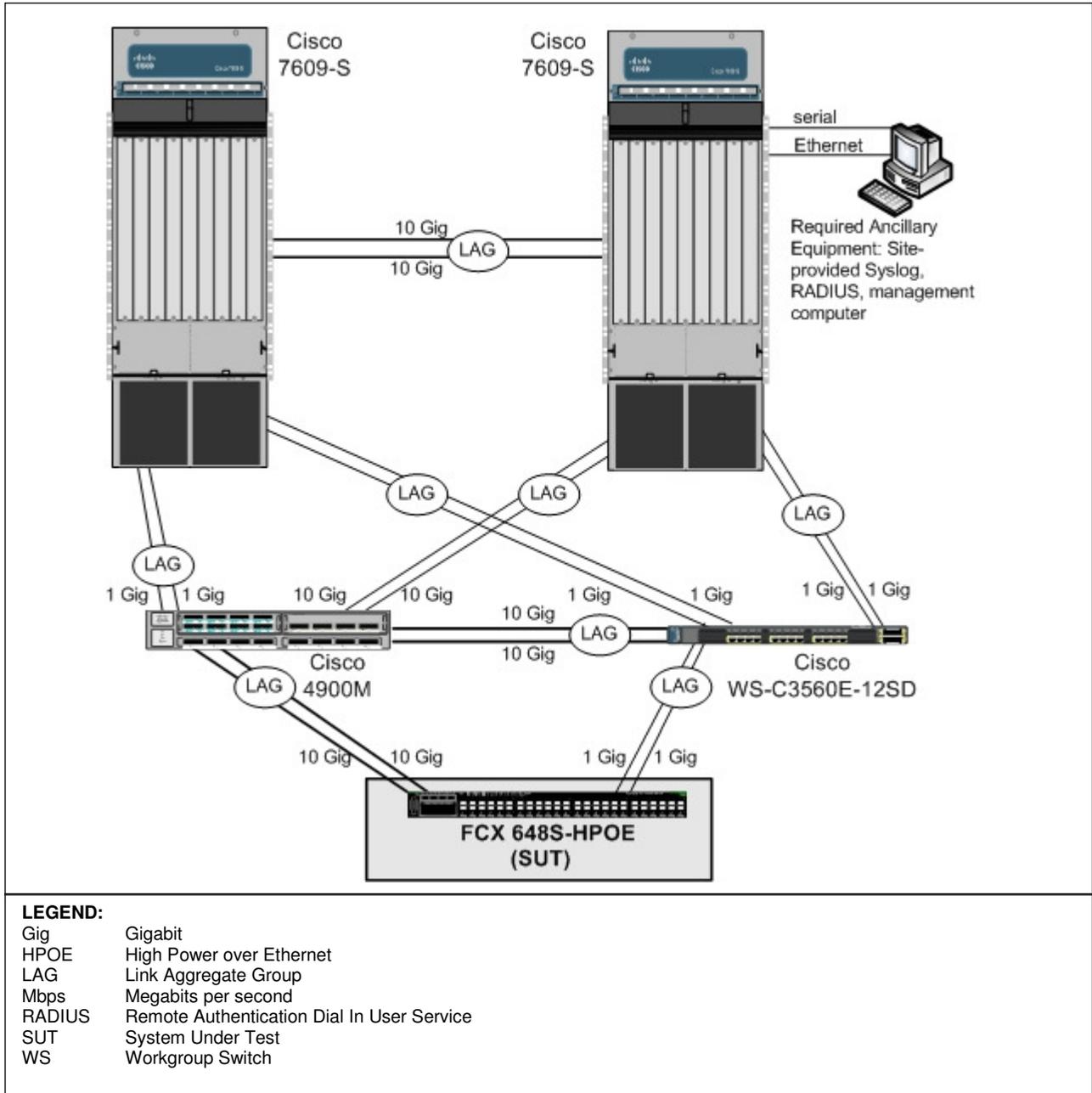


Figure 2-6. SUT Heterogeneous Test Configuration with Cisco

9. SYSTEM CONFIGURATIONS. Table 2-2 provides the system configurations, hardware, and software components tested with the SUT. The SUT is certified with other IP systems listed on the UC APL that are certified for use with an ASLAN or non-ASLAN.

Table 2-2. Tested System Configuration

System Name	Release														
Extreme BlackDiamond 12804	12.3.1														
Extreme BlackDiamond 8806	12.3.1														
Extreme BlackDiamond 8810	12.3.1														
Extreme Summit X650-24x	12.3.1														
Extreme Summit X450e-24P	12.3.1														
Extreme Summit X250e-48P	12.3.1														
Extreme Summit X350-48T	12.3.1														
Brocade NetIron MLX-8	4.0.06														
Brocade BigIron RX-8	2.7.01														
Brocade FastIron SX-800	5.0.00														
Brocade FastIron Edge 4802-PoE	4.1.01														
Brocade FastIron GS-648P-PoE	4.3.02														
Brocade FastIron GS-648P-PoE	5.0.00														
Brocade FastIron FWS-648G-PoE	4.3.02														
Cisco 7609-S	Internetwork Operating System (IOS) 12.2 (33) SRD														
Cisco 4900M	Internetwork Operating System (IOS) 12.2 (50) SG														
Cisco WS-C3560E-12SD	Internetwork Operating System (IOS) 12.2 (46) SE														
Component (See note.)	Release	Function	Sub-component												
<u>FCX 648S-HPOE</u> , FCX 624S-HPOE, FCX 648S, FCX 624S, FCX 624S-F, FCX 648, and FXC 624	7.0	Access	NA												
<p>NOTE: Components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, they utilize the same software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes and they are also certified for joint use. Although the <u>FCX 648S-HPOE</u>, FCX 624S-HPOE, FCX 648S, FCX 624S, and FCX 624S-F are stackable switches, the SUT was not tested in a stacked configuration. Therefore, none of the certified switches are certified in a stacked configuration.</p> <p>LEGEND:</p> <table> <tr> <td>F</td> <td>Fiber</td> <td>JITC</td> <td>Joint Interoperability Test Command</td> </tr> <tr> <td>FCX</td> <td>FastIron CX</td> <td>S</td> <td>Stackable</td> </tr> <tr> <td>HPOE</td> <td>High Power over Ethernet</td> <td></td> <td></td> </tr> </table>				F	Fiber	JITC	Joint Interoperability Test Command	FCX	FastIron CX	S	Stackable	HPOE	High Power over Ethernet		
F	Fiber	JITC	Joint Interoperability Test Command												
FCX	FastIron CX	S	Stackable												
HPOE	High Power over Ethernet														

10. TESTING LIMITATIONS. No software was available to evaluate Simple Network Management Protocol (SNMP) requirements. There is no impact because these requirements were verified through the vendor’s LoC.

11. TEST RESULTS

a. Discussion. The SUT is certified to support DSN Assured Services over IP. If a component meets the minimum requirements for deployment in an ASLAN, it also meets the lesser requirements for deployment in a non-ASLAN. Non-ASLANs are “commercial grade” and provide support to Command and Control (C2) (ROUTINE only

calls) (C2(R)) or non-C2 voice subscribers. The SUT is certified for joint use deployment in a non-ASLAN for C2R and non-C2 traffic. When deployed in a non-ASLAN, the SUT may also be used to receive all levels of precedence, but are limited to originating ROUTINE precedence only. Non-ASLANs do not need to meet the availability or redundancy requirements of the C2 or Special C2 users and they are not authorized as subscribers on a non-ASLAN.

b. Test Conduct. The SUT was tested as a layer 2 access switch in both homogeneous and heterogeneous ASLAN configurations and met all of the requirements with testing and/or the vendor's LoC as outlined in the sub paragraphs below.

(1) The UCR 2008, Change 1, paragraphs 5.3.1.2.1, 5.3.1.7.7, 5.3.1.7.7.1, 5.3.1.7.7.2, state that ASLAN components can have no single point of failure for more than 96 users for C2 and Special C2 users. The UCR 2008, Change 1, paragraph 5.3.1.7.7, states the following Redundancy requirements. Redundancy can be met if product itself provides redundancy internally or a secondary product is added to the ASLAN to provide redundancy to the primary product. Single-product redundancy may be met with a modular chassis that at a minimum provides the following: Dual power supplies, dual processors, termination sparing, redundancy protocol, no single point of failure, and switch fabric or backplane redundancy. In the event of a component failure in the network, all calls that are active shall not be disrupted (loss of existing connection requiring redialing) and the path through the network shall be restored within five seconds, a secondary product has been added to provide redundancy to a primary product, the failover to the secondary product must meet the same requirements. Non-ASLAN components can have a single point of failure for C2(R) and non-C2 users. The SUT supports 48 users and was equipped with redundant uplinks and power supplies. Although redundancy is not required for the SUT, all of the redundant components were tested and found to meet all the failover requirements. Link Aggregation Control Protocol (LACP) failover was achieved within 0.5 seconds. Non-LACP failover was achieved within 0.77 seconds. Power failover was achieved within 0.99 seconds. There was no loss of existing active circuits if dual uplinks are used.

(2) The UCR 2008, Change 1, paragraph 5.3.1.3, states that the ASLAN infrastructure components shall meet the requirements in the subparagraphs below. The SUT was tested using 155 percent oversubscription of the total aggregate uplink bandwidth for both 1 Gbps and 10 Gbps. The test included 100 percent of uplink aggregate in untagged best effort data, and 55 percent of uplink aggregate in tagged Internet Protocol version 4 (IPv4) and Internet Protocol version 6 (IPv6) voice, video, and preferred data traffic.

(a) The SUT shall be non-blocking for a minimum of 50 percent (maximum voice and video traffic) of its maximum rated output capacity for egress ports that interconnect (trunk) the product to other products. Non-blocking is defined as the capability to send and receive 64 to 1518 byte packets at full duplex rates from ingress

ports to egress ports without losing any packets. The SUT met this requirement by insuring that higher priority tagged traffic was queued above lower priority tagged traffic and untagged best effort data.

(b) The SUT shall have the capability to transport prioritized voice packets (media and signaling) with no more than 1 millisecond (ms) jitter across all switches. All ASLAN infrastructure components shall have the capability to transport prioritized video packets (media and signaling) with no more than 10 ms jitter across all switches. The jitter shall be achievable over any five-minute period measured from ingress ports to egress ports under congested conditions. The SUT met this requirement with a measured jitter of 0 ms for voice and video packets.

(c) All access products shall have the capability to transport prioritized voice and video packets with no more than 0.01 percent packet loss. The packet loss shall be achievable over any five-minute period measured from ingress ports to egress ports under congested conditions. The SUT met this requirement with a measured packet loss of 0.00 percent for voice and video packets.

(d) The SUT shall have the capability to transport prioritized voice packets (media and signaling), with no more than 2 ms latency. All ASLAN infrastructure components shall have the capability to transport prioritized video packets (media and signaling), with no more than 10 ms latency. The latency shall be achievable over any five-minute period measured from ingress ports to egress ports under congested conditions. The SUT met this requirement with measured latency of 0 ms to .001 with an average of .005 ms of latency for voice and video packets.

(3) The UCR 2008, Change 1, paragraph 5.3.1.3.1, states that, at a minimum, access products shall provide the following interface rates and other rates may be provided as conditional interfaces: 10 Mbps in accordance with IEEE 802.3i and 100 Mbps in accordance with IEEE 802.3u. Refer to Table 2-3 for a detailed list of interfaces that were tested. The SUT met these requirements.

Table 2-3. SUT Interface Status

Interface	Applicability	CRs/FRs (See note 1.)	Status
	Access		Access
Network Management Interfaces for Layer 2 Access Switches			
EIA/TIA (Serial) 232	R	EIA/TIA-232	Met
IEEE 802.3i (10BaseT UTP)	C	1, 6-15, 18-28, 31, 32-36, 49	Not Tested ²
IEEE 802.3u (100BaseT UTP)	C	1, 6-15, 18-28, 31, 32-36, 49	Met
IEEE 802.3ab (1000BaseT UTP)	C	1, 6-15, 18-28, 31, 32-36, 49	Met
Uplink Interfaces for Layer 2 Access Switches			
IEEE 802.3u (100BaseT UTP)	R	1-15, 16, 18-24, 28-31, 40, 49	Met
IEEE 802.3u (100BaseFX)	C	1-6, 11, 16, 18-24, 28-31, 40-41, 49	Met
IEEE 802.3ab (1000BaseT UTP)	C	1-16, 18-24, 28-31, 40, 49	Met
IEEE 802.3z1000BaseX Fiber	C	1-5, 8-16, 18-24, 28-31, 40, 49	Met
IEEE 802.3ae (10GBaseX)	C	1-5, 8-16, 18, 19, 40-41, 49	Met

Table 2-3. SUT Interface Status (continued)

Interface	Applicability	CRs/FRs (See note 1.)	Status																																																																												
	Access		Access																																																																												
Access Interfaces for Layer 2 Access Switches																																																																															
IEEE 802.3I (10BASET UTP)	R	1-15, 18-24, 28-41, 49	Met																																																																												
IEEE 802.3u (100BaseT UTP)	R	1-15, 18-24, 28-41, 49	Met																																																																												
IEEE 802.3u (100BaseFX)	C	1-6, 11, 18-24, 28-31, 49	Met																																																																												
IEEE 802.3ab (1000BaseT UTP)	C	1-15, 18-24, 28-41, 49	Met																																																																												
IEEE 802.3z (1000BaseX Fiber)	C	1-6, 11, 18-24, 28-31, 49	Met																																																																												
Generic Requirements for all Interfaces																																																																															
Generic Requirements not associated with specific interfaces	R	30-32, 35, 36, 40, 69-71	Met																																																																												
DoD IPv6 Profile Requirements	R	UCR Section 5.3.5.5 (See note 3.)	Met																																																																												
Security	R	UCR Sections 5.3.1.3.8, 5.3.1.5, 5.3.1.6, and 5.4 (See note 4.)	Met																																																																												
<p>NOTES:</p> <p>1 The SUT's specific capability and functional requirement ID numbers depicted in the CRs/FRs column can be cross-referenced in Table 2-1. These requirements are for the following Brocade FastIron switch models, which are certified in the Layer 2 access layer: <u>FCX 648S-HPOE</u>, FCX 624S-HPOE, FCX 648S, FCX 624S, FCX 624S-F, FCX 648, and FCX 624. The JITC tested the devices that are bolded and underlined. The other devices listed that are not bolded or underlined are in the same family series as the SUT were not tested; however, they utilize the same OS software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes. Although the <u>FCX 648S-HPOE</u>, FCX 624S-HPOE, FCX 648S, FCX 624S, and FCX 624S-F are stackable switches, the SUT was not tested in a stacked configuration. Therefore, none of the certified switches are certified in a stacked configuration.</p> <p>2 This interface is not offered by the SUT, and is not a required interface.</p> <p>3 IPv6 requirements are met by both testing and a vendor letter of compliance.</p> <p>4 Security testing is accomplished via DISA-led Information Assurance test teams and published in a separate report, Reference (e).</p> <p>LEGEND:</p> <table border="0"> <tr> <td>802.3ab</td> <td>1000BaseT Gbps Ethernet over twisted pair at 1 Gbps (125 Mbps)</td> <td>EIA-232</td> <td>Standard for defining the mechanical and electrical characteristics for connecting DTE and DCE data communications devices</td> </tr> <tr> <td>802.3ae</td> <td>10 Gbps Ethernet</td> <td></td> <td></td> </tr> <tr> <td>802.3i</td> <td>10BaseT Mbps over twisted pair</td> <td>F</td> <td>fiber</td> </tr> <tr> <td>802.3u</td> <td>Standard for carrier sense multiple access with collision detection at 100 Mbps</td> <td>FCX</td> <td>FastIron CX</td> </tr> <tr> <td>802.3z</td> <td>Gigabit Ethernet Standard</td> <td>FRs</td> <td>Functional Requirements</td> </tr> <tr> <td>1000BaseFX</td> <td>1000 Mbps Ethernet over fiber</td> <td>Gbps</td> <td>Gigabits per second</td> </tr> <tr> <td>1000BaseT</td> <td>1000 Mbps (Baseband Operation, Twisted Pair) Ethernet</td> <td>HPoE</td> <td>Power over Ethernet</td> </tr> <tr> <td>ASLAN</td> <td>Assured Services Local Area Network</td> <td>ID</td> <td>Identification</td> </tr> <tr> <td>C</td> <td>Conditional</td> <td>IEEE</td> <td>Institute of Electrical and Electronics Engineers</td> </tr> <tr> <td>Co</td> <td>core</td> <td>IPv6</td> <td>Internet Protocol version 6</td> </tr> <tr> <td>CRs</td> <td>Capability Requirements</td> <td>JITC</td> <td>Joint Interoperability Test Command</td> </tr> <tr> <td>DCE</td> <td>Data Circuit-terminating Equipment</td> <td>Mbps</td> <td>Megabits per second</td> </tr> <tr> <td>DISA</td> <td>Defense Information Systems Agency</td> <td>NA</td> <td>Not Applicable</td> </tr> <tr> <td>DoD</td> <td>Department of Defense</td> <td>OS</td> <td>Operating System</td> </tr> <tr> <td>DTE</td> <td>Data Terminal Equipment</td> <td>R</td> <td>Required</td> </tr> <tr> <td>EIA</td> <td>Electronic Industries Alliance</td> <td>S</td> <td>stackable</td> </tr> <tr> <td></td> <td></td> <td>SUT</td> <td>System Under Test</td> </tr> <tr> <td></td> <td></td> <td>TIA</td> <td>Telecommunications Industry Association</td> </tr> <tr> <td></td> <td></td> <td>UTP</td> <td>Unshielded Twisted Pair</td> </tr> </table>				802.3ab	1000BaseT Gbps Ethernet over twisted pair at 1 Gbps (125 Mbps)	EIA-232	Standard for defining the mechanical and electrical characteristics for connecting DTE and DCE data communications devices	802.3ae	10 Gbps Ethernet			802.3i	10BaseT Mbps over twisted pair	F	fiber	802.3u	Standard for carrier sense multiple access with collision detection at 100 Mbps	FCX	FastIron CX	802.3z	Gigabit Ethernet Standard	FRs	Functional Requirements	1000BaseFX	1000 Mbps Ethernet over fiber	Gbps	Gigabits per second	1000BaseT	1000 Mbps (Baseband Operation, Twisted Pair) Ethernet	HPoE	Power over Ethernet	ASLAN	Assured Services Local Area Network	ID	Identification	C	Conditional	IEEE	Institute of Electrical and Electronics Engineers	Co	core	IPv6	Internet Protocol version 6	CRs	Capability Requirements	JITC	Joint Interoperability Test Command	DCE	Data Circuit-terminating Equipment	Mbps	Megabits per second	DISA	Defense Information Systems Agency	NA	Not Applicable	DoD	Department of Defense	OS	Operating System	DTE	Data Terminal Equipment	R	Required	EIA	Electronic Industries Alliance	S	stackable			SUT	System Under Test			TIA	Telecommunications Industry Association			UTP	Unshielded Twisted Pair
802.3ab	1000BaseT Gbps Ethernet over twisted pair at 1 Gbps (125 Mbps)	EIA-232	Standard for defining the mechanical and electrical characteristics for connecting DTE and DCE data communications devices																																																																												
802.3ae	10 Gbps Ethernet																																																																														
802.3i	10BaseT Mbps over twisted pair	F	fiber																																																																												
802.3u	Standard for carrier sense multiple access with collision detection at 100 Mbps	FCX	FastIron CX																																																																												
802.3z	Gigabit Ethernet Standard	FRs	Functional Requirements																																																																												
1000BaseFX	1000 Mbps Ethernet over fiber	Gbps	Gigabits per second																																																																												
1000BaseT	1000 Mbps (Baseband Operation, Twisted Pair) Ethernet	HPoE	Power over Ethernet																																																																												
ASLAN	Assured Services Local Area Network	ID	Identification																																																																												
C	Conditional	IEEE	Institute of Electrical and Electronics Engineers																																																																												
Co	core	IPv6	Internet Protocol version 6																																																																												
CRs	Capability Requirements	JITC	Joint Interoperability Test Command																																																																												
DCE	Data Circuit-terminating Equipment	Mbps	Megabits per second																																																																												
DISA	Defense Information Systems Agency	NA	Not Applicable																																																																												
DoD	Department of Defense	OS	Operating System																																																																												
DTE	Data Terminal Equipment	R	Required																																																																												
EIA	Electronic Industries Alliance	S	stackable																																																																												
		SUT	System Under Test																																																																												
		TIA	Telecommunications Industry Association																																																																												
		UTP	Unshielded Twisted Pair																																																																												

(4) The UCR 2008, Change 1, paragraph 5.3.1.3.2, states that the ASLAN infrastructure components shall provide the following parameters on a per port basis: auto-negotiation, force mode, flow control, filtering, link aggregation, spanning tree protocol, multiple spanning tree, rapid reconfiguration of spanning tree, and port-based access control. The SUT was tested with a series of forced port speeds as well as

auto-negotiation. Link failover testing was performed which confirmed spanning tree convergence. All these requirements were met by both testing and vendors LoC.

(5) The UCR 2008, Change 1, paragraph 5.3.1.3.3, states that the ASLAN infrastructure components shall support Differentiated Services Code Points (DSCP) in accordance with Request for Comment (RFC) 2474 as stated in the subparagraphs below:

(a) The ASLAN infrastructure components shall be capable of accepting any packet tagged with a DSCP value (0-63) on an ingress port and assign that packet to a QoS behavior listed in Section 5.3.1.3.6. The SUT prioritized the following traffic for queuing from lowest to highest with distinct IPv4 DSCP tags using an IP loader: Data best effort, preferred data, video media and signaling, and voice media and signaling. The IP load included a data best effort load of 100 percent line rate and the other traffic at 55 percent of line rate (25 percent of video signaling, voice signaling, and voice media in the highest priority queue, and 25 percent of video media in the next lower priority queue, and 5 percent of preferred data in the lowest priority queue). The IP loader recorded that the higher prioritized traffic was properly queued by the SUT above lower prioritized best effort traffic. In addition, it was verified that the SUT can assign any DSCP value from 0-63 for each type of traffic, which met this requirement.

(b) The ASLAN infrastructure components shall be capable of accepting any packet tagged with a DSCP value (0-63) on an ingress port and reassign that packet to any new DSCP value (0-63). Current DSCP values are provided in Section 5.3.3.3.2. The SUT met this requirement through vendors LoC.

(c) The ASLAN infrastructure components must be able to support the prioritization of aggregate service classes with queuing according to Section 5.3.1.3.6. The SUT prioritized the following traffic for queuing from lowest to highest with distinct IPv6 service class tags using an IP loader: Data best effort, preferred data, video media and signaling, and voice media and signaling. The IP load included a data best effort load of 100 percent line rate and the other traffic at 55 percent of line rate (25 percent of video signaling, voice signaling, and voice media in the highest priority queue, and 25 percent of video media in the next lower priority queue, and 5 percent of preferred data in the lowest priority queue). The IP loader recorded that the higher prioritized traffic was properly queued by the SUT above lower prioritized best effort traffic. In addition it was verified that the SUT can assign any IPv6 traffic class value from 0-63 for each type of traffic which met this requirement.

(d) The ASLAN infrastructure components may support the 3-bit user priority field of the IEEE 802.1Q 2-byte Tag Control Information (TCI) field. Default values are provided in Table 5.3.1-4. If provided, the following Class of Service (CoS) requirements apply: The ASLAN infrastructure components shall be capable of accepting any frame tagged with a user priority value (0-7) on an ingress port and assign that frame to a QoS behavior listed in Section 5.3.1.3.6. The ASLAN

infrastructure components shall be capable of accepting any frame tagged with a user priority value (0-7) on an ingress port and reassign that frame to any new user priority value (0-7). The SUT met this requirement with a vendor LoC.

(6) The UCR 2008, Change 1, paragraph 5.3.1.3.4, states that the ASLAN infrastructure components shall be capable of the Virtual LAN (VLAN) capabilities in accordance with IEEE 802.1Q. The SUT was configured with a preset VLAN ID tag using the IP loader. The load was captured at the egress and ingress to ensure that the SUT assigned the VLAN ID in the proper VLAN. The data was not modified or misplaced and the assigned VLAN traffic was not lost. In addition, the SUT has the ability to assign any VLAN ID any value from 0 through 4096. The SUT met this requirement with both testing and vendor LoC.

(7) The UCR 2008, Change 1, paragraph 5.3.1.3.5, states that the ASLAN infrastructure components shall meet the Department of Defense Information Technology Standards Registry (DISR) protocol requirements for IPv4 and IPv6. The SUT prioritized the following traffic for queuing from lowest to highest with distinct IPv4 DSCP tags and IPv6 service class tags using an IP loader: Data best effort, preferred data, video media and signaling, and voice media and signaling. The IP load included a data best effort load of 100 percent line rate and the other traffic at 55 percent of line rate (25 percent of video signaling, voice signaling, and voice media in the highest priority queue, and 25 percent of video media in the next lower priority queue, and 5 percent of preferred data in the lowest priority queue). The IP loader recorded that the higher prioritized traffic was properly queued by the SUT above lower prioritized best effort traffic. The SUT assigned any IPv4 DSCP or IPv6 traffic class value from 0-63 for each type of traffic which met the requirement. The IPv6 RFC DISR profile requirements were also met by the vendor's LoC.

(8) The UCR 2008, Change 1, paragraph 5.3.1.3.6, states that the ASLAN infrastructure components shall be capable of providing the following QoS features:

(a) Provide a minimum of four queues. The SUT has the ability to support up to eight assignable queues; however, only a four-queue model was tested and is covered under this certification.

(b) Assign a DSCP or Traffic Class value to any of the queues. The SUT met this requirement through testing and the vendor's LoC.

(c) Support Differentiated Services (DiffServ) per hop behaviors (PHBs) in accordance with RFCs 2472, 2494, 2597, 2598, and 3246. The SUT met this requirement through testing of the queuing process.

(d) Support, at a minimum, one of the following: Weighted Fair Queuing (WFQ) in accordance with RFC 3662, Priority Queuing (PQ) in accordance with RFC

1046, or Class-Based WFQ in accordance with RFC 3366. The SUT met this requirement with WFQ.

(e) All queues shall be capable of having bandwidth assigned or percentage of traffic. The SUT prioritized the following traffic for queuing from lowest to highest with distinct IPv4 DSCP tags and IPv6 service class tags using an IP loader: Data best effort, preferred data, video media and signaling, and voice media and signaling. The IP load included a data best effort load of 100 percent line rate and the other traffic at 55 percent of line rate (25 percent of video signaling, voice signaling, and voice media in the highest priority queue, and 25 percent of video media in the next lower priority queue, and 5 percent of preferred data in the lowest priority queue). The IP loader recorded that the higher prioritized traffic was properly queued by the SUT above lower prioritized best effort traffic at the assigned bandwidth per queue. Subsequently, the IP loader was reconfigured to increase the video traffic at 35 percent of line rate to ensure the SUT only allowed 25 percent throughput of the video traffic. The captured video throughput measured by the IP loader was 24.999 percent of the line rate, which met this requirement. In addition to testing, this requirement was met by the vendor's LoC.

(9) The UCR 2008, Change 1, paragraph 5.3.1.3.7, states that the ASLAN infrastructure components shall be capable of providing the following Network Monitoring features:

(a) Simple Network Management Protocol (SNMP) in accordance with RFCs 1157, 2206, 3410, 3411, 3412, 3413, and 3414. The SUT met this requirement through the vendor's LoC.

(b) SNMP Traps in accordance with RFC 1215. The SUT met this requirement through the vendor's LoC.

(c) Remote Monitoring (RMON) in accordance with RFC 2819. The SUT met this requirement through the vendor's LoC.

(d) Coexistence between Version 1, Version 2, and Version 3 of the Internet-standard Network Management Framework in accordance with RFC 3584. The SUT met this requirement through the vendor's LoC.

(e) The Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model in accordance with RFC 3826. Security is tested by DISA-led Information Assurance test teams and published in a separate report, Reference (e).

(10) The UCR 2008, Change 1, paragraph 5.3.1.3.9, states that all switches meet Product Requirements in accordance with UCR 2008, Change 1, Table 5.3.1-5.

The SUT met these requirements listed in Table 5.3.1-5 as stipulated throughout this document by testing and/or vendor LoC.

(11) The UCR 2008, Change 1, section 5.3.1.4, states that the ASLAN infrastructure components shall be capable of meeting the End-to-End (E2E) performance requirements for voice, video, and data services. E2E performance across a LAN is measured from the traffic ingress point to the traffic egress port. The requirements are measured over any five-minute period under congested conditions. Congested condition is defined as 100 percent of link capacities (as defined by baseline traffic engineering (25 percent voice/signaling, 25 percent video, 25 percent preferred data, and 25 percent best effort traffic)). The E2E requirements are ASLAN requirements. However, all of the E2E voice, video, and data services performance requirements were met by the SUT when included within an ASLAN. Refer to paragraphs 11.b.(2)(b), 11.b.(2)(c), and 11.b.(2)(d).

(12) The UCR 2008, Change 1, section 5.3.1.6, states that LAN infrastructure components must meet the requirements in the subparagraphs below. Near Real Time (NRT) is defined as within five seconds of detecting the event, excluding transport time.

(a) LANs shall have the ability to perform remote network product configuration/reconfiguration of objects that have existing DoD GIG management capabilities. The NMS shall report configuration change events in NRT, whether or not the change was authorized. The system shall report the success or failure of authorized configuration change attempts in NRT. The SUT met this requirement with the LoC.

(b) LAN infrastructure components must provide metrics to the NMS to allow them to make decisions on managing the network. Network management systems shall have an automated NM capability to obtain the status of networks and associated assets in NRT 99 percent of the time (with 99.9 percent as an Objective Requirement). Specific metrics are defined in UCR 2008, Change 1, Sections 5.3.2.17 and 5.3.2.18. The SUT met this requirement with the LoC.

(c) LAN components shall be capable of providing status changes 99 percent of the time (with 99.9 percent as an Objective Requirement) by means of an automated capability in NRT. An NMS will have an automated NM capability to obtain the status of networks and associated assets 99 percent of the time (with 99.9 percent as an Objective Requirement) in NRT. The NMS shall collect statistics and monitor bandwidth utilization, delay, jitter, and packet loss. The SUT met this requirement with the LoC.

(d) LAN components shall be capable of providing SNMP alarm indications to an NMS. The NMSs will have the NM capability to perform automated fault management of the network, to include problem detection, fault correction, fault isolation and diagnosis, problem tracking until corrective actions are completed, and historical archiving. Alarms will be correlated to eliminate those that are duplicate or

false, initiate test, and perform diagnostics to isolate faults to a replaceable component. Alarms shall be reported as TRAPs via SNMP in NRT. More than 99.95 percent of alarms shall be reported in NRT. The SUT met this requirement with the LoC.

(e) An NMS will have the NM capability of automatically generating and providing an integrated/ correlated presentation of network and all associated networks. The SUT met this requirement with the vendor's LoC.

(13) The UCR 2008, Change 1, paragraph 5.3.5.4, states that layer 2 switches must support IPv6 packets over Ethernet in accordance with RFC2464. The SUT met this requirement with both testing and the vendor LoC

(14) The UCR 2008, Change 1, paragraphs 5.3.1.3.8, 5.3.1.5, 5.3.1.6, state that ASLAN components must meet security requirements. Security is tested by DISA-led Information Assurance test teams and published in a separate report, Reference (e).

c. System Interoperability Results. The SUT is certified for joint use within the DSN as an access layer switch. It is also certified with any digital switching systems listed on the UC APL which are certified for use with an ASLAN or non-ASLAN. The SUT is certified to support DSN Assured Services over IP as an ASLAN in accordance with the requirements set forth in the UCR. If a system meets the minimum requirements for an ASLAN, it also meets the lesser requirements for a non-ASLAN. Non-ASLANs are "commercial grade" and provide support to C2R or non-C2 voice subscribers. The SUT is certified for joint use as a non-ASLAN for C2R and non-C2 traffic. Non-ASLANs may provide MLPP to users authorized to originate only ROUTINE precedence calls but terminate all precedence levels. Non-ASLANs do not need to meet the availability or redundancy requirements of the Special C2 users or the C2 users capable of originating precedence calls above ROUTINE. Since non-ASLANs are not required to support the reliability requirements detailed in the UCR for ASLANs, C2 users and Special C2 users are not authorized to be served by a non-ASLAN. Although the **FCX 648S-HPOE**, FCX 624S-HPOE, FCX 648S, FCX 624S, and FCX 624S-F are stackable switches, the SUT was not tested in a stacked configuration. Therefore, none of the certified switches are certified in a stacked configuration.

12. TEST AND ANALYSIS REPORT. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at <https://stp.fhu.disa.mil>. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at <http://jit.fhu.disa.mil> (NIPRNet), or <http://199.208.204.125> (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at <http://jitc.fhu.disa.mil/tssi>. Due to the sensitivity of the information, the Information Assurance Accreditation Package (IAAP) that contains the approved configuration and

deployment guide must be requested directly through government civilian or uniformed military personnel from the Unified Capabilities Certification Office (UCCO), e-mail: ucco@disa.mil.