

Hewlett-Packard Company

HP 1:10Gb Ethernet BL-c Switch & 10Gb Ethernet BL-c Switch for BladeSystem c-Class

Functionality Certification and Cooperative Interoperability Evaluation



Test Summary

***Premise:** Heterogeneous, multivendor networks are the rule rather than the exception. IT managers who deploy a variety of Fast Ethernet, Gigabit Ethernet and 10GbE switching devices in their networks need guaranteed interoperability of these switches to maintain a functional network.*

Hewlett-Packard Co. and BLADE Network Technologies, Inc. commissioned The Tolly Group to evaluate two HP integrated blade switches designed and manufactured by BLADE (BladeSystem c-Class) for interoperability with other switch brands.

Tolly Group engineers subjected the HP 1:10Gb Ethernet BL-c Switch and HP 10Gb Ethernet BL-c Switch to 10 different tests with switches from 3Com, Cisco Systems, Inc., Enterasys Networks, Inc., Force10 Networks, Inc., Foundry Networks, Inc., IBM, HP and NEC.

Engineers subjected the HP switches to advanced LAN services tests, including support for auto-negotiation, 802.1p/Q VLAN tag propagation, 10GbE LAN PHY Support, 802.3ad LACP Support, Rapid Spanning Tree Protocol Support, Multiple Spanning Tree Protocol Support 802.1s, RIPv2, OSPFv2, Virtual Router Redundancy Protocol (VRRP) and Jumbo Frames.

Tests were conducted in August 2008 in Santa Clara, CA at Ixia's iSimCity lab facility.

Test Highlights

- ▶ Earns 10 Switch Interoperability certifications for Layer 2 and Layer 3 advanced LAN functions
- ▶ Achieves broad Layer 2 and Layer 3 interoperability with 18 other switches from seven vendors
- ▶ Interoperates with other devices tested when supporting 10GbE LAN PHY interface, 802.1p/Q VLAN tags, Link Aggregation, Multiple Spanning Tree Protocol, RSTP, VRRP, OSPF protocols and more

HP 1:10Gb Ethernet BL-c Switch and HP 10Gb Ethernet BL-c Switch Interoperability Certified Features/Functions

Certification	HP 1:10Gb Ethernet BL-c	HP 10Gb Ethernet BL-c
802.1p/Q VLAN Tag Propagation	✓	✓
Jumbo Frame support	✓	✓
Link Aggregation Control Protocol	✓	✓
10-GbE LAN PHY support	✓	✓
Rapid Spanning Tree Protocol	✓	✓
Multiple Spanning Tree Protocol	✓	✓
Routing Information Protocol v2	✓	✓
Open Shortest Path First v2	✓	✓
Virtual Router Redundancy Protocol	✓	✓

Source: The Tolly Group, August 2008

Figure 1

Executive Summary

HP 1:10Gb BL-c Switch and HP 10Gb BL-c Switch for HP BladeSystem c-Class demonstrated broad interoperability with 19 and 14 switches, respectively, for advanced LAN and routing functions at Layer 2 and Layer 3.

In a world of ever-evolving standards and tight budgets, network managers searching for new equipment need to know that the switches they purchase are interoperable with their current infrastructures. It is important for managers to know which devices can maintain their interoperability with different standardized functions.

Engineers tested 20 switches from eight vendors to determine the various levels of interoperability offered. However, the HP 10Gb BL-c Switch was outfitted with 10GbE interfaces

only. Hence, this switch was not able to connect with five other switches that did not support 10GbE interfaces.

In Layer 2 interoperability tests, the two HP switches, the HP 1:10Gb Ethernet BL-c Switch and HP 10Gb Ethernet BL-c Switch, consistently demonstrated interoperability with switches from 3Com, Cisco, Force10, IBM, NEC, Foundry and Enterasys Networks.

(The IBM, NEC and HP integrated blade switch modules were manufactured by BLADE Network Technologies, Inc.)

Layer 2/3 Interoperability Certifications Awarded to HP 1:10Gb BL-c Switch for HP c-Class BladeSystem

Certifications	10/100/1000 Auto-Negotiation	802.1p/Q VLAN Tag Propagation	Jumbo Frame support	Link Aggregation (LACP) support	10G LAN PHY	Rapid Spanning Tree Protocol Support	Multiple Spanning Tree Protocol Support	RIP v2	OSPF v2	VRRP
3Com Switch 4800G 24-Port	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cisco Catalyst 6506-E	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enterasys SecureStack A2H124-48	✓	✓	✓	✓	N/S	✓	✓	N/S	N/S	N/S
Enterasys SecureStack B3G124-24	✓	✓	✓	✓	N/S	✓	✓	✓	N/S	N/S
Enterasys SecureStack C3G124-48	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enterasys D2G124-12	✓	✓	✓	✓	N/S	✓	✓	N/S	N/S	N/S
Enterasys G3G124-24P	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enterasys Matrix-N 7G4282-49	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enterasys Matrix-X4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Force10 C300 Resilient Switch	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry FastIron GS 624P-PoE	✓	✓	✓	✓	✓	✓	✓	N/S	N/S	✓
Foundry FastIron LS 624	✓	✓	✓	✓	✓	✓	✓	N/S	N/S	✓
Foundry FastIron Edge X 624E+2XG-PREM6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry BigIron RX-4-AC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
HP 10Gb BL-c Switch	N/S	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nortel 1/10G Uplink Ethernet Switch Module for IBM BladeCenter	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NEC 1G Intelligent L2 Switch	✓	✓	✓	✓	N/S	✓	✓	N/S	N/S	N/S
NEC 1G Intelligent L3 Switch	✓	✓	✓	✓	N/S	✓	✓	✓	✓	✓
NEC 10G Intelligent L3 Switch	N/S	✓	✓	✓	✓	✓	✓	✓	✓	✓

✓ PASS N/S= Not Supported N/A= Not Tested

Source: The Tolly Group, August 2008

Figure 2

In Layer 3 interoperability tests, the HP switches achieved interoperability with a 3Com Switch 4800G, five Enterasys Networks models tested, a Cisco Catalyst 6500, one IBM, four Foundry switches, one Force10 C300 switch and two NEC intelligent switches.

LAYER 2 FUNCTIONS

AUTO-NEGOTIATION

The HP 1:10G BL-c Switch interoperated with all of the switches tested. Devices earning this certification demonstrated the ability to establish the highest available speed and duplex settings in all possible vendor combinations.

802.1P/Q VLAN TAG PROPAGATION

The HP switches interoperated with all of the switches tested. Devices earning this certification demonstrated the ability to recognize and maintain 802.1p and 802.1Q tags across all vendor combinations tested.

JUMBO FRAME SUPPORT

The HP switches interoperated with every switch tested. Devices earning this certification have demonstrated the ability to transmit Jumbo Frames (9K bytes) across all possible vendor combinations.

10GbE LAN PHY

This verifies that the HP switches tested have the ability to transmit data

between multiple vendors' 10-Gigabit LAN PHY interfaces. In this test, the HP switches successfully interoperated with almost all of the switches, except for models that do not offer the 10GbE support.

LINK AGGREGATION CONTROL PROTOCOL (LACP)

This test verifies a device's ability to trunk ports across multiple vendor combinations using IEEE 802.3ad Link Aggregation Control Protocol (LACP). For this Layer 2 test, the HP 1:10G Ethernet BL-c Switch achieved interoperability with all 19 switches, while the HP 10G Ethernet BL-c Switch interoperated with 14 switches.

Devices earning this certification demonstrated the ability to balance the loads evenly across the aggregated link.

RAPID SPANNING TREE PROTOCOL (RSTP)

Devices earning this certification demonstrated the ability to detect a failure of the Layer 2 spanning tree via IEEE 802.1w Rapid Spanning Tree protocol and to establish a new Layer 2 "tree." In networks where multiple data paths exist, this approach provides a quicker re-establishment of traffic paths and dramatically reduces user downtime when compared with the recovery mechanism of traditional 802.1D spanning tree bridges/switches.

For this test, the HP switches tested demonstrated interoperability with all switches. Switches from 3Com, Cisco, Enterasys, Force10, Foundry, IBM, and NEC.

MULTIPLE SPANNING TREE PROTOCOL (MSTP)

This verifies that the HP switches tested implement

HP and
BLADE
Network
Technolo-
gies



- HP 1:10Gb Ethernet BL-c Switch
- HP 10Gb Ethernet BL-c Switch

Layer 2/3 Feature Interoperability

Product Specifications

Vendor-supplied information not necessarily verified by The Tolly Group

Hewlett-Packard Co.

HP 1:10Gb BL-c Switch

External ports:

- 4 external 10/100/1000BASE-T uplinks
- 1 external 10Gb CX4 uplink
- 2 external 10Gb XFP uplinks
- 1 management console port

Internal ports:

- 16 internal 1Gb downlinks to servers
- 1 internal 10Gb cross-connect
- Full line-rate performance: 120 Gbps full duplex

HP 10Gb BL-c Switch

External ports:

- 16 internal 10Gb downlinks
- 1 management console port

Internal ports:

- 16 internal 10Gb downlinks to servers
- Full line-rate performance: 400 Gbps full duplex

Common Software Features

- **Availability/Resiliency:** Ready for mission-critical applications
- **VLANs:** Customizable Virtual LAN support
- **High Availability:** Link Aggregation Protocol, Uplink Failure detection, VRRP, Spanning Tree
- **Traffic Management/Routing:**
- **CLI:** Alteon OS, Cisco-like CLI
- **Protocols supported:** SSH v2, TACACS+, RADIUS, 802.3, 802.3u, 802.3ab, 802.1d, 802.1s, 802.1w, 802.1p, 802.3ac, 802.1x, 802.3ad (Static), and 802.1Q, IGMP Snooping, BOOTP

IEEE 802.1s Multiple Spanning Tree instances on a switch port to selectively allow or block multiple VLANs., without blocking the entire traffic traversing the port.

LAYER 3 FUNCTIONS

RIPv2

This test verifies that the switches exchanges IPv4 routing table information

via RIP v2 protocols. The HP switches interoperated with switches from 3Com, Cisco, Enterasys, Force10, IBM, Foundry and NEC.

OSPFv2

Tolly Group engineers verified that the Foundry switches exchanged routing table information via OSPFv2 with other brand switches.


Tests show that the two HP switches share OSPF routing

table data with participating switches from 3Com, Cisco, Enterasys, Force10, Foundry, IBM and NEC. (See Figures 1, 2 and 3.)

VIRTUAL ROUTER REDUNDANCY PROTOCOL (VRRP)

Devices earning this certification have demonstrated interoperability using VRRP in both master and backup configurations with all possible vendor combinations. This veri-

Layer 2/3 Interoperability Certifications Awarded to HP 10Gb BL-c Switch for HP c-Class BladeSystem									
Certifications	802.1p/Q VLAN Tag Propagation	Jumbo Frame support	Link Aggregation (LACP)support	10G LAN PHY	Rapid Spanning Tree Protocol Support	Multiple Spanning Tree Protocol Support	RIP v2	OSPF v2	VRRP
3Com Switch 4800G 24-Port	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cisco Catalyst 6506-E	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enterasys SecureStack C3G124-48	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enterasys G3G124-24P	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enterasys Matrix-N 7G4282-49	✓	✓	✓	✓	✓	✓	✓	✓	✓
Enterasys Matrix-X4	✓	✓	✓	✓	✓	✓	✓	✓	✓
Force10 C300 Resilient Switch	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry FastIron GS 624P-PoE	✓	✓	✓	✓	✓	✓	N/S	N/S	✓
Foundry FastIron LS 624	✓	✓	✓	✓	✓	✓	N/S	N/S	✓
Foundry FastIron Edge X 624E+2XG-PREM6	✓	✓	✓	✓	✓	✓	✓	✓	✓
Foundry BigIron RX-4-AC	✓	✓	✓	✓	✓	✓	✓	✓	✓
HP 1:10Gb BL-c Switch	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nortel 1/10G Uplink Ethernet Switch Module for IBM BladeCenter	✓	✓	✓	✓	✓	✓	✓	✓	✓
NEC 10G Intelligent L3 Switch	✓	✓	✓	✓	✓	✓	✓	✓	✓

 **PASS** N/S= Not Supported N/A= Not Tested

NOTE: Five other switches were not tested with HP 10Gb Ethernet BL-c Switch due to their lack of common physical interfaces.

Source: The Tolly Group, August 2008 Figure 3

fies a device's ability to act as a standby router in the event of failure using VRRP standards in a multivendor network.

For this test, the HP devices tested achieved interoperability using VRRP with participating switches from 3Com, Enterasys, Cisco, Force10, Foundry, IBM and NEC.

TEST SETUP AND METHODOLOGY

Tolly Group engineers tested two BLADE Network Technologies switch models — the HP 1:10Gb Ethernet BL-c Switch and HP 10Gb

Ethernet BL-c Switch for HP c-Class BladeSystem.

Full details on the software versions of the HP switches tested, and info on the other 18 switches can be found in Figure 4 below.

The Cisco Catalyst 6506-E switch and associated accessories were provided by Network Hardware Resale, LLC — a leading provider of used, pre-owned, refurbished equipment from leading vendors like Cisco Networks, Juniper Networks, Extreme Networks, Redback, etc.

Ixia provided valuable facilities and logistics support for the Switches Interoperability Study 2008 Tests. Ixia's new iSim City lab facility in Santa Clara,

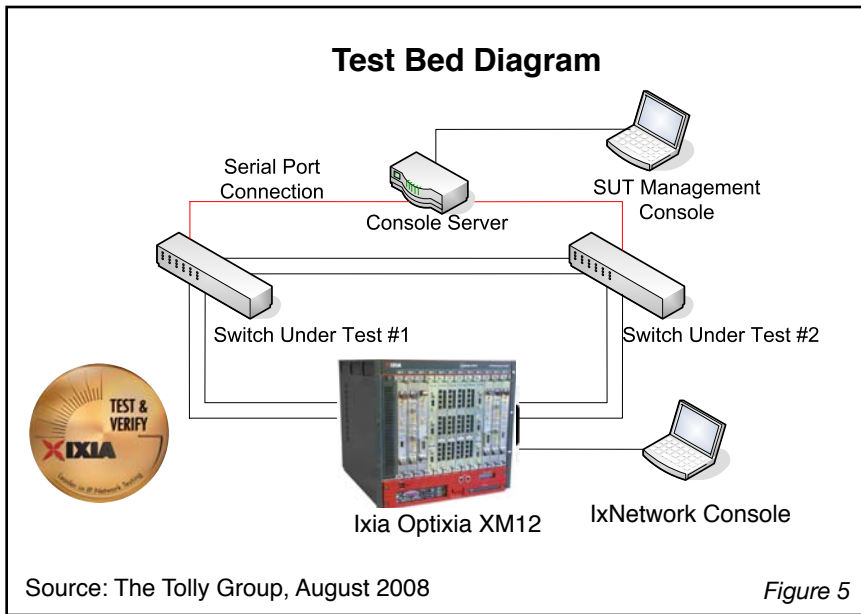
CA hosted the testing, and provided state-of-the-art power provisioning, management and cooling that were critical to a test of this scale.

The testbed utilized IxYukon, Ixia's latest solution for testing 10 GbE devices and networks. IxYukon interface modules are inserted into the Ixia's latest XM family of chassis: the XM12 and XM2. IxYukon's high-density packaging provides up to 96 ports of 10 GbE in a 10U rack-mount chassis and 16 ports in a 2-slot portable chassis. Ixia IxNetwork (Ver. 5.30 EA SP2) application was used to control the Ixia test platform.

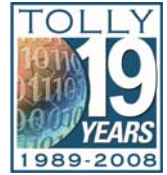
Device Under Test (DUT) Information		
Device Under Test	Software Version	HW Revision (Chassis Revision for Modular Switch)
3Com Switch 4800G 24-Port	5.2	REV. B
Cisco Catalyst 6506-E	12.2	WS-C6506-E
Enterasys SecureStack A2H124-48	A2-Series 02.01.02.0001	N/A
Enterasys Secure Stack B3G124-24	B3-Series 01.01.05.0004	N/A
Enterasys SecureStack C2K122-24	C2-Series 05.01.05.0004	N/A
Enterasys G3G124-24P w/G3K-4XFP	G3-Series 01.00.03.0002	N/A
Enterasys D2G124-12	D2-Series 01.00.01.0005	N/A
Enterasys Matrix N 7G4282-49 w/7K-2XFP	6.01.01.020	N1chassis
Enterasys Matrix X4	1.6.4.P3	N/A
Force10 C300 Resilient Switch	FTOS 7.7.1.0	N/A
IBM Nortel 1/10Gb Uplink Ethernet Switch Module	1.0.1	N/A
HP 1:10Gb Ethernet Blade Switch for C-Class Blade System	1.0.51.0	N/A
HP 10GB Ethernet BL-C Switch	1.0.51.0	N/A
NEC 1G Intelligent L2 Switch	1.2.0.10	N/A
NEC 1G Intelligent L3 Switch	1.1.0.11	N/A
NEC 10G Intelligent L2 Switch	1.0.2.0	N/A
Foundry FastIron GS 624-PoE	4.200a	N/A
Foundry FastIron LS 624	4.2.00b	N/A
Foundry FastIron Edge Series X624E+2XG-PREM6	4.1.00a	N/A
Foundry BigIron RX-4-AC	2.4.0e	N/A

Source: The Tolly Group, August 2008

Figure 4




The Tolly Group is a leading global provider of third-party validation services for vendors of IT products, components and services.



The company is based in Boca Raton, FL and can be reached at <http://www.tolly.com>, sales@tolly.com or +1 (561) 391-5610

Test Equipment Summary

The Tolly Group gratefully acknowledges the providers of test equipment used in this project.

Vendor	Product	Web
IXIA	Ixia Optixia XM12 chassis with IxYukon 8-port 10GbE module	http://www.ixiacom.com
 NETWORK HARDWARE RESALE	Cisco Catalyst 6506-E	http://www.networkhardware.com

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