

Blade Network Technologies, Inc.



Test Summary

HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem

Functionality Certification and Cooperative Interoperability Evaluation

Premise: Network managers who deploy a variety of Fast Ethernet, Gigabit Ethernet and 10GbE switching devices in their networks need guaranteed interoperability of these switches in order to maintain a functional network.

Blade Network Technologies, Inc. commissioned The Tolly Group to evaluate its HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem for interoperability with other brand switches.

Tolly Group engineers subjected the HP GbE2c Layer 2/3 Ethernet Blade Switch to more than a dozen tests with switches from 3Com, Alcatel-Lucent, Cisco Systems, Enterasys, Extreme Networks, Foundry Networks, Fujitsu, and IBM Nortel.

Engineers subjected the switch to advanced LAN services tests, including support for auto-negotiation, 802.1p/Q VLAN tag propagation, RIP v2, OSPF, BGP, Virtual Router Redundancy Protocol (VRRP), Rapid Spanning Tree Protocol (RSTP) and others.

Tests were conducted in March/April 2007 at Terremark Worldwide Inc.'s NAP of the Americas facility in Miami, a major Internet peering point.

Test Highlights

- ▶ Earns nine Switch Interoperability certifications for Layer 2 and Layer 3 advanced LAN functions
- ▶ Achieves broad Layer 2 and Layer 3 interoperability with 22 switches from nine vendors
- ▶ Interoperates with other devices tested when supporting 802.1p/Q VLAN tags, Link Aggregation, Multiple Spanning Tree, RIPV2, RSTP, VRRP, OSPF protocols and more

HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem Switch Interoperability Certifications Earned

Certification	Result
10/100/1000 Auto-Negotiation	
802.1p/Q VLAN Tag Propagation	
Jumbo Frame Support	
Link Aggregation Control Protocol (LACP)	
Rapid Spanning Tree Protocol (RSTP)	
Multiple Spanning Tree Protocol (MSTP)	
OSPF Routing Protocol Support	

Source: The Tolly Group, April 2007

Figure 1

Executive Summary

The GbE2c Layer 2/3 Ethernet Blade Switch demonstrated broad interoperability with 22 other switches 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 infrastructure. It is important for managers to know which devices can maintain their interoperability with different standardized and non-standardized functions.

Engineers tested 23 switches from nine vendors to determine the various levels of interoperability offered.

In Layer 2 interoperability tests, the Blade Networks switch tested — the HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem — consistently demonstrated interoperability with switches from 3Com, Alcatel-Lucent, Cisco Systems, Enterasys Networks, Extreme Networks, Foundry Networks, and

IBM Nortel.

(Both the IBM Nortel and HP switch modules were manufactured by Blade Network Technologies.)

In Layer 3 interoperability tests, the HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem achieved

broad interoperability with a 3Com Switch 5500G-EI, two Alcatel-Lucent OmniSwitch models, a Cisco Catalyst 6509-E, two Enterasys routers, two Extreme switches, three IBM Nortel switches, and four Foundry Networks switches.

Layer 2 Tolly Interoperability Certifications Awarded to HP GbE2c L2/3 Ethernet Blade Switch for HP c-Class BladeSystem						
Certification	10/100/1000 Auto-Negotiation	802.1p/Q VLAN Tag Propagation	Jumbo Frame support	Link aggregation	Rapid Spanning Tree Protocol support	Multiple Spanning Tree Protocol support
3Com Switch 4200G 24-Port	✓	✓	✓	✓	✓	✓
3Com Switch 4500G 24-Port	✓	✓	✓	✓	✓	✓
3Com Switch 5500G-EI PWR 48-Port	✓	✓	✓	✓	✓	✓
Alcatel-Lucent OmniSwitch 6850-P24X	✓	✓	✓	✓	✓	✓
Alcatel-Lucent OmniSwitch 9800	✓	✓	✓	✓	✓	✓
Cisco Catalyst 6509-E	✓	✓	✓	✓	✓	✓
Enterasys SecureStack A2H124-48*	✓	✓	✓	✓	✓	✓
Enterasys SecureStack B3G124-24*	✓	✓	✓	✓	✓	✓
Enterasys SecureStack C3G124-48*	✓	✓	✓	✓	✓	✓
Enterasys Matrix N1-DFE*	✓	✓	✓	✓	✓	✓
Enterasys Matrix X4 Secure Core Router	✓	✓	✓	✓	✓	✓
Extreme Summit X450a-24t	✓	✓	✓	✓	✓	✓
Extreme BlackDiamond 8806	✓	✓	✓	✓	✓	✓
Foundry FastIron Edge X424 Premium	✓	✓	✓	✓	✓	✓
Foundry FastIron SX 800	✓	✓	✓	✓	✓	✓
Foundry NetIron MLX	✓	✓	✓	✓	✓	✓
Foundry BigIron RX	✓	✓	✓	✓	✓	✓
Fujitsu XG700	N/A	!	!	!	!	N/A
Fujitsu XG2000	N/A	!	!	!	!	N/A
IBM Nortel Layer 2-3 GbE Switch Module*	✓	✓	✓	✓	✓	✓
IBM Nortel 10Gb Ethernet Switch Module	N/A	!	!	!	!	!
IBM Nortel 10Gb Uplink Ethernet Switch Module	✓	✓	✓	!	!	!
HP GbE2c L2/3 Ethernet Blade Switch for HP c-Class BladeSystem*	✓	✓	✓	✓	✓	✓

✓ = PASS N/A = Feature not supported
 ! = Not enough common physical interfaces between HP GbE2c L2/3 Ethernet Blade Switch and IBM Nortel or Fujitsu models

NOTES: (*) : Does not offer 10GbE uplink ports

Source: The Tolly Group, April 2007

Figure 2

LAYER 2 FUNCTIONS

AUTO-NEGOTIATION

The HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem interoperated with all of the switches tested. This feature was not tested on the 10GbE ports of the participant switches. Devices earning this certification have demonstrated the ability to establish the highest available speed and duplex settings in all vendor combinations. (See Figures 1 and 2.)

802.1P/Q VLAN TAG PROPAGATION

The HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem switch interoperated with all of the switches tested. Devices earning this certification demonstrated the ability to recognize and maintain 802.1p/Q tags across all vendor combinations tested. (See Fig. 2.)

Note that the switch was not tested with an IBM Nortel 10Gb Ethernet Switch Module and all Fujitsu models tested due to the lack of common physical interfaces.

JUMBO FRAME SUPPORT

The HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem interoperated with every switch tested.

Please note that the switch was not tested with an IBM Nortel 10Gb Ethernet Switch Module and all Fujitsu models tested due to the lack of common physical interfaces.

Devices earning this certification have demonstrated the ability to transmit Jumbo Frames (9K bytes) across all possible vendor switch combinations. (See Figures 1 and 2.)

LINK AGGREGATION 802.3AD

This test verifies a device's ability to trunk ports across multiple vendor combinations using LACP. For this Layer 2 test, the HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem achieved interoperability with 18 other participating switches.

Again, note that the switch was not tested with two IBM Nortel and all Fujitsu models tested due to the lack of common physical interfaces. (See Figure 2 for more details.)

RAPID SPANNING TREE PROTOCOL (802.1W)

Devices earning this certification have demonstrated the ability to detect a failure of the Layer 2 Spanning Tree via the 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.

Blade Network Technologies, Inc.



HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem

Layer 2/3 Feature Interoperability

Product Specifications

Vendor-supplied information not necessarily verified by The Tolly Group

**Blade Network Technologies
HP GbE2c Layer 2/3 Ethernet
Blade Switch for HP c-Class
BladeSystem**

🔧 Performance and Form Factor:

Blade type: Single bay

Performance: 48 Gb switching fabric, 128MB SDRAM, 16MB flash memory

Port configuration: 16 Internal 1Gb downlinks, 5 external 10/100/1000BASE-T uplinks, 4 optional external 1000SX fiber uplinks, 2 Internal cross-connects, 1 management console port

Media types: Copper RJ-45, SFP Fiber SX

🔧 Management and Protocols:

Management features: Dual mode CLI: AOS and ISCLI, SNMP v1, v2, v3, HTTP, HTTPS, NTP server support, RMON

High availability features: Link Aggregation Protocol, uplink failure detection, Spanning Tree, Virtual Router Redundancy Protocol (VRRP)

Protocols Supported: SSH v2, TACACS, 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

🔧 Deployment:

Max per enclosure: 8

Options available: Fiber SFP module kit - PN440627-B21 (max 2 per switch)

Warranty - year(s) (parts/labor/onsite): 1-1-1

For more information contact:

Blade Network Technologies, Inc.
www.bladenetwork.net
Tel: (408) 850-8999
Fax: (408) 855-9550

The HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem tested demonstrated interoperability with switches from 3Com, Alcatel-Lucent, Cisco, Enterasys, Extreme Networks, Foundry Networks, and IBM Nortel. (See Figures 1 and 2.)

Also, note that the HP switch was not tested with two IBM Nortel and all Fujitsu models tested due to the lack of common physical interfaces. (See Figure 2.)

MULTIPLE SPANNING TREE PROTOCOL SUPPORT

This verifies that the HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem implements multiple Spanning Tree instances on a switch port to selectively allow or block multiple VLANs, without blocking the entire traffic traversing the port.

Note that the switch was not tested with two IBM Nortel models due to the lack of common physical interfaces.

LAYER 3 FUNCTIONS

RIP v2 ROUTING PROTOCOL SUPPORT

This test verifies that the switches exchange IPv4 routing table information via the RIP v2 protocol.

The HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem inter-operated with switches from 3Com, Alcatel-Lucent, Cisco, Enterasys, Extreme Networks, Foundry Networks, and IBM Nortel.

OSPF SUPPORT

Tolly Group engineers verified that the switch exchanged routing table information via OSPF

with other brand switches. Tests show that the HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem shares OSPF routing table data with participating switches from Alcatel-Lucent, Cisco, Extreme Networks, Foundry Networks, and IBM Nortel. (See Figure 3.)

VRRP SUPPORT

Layer 3 Tolly Interoperability Certifications Awarded to HP GbE2c L2/3 Ethernet Blade Switch for HP c-Class BladeSystem				
Certification	RIP v2	OSPF	Virtual Router Redundancy Protocol (VRRP)	
3Com Switch 4500G 24-Port	✓	N/A	N/A	
3Com Switch 5500G-EI PWR 48-Port	✓	✓	✓	
Alcatel-Lucent OmniSwitch 6850-P24X	✓	✓	✓	
Alcatel-Lucent OmniSwitch 9800	✓	✓	✓	
Cisco Catalyst 6509-E	✓	✓	✓	
Enterasys Matrix N1-DFE	✓	✓	✓	
Enterasys Matrix X4 Secure Core Router	✓	✓	✓	
Extreme Summit X450a-24t	✓	✓	✓	
Extreme BlackDiamond 8806	✓	✓	✓	
Foundry FastIron Edge X424 Premium	✓	✓	✓	
Foundry FastIron SX 800	✓	✓	✓	
Foundry NetIron MLX	✓	✓	✓	
Foundry BigIron RX	✓	✓	✓	
IBM Nortel Layer 2-3 GbE Switch Module	✓	✓	✓	
IBM Nortel 10Gb Ethernet Switch Module	✓	✓	✓	
IBM Nortel 10Gb Uplink Ethernet Switch Module	✓	✓	✓	
HP GbE2c L2/3 Ethernet Blade Switch for HP c-Class BladeSystem	✓	✓	✓	

✓ = PASS N/A = Feature not supported

Source: The Tolly Group, April 2007

Figure 3

Devices earning this certification have demonstrated interoperability using VRRP in both Master and Back-up configurations with all possible vendor combinations. This verifies a device's ability to act as a standby router in the event of failure using VRRP standards in a multi-vendor network.

For this test, the switch achieved interoperability using VRRP with participating switches from 3Com, Alcatel-Lucent, Enterasys, Extreme Networks, Foundry Networks, and IBM Nortel.

TEST SETUP AND METHODOLOGY

Tolly Group engineers tested the Blade Network Technologies HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem.

Full details on the software version of the HP GbE2c Layer 2/3 Ethernet Blade Switch for HP c-Class BladeSystem tested, and information on the other 22 switches can be found in Figure 4 below.

Details on the methodology used for each of the tests can be located on The Tolly Group's Web site at www.tolly.com.

Terremark Worldwide provided valuable facilities and logistics

support for the Switch Interoperability Study 2007. Terremark's NAP of the Americas facility in Miami, FL hosted the testing, and provided state-of-the-art power provisioning, management and cooling that were critical to a test of this scale.

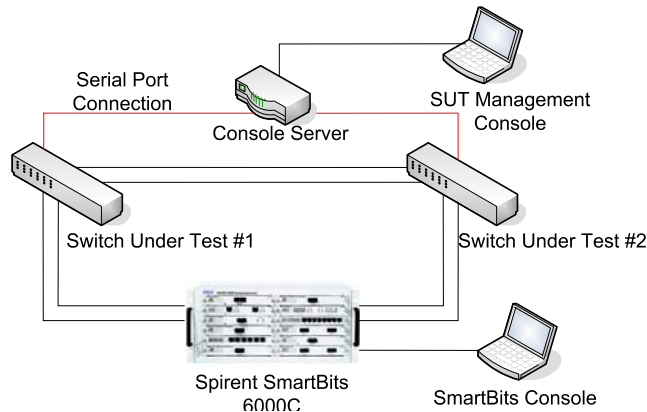
The Siemon Company provided custom length, reliable, high quality patch cables for the testing – 10G Augmented Cat 6 Shielded patch cables, and XGLO™ Singlemode Fiber Optic Cables.

The Tolly Group Switch Interoperability Study 2007 Device Under Test (DUT) Information		
Device Under Test	SW Version	HW Revision (Chassis Revision for Modular Switch)
3Com Switch 4200G 24-Port	3Com OS V3.01.00s168	REV. B
3Com Switch 4500G 24-Port	3Com OS V5.01.00s168p01	REV. B
3Com Switch 5500G-EI PWR 48-Port	3Com OS V3.02.00s168	REV. C
Alcatel-Lucent OmniSwitch 6850-P24X	AOS 6.1.3.719.R01	06
Alcatel-Lucent OmniSwitch 9800 (OS9800-CMM, OS9-XNI-U2, OS9-GNI-C24)	AOS 6.1.3.719.R01	B05
Cisco Catalyst 6509-E (WS-SUP720-3BXL, WS-X6704-10GE, WS-X6748-GE-TX)	12.2(18)SXF4	1.2
Enterasys SecureStack A2H124-48	01.04.05	BCM5655 REV 18
Enterasys SecureStack B3G124-24	01.00.70	BCM56504 REV 19
Enterasys SecureStack C3G124-48	01.00.76	BCM56504 REV 19
Enterasys Matrix N1-DFE (7G4202-30)	05.35.16	0
Enterasys Matrix X4 Secure Core Router (X-CM-00-RH, X4-FM-RH, X-M2-00-RH, X-T32-00)	1.3.3	0
Extreme Summit X450a-24t	ExtremeXOS ver. 11.6.1.9	1.0
Extreme BlackDiamond 8806 (800112-00-20, 800116-00-02, 800159-00-04)	ExtremeXOS ver. 11.6.1.9	5.0
Fujitsu XG700	E10L10 XF0073 2005/10/26-13:14:42	
Fujitsu XG2000	E10L10 X12 2007/02/09-08:26:03	
Foundry FastIron Edge X424 Premium	03.2.00T3e3	
Foundry FastIron SX 800 (SX-FI2XGMR4, SX-F424C)	03.2.00T3e3	
Foundry NetIron MLX (NI-MLX-MR, NI-MLX-10Gx4, NI-MLX-1Gx20-GC)	IronWare Ver. 3.3.0T163	
Foundry BigIron RX (RX-BI-MR, RX-BI-4XG, RX-BI-24C)	IronWare Ver. 2.3.0bT143	
IBM Nortel Layer2-3 GbE Switch Module (Copper)	1.2.5.0	1
IBM Nortel 10Gb Uplink Ethernet Switch Module	1.0.1.1	0
IBM Nortel 10Gb Ethernet Switch Module	1.0.1.1	5
HP GbE2c L2/3 Ethernet Blade Switch for HP c-Class BladeSystem	2.0.0	0A

Source: The Tolly Group, April 2007

Figure 4

Switch Interoperability Test Bed



Source: The Tolly Group, April 2007

Figure 5


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 by phone at (561) 391-5610, or via the Internet at <http://www.tolly.com>, sales@tolly.com

Test Equipment Summary

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

Vendor	Product	Web
Spirent Communications 	SmartFlow 5.5, SmartWindow 9.0, SmartBits 6000C, SmartMetrics 10G Ethernet module XFP-3730A, SmartMetrics XD module LAN-3324A	http://www.spirent.com

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