TEST REPORT

Tolly.

#209143
November 2009

Commissioned by 3Com Corporation

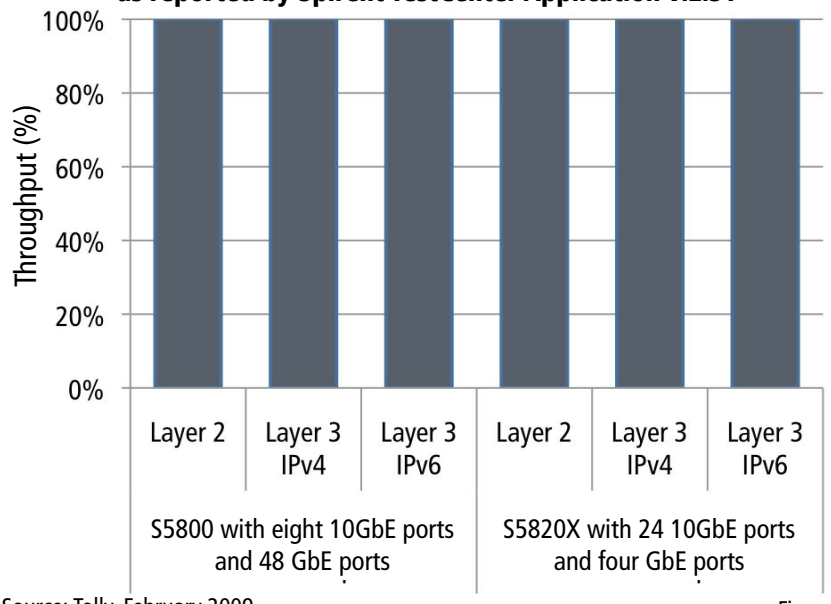
H3C S5800/S5820X Series Flex Chassis 10GbE Switches
Feature Validation and Performance Evaluation

EXECUTIVE SUMMARY

Tolly engineers selected several models from 3Com's H3C S5800 and S5820X series of 10Gigabit Ethernet (10GbE) flex chassis switches to verify the performance and key features that make them optimally suited for deployment as access or aggregation switches in data center networks, carrier networks, or enterprise networks where there is a need to aggregate voice, data and video applications.

. . . continued on next page

H3C S5800/S5820X Series - RFC 2544 Throughput
Using Various Switch Modules with all Ports in Full-Mesh
as reported by Spirent TestCenter Application v.2.31



Source: Tolly, February 2009

Figure 1

THE BOTTOM LINE

1. Achieved Layer 2, Layer 3 IPv4 and IPv6 wire-speed throughput for S5800 and S5820X
2. S5800 and S5820X Series switches supported H3C's Intelligent Resilient Framework (IRF™) for increased availability and resiliency, just two of the benefits of switch virtualization
3. S5800 and S5820X supported an Open Application Architecture (OAA) which enable network service modules such as firewall to be added to these platforms
4. Provided up to 24 10GbE wire-speed ports, with flexible interface configuration options
5. Received Tolly Certified ratification of more than 140 features

Today's enterprise networks need to provide robust levels of reliability and availability to fulfill their role in any organization. The H3C S5800 and S5820X series switches demonstrated wire-speed Layer 2 and Layer 3 IPv4/IPv6 forwarding capability with no packet loss for all standard frame and packet sizes in full-mesh configuration.

For next-generation desktop switches, rich service features enable them to be used as either aggregation or access devices in both Local Area Networks (LANs) and Metropolitan Area Networks (MANs). Tolly Group certified more than 140 features for the H3C S5800 and S5820X series switches.

Services such as streaming multimedia (video on demand, videoconferencing, etc.) and multicast routing continue to gain user adoption and remain bandwidth-intense applications. The H3C S5800 and S5820X series of 10Gigabit Ethernet flex chassis switches provided the throughput required for these and future services with support for 1,024 IPv4 and 512 IPv6 multicast groups. They also supported a broad range of IPv4 and IPv6 multicast protocols.

In today's challenging "always available" enterprise network environment, reliability and security must be guaranteed to justify any infrastructure investment. The H3C S5800 and S5820X series switches showcased outstanding reliability in Bidirectional Forwarding Detection (BFD) tests for network fault detection. These switches also supported various security features like Endpoint Admission Defense (EAD), unicast Reverse Path Forwarding (uRFP), Media Access Control (MAC) authentication, 802.1x authentication and others.

Used as access or aggregation switches, the S5800 and S5820X series switches fully supported Intelligent Resilient Framework (IRF) technology, which enables a stack of interconnected switches to function and be managed as a single logical entity, provides distributed link aggregation to eliminate single points of failure, and enables the creation of remote stacks of virtual switches. All these switches supported robust Quality of Service (QoS) features like ingress and egress traffic limit, ingress and egress Access Control Lists (ACLs), as well as various queue scheduling policies. The S5800 and S5820X also supported VLAN-based traffic shaping and service policies.

3Com Corporation

H3C S5800/S5820X Series Switches

Feature Validation and Performance Evaluation

Tolly. Certified

Tested February 2009

To minimize an enterprise network's Total Cost of Ownership (TCO), network devices must have intelligent and flexible maintenance and management features that reduce demands on your IT staff. The H3C S5800/S5820X series switches

Summary of Devices Under Test

Product Line	Hardware Version	Software Version	Certified Products
S5800 Series	S5800-56C S5800-60C-PWR S5800-32C-PWR S5800-32F	Comware Software Version 5.20 Release 1102	S5800-60C-PWR, S5800-56C S5800-56C-PWR, S5800-32C S5800-32C-PWR, S5800-32F
S5820X Series	S5820X-28C S5820X-28S	Comware Software Version 5.20 Release 1102	S5820X-28C S5820X-28S

Source: Tolly, February 2009

Figure 2

supported Link Layer Discovery Protocol (LLDP), Simple Network Management Protocol (SNMP) and Remote Monitoring (RMON). The S5800 and S5820X switches also supported Operation, Administration and Maintenance (OAM), and Rapid Ring Protection Protocol as well as abundant IPv6 features that safeguard your network infrastructure investment from obsolescence.

Functionality Certification

Layer 2 VLAN Features

For the S5800 and S5820X series switches, Tolly engineers verified seven features: support for 4,094 VLANs, Voice VLAN, port-based VLAN, protocol-based VLAN, MAC address-based VLAN, 1:1 VLAN mapping and GARP VLAN Registration Protocol (GVRP).

Physical Port Functionality

The S5800/S5820X series switches provided SFP+ ports, auto-negotiating 10/100/1000 ports, auto Media-Dependent Interface (MDI)/Media-Dependent Interface with Crossover (MDIX) and 802.3x full-duplex Ethernet switching.

Frame Forwarding

The S5800/S5820X series switches provided wire-speed Layer 2 throughput with all Gigabit Ethernet ports in full-mesh and all 10Gigabit Ethernet ports in full-mesh configuration. (See figure 1 for the results.)

MAC-Forced Forwarding

The S5800/S5820X series flex chassis switches support MAC-forced forwarding (MACFF) to control unwanted broadcast traffic and host-to-host communication.

Link Aggregation

The S5800/S5820X series switches supported static and dynamic link aggregation with fair load sharing.

Mirroring Functionality

These switches featured port mirroring, traffic mirroring and Remote Switched Port Analyzer (RSPAN). The S5800 and S5820X series switches also delivered Encapsulated Remote Switched Port Analyzer (ERSPAN) technology.

MAC Address Management

Each switch in the S5800 and S5820X series supported 32,786 MAC addresses.

Ethernet Port Storm Control

These flex chassis switches supported unknown unicast, unknown multicast and broadcast storm control.

Power over Ethernet

The S5800 series switches were tested to deliver Power over Ethernet (PoE) of 24 watts per port, and support a maximum of up to 30 watts per port.

QinQ Support

The S5800 and S5820X series switches provided QinQ and selective QinQ.

Spanning Tree Protocols

The S5800/S5820X series switches supported Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP). Tolly engineers verified that the convergence time for RSTP was as low as 120.8 ms on S5800 switches and 72.7 ms on the S5820X switches.

For MSTP, convergence times were as low as 145.4 ms for the S5800 series and 134.0 ms for the S5820X.

Link Down Delay Support

The S5800 and S5820X series switches enabled custom setting of the carrier delay timer so network administrators could adjust the amount of time that must elapse before the rest of the software on a switch was aware of a link-down event.

DLDP Support

The S5800 and S5820X series switches provided H3C Device Link Detection Protocol (DLDP) for unidirectional link status detection.

RRPP Support

The S5800 and S5820X series switches supported Rapid Ring Protection Protocol (RRPP) and RRPP multi-instance; failover time could be as low as 2.2 ms on S5800 switches and 1.3 ms on the S5820X switches.

OAM Functionality

The S5800 and S5820X series switches supported 802.1AB Link Layer Discovery Protocol (LLDP) and loopback detection functions. The S5800 and S5820X switches also provided Operation, Administration and Maintenance (OAM) functions including 802.1ag Connectivity Fault Management/Detection (CFM/CFD) service OAM and 802.3ah Ethernet in the First Mile (EMF) link-layer OAM.

Smart Link Support

H3C's Smart Link technology enhances the Spanning Tree Protocol. Failover times were as low as 4.3 ms with the S5800 switches and 4.5 ms with the S5820X.

Layer 3 Functionality

The H3C S5800 and S5820X series switches offered support for static routing, Policy-Based Routing (PBR), Routing Information Protocol version 1 (RIPv1), RIPv2, Intermediate System to Intermediate System (IS-IS) routing, Border Gateway Protocol (BGP4), and Open Shortest Path First (OSPF), as well as a full range of IPv6 routing protocols, including IPv6 static routing, IPv6 PBR, Routing Information Protocol next generation (RIPng), IS-ISv6, BGP4+ and OSPFv3.

These switches also offered Bidirectional Forwarding Detection (BFD) to detect faults between two forwarding engines utilizing static routing, OSPF, RIP or Virtual Router Redundancy Protocol (VRRP). BFD provided fault detection times of less than 40 ms.

The S5800 flex chassis switch series supported 16,384 IPv4 route entries and 8,192 IPv6 route entries. The S5820X series of 10Gigabit Ethernet switches supported 12,288 IPv4 route entries and 6,144 IPv6 route entries in the routing table.

Packet Forwarding

The H3C S5800 and S5820X flex chassis switches deliver wire-speed IPv4 and IPv6 Layer 3 throughput with all Gigabit Ethernet ports in full-mesh and all 10Gigabit Ethernet ports in full-mesh configuration. (See figure 1.)

Cut-Through Switching

The S5820X portfolio of switches delivered cut-through forwarding to reduce network latency. Tolly engineers verified that for one-to-one port bidirectional packet forwarding, cut-through forwarding produced significantly less latency than store-and-forward, especially with large packet sizes. (Results are shown in Figure 3.)

Multicast Functionality

The H3C S5800 and S5820X switches supported up to 1,024 IPv4 multicast groups. In addition, Tolly engineers also verified the following protocols: Internet Group Management Protocol (IGMP) v1/v2/v3, IGMP v1/v2/v3 snooping, Protocol Independent Multicast (PIM)-Dense Mode (DM)/ Sparse Mode (PIM-SM)/Source Specific Multicast (PIM-SSM) protocols, Multicast VLAN Registration (MVR), Multicast VLAN+ Registration (MVR+) with super VLAN as multicast VLAN, and Multicast Source Discovery Protocol (MSDP).

Also confirmed for these switches is a full range of IPv6 multicast functionality for up to 512 IPv6 multicast groups: IPv6 Multicast Listener Discovery (MLD) v1/v2 protocols, MLD v1/v2 snooping and IPv6 PIM DM/SM/SSM protocols.

Network Protocols

These three switch series supported Network Time Protocol (NTP) client, data link layer DHCP snooping and DHCP option 82 protocols. The S5800 and S5820X switches also supported Dynamic Host Configuration Protocol (DHCP) relay, DHCP server, DHCP client/BOOTstrap Protocol (BOOTP) client, VRRP, VRRPv3 for IPv6 and Multi-Customer Edge (MCE) functionality for BGP/MPLS VPN to optimize network traffic.

Tunneling Functionality

The S5800 and S5820X switches offered networking technologies that will maximize the return on the network infrastructure investment. IPv6 over IPv4 tunneling protocols, including IPv6 manual tunneling, automatic 6to4 tunneling and Intra-Site Automatic Tunnel Addressing Protocol (ISATAP) ensure the network will keep pace with an expanding pool of users and the throughput-intensive applications they demand.

These switches also supported IPv4 over IPv4 tunneling and IPv4 over IPv4 Generic Routing Encapsulation (GRE) tunneling, as well as IPv6 over IPv6 tunneling and IPv6 over IPv6 GRE tunneling.

IPv6 Support

In addition to IPv6 routing and tunneling features, the S5800 and S5820X switches supported IPv6 Telnet, IPv6 tracert, IPv6 TFTP, IPv6 Neighbor Discovery, Domain Name System (DNS) client6, ping v6, FTP v6, SNMP v6, SSH v6 and IPv6 ACL.

Security Functionality

To protect enterprises' proprietary information as well as that concerning their customers, the S5800 and S5820X feature a wide range of security features and functionality such as hierarchical user management, password protection, SSHv2, Terminal Access Controller Access Control System (TACACS), and Layer 3/4 access control list (ACL) user authentication. S5800 and S5820X switches also supported 802.1x authentication, centralized MAC authentication, portal authentication that forces access users to navigate through a portal Web site, H3C Endpoint Admission Defense (EAD) authentication for attack defense, ACL, unicast Reverse Path Forwarding (uRPF) and H3C port-security functionality.

Quality of Service (QoS)

The H3C S5800/S5820X series switches featured traffic shaping and traffic

Test Metrics from Latency Tests
as reported by Spirent TestCenter Application v.2.31

	64 (78 for IPv6) bytes	128 bytes	256 bytes	512 bytes	1,024 bytes	1,280 bytes	1,518 bytes	9,212 bytes
S5800 Layer 2	4.02	4.45	5.38	7.27	11.08	12.97	14.77	72.22
S5800 IPv4 Layer 3	4.02	4.45	5.38	7.27	11.08	12.97	14.76	72.16
S5800 IPv6 Layer 3	4.10	4.45	5.38	7.27	11.08	12.97	14.77	72.17
S5820X Layer 2	2.18	2.35	2.69	3.40	4.85	5.53	6.18	25.78
S5820X IPv4 Layer 3	2.18	2.35	2.70	3.37	4.88	5.59	6.21	25.90
S5820X IPv6 Layer 3	2.22	2.35	2.70	3.38	4.81	5.51	6.22	26.43
S5820X Cut-Through	2.02	2.32	2.32	2.31	2.31	2.31	2.31	2.32
S5820X Store-and-Forward	2.02	2.32	2.73	3.12	3.51	5.13	6.70	9.28

Note:
* The units of columns' titles are bytes/frame or bytes/packet according to different test entries.
* The units of results are all uSec.
* All ports on the tested modules are in full-mesh configuration with no packet or frame loss except the last two entries.
* As the device under test, S5800 switches have eight 10GbE ports and 48 GbE ports; S5820X switches have 24 10GbE ports and four GbE ports.

Source: Tolly, February 2009

Figure 3

policy, including Committed Access Rate (CAR) and line rate, traffic redirection, traffic statistics, 802.1p priority mapping, Strict Priority (SP) queuing, Weighted Round Robin (WRR) queuing, SP + WRR queuing, traffic shaping, priority mapping and replacing 802.1p/ Differentiated Services Code Point (DSCP) preference values functionality. The S5800 and S5820X switch lines also provided ingress and egress VLAN-based QoS policy, VLAN-based traffic shaping and Weighted Fair Queuing (WFQ).

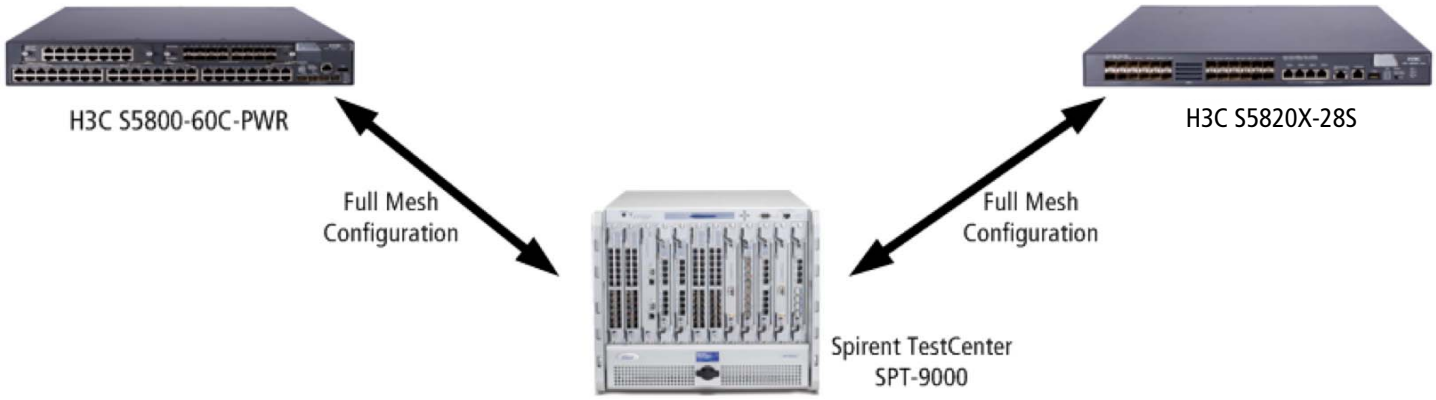
System Monitoring and Management

These 10Gigabit Ethernet flex chassis switches delivered various system management methods, including Web-based and Command-Line Interface (CLI) through Telnet and console port. They also offered options for: system logging to PC, system upgrade via FTP, saving/loading configuration to text file, USB port, SNMP, RMON, sFlow and group management through switch stack technology. Additionally, the H3C 5800-32F and S5820X-28S provided out-of-band management ports.

Intelligent Resilient Framework (IRF)

The S5800 and S5820X switch lines also supported H3C Intelligent Resilient Framework (IRF), which enables multiple, interconnected Layer 3 switches to form a distributed switching architecture and run as a single logic switching entity. IRF primarily delivers

H3C S5800/S5820X Series Throughput and Latency with Full-Mesh Configuration



Source: Tolly, February 2009

Figure 4

three technical advantages: single IP management, cross-device link aggregation and distributed resilient routing.

Open Application Architecture

H3C S5800-60C and S5820X-28C were built on an Open Application Architecture (OAA), so that in addition to providing packet forwarding functions as other S5800/S5820X series switches do, they also provided deeper and wider services that can be integrated into the network like firewalls or other applications users will require in the future.

Test Bed Setup & Methodology

Tolly engineers tested 3Com's H3C S5800/S5820X series switch functionality and performance using models: S5800-56C, S5800-60C-PWR, S5800-32C-PWR, S5800-32F, S5820X-28C and S5820X-28S, all running the Comware Operating System v5.20, release 1132. (See Figure 2 for detail.)

In performance tests, Tolly engineers configured a Spirent TestCenter SPT-9000 traffic generator and the TestCenter Application v2.31 to measure throughput and latency for Layer 2 and Layer 3 IPv4 and IPv6 forwarding.

Tolly Engineers used full-mesh configuration with all ports on tested device. Strict RFC 2544 recommendations with no frame or packet loss were used to measure untagged 64- (78- for IPv6), 128-, 256-, 512-, 1,024-, 1,518- and 9,212-byte frames' or packets' traffic. Each test was run for 60 seconds.

About Tolly…

The Tolly Group companies have been delivering world-class IT services for 20 years. Tolly is a leading global provider of third-party validation services for vendors of IT products, components and services.
You can reach the company via E-mail at sales@tolly.com, or via telephone at +1 (561) 391-5610.

Visit Tolly on the Internet at: http://www.tolly.com

Test Equipment Summary

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

Vendor	Product	Web
Spirent Communications	TestCenter SPT-9000 chassis EDM-1003B, EDM-2003A, EDM-2003B, MSA1001B, MSA2001B modules XFP-4001A, XEN-4001A personality boards	http://www.spirent.com/ TESTED with SPIRENT
Wireshark Foundation	Wireshark Network Protocol Analyzer	http://www.wireshark.org/

Terms of Usage

This document is provided, free-of-charge, to help you understand whether a given product, technology or service merits additional investigation for your particular needs. Any decision to purchase a product must be based on your own assessment of suitability based on your needs. The document should never be used as a substitute for advice from a qualified IT or business professional. This evaluation was focused on illustrating specific features and/or performance of the product(s) and was conducted under controlled, laboratory conditions. Certain tests may have been tailored to reflect performance under ideal conditions; performance may vary under real-world conditions. Users should run tests based on their own real-world scenarios to validate performance for their own networks.

Reasonable efforts were made to ensure the accuracy of the data contained herein but errors and/or oversights can occur. The test/audit documented herein may also rely on various test tools the accuracy of which is beyond our control. Furthermore, the document relies on certain representations by the sponsor that are beyond our control to verify. Among these is that the software/hardware tested is production or production track and is, or will be, available in equivalent or better form to commercial customers. Accordingly, this document is provided "as is", and Tolly Enterprises, LLC (Tolly) gives no warranty, representation or undertaking, whether express or implied, and accepts no legal responsibility, whether direct or indirect, for the accuracy, completeness, usefulness or suitability of any information contained herein. By reviewing this document, you agree that your use of any information contained herein is at your own risk, and you accept all risks and responsibility for losses, damages, costs and other consequences resulting directly or indirectly from any information or material available on it. Tolly is not responsible for, and you agree to hold Tolly and its related affiliates harmless from any loss, harm, injury or damage resulting from or arising out of your use of or reliance on any of the information provided herein.

Tolly makes no claim as to whether any product or company described herein is suitable for investment. You should obtain your own independent professional advice, whether legal, accounting or otherwise, before proceeding with any investment or project related to any information, products or companies described herein. When foreign translations exist, the English document is considered authoritative. To assure accuracy, only use documents downloaded directly from Tolly.com.

209143-ivcfs4-yx-kk-04Nov09-verG