THE TOLLY GROUP

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Hewlett-Packard Co.

HP Procurve Switch 5308xl versus Cisco Systems, Inc. Catalyst 4006 Switch

Competitive Evaluation

Test Summary

Premise: *Network managers, regardless of network size, require Layer 2 and Layer 3 switches that can deliver bidirectional line-rate traffic with zero-loss. Furthermore, they need to know that the devices they deploy can provide QoS functionality to satisfy the demands of today's converged networks.*

Hewlett-Packard Co. commissioned The Tolly Group to evaluate its HP Procurve Switch 5308xl, versus a Cisco Systems, Inc. Catalyst 4006 switch in competitive Layer 2/Layer 3 Fast Ethernet/Gigabit Ethernet performance tests. The HP Procurve Switch 5308xl is a high-density, high-performance Layer 2/3/4 switch with eight slots that accommodate a variety of modules. For these tests, The Tolly Group tested the switch with Gigabit-over-copper modules. The Catalyst 4006 offers six slots; for this test, engineers also outfitted the device with Gigabit-over-copper modules. Testing was performed in August 2002.

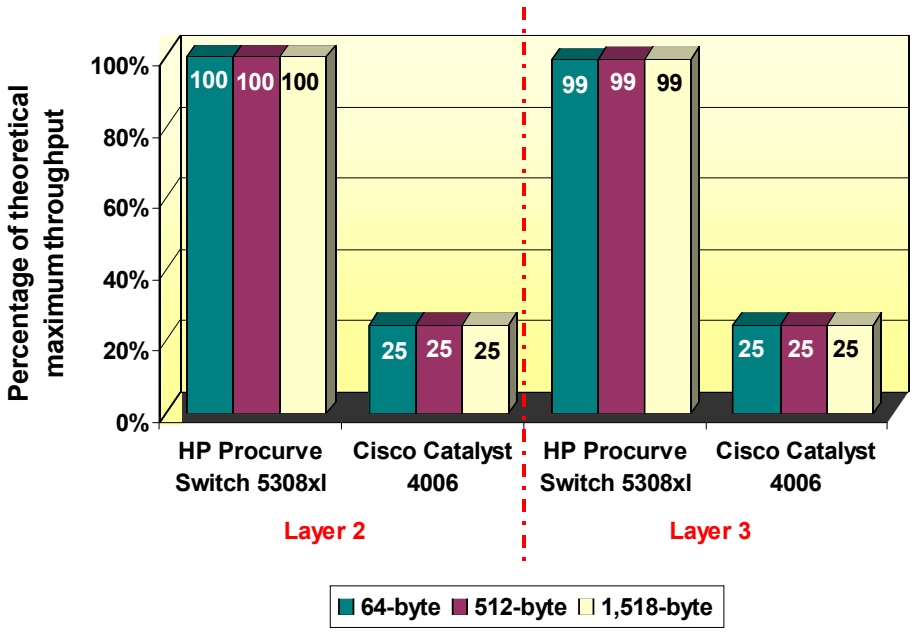
The Tolly Group evaluated the steady-state, zero-loss (≤ 0.001%) bidirectional (full-duplex) packets-per-second (pps) throughput of both switches using 64-, 512- and 1,518-byte packet sizes at both Layer 2 and Layer 3. The Tolly Group engineers tested both switches in the following scenarios: a Fast Ethernet only topology with 192 ports; a Gigabit Ethernet only topology using 32 Gigabit Ethernet ports; and a mixed topology of 120 Fast Ethernet ports and 12 Gigabit Ethernet ports.

Test Highlights

- Delivers 100% of wire speed Layer 2 throughput with Gigabit Ethernet uplinks compared to the Catalyst 4006 which delivered only 25% in the same scenario
- Exhibits at least 20% lower latency for all packet sizes tested compared to the Catalyst 4006
- Conforms more closely to defined mapping and management of multiple priority queues than the Catalyst 4006
- Offers four times better performance at one-fourth of the price of the Catalyst 4006 with Gigabit-over-copper ports

Zero-Loss Layer 2 and Layer 3 Throughput across 120 Fast Ethernet, 12 Gigabit Ethernet ports

Full-duplex traffic as measured by IXIA



Source: The Tolly Group, August 2002

Figure 1

Catalyst 4006 only delivered 25% of line rate for all packets at Layer 2 and Layer 3 with zero-loss. (See Figure 1.)

Bidirectional, inter-module performance tests in a Gigabit Ethernet only topology utilized a full-mesh configuration and a port-pair configuration. Results demonstrate that the 5308xl delivered 100% of the theoretical maximum throughput for all packet sizes tested at Layer 2 and Layer 3 with zero-loss in both scenarios. In comparison, the Catalyst 4006 only delivered 25% of line rate for all packets at Layer 2 and Layer 3 with zero-loss.

Bidirectional, inter-module tests in a Fast Ethernet only topology also utilized both a full-mesh and port-pair configuration. Results demonstrate that both devices delivered 100% of the theoretical maximum for all packet sizes tested with zero-loss in both scenarios.

Latency

In latency measurements, lower numbers are better, since they indicate less delay. Latency tests in a Fast Ethernet topology reveal that when handling 1,518-byte packets, the 5308xl had an average latency of 153 microseconds at both Layer 2 and 3, or 22% lower than the Catalyst 4006 which had an average latency of 223 microseconds at Layer 2 and 195 microseconds at Layer 3.

Latency tests in a Gigabit Ethernet topology demonstrate that when handling 1,518-byte packets, the 5308xl achieved an average latency of 22 microseconds for Layer 2 and Layer 3, or 27% lower than the Catalyst 4006 which achieved an average latency of 30 microseconds.

The latency of a packet is made up of several components. One component is a function of packet size. Another is the forwarding speed and consistency of a switch. Relative latency calculations normalize the packet size component of latency and highlight the component of latency attributed directly to the forwarding speed as well as any differences in the latency of different packets (jitter).

To obtain relative latency, measurements are grouped by packet size and line speed; then the difference between the average latency measurement and the smallest latency measurement is divided by the smallest latency measurement (the base). In terms of relative latency, the Catalyst 4006 has an almost 50% higher latency for all packet sizes tested compared to the HP 5308xl device for Fast Ethernet Layer 2 (see Figure 2) and almost 30% higher for the Gigabit Ethernet configuration.

Flow Rate

The objective of this test was to determine whether the DUTs were capable of properly implementing defined queuing behavior in handling prioritized traffic. For both systems, the default priority policies were used. Traffic was sent from 20 Fast Ethernet ports to a single outbound Gigabit Ethernet port which was oversubscribed by 25% of line rate.

With the default priority for unmarked or best effort traffic marked as "0", the IEEE recommends mapping traffic lower in priority than best effort traffic as priority 1 and priority 2 for devices implementing QoS with four or more queues. Both the 5308xl and the Catalyst 4006 implement QoS with four queues. Results show that the 5308xl uniformly dropped 100% of oversubscribed packets from priority 1 and priority 2 traffic. In contrast, the Catalyst 4006 dropped the majority of packets uniformly from priority 1 and from priority 0 traffic and dropped the remainder from traffic designated as higher priority. This demonstrates that the 5308xl correctly forwarded and dropped traffic according to the defined policy parameters based on QoS classifications as recommended by

Hewlett-Packard

HP Procurve 5308xl

Competitive Evaluation

Hewlett-Packard Co.
HP Procurve Switch 5308xl
Product Specifications*

Feature

- Non-blocking architecture: 76.8 Gbit/s non-blocking crossbar switching fabric provides up to 48 million pps
- HP switch meshing
- IP Layer 3 Router Redundancy Protocol (XRRP)*
- IP multicast (data-driven IGMP)
- Rapid Convergence Spanning Tree Protocol (802.1w)
- 802.3ad Link Aggregation Control Protocol (LACP) and HP trunking
- 802.1x and RADIUS network login and OpenVLAN
- VLAN support and tagging
- Access control lists (ACLs)*
- MAC address lockdown port security
- Source port filtering
- TACACS+, CDP, Cisco Fast EtherChannel
- Secure Shell (SSH)
- Secure Sockets Layer (SSL)*
- Layer 4 prioritization, Traffic prioritization (802.1p), and IEEE 802.1p Class of Service (CoS)
- Group VLAN Registration Protocol (GVRP)
- Lifetime warranty: for as long as you own the product, with next-business-day advance replacement (available in most countries)

* Available January 2003 via a FREE software update from the Web

For more information contact:
Hewlett-Packard Co.
8000 Foothills Blvd.
Roseville, CA 95747
Phone: (800) 477-6111 ext. 41682
(U.S. and Canada)
URL: http://www.hp.com/go/hpprocurve
(worldwide)

**Vendor-supplied information not verified by The Tolly Group*

configured IXIA for the tested frame size, network utilization, test duration and operational mode. (See Figure 5.)

Engineers initiated each test and recorded results. If frame loss occurred, they repeated the procedure and lowered the network utilization until no frame loss occurred. IXIA 1600 recorded total transmitted frames, and total received frames, plus frame loss, if any. Tests were run for 60 seconds for each of three iterations and results were averaged.

Latency testing was completed using the IXIA 1600 test suite for latency defined in the RFC 2544. While generating traffic at 1% of the theoretical maximum, latency calculations of the various frame sizes were obtained and reported.

For the flow rate tests, engineers configured 20 Fast Ethernet ports, with each port grouped by priority level and each priority level given a unique traffic rate, to send traffic to one Gigabit Ethernet egress port oversubscribed by 25% of line rate.

For classification tests, engineers configured twenty Fast Ethernet ports to transmit traffic to one Gigabit Ethernet port. Each DUT had one of three policies defined and traffic was offered, 50% of which complied with the defined policy. Engineers verified that the output traffic matched the uniformly divided input traffic in conformance with policy.

Equipment Acquisition and Support

The Cisco Catalyst 4006 was acquired through normal product distribution channels. The Tolly Group contacted executives at Cisco and invited them to provide a higher level of support than available through normal channels. Cisco executives did not respond to several invitations from The Tolly Group. Results were shared with Cisco executives who neither acknowledged nor disputed their accuracy.

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

Vendor	Product	Web address
Ixia Communications	IXIA 1600 v. 3.50	http://www.ixiacom.com

Tolly Group Services

With more than a decade of testing experience of leading-edge network technologies, The Tolly Group employs time-proven test methodologies and fair testing principles to benchmark products and services with the highest degree of accuracy. Plus, unlike narrowly focused testing shops, The Tolly Group combines its vast technology knowledge with focused marketing services to help clients better position product benchmarks for maximum exposure. The company offers an unparalleled array of reports and services including: Test Summaries, Tolly Verifieds, performance certification programs, educational Webcasts, white paper production, proof-of-concept testing, network planning, industry studies, end-user services, strategic consulting and integrated marketing services. Learn more about The Tolly Group services by calling (732) 528-3300, or send E-mail to info@tolly.com.

For info on the Fair Testing Charter, visit: www.tolly.com/About/ftc.asp

Project Profile

Sponsor: Hewlett-Packard Co.
Document number: 202153
Product Class: Layer 2/3 Fast Ethernet/Gigabit Ethernet switch
Products under test:

- Hewlett-Packard Procurve Switch 5308xl (HP J4819A)
- Procurve Switch XL10/100-TX Module (HP J4820A)
- Procurve Switch XL 100/1000-T Module (HP J4821A)
- Cisco Systems, Inc. Catalyst 4006 with Supervisor Engine III (WS-X4014)
- Catalyst 4000 10/100 Auto Module (WS-X4148-RJ)
- GE Switch Module, 12-1000T RJ45+2 1000XGBIC (WS-X4412-2GB-T)

Testing window: August 2002
Software versions tested:

- Hewlett-Packard Procurve Switch 5308xl, firmware E.06.02, software E.05.02
- Cisco Systems, Inc. Catalyst 4006, HW 1.2, firmware 12.1(8r)EW, software 12.1(8A)EW

Software status: Generally available

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