

3Com Corp.

3Com Router 6000 Series

Competitive Interoperability Evaluation with Cisco 3745



***Premise:** Architects of enterprise networks require WAN access technology that delivers high-performance, interoperability with existing hardware and is “future-proof.” Recognizing the size of the existing installed base of Cisco WAN routers, any third-party vendor must be proven to be interoperable with Cisco, in addition to offering superior price/performance, if it is to be considered a viable router candidate or alternative.*

3Com Corp. commissioned The Tolly Group to illustrate that its 3Com Router 6000 Family (Router 6040 and Router 6080 tested) router line offers seamless interoperability with Cisco’s WAN router IOS and furthermore that the 3Com Router 6040 provides a more powerful platform than the Cisco 3745 Multiservice Access Router. The 3Com Router 6040 and Router 6080 are modular, fault-tolerant and resilient rackmount routers chassis equipped with four or eight Flexible Interface Card slots.

To validate the claim that 3Com’s router offerings can interoperate in a heterogeneous network with Cisco devices, The Tolly Group built an interoperability testbed anchored by both routers. Using this environment, engineers validated more than a dozen different interoperability scenarios focused on core routing protocols, key data link protocols and other advanced functions.

To validate the claim that 3Com’s router offering provides a better platform for future requirements, The Tolly Group benchmarked the packet throughput of the Router 6040 when routing IP between its LAN interfaces set to 100 Mbps (Fast Ethernet).

Test Highlights

- Interoperates with Cisco 3745 during tests of routing protocols including RIP, IPX, OSPF and multicasting (PIM Dense and Sparse modes)
- Achieves extensive interoperability with Cisco 3745 when supporting advanced functions such as 802.1p/Q VLAN tag propagation, VRRP and IPsec VPNs
- Interoperates with Cisco 3745 during tests of link-level protocols including PPP, HDLC and frame relay
- Matches or exceeds the performance of the Cisco 3745 in zero-loss, IP Layer 3 throughput tests of two 100-Mbps Fast Ethernet ports

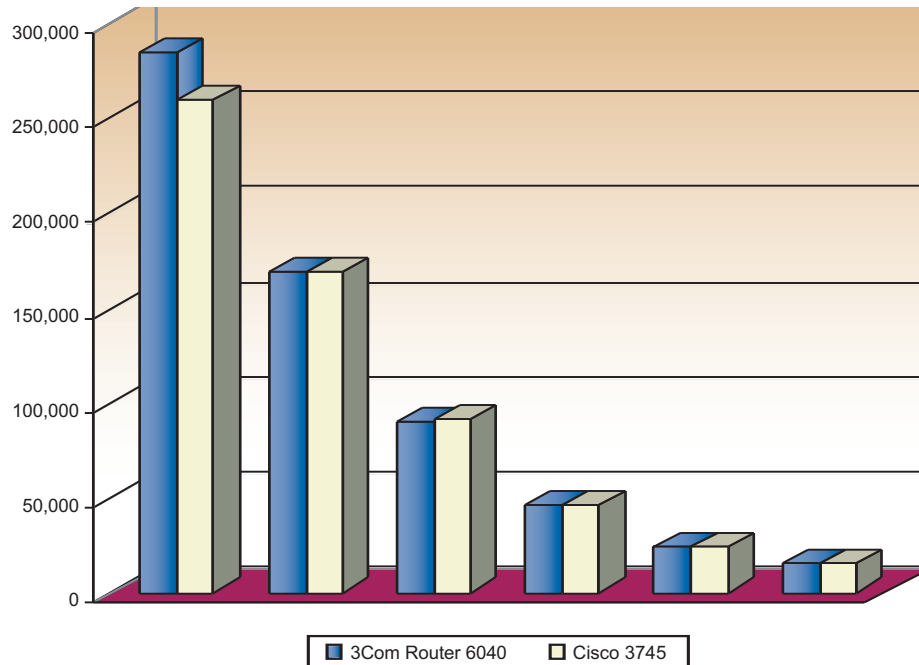
3Com Router 6040 — Tolly Verified Performance Certifications Earned

Certification ID	Certification	Packets/sec performance
90112	Fast Ethernet (100 Mbps) Layer 3 Zero-loss, full-duplex, two-port throughput results - 64-byte packets	284,366
90113	Fast Ethernet (100 Mbps) Layer 3 Zero-loss, full-duplex, two-port throughput results - 128-byte packets	168,919
90114	Fast Ethernet (100 Mbps) Layer 3 Zero-loss, full-duplex, two-port throughput results - 256-byte packets	89,943
90115	Fast Ethernet (100 Mbps) Layer 3 Zero-loss, full-duplex, two-port throughput results - 512-byte packets	46,992
90116	Fast Ethernet (100 Mbps) Layer 3 Zero-loss, full-duplex, two-port throughput results - 1,024-byte packets	23,946
90117	Fast Ethernet (100 Mbps) Layer 3 Zero-loss, full-duplex, two-port throughput results - 1,518-byte packets	16,217

Source: The Tolly Group, September 2004

Figure 1

Layer 3 Zero-Loss (< 0.0019%)
Aggregate Packets per Second Rate
 with Two Fast Ethernet Ports, as Reported by Spirent SmartFlow



Source: The Tolly Group, September 2004

Figure 2

Tests showed the 3Com Router 6040 and Router 6080 are interoperable with the Cisco 3745 in every test scenario attempted. Moreover, performance tests show that the 3Com Router 6040 matches the Cisco device packet for packet in the majority of throughput tests, except in 64-byte tests where the 3Com router delivered a 9% higher packet rate. Testing was performed in September 2004.

RESULTS

LAYER 3 IP PACKET PERFORMANCE

The 3Com Router 6040 passed all six performance-based Tolly Verified certifications, delivering competitive zero-loss packet/sec rates for taxing 64-byte packets ranging up to 1,518-byte packets in zero-loss, Layer 3 throughput tests of two Ethernet ports. Both products were able to forward at wire speed with 512-byte packets and larger. (See Figure 1.) When compared to the Cisco 3745, the

3Com Router 6040 achieved comparable packet processing rates for most packet sizes tested. However, at the most taxing 64-byte packet, the 3Com Router 6040 delivered almost 9% more packets than the Cisco router. (See Figures 2 & 3.)

In terms of the percentage of maximum throughput delivered, both devices achieved 100% zero-loss throughput for most tests, though with the 64-byte packet test, the 3Com Router 6040 delivered 96% of the theoretical maximum throughput versus 87% for the Cisco 3745.

INTEROPERABILITY

These tests included not only link protocols such as PPP (with various levels of authentication), HDLC and frame relay but routing protocols such as RIP1, RIP2, OSPF and even IPX (used by legacy Novell, Inc. NetWare systems). Testing went on to exercise advanced IP Multicast routing (both sparse and dense mode) as well as

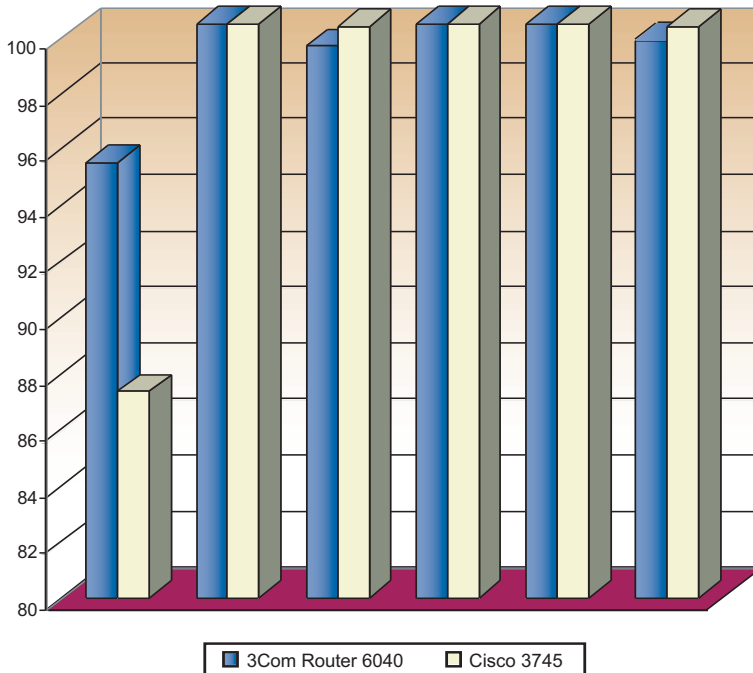
IPSec VPNs, VLANs and VRRP (Virtual Router Redundancy Protocol) support. All tests were successful. (See Figures 4 & 5.)

The 3Com Router 6040 and Router 6080 were tested for IPSec VPNs with the Cisco 3745 and passed, proving that they can operate in an IPSec VPN pairing with the Cisco box.

Testing encompassed a wider array of protocol and features than would likely be encountered at even fairly leading-edge enterprise companies, thus a buyer can be confident not only that the 3Com offerings work with currently deployed features and protocols but also will interoperate effectively when advanced functions like IP multicast and VPN are deployed.

Both the 3Com Router 6040 and Router 6080 earned 15 interoperability-related Tolly Verified certifications, and more than 30

Layer 3 Zero-Loss (< 0.0019%) Throughput with Two Fast Ethernet Ports As Reported by Spirent SmartFlow



Source: The Tolly Group, September 2004

Figure 3

certifications overall. These are far too numerous to detail in this report; readers may refer to The Tolly Group's Web site to learn more about the Tolly Verified certifications earned by 3Com in this report. Go to:

<http://www.tolly.com/TVDetail.aspx?ProductID=172>

Beyond interoperability, Tolly Group engineers verified a number of high-availability/resiliency features. The 3Com Router 6040/6080 provides high availability and fault tolerance through features such as hot swappable fans, plus hot-swappable and redundant power modules. The 3Com routers also support non-destructive code upgrades, dual firmware images and multiple configuration images which provide for hassle-free, fail-safe upgrades of equipment at remote sites when combined with the ability to download configuration images via TFTP connections. All of these functions received Tolly Verified certifications.

ANALYSIS

Enterprise IT organizations are committed to exercising choice – while Cisco Systems routers may anchor network backbones in many organizations, users prefer a best-of-breed device strategy in which they can select WAN access and edge network routers that offer price/performance that is superior to Cisco devices. Key to adopting such a strategy is that third-party WAN access routers must interoperate with the Cisco backbone into which they must communicate.

The 3Com routers tested prove that they are interoperable with Cisco routers for a diverse set of router functions that include router protocols, link-level service protocol and advanced services such as multicasting and router redundancy protocols. This demonstration of versatile interoperability should put prospective users at ease regarding the decision to deploy 3Com Router 6000 family devices.

3Com Corp.

3Com Router
6000 Series



Interoperability and
Layer 3 Throughput

3Com Corp. Router 6000 Series Product Specifications*

Routing

- Routing: IP, IPX, OSPF, RIP V1/V2,
- BGP-4, Integrated IS-IS
- IP Multicast: IGMP, PIM-SM, PIM-DM

Serial WAN

- Full/fractional E1/E3/T1/T3, high-speed serial, ISDN PRI, ATM & ADSL

Services

- 802.1Q VLAN, Inter-VLAN routing
- 802.1p QoS /DiffServ
- DHCP Server, Relay, DLSw
- Dual Software Images with roll-back

Hardware

- 512MB DRAM / 32MB flash memory
- Hot-swap LAN and WAN FIC Modules
- Hot-swap power & fan modules
- 3Com Router 6040 4-slot chassis model
- 3Com Router 6080 8-slot chassis model

Security & VPN

- MPLS Layer 2 & 3 VPN
- L2TP L2 Tunnels
- IPSec L3 Tunnels
- GRE Tunnels
- Stateful Firewall & DoS Blocking
- DES,3DES, AES Encryption
- SNMP 1/2/3, SSH
- RADIUS
- PAP, CHAP, NAT

For more information contact:

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Address: 350 Campus Drive, Marlborough,
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Fax: (508) 323-1111
URL: <http://www.3com.com>

*Vendor-supplied information not verified by
The Tolly Group

And, while the 3Com Router 6000 devices provide a depth of interoperability with the Cisco 3745, tests also prove that the 3Com Router 6000 offers zero-loss throughput that is on-par with, or better than, the Cisco 3745 for most

packet sizes tested. In fact, the 3Com router outperformed the Cisco 3745 when tested at 64-byte packets, the most taxing packet size utilized in our tests. By delivering more than 284,000 in the tests of Fast Ethernet routing, the 3Com Router 6040

illustrates that it is more than sufficient processing power for demanding branch-office requirements thus offering a viable platform for future growth. Packet rate and throughput results also indicate that the Router 6040

Tolly Verified Interoperability Certifications Earned - 3Com Router 6040/6080

Certification ID	Certification	Category
10732	802.1Q VLAN Tag Propagation	Advanced Features
10733	Virtual Router Redundancy Protocol (VRRP)	Cisco Interoperability - Advanced Features
10734	VPN IPsec Interoperability	Cisco Interoperability - Advanced Features
10726	PPP Basic Operation (No Authentication)	Cisco Interoperability - Link Protocols
10727	PPP Multilink Operation	Cisco Interoperability - Link Protocols
10728	PPP - PAP Authentication	Cisco Interoperability - Link Protocols
10729	PPP - CHAP Authentication	Cisco Interoperability - Link Protocols
10730	HDLC Operation	Cisco Interoperability - Link Protocols
10731	Frame Relay Operation	Cisco Interoperability - Link Protocols
10720	IPv4 - RIP v1 - Routing Protocol Support	Cisco Interoperability - Routing Protocols
10721	IPv4 - RIP v2 - Routing Protocol Support	Cisco Interoperability - Routing Protocols
10722	IPX - Routing Protocol Support	Cisco Interoperability - Routing Protocols
10723	IPv4 - OSPF - Routing Protocol Support	Cisco Interoperability - Routing Protocols
10724	PIM Dense Mode - IP Multicasting	Cisco Interoperability - Routing Protocols
10725	PIM Sparse Mode - IP Multicasting	Cisco Interoperability - Routing Protocols

Source: The Tolly Group, September 2004

Figure 4

exhibits the type of performance to support several T1/E1 ports. While not a formal element of the evaluation, engineers were able to observe that the product implements a "familiar," Cisco-style command line interface. Technicians familiar with configuring Cisco gear should quickly adapt to using the 3Com products.

TEST CONFIGURATION AND METHODOLOGY

For tests, The Tolly Group tested a 3Com Router 6000 SW Version 2.02, configured with a Router Processing Unit (RPU) that includes two 10/100BASE-TX ports for local LAN connection, AUX, console port, 512MB DRAM, 32MB flash memory and LED indicators. The Tolly Group also tested a Cisco 3745 Multiservice Access Router configured with two 10/100 LAN ports, two Integrated Advanced Integration Modules (AIM) slots,

three WAN Interface Card (WIC) slots, 32MB of compact flash memory, and 256MB DRAM. The Cisco 3745 was running IOS Version 12.3.

During Layer 3 performance tests, throughput was measured for the 3Com Router 6040 and the Cisco 3745. The test plan set out to measure the number of packets each router can move through a pair of Fast Ethernet connections. All devices under test connected to a SmartBits test tool traffic generator. Each device under test connected directly to the SmartBits 600 via the Fast Ethernet connections. Spirent SmartFlow was used to run The Tolly Group's standard zero-loss performance tests. Packet loss had to remain at or below 0.001% of offered load for a test to be considered valid. Tests were all full-duplex (bidirectional traffic) and were run separately for streams of 64-, 128-, 256-, 512-, 1,024- and 1518-byte packets. OSPF routing

was enabled on the tested routers. All performance tests were run three times and the results averaged.

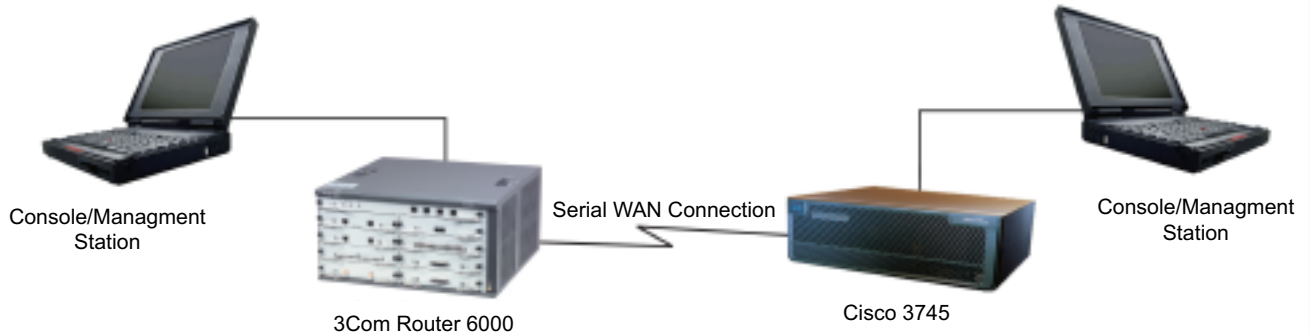
RELATED TESTS

In February 2004, The Tolly Group published Test Summary 204110 in which 3Com commissioned The Tolly Group to illustrate that its router offerings offer seamless interoperability with Cisco's WAN router IOS and furthermore that the 3Com Router 5000-class (Router 5009) provides a more powerful platform than the Cisco 1751 Modular Access Router. Tests showed the 3Com Router 3000/Router 5000 Series offerings are interoperable with Cisco (as represented by the Cisco 1751 router and, for VPN testing, a Cisco 2621) in every test scenario attempted. For more information, got to Test Summary 204110 at <http://www.tolly.com/DocDetail.aspx?DocNumber=204110>.

Tolly Verified Certifications Earned 3Com Router 6040/6080		
Certification ID	Certification	Category
10555	System Upgrade via Trivial File Transfer Protocol (TFTP)	System Management
10502	Non-Destructive Code Upgrade	System Management
10518	Dual firmware images	System Management
10519	Dual configuration images	System Management
10516	Redundant Power Supply	High-Availability Core (Product-type Independent)
10594	Redundant Power Supply - Hot-Swappable	High-Availability Core (Product-type Independent)
10595	Hot-Swappable Fan	High-Availability Core (Product-type Independent)
10719	Dynamic, Variable-speed Fan	High-Availability Core (Product-type Independent)
10508	10/100 Auto-negotiation	LAN Connectivity
10575	Secure Shell (SSH) remote access	System Security and User Management

Source: The Tolly Group, September 2004 Figure 5

Interoperability Test Bed



Source: The Tolly Group, September 2004

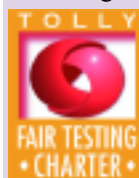
Figure 6

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

Vendor	Product	Web address
Ethereal	Ethereal: Ver 0.10.4	http://www.ethereal.com
Spirent Communications	SmartBits 600 SW Ver. 2.60.005	http://www.spirentcom.com
Spirent Communications	SmartMultiCastIP: Ver 2.00 Build 15	http://www.spirentcom.com
Spirent Communications	SmartWindow: Ver 8.0.162	http://www.spirentcom.com

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PROJECT PROFILE

Sponsor: 3Com Corporation

Document number: 204141

Product Class: LAN/WAN router

Products under test:

3Com Router 6000 SW Version 2.02

Cisco System 3745Multiservice Access Router, IOS Version 12.3

Testing window: September 2004

Software status: Generally available

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