

# 3Com Corp.

## SuperStack 3 Switch 4400

### Layer 2/4 Fast Ethernet Switch Performance Evaluation

## Test Summary

***Premise:** Network managers deploying Fast Ethernet switches already understand the importance of installing wire-speed devices in their networks. But wire-speed performance is not always the complete answer. With the frantic evolution of advanced applications such as voice over IP and real-time video, LAN technology is struggling to keep pace, thus driving the demand for intelligent techniques to ensure service levels. Quality-of-Service functionality adds a level of intelligence necessary to ensure delay-sensitive traffic and mission-critical data is prioritized, even in a severely congested network.*

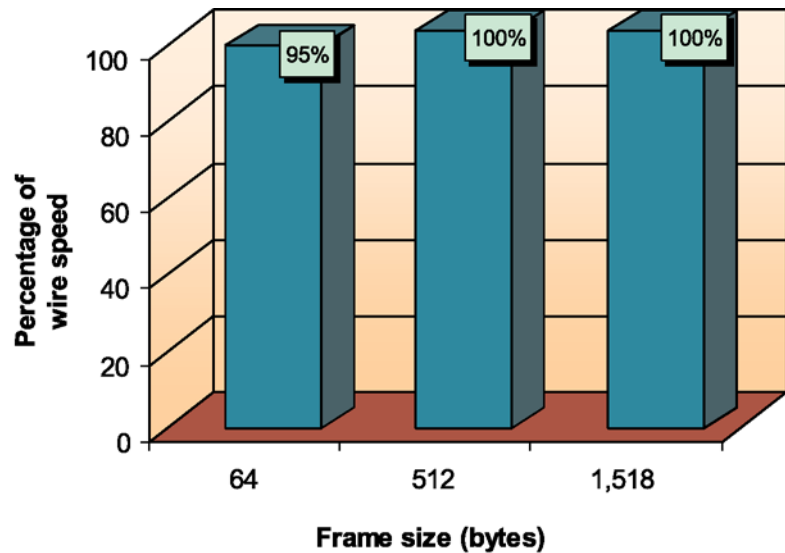
3Com Corp. commissioned The Tolly Group to evaluate its SuperStack 3 Switch 4400, a 24-port Fast Ethernet desktop switch with advanced multi-layer packet identification and classification functionality, for Fast Ethernet throughput, as well as to validate the device's capability to allocate bandwidth to prioritized traffic in situations where ports experience severe congestion. 3Com also requested that The Tolly Group verify the step-by-step setup for Quality-of-Service (QoS) capabilities using 3Com's Network Supervisor (3NS) software. Testing was performed in July 2001 and August 2001.

Test results show that when presented with an oversubscription scenario of 200%, the 3Com SuperStack 3 Switch 4400 properly identified traffic types, and prioritized or dropped data frames according to defined policy parameters. Moreover, the SuperStack 3 Switch 4400 ensured that sensitive network-critical traffic types such as SNMP and voice, continued to flow while less-critical traffic such as Web and E-mail were discarded. Lastly, Tolly Group engineers verified that only six steps are required to establish a QoS scheme via 3Com's 3NS software under-

### Test Highlights

- Delivers zero-loss wire-speed throughput in Layer 2 Fast Ethernet tests forwarding 512- and 1,518-byte frames
- Manages traffic priorities effectively during port congestion and "starves out" low-priority traffic to guarantee bandwidth to high-priority traffic types
- Configures QoS prioritization in only six steps using 3Com Network Supervisor software

### Layer 2 Zero-Loss Fast Ethernet Throughput Bidirectional SmartBits Traffic



Source: The Tolly Group, August 2001

Figure 1

scoring the fact that QoS configuration does not have to be complex.

### RESULTS

#### ZERO-LOSS BIDIRECTIONAL LAYER 2 THROUGHPUT

Testing demonstrated that the 3Com SuperStack 3 Switch 4400 delivered 95% of wire-speed throughput or a total of 6,235,534 packets per second (pps), in a full-mesh Layer 2 configuration with zero loss, when forwarding 64-byte frames. Furthermore, results show that the 3Com

SuperStack 3 Switch 4400 delivered 100% wire-speed throughput in the same configuration when forwarding 512- and 1,518-byte packets, or a total of 1,033,834 pps with 512-byte frames and a total of 357,607 pps with 1,518-byte frames (see Figure 1).

**QoS PRIORITIZATION DURING PORT CONGESTION**

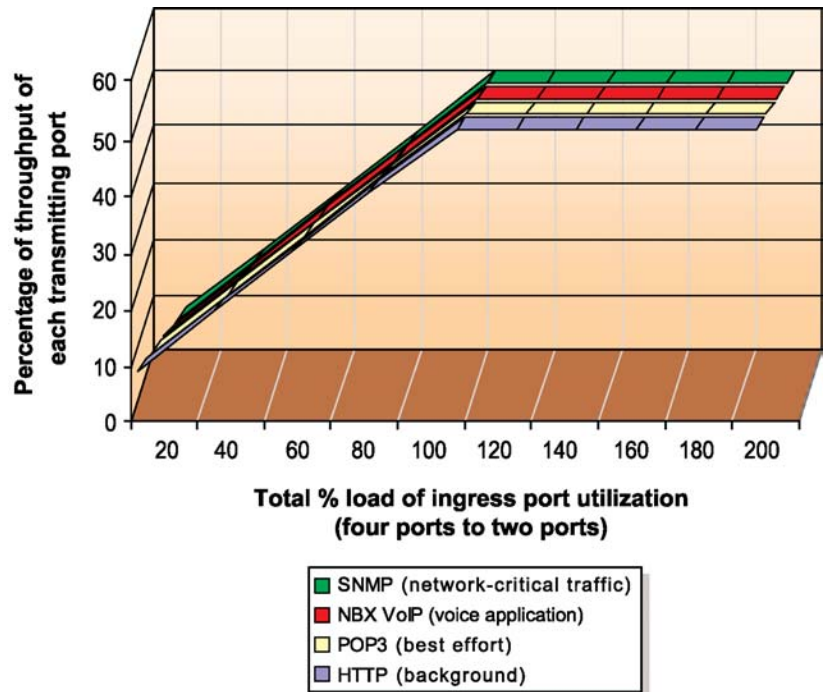
The objective of this test was to determine the Layer 4 QoS capabilities as the SuperStack 3 Switch 4400 apportioned bandwidth according to TCP port or IP address.

To demonstrate how a conventional Layer 2-only switch manages a bandwidth bottleneck, a baseline test was conducted with the SuperStack 3 Switch 4400's QoS features disabled. Engineers ran four Fast Ethernet streams of traffic — SNMP, NBX Voice-over-IP (VoIP), POP3 (E-mail) and HTTP (Web traffic) — via SmartBits at the same offered load, resulting in all streams transmitting and receiving about the same amount. At 50% utilization across the four transmitting ports (200 Mbit/s aggregate throughput), the total throughput fully taxed the two Fast Ethernet receiving ports. Subsequent increases in the offered load across the four transmitting ports resulted in proportionate packet losses across the four different traffic types supported by each transmitting port in the absence of any QoS (see Figure 2).

Tolly Group engineers then ran the test again, this time, enabling QoS and assigning each of the four traffic types their own QoS traffic priority, with prioritization ranging from the highest for SNMP to the lowest for HTTP traffic, indicating it would be the first to be discard eligible.

Next, with the four transmitting ports fully utilizing the two receiving ports, traffic loads were increased beyond 50% port utilization on the four transmitting ports. As the total offered load increased beyond 100%, network-critical traffic remained largely unaffected, as shown in Figure 3. In essence, the SuperStack 3 Switch 4400 throttled down background applications, such as Web traffic, to allow voice and

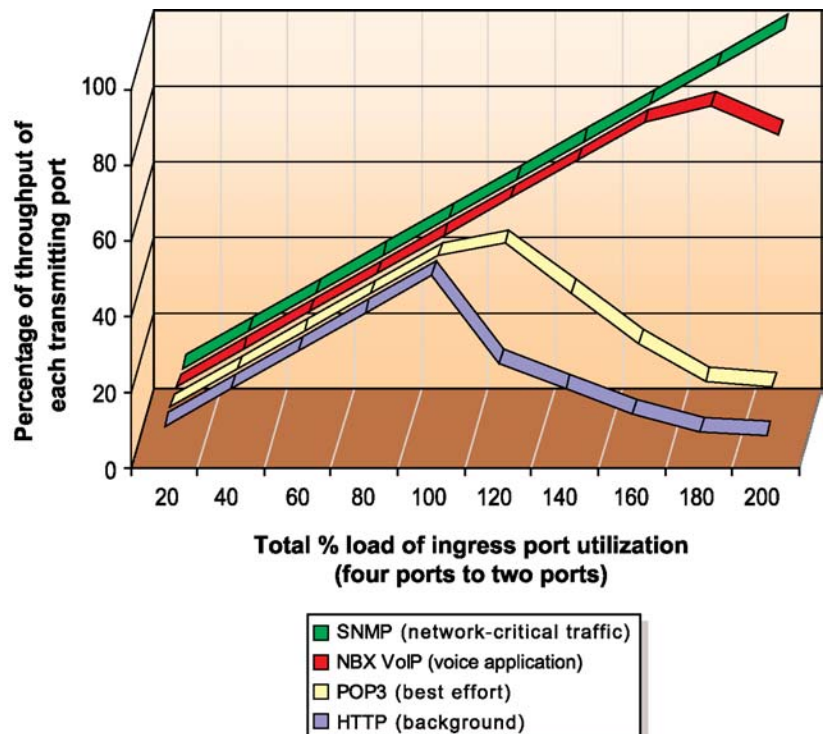
**Port Utilization for Test of QoS Prioritization with Port Congestion**



Source: The Tolly Group, August 2001

Figure 2

**QoS Prioritization of Critical Traffic During Excessive Network Loading**



Source: The Tolly Group, August 2001

Figure 3

SNMP high-priority traffic to receive the necessary bandwidth to reach their destinations unaffected by the oversubscription scenario.

#### “EASE-OF-USE” QoS PRIORITIZATION FEATURE

In deployment of the QoS traffic prioritization via 3Com 3NS software, after network discovery was made via the 3NS software, Tolly Group engineers performed only six steps to establish a prioritization scheme.

#### ANALYSIS

Zero-loss wire-speed throughput has become a de facto requirement for enterprise-class switches for all but the most taxing packet sizes. No longer is switch throughput a differentiating factor, though it is still an important selection criterion. Instead, the differences between different brand switches emerge in the inherent intelligence of each product to provide flexibility and manageability in how bandwidth is utilized according to available QoS facilities.

In the first group of tests, the 3Com SuperStack 3 Switch 4400 performed at wire-speed throughput for tests of 512-byte and 1,518-byte packets, and near wire-speed throughput with more taxing 64-byte packets, in a full-duplex, full-mesh configuration.

Beyond throughput, support for QoS emerged as a key differentiator for the switch to support delay-sensitive traffic such as VoIP and real-time SNMP network management data. As congestion builds and data types contend for bandwidth, the proper mechanisms need to be in place to ensure delay-sensitive traffic gets the bandwidth it needs, when it needs it.

Testing of the 3Com SuperStack 3 Switch 4400 under port congestion consisted of routine traffic and network-priority-traffic (such as delay-sensitive voice) showed that the SuperStack 3 Switch 4400 appropriately allocated and restricted traffic based on the prioritization scheme. With an oversubscription rate of four Fast Ethernet ports streaming to two Fast Ethernet ports, the QoS

mechanisms on the SuperStack 3 Switch 4400 treated the traffic streams according to their assigned priorities ensuring that the network-priority traffic experienced zero loss, while routine traffic was allocated leftover bandwidth.

Furthermore, Tolly Group engineers validated that setting up QoS services on the SuperStack 3 Switch 4400 is straight-forward, requiring just six steps to establish a QoS prioritization scheme. While QoS facilities on some switches may be branded as complex, 3Com demonstrated its 3NS software facilitates QoS setup.

#### TEST CONFIGURATION AND METHODOLOGY

For this series of performance tests, The Tolly Group tested a 3Com Corp. SuperStack 3 Switch 4400, version 3C17203. This switch was configured with 24 Fast Ethernet ports and two Gigabit Ethernet copper interfaces.

Tolly Group engineers connected the SuperStack 3 Switch 4400 to a Spirent Communications SmartBits SMB-2000 via 24 Fast Ethernet connections and two Gigabit Ethernet uplinks. An Acterna Corp. Domino Internetwork Analyzer also tapped into the SMB-2000 to verify packet content, but was removed prior to performance testing (see Figure 4).

A 500-MHz Pentium III PC with 128 Mbytes of RAM and 2 Gbytes of hard disk space, running Windows 2000 Professional, Service Pack 1 was used as the host device for the SmartBits and Domino analyzer.

The 3Com SuperStack 3 Switch 4400 was subjected to steady state, zero-loss (0.001%) bidirectional, packet-per-second throughput tests of 64-, 512-, 1,518-byte frames at a load of 100% utilization, decreasing in 5% increments if greater than 0.001% loss should provide sufficient data for traffic.

For throughput tests, engineers configured each port on the SuperStack 3 Switch 4400 for maximum speed and full-duplex operation.

For QoS tests of traffic prioritization, engineers also configured the system

### 3Com Corp.

### SuperStack 3 Switch 4400

### Performance Evaluation



#### 3Com Corp. SuperStack 3 Switch 4400 Product Specifications\*

##### Hardware

- 24 10/100-TX auto-negotiating ports
- Two slots for stacking or media modules
- Layer 3&4 advanced packet classification at wire speed
- 8.8 Gbit/s switching capacity
- 6.6 million packets per second
- 8,000 MAC addresses supported

##### Advanced Traffic Prioritization

- Classification using IP address, IP protocol, DSCP, application type (UDP/TCP ports), protocol (ethertype)
- Remarking of DSCP and 802.1p
- Fully programmable service levels for flexibility
- Four queues for traffic prioritization

##### Resiliency Features

- Stackwide trunking
- Resilient links
- Resilient stacking
- Rapid Spanning Tree
- Redundant power supply support

##### Management

- Web-based GUI
- Command line interface (Telnet or RS-232)
- 3Com Network Supervisor (via free CD)
- E-mail/pager notification

##### Dimensions

- Height: 43.6 mm (1.7 in or 1U)
- Width: 440 mm (17.3 in)
- Depth: 274 mm (10.8 in)
- Weight: 24-port: 2.8 kg (6.2)

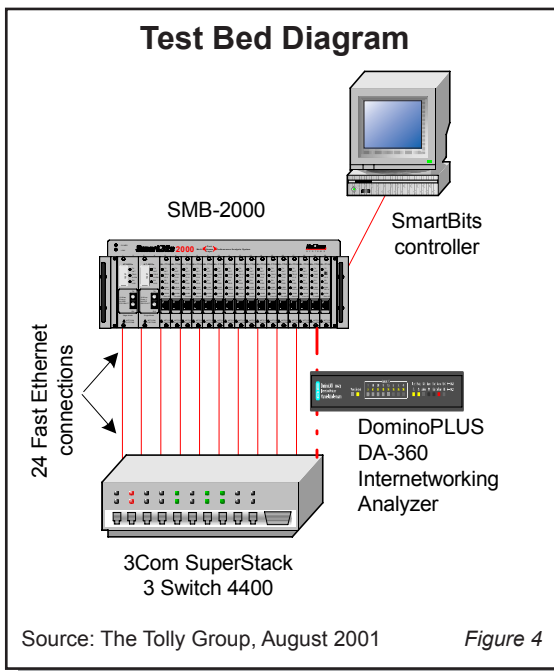
##### Support Services

- Limited lifetime warranty
- Advance hardware replacement
- Free software upgrades

##### For more information contact:

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



under test to assign priority, which included a four port to two port oversubscription of the egress link using SNMP, NBX VoIP, POP3 and HTTP traffic in four separate streams via 3Com's 3NS software version 3.

In validation tests to quantify steps to establish a QoS scheme via 3NS software, engineers configured SmartBits to generate two streams of FTP and HTTP traffic, in a two port to one oversubscription rate.

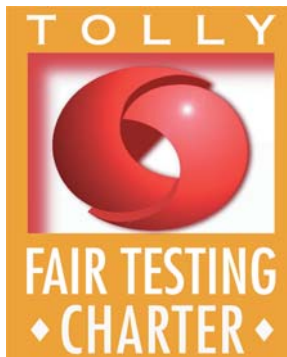
Engineers also disabled Spanning Tree, flow control and other ancillary features that otherwise would impact switch performance. Then they configured the SmartBits for the tested frame size, network utilization and test duration.

The SmartFlow and/or SmartWindows application(s) recorded total transmitted frames, and total received frames, plus frame loss, if any. Tests were run for 60 seconds for each of three test iterations.



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

Vendor	Product	Web address
Acterna Corp.	Domino Internetwork Analyzer	<a href="http://www.acterna.com">http://www.acterna.com</a>
Spirent Communications	SmartBits SMB-2000	<a href="http://www.spirent.com">http://www.spirent.com</a>
Spirent Communications	SmartFlow 1.3	<a href="http://www.spirent.com">http://www.spirent.com</a>
Spirent Communications	SmartWindows 7.20	<a href="http://www.spirent.com">http://www.spirent.com</a>



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## PROJECT PROFILE

**Sponsor:** 3Com Corp.

**Document number:** 201129

**Product class:**

- Layer 2/Layer 4 desktop switch

**Products under test:**

- 3Com Corp. SuperStack 3 Switch 4400

**Testing window:** July through August 2001

**Software versions tested:**

- Firmware: 3C17203

**Software status:**

- Generally available

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