THE TOLLY GROUP

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SysKonnect GmbH

SysKonnect SK-9843-SX Gigabit Ethernet Adapter versus Intel Corp. Pro/1000 F Server Adapter and 3Com Corp. Gigabit EtherLink Server NIC

Gigabit Ethernet Server Adapter Competitive Evaluation

Test Summary

Premise: *Today's network managers who require the fastest network connection possible for their high-end servers are migrating to Gigabit Ethernet. Throughput levels of various Gigabit Ethernet adapters may vary due to differences in both hardware design and software device drivers. Performance can also be impacted by the network operating system, frame size and the direction of the traffic flow.*

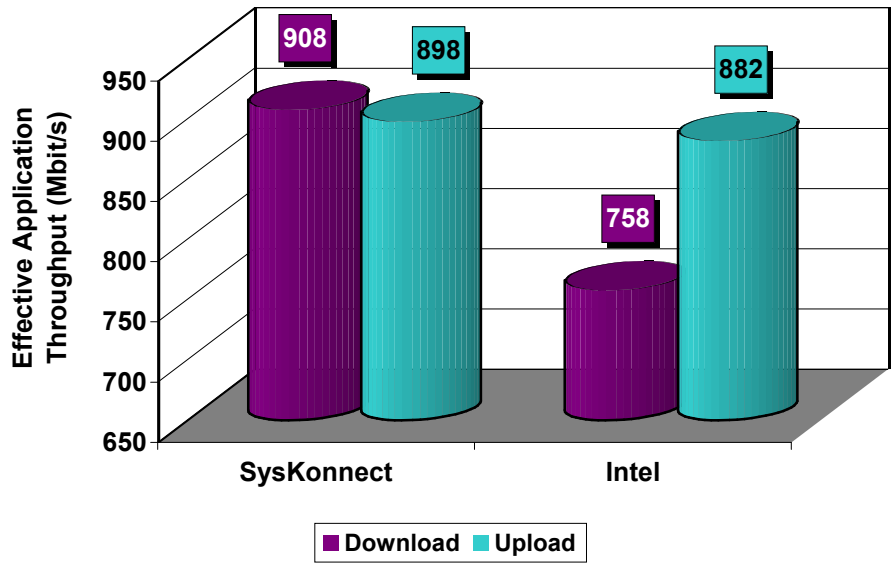
SysKonnect GmbH commissioned The Tolly Group to test the performance of its SysKonnect SK-9843-SX Gigabit Ethernet adapter, with a PCI bus architecture and a multimode (SX) fiber network interface, an Intel Corp. Pro/1000 F Server Adapter and a 3Com Corp. Gigabit EtherLink Server NIC, each installed on a Compaq ML530 server, a dual-CPU Pentium III Xeon running at 800 MHz.

Tests measured the unidirectional, TCP/IP file transfer throughput of each adapter in both download and upload scenarios under the Microsoft Windows 2000 Advanced Server and Red Hat Linux 6.2 operating systems. Multiple Gigabit Ethernet clients communicated with the server outfitted with the adapter under test. Testing was performed September through October 2000.

Results show that when testing the SysKonnect and the Intel Pro/1000 F Server Adapter, in both download and upload scenarios in a Windows 2000 environment, throughput measurements were higher using the SysKonnect

Test Highlights

- Achieves aggregate throughput exceeding 900 Mbit/s in Windows 2000 "download" tests using 9,018-byte "Jumbo Frames"
- Downloads 1,518-byte frames at 879 Mbit/s or 18% faster than Intel's adapter and 42% faster than 3Com's adapter under Windows 2000
- Processes data at 959 Mbit/s in "download" tests of 9,018-byte "Jumbo Frames" in a Red Hat Linux 6.2 operating environment, 30% more than its Intel competitor
- Exceeds an aggregate throughput of 500 Mbit/s, 19% faster than Intel's adapter in "download" tests of 1,518-byte frames in a Red Hat Linux 6.2 operating environment

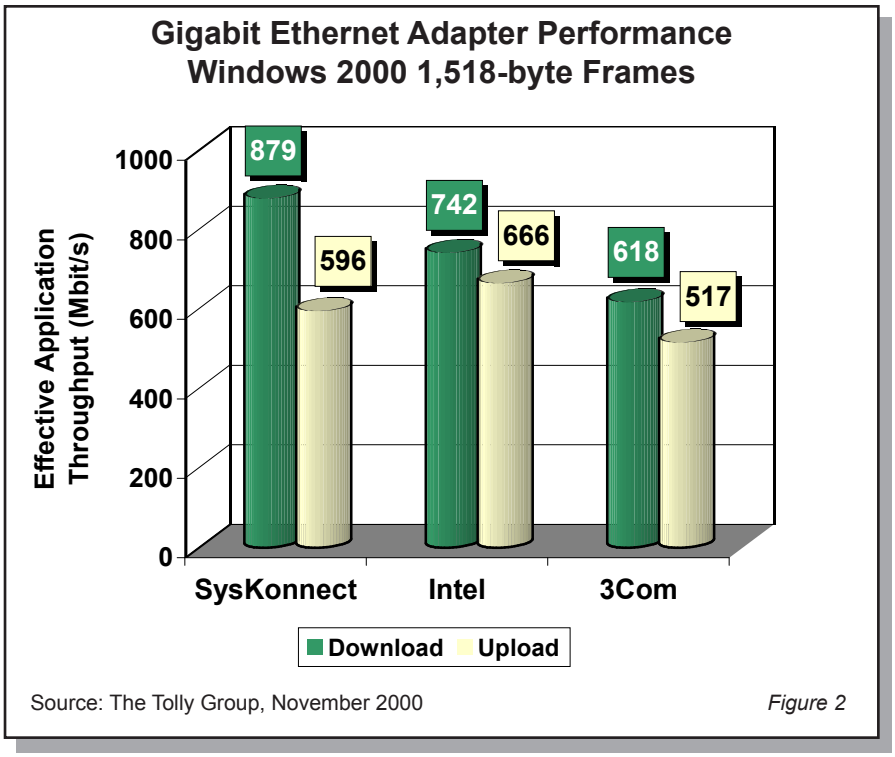


Source: The Tolly Group, November 2000 *Figure 1*

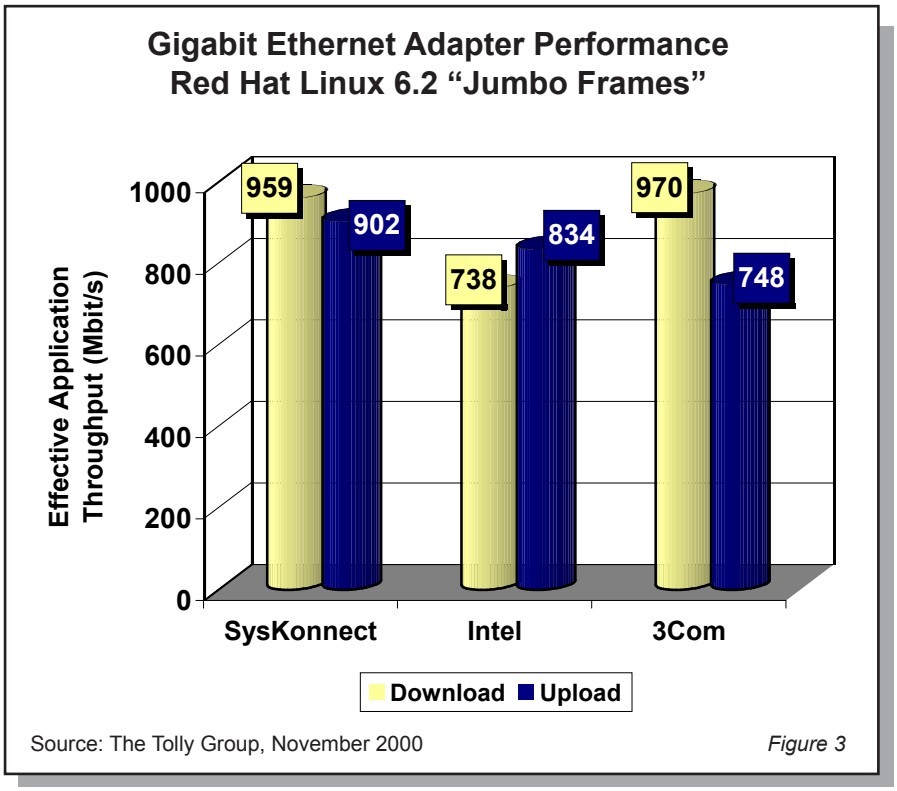
adapter when forwarding 9,018-byte or "Jumbo Frames." When engineers measured the download throughput of 1,518-byte frames in the same operating environment, the SysKonnect processed more data than the Intel and 3Com adapters. In upload tests, the SysKonnect demonstrated higher throughput than the 3Com adapter and was slightly lower in throughput than the Intel adapter.

In a Red Hat Linux 6.2 server operating environment, results show that the SysKonnect adapter processed more data than the Intel adapter when testing in both download and upload scenarios using 9,018-byte or "Jumbo Frames," and measures higher throughput than the 3Com adapter in upload tests, and minimally lower than 3Com in download tests. (Note: 3Com does not develop drivers for the Linux environment but refers customers to drivers provided through the Organisation Européenne pour la Recherche Nucléaire.) When Tolly Group engineers tested 1,518-byte frames in the same operating environment, results show that SysKonnect processed data in a download scenario faster than the Intel Pro/1000 and slightly slower than the 3Com adapter. In upload tests, the SysKonnect processed data at nearly the same rate as the Intel and 3Com adapters.

Note: The 3Com Gigabit EtherLink Server NIC drivers do not support "Jumbo Frames" under Windows 2000.



Source: The Tolly Group, November 2000 *Figure 2*



Source: The Tolly Group, November 2000 *Figure 3*

Results

Windows 2000 Server Throughput with 9,018-byte "Jumbo Frames"

The Tolly Group first tested the SysKonnect SK-9843-SX and the Intel Pro/1000 F Server Adapter in a Windows 2000 server environment with the adapters configured to support "Jumbo Frames" and results demonstrate that in a download scenario, the SysKonnect adapter delivered average aggregate throughput of 908 Mbit/s, 19.8% faster than the Intel adapter's 758 Mbit/s. In an upload scenario, the SysKonnect maintained its throughput at 898 Mbit/s. This is still faster than Intel's throughput of 882 Mbit/s. See figure 1.

Windows 2000 Server Throughput With 1,518-byte Frames

Engineers continued to test in a Windows 2000 server environment but reconfigured the drivers to use the industry-standard maximum

Ethernet frame size of 1,518-bytes. In download tests, results show that SysKonnect processed data at 879 Mbit/s, 18% faster than Intel at 742 Mbit/s. The SysKonnect also processed data 42% faster than the 3Com adapter with throughput of 618 Mbit/s.

In upload tests, results show that the SysKonnect adapter processed data at 596 Mbit/s, 15% faster than the 3Com adapter at 517 Mbit/s. Results demonstrate that the Intel adapter processed data in this test at 666 Mbit/s. See figure 2.

Red Hat Linux 6.2 Server Throughput With 9,018-byte "Jumbo Frames"

The Tolly Group tested the three Gigabit Ethernet adapters under test in a Red Hat Linux 6.2 operating environment. In download tests using 9,018-byte "Jumbo Frames," the SysKonnect processed data at 959 Mbit/s, almost 30% faster than Intel's adapter at 738 Mbit/s. The 3Com adapter processed data at 970 Mbit/s.

Results show that the SysKonnect adapter processed data faster than both its competitors in upload tests of 9,018-byte "Jumbo Frames" in a Red Hat Linux 6.2 testing environment. At 902 Mbit/s, SysKonnect processed data 8% faster than Intel's adapter at 834 Mbit/s, and 20% faster than 3Com's adapter that processed data at 748 Mbit/s. See figure 3.

Red Hat Linux 6.2 Server Throughput With 1,518-byte Frames

Finally, engineers tested throughput using 1,518-byte frames in a Red Hat Linux 6.2 operating environment and found that in a download scenario, SysKonnect processed data at 519 Mbit/s, 19% faster than the Intel adapter, which processed data at 436 Mbit/s. In this set of tests the 3Com adapter processed data at 627 Mbit/s. In upload tests the SysKonnect adapter processed data at 473 Mbit/s while the Intel and 3Com adapters processed data at 526 Mbit/s and 564 Mbit/s respectively. See figure 4.

Analysis

Network administrators will be looking for Gigabit Ethernet adapters to provide the highest throughput possible for their particular application. As one would expect, those implementing Gigabit Ethernet can expect to obtain much higher aggregate server throughput than currently available through Fast Ethernet. Testing illustrates that operating system, frame size and "direction" of traffic all can dramatically influence throughput.

It is important to note that while the testing was performed in a full-duplex switched environment, the tests were logically half duplex. That is, the primary traffic flow for each test was overwhelmingly unidirectional. Thus it is appropriate to view the "theoretical maximum" throughput as 1 Gigabit rather than the 2 Gigabit level that would be used for a true full-duplex test.

The Gigabit Ethernet adapters under test achieved throughput closer to wire speed than seen to date on a single adapter test. Because of bus limitations and CPU processing requirements, Gigabit Ethernet adapter tests in the past have often shown lackluster results. In the current tests, the systems come relatively close to achieving wire speed in a number of different test scenarios. The higher throughput figures are obtained from the use of the 64-bit, 66-MHz PCI slot and the offloading of the TCP/IP checksum calculations to the adapters. The 64-bit, 66-MHz PCI slots provide four times the bus bandwidth over conventional 32-bit, 33-MHz PCI slots. Additionally, the SysKonnect adapter has dynamic interrupt moderation capabilities, which minimizes the number of interrupts

SysKonnect GmbH

SysKonnect SK-9843-SX

Competitive Evaluation

SysKonnect GmbH
SysKonnect SK-9843-SX
Product Specifications*

- Bus interface
  - PCI Bus: 64 bit/66-MHz
  - PCI Hot Plug
- Network interface
  - IEEE 802.3z compatible 1000Base-SX
  - Full- and half-duplex support
- LAN Interface
  - Xaqti XMAC II
- DMA
  - Automatic
  - PCI busmaster
- Parity
  - Parity generation and checking
- Safety standards
  - CSA
  - CB
  - CE
  - UL
- EMC
  - CE
  - FCC Class B
  - VCCI

Onboard Memory

- 1 Mbyte SRAM
- 512 Byte PCI Vital Product Data
- Flash EEPROM 128 KB

Additional Benefits

- Advanced Power Management
- Redundant Link Management for configuration of redundant links
- Parity monitoring on all data paths
- Sensors for temperature and voltage
- TCP, UPD and IP checksum generation and checking in ASIC
- Interrupt Moderation
- PCI v2.1 Plug & Play compliant

Warranty

- Five years

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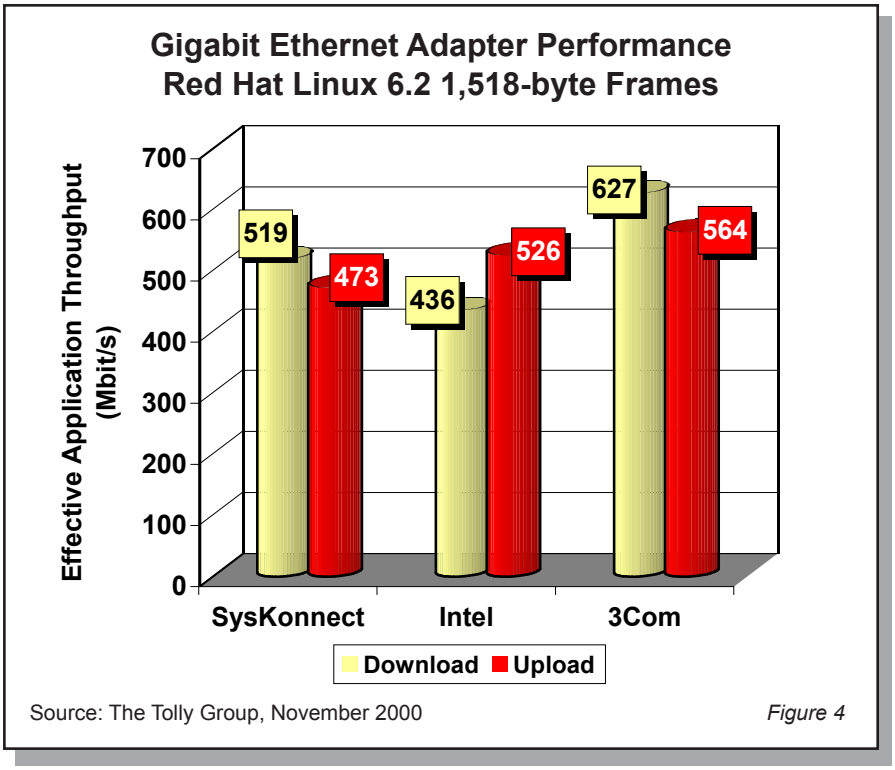
**Vendor-supplied information not verified by The Tolly Group*

and improves performance at high packet rates. The Compaq server used in tests is a dual-CPU system which guarantees a higher processing rate.

Network managers needing to maximize throughput of bulk data between servers should consider implementing systems (adapters and switches) that support "Jumbo Frames." "Jumbo Frames" tests were conducted using the Alteon WebSystems, Inc. proprietary "Jumbo Frames" extension to 802.3 Ethernet. "Jumbo Frames" have a maximum frame size of 9,018-bytes including CRC. It is important to note that "Jumbo Frames" are a proprietary standard and network managers would need to test the compatibility of adapters with specific Gigabit Ethernet switches.

Since there is less packet processing (and fewer interrupts), systems using "Jumbo Frames" will generally be capable of higher throughput than that seen with "standard" Ethernet maximum-size frames. While "Jumbo Frames" are six times larger than the standard maximum Ethernet frame size, network managers should expect significant, though not linear, performance increases. In our tests, for example, the SysKonnect adapter delivered roughly a 50% greater throughput when Linux tests were conducted using Jumbo rather than standard Ethernet frames.

It is important to note a couple of issues surrounding the Linux tests. First, none of the adapters were properly detected under Linux in our Compaq ML530 server; this is due to an issue with the Linux multi-processor kernel recognizing the adapter. In order to resolve this issue, The Tolly Group was required to configure the system BIOS lock adapter to IRQ 5. This may be a Compaq-specific issue and may not apply to other hardware providers. It is also important to note that 3Com does not support or provide drivers for their adapter under Linux,



Source: The Tolly Group, November 2000 *Figure 4*

although they do provide a link to a third-party site where drivers used in our test were located.

Test Configuration and Methodology

Three SX fiber Gigabit Ethernet PCI-bus adapters were tested for throughput while running on an 800-MHz dual processing Compaq Pentium III Xeon ML 530 with 640 Mbytes of RAM. In tests using Microsoft Windows 2000 Advanced Server operating system with Service Pack 1, the server had 9.1 Gbytes of fixed-disk space; and in tests using Red Hat Linux 6.2 version 2.2.14-5smp-kernel operating system, the server had 4.3 Gbytes of fixed-disk space.

In separate tests using each operating system, the following Gigabit Ethernet adapters were installed in the server: a SysKonnect SK-9843-SX Gigabit Server Adapter; an Intel Corp. Pro/1000 F Gigabit Ethernet Server Adapter; and a 3Com Corp. 3C985B-SX Gigabit Ethernet Server NIC. See figure 5. Intel built its own drivers while 3Com's Linux driver was authored by programmers at the Organisation Européenne pour la Recherche Nucléaire (CERN) (http://jes.home.cern.ch/jes/gige/acenic.html).

While 3Com does not offer any support for this driver, 3Com's Web site pointer to CERN does serve as an informal endorsement. It is the only Linux driver that 3Com so references.

All adapters were installed in the 64-bit, 66-MHz PCI slot and configured to run at full duplex. Frame size was altered for the particular test to use either 1518-byte Ethernet frames, or 9018-byte "Jumbo" Ethernet frames. The interrupt request was locked to IRQ 5 in the adapter under test in the BIOS when running Linux. All other driver settings were left as default. The server also ran the application simulation software, the NetIQ Chariot 3.5 endpoint.

A NetIQ Chariot 3.2 controller ran on a 200-MHz Pentium generic PC with 64 Mbytes of RAM and 2 Gbytes of fixed-disk space. This PC was equipped with a SysKonnect

Adapter and Driver Information for Products Tested

Product Name	Hardware Version	Windows 2000 Driver Version	Red Hat Linux 6.2 Driver Version	Duplex Mode
SysKonnect SK-9843-SX Gigabit Ethernet Server Adapter	1.40	sk98win.sys v. 1.19	sk98lin (included with 2.2.14 Linux Kernel)	Full
Intel Pro/1000 F Gigabit Ethernet Server Adapter	738640-006	e1000nt5.sys v. 2.19.219.0	e1000v.2.5.11	Full
3Com 3C985B-SX Gigabit Ethernet Server NIC (*Third-party driver. Not supported by 3Com*)	C	el985nd5.sys v. 2.0.0	Acenic (included with 2.2.14 Linux Kernel)	Full

Source: The Tolly Group, November 2000

Figure 5

SK-9843-SX PCI bus card and was running Microsoft Corp. Windows NT operating system version NT 4.0, Service Pack 5. The application was configured to run the following scripts: a filesndl.scr (file send long) and filercvl.scr (file receive long). The scripts were modified to change the parameter "transactions per record" from 1 to 10. On the client machines, interrupt moderation was disabled, maximum IRQs per second was set to 2500, maximum transmit buffers was set to 500, maximum receive buffers was set to 1500, and the TCP Window Size was set to 65k.

The test bed hosted an Alteon WebSystems, Inc. ACEswitch 180 10/100/1000 Gigabit Ethernet Server Switch, hardware revision P6, software version 8.0.30. The following four NetIQ Chariot end-points and the PC running Chariot console function each connected to a dedicated switch port: a 550-MHz Compaq Pentium III Xeon Proliant 6400R with 256 Mbytes of RAM and 9.1 Gbytes of fixed-disk space; a 450-MHz Compaq Pentium II Xeon Proliant 5500 with 256 Mbytes of RAM and 4.3 Gbytes of fixed-disk space; and two 550-MHz Pentium III generic PCs with 128 Mbytes of RAM and 18 Gbytes of fixed-disk space. Each of the client machines was also running Microsoft Windows 2000 Professional Service Pack 1 and each was equipped with a SysKonnect SK-9843-SX PCI bus card. All clients were running a Windows 2000 driver version sk98win.sys v. 1.19.

In order to monitor traffic between the server and clients, The Tolly Group engineers deployed an Acterna DominoGigabit DA-350 Internetwork Analyzer in line between the server and the Alteon ACEswitch. See figure 6.

Tests were conducted for each Gigabit Ethernet adapter in both the Windows 2000 and Red Hat Linux operating systems. Once engineers configured the server under test, they configured Chariot to perform separate file transfer upload and download tests.

Results from this testing are the average of the aggregate application throughput as reported from NetIQ Chariot. The adapters were tested in a server environment, which indicates that more than one client was connected into the main server. Chariot reported the throughput measurements of three iterations of three minutes each and the results were averaged. The Acterna test tool was used to analyze and monitor traffic.

For more information on Jumbo Frames, go to: http://www.alteon-websystems.com/products/whitepapers/jumboframes/

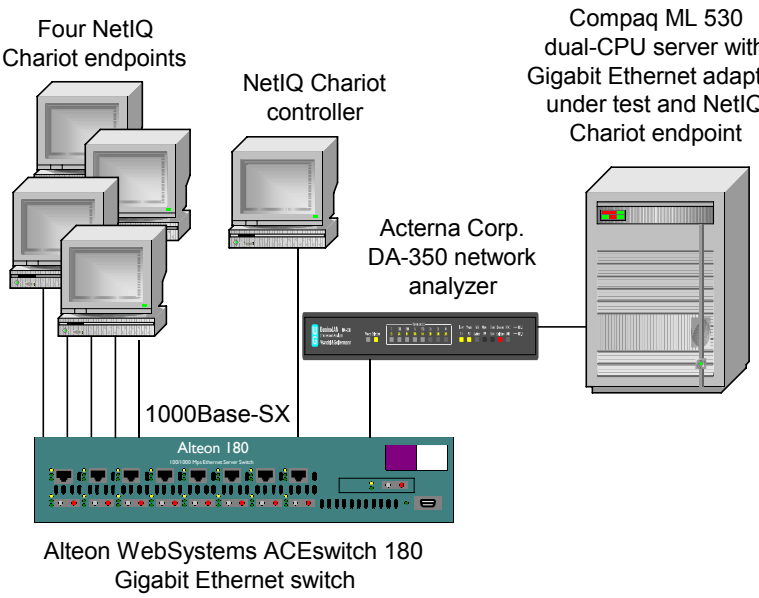
Equipment Acquisition and Support

The Intel Corp. Pro/1000 F Server Adapter and the 3Com Corp. Gigabit EtherLink Server NIC were both acquired through normal product distribution channels. The Tolly Group contacted executives at both companies and invited them to provide a higher level of support than available through normal channels. Intel accepted our offer and although 3Com initially accepted our offer, they later declined to support the test because The Tolly Group, in accordance with its Fair Testing Charter, declined to reveal the commissioning vendor. Intel technical support was used to configure its NIC for the test suites executed by The Tolly Group.

The Tolly Group verified product release levels and shared test configurations with Intel and 3Com in order to give them an opportunity to configure their devices for the tests. Intel did support Tolly Group engineers to configure its adapter. Results were shared with both Intel and 3Com. Intel acknowledged the accuracy of the results; and 3Com did not comment on the results. For a more complete understanding of the interaction between The Tolly Group, Intel and 3Com, check out the Technical Support Diary for Competitive Products Tested posted on The Tolly Group's World Wide Web site at http://www.tolly.com (see document 200233).

TESTED with SmartBits NETCOM SYSTEMS

Test Bed



Source: The Tolly Group, November 2000

Figure 6

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

Vendor	Product	Web address
NetIQ	Chariot 3.2	http://www.netiq.com
Acterna Corp.	DominoGigabit DA-350	http://www.acterna.com

TOLLY FAIR TESTING ♦CHARTER♦

Since its inception, The Tolly Group has produced high-quality tests that meet three overarching criteria: All tests are objective, fully documented and repeatable.

We endeavor to provide complete disclosure of information concerning individual product tests, and multiparty competitive product evaluations.

As an independent organization, The Tolly Group does not accept retainer contracts from vendors, nor does it endorse products or suppliers. This open and honest environment assures vendors they are treated fairly, and with the necessary care to guarantee all parties that the results of these tests are accurate and valid. The Tolly Group has codified this into the Fair Testing Charter, which may be viewed at http://www.tolly.com.

Project Profile

Sponsor: SysKonnect GmbH

Document number: 200233

Product class: SX Fiber Gigabit Ethernet PCI-bus adapters

Products under test:

- SysKonnect SK-9843-SX Gigabit Ethernet Adapter
- Intel Pro/1000 F Server Adapter
- 3Com Gigabit EtherLink Server NIC

Testing window: September through October 2000

Additional information available:

- Technical Support Diary

For more information on this document, or other services offered by The Tolly Group, visit our World Wide Web site at http://www.tolly.com, send E-mail to info@tolly.com, call (800) 933-1699 or (732) 528-3300.

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