

IBM Corp.

2216 Nways Multiaccess Connector and Network Utility TN3270E Server

TN3270 Channel-Attached Gateway Performance Competitive Evaluation

Test
Summary



Premise: The dominance of IP as the preferred client protocol combined with the massive installed base of SNA-based mainframe applications has made TN3270E of prime importance to large, enterprise customers. The TN3270E server component is key to any solution for it provides the translation between TCP/IP and SNA. Ideally, a server implementation must be scalable to support many thousands of simultaneous sessions while delivering sub-second response time at reasonable transaction rates.

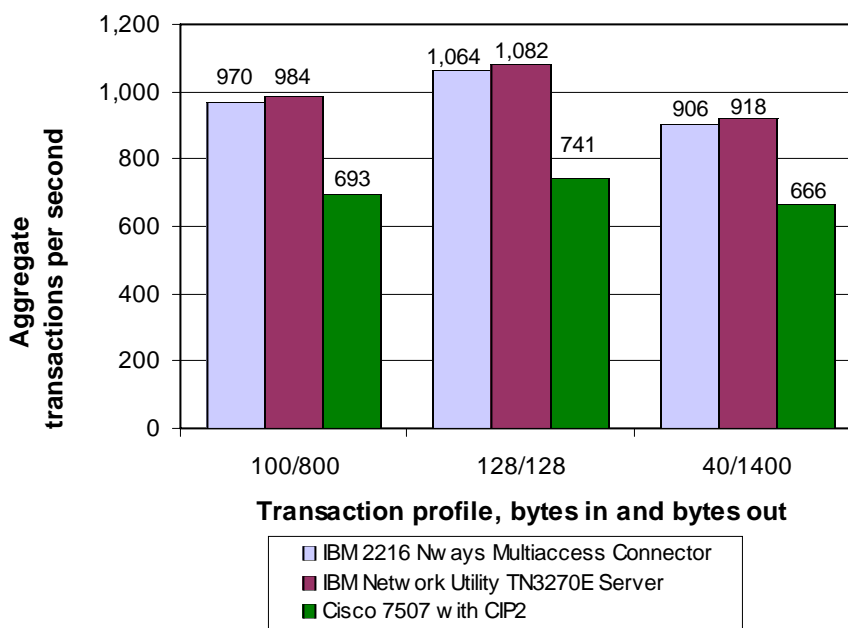
IBM Corp. commissioned The Tolly Group to evaluate the transaction throughput of the TN3270E server function of its 2216 Nways Multiaccess Connector and its Network Utility TN3270E Server, versus the TN3270E server function of the Cisco Systems, Inc.'s 7507/4 equipped with a Channel Interface Processor 2 (CIP2) and Route Switch Processor 4 (RSP4). The test suite was comprised of three different transaction profiles corresponding to interactive transactions that moved varying amounts of data between the client and the mainframe. Tests measured response time and transaction rates when supporting sessions with thousands of simultaneous users. All tests used Fast Ethernet on the "downstream" LAN side and were conducted using LSA and MPC+ from IBM, and CSNA and CMPC from Cisco, on the "upstream" mainframe side of the connection.

The tests revealed the IBM 2216 and the IBM Network Utility deliver signifi-

Test Highlights

- Processes up to 77% more transactions per second than the Cisco 7507 with CIP2
- Offers two to three times better price/performance than the Cisco 7507 with CIP2
- Supports at least 16,000 simultaneous TN3270 sessions
- Delivers 1,000+ transactions per second while maintaining sub-second response time

TN3270 Server Transaction Throughput 9,000 Sessions via Fast Ethernet and LSA/CSNA



Source: The Tolly Group, May 1999

Figure 1

cantly higher transaction rates for all transaction profiles/types tested than the Cisco 7507, while still maintaining sub-second network transport response times for all transactions. Moreover, when the cost of the devices is figured into the equation, the cost per transaction of the Cisco 7507 is, on average, more than twice that of the IBM devices

Results were consistent across tests using the following mainframe channel protocols: the Link Services Architecture (LSA, used with VTAM providing the SNA boundary function, and no SNA routing provided by the TN3270 gateway), and Advanced Peer-to-Peer Networking (APPN) High Performance Routing (HPR) in conjunction with IBM's Multi-Path Channel Plus (MPC+) or Cisco's Multi-Path Channel (CMPC). Although IBM and Cisco do not employ identical channel protocol implementations, both companies offer comparable protocols that engineers matched up for the purposes of testing.

Testing was performed in March and April 1999.

RESULTS

TN3270E SERVER PERFORMANCE

The Tolly Group benchmarked the transaction per second (tps) throughput and session load performance of the TN3270E server components of the channel-attached gateways. Tests were conducted at two different session loading levels – first with 9,000 sessions active and then with 16,000 sessions active. High tps processing coupled with poor response time would be of no value to the customer. In order to assure that response time remained in a useful range, The Tolly Group stopped any given test when the average transaction response time exceeded one second.

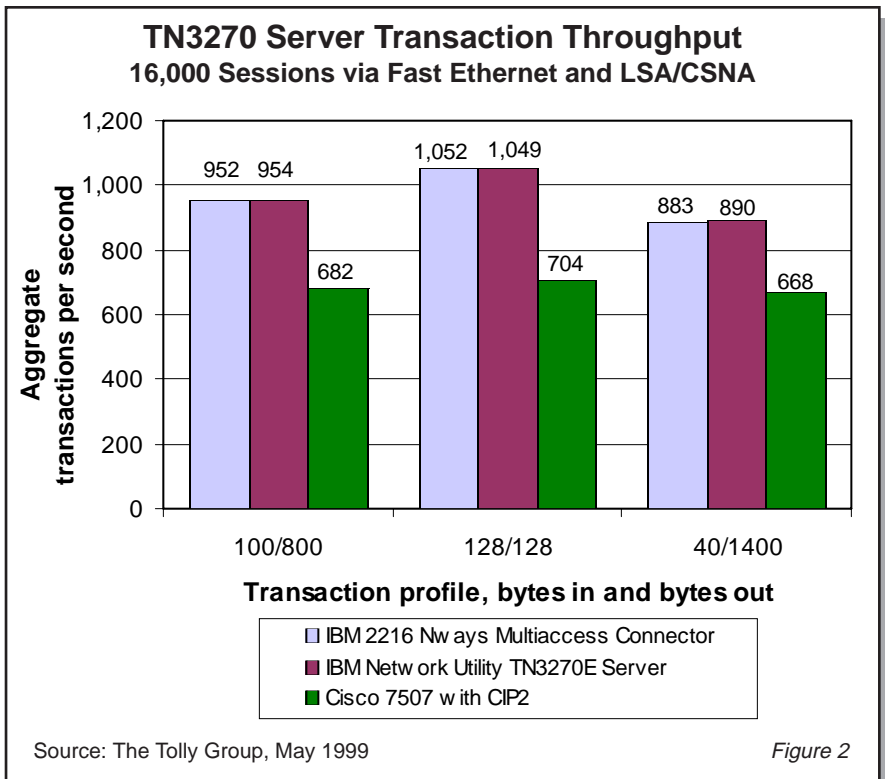


Figure 2

LSA WITH VTAM BOUNDARY FUNCTION RUNNING 9,000 SESSIONS

The Tolly Group tested the channel-attached gateways to determine their maximum tps throughput rate in an

environment supporting 9,000 simultaneous sessions using the LSA protocol for the gateway-to-mainframe channel connection. (LSA indicates LSA Direct over the ESCON channel; boundary and routing functions are performed in OS/390 SNA

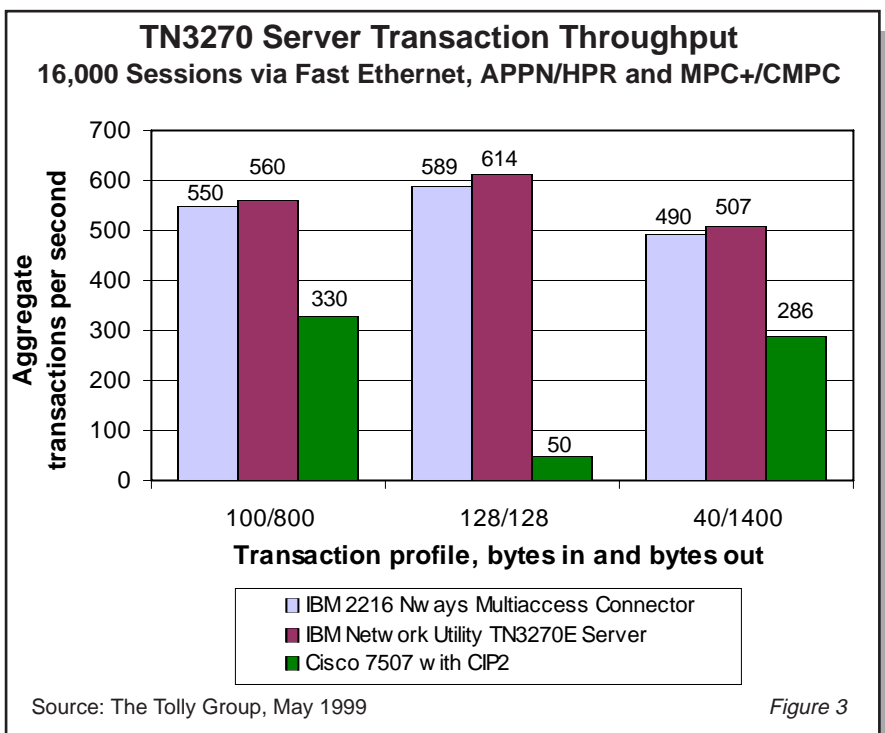


Figure 3

Services, formerly called VTAM. Cisco refers to LSA as Cisco SNA or CSNA.)

When tested with streams that support a session profile of 100 bytes in and 800 bytes out, IBM's Network Utility supported an average of 984 tps versus 693 for the Cisco 7507, or a 42% transaction throughput advantage for the IBM device. The IBM 2216 achieved 970 tps. With a traffic profile of 128 bytes in and 128 bytes out, the Cisco 7507 hit its high of 741 tps. But that trailed both IBM products by up to 31%; the IBM 2216 achieved 1,064 tps, and the IBM Network Utility handled 1,082 tps. See figure 1.

LSA WITH VTAM BOUNDARY FUNCTION RUNNING 16,000 SESSIONS

Transaction throughput testing at 16,000 sessions with support for the LSA protocol paralleled results for the 9,000 session tests. IBM's Network Utility topped all device tps rates in tests that used a session traffic profile of 100 bytes in and 800 bytes out. The Network Utility reported 954 tps, the IBM 2216 achieved 952 tps and Cisco's 7507 trailed both IBM devices with 682 tps, lagging the IBM gear by 40%. With a session traffic profile of 128 bytes in and 128 bytes out, the IBM 2216 led all devices with 1,052 tps, IBM's Network Utility achieved 1,049 tps and Cisco's 7507 again trailed the field with 704 tps, or 33% less throughput. See figure 2.

APPN/HPR RUNNING 16,000 SESSIONS

Transaction throughput testing at 16,000 sessions with support for the MPC+ protocol continued to demonstrate IBM dominance. MPC+ and CMPC indicate Advanced Peer-to-Peer Networking (APPN) High Performance Routing (HPR) Network Node functionality running

on the gateway; boundary and routing functions are performed in the gateway also. The Network Utility and 2216 support MPC+. CMPC is Cisco's term for its implementation of MPC (vs. MPC+).

With a session profile of 100 bytes in and 800 bytes out for 16,000 sessions, the IBM Network Utility posted a high of 560 tps versus the Cisco 7507's low of 330 tps, meaning the IBM gateway offered 70% greater throughput. With a more demanding traffic profile of 128 bytes in and 128 bytes out, the IBM Network Utility again led the pack with 614 tps versus 589 tps for the IBM 2216. And with a traffic profile of 40 bytes in and 1,400 bytes out, the Network Utility offered 507 tps, the IBM 2216 offered 490 tps and the Cisco 7507 delivered 286 tps. See figure 3.

Cisco could not complete the 128/128 test. The Tolly Group initiated 16,000 sessions and allowed those sessions to stabilize for several hours with a light traffic load [1 trans/min/user = offered load of 267 tpm]. In this configuration, the Cisco 7507 delivered 50 tps with a response time of several minutes.

ANALYSIS

Pure sub-second, transaction-processing throughput alone does not tell the entire story when evaluating the TN3270E server support from IBM and Cisco Systems. Clearly, IBM's 2216 Nways Multiaccess Connector and Network Utility TN3270E Server offer consistent transaction throughput advantages, whether measured across 9,000 or 16,000 sessions. Throughput testing demonstrates that the IBM 2216 and Network Utility offer from 31% (with LSA and VTAM boundary function) to 77% (with MPC+ and APPN/HPR routing) greater throughput than the Cisco 7507/4 with CIP2.

IBM Corp.

**IBM 2216
Multiaccess
Connector
IBM Network
Utility
TN3270E
Server**

**TN3270E
Server Transaction Performance**



IBM 2216 Multiaccess Connector IBM Network Utility TN3270E Server Product Specifications*

Features:

- IBM ESCON and parallel channel support for access to as many as 256 S/390 hosts
- Specification ideal for secure IP/SNA integration networking
- Offers scalable TN3270E Server capacity at cost effective price per session supporting up to 16,000 sessions at over 1,000 transactions per second
- Offers IBM host on-demand client caching for browser access to TN3270E Server
- Integrated Network Dispatcher for load balancing traffic to IP Web servers, file transfer, mail, news, telnet and TN3270E Servers
- Provides high session concentration for Data Link Switching, APPN DLuR and Enterprise Extender networks
- Supports up to 500 downstream Data Link Switching branch routers transporting SNA client traffic over IP backbone
- Full APPN support includes Extended Border Node and up to 16,000 DLuR sessions
- Enterprise Extender technology for APPN/HPR QoS and persistent user sessions for SNA client traffic over IP backbones
- TCP/IP 3172 emulation, bridging, and routing provides upgrade path for 3172 Interconnect Controller users
- Includes secure Virtual Private Networks (VPN) with Internet Key Exchange for automated key distribution
- Data and voice consolidation with voice packet forwarding and segmentation over frame relay
- Provides Quality of Service (QoS) and security policy mapping for Differentiated Services queuing...Application Driven Networking

For more information contact:

Your local IBM sales representative or business partner.

URL: <http://www.networking.ibm.com>

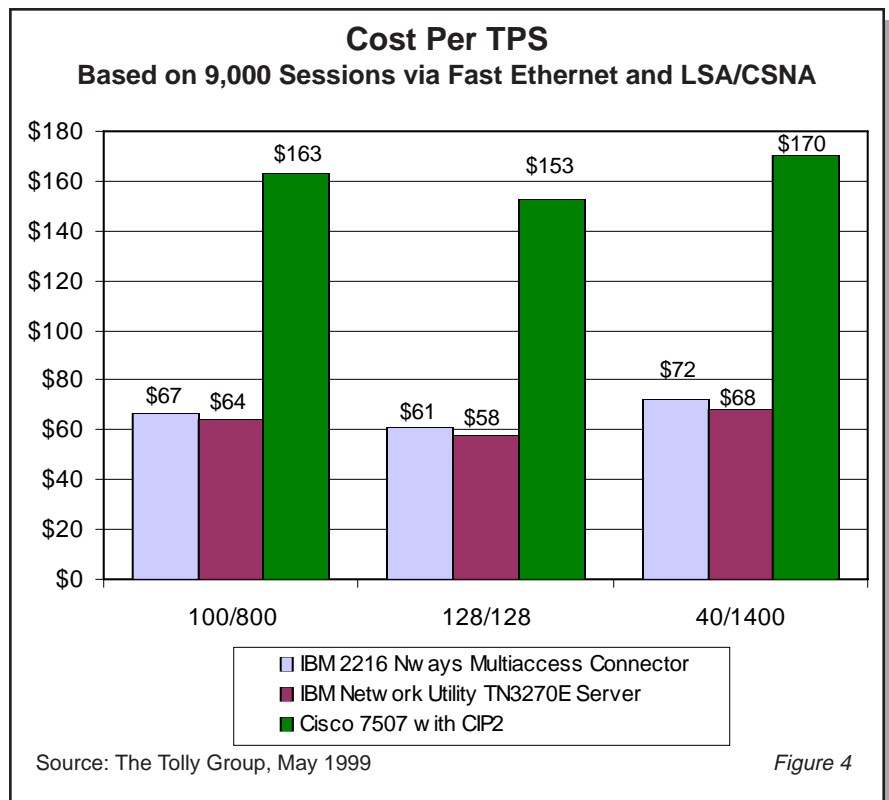
** Vendor-supplied information not verified by
The Tolly Group*

As configured, the IBM 2216-400 cost \$65,245 and the IBM Network Utility cost \$62,500. The Cisco 7507/4 cost \$119,650 as configured for CMPC testing and \$113,150 for LSA testing. The Tolly Group's analysts factored in the total cost of the systems as tested and calculated a cost per unit throughput (tps) to provide a basis for price/performance comparisons. With these figures in hand, a more complete picture emerged: Not only did the Cisco 7507 deliver consistently lower throughput than the IBM gateways, but it comes at a markedly higher price than the IBM products.

In a 9,000-session TN3270E environment supporting the LSA protocol and a traffic profile of 100/800 bytes, IBM's Network Utility and 2216 offer a transaction per second cost of \$64 and \$67 respectively, versus \$163 for Cisco's 7507 — or 1.5 times greater than the transaction cost when using an IBM gateway. And that pricing spread remains consistent across all three traffic scenarios tested. See figure 4. Likewise, in a 16,000-session LSA environment, the price per transaction disparity remains about the same. See figure 5.

The same hardware configurations were used for the 9,000 and 16,000 session tests. While oftentimes, scaling up a test requires adding more memory or processing power thereby increasing the price, that was not necessary here. While the additional overhead of handling 7,000 additional sessions did result in a slight decrease in the number of sub-second transactions per second handled by the various boxes, that number did not degrade significantly. Thus, the price/performance calculations yield similar results for both the 9,000 and 16,000 session tests.

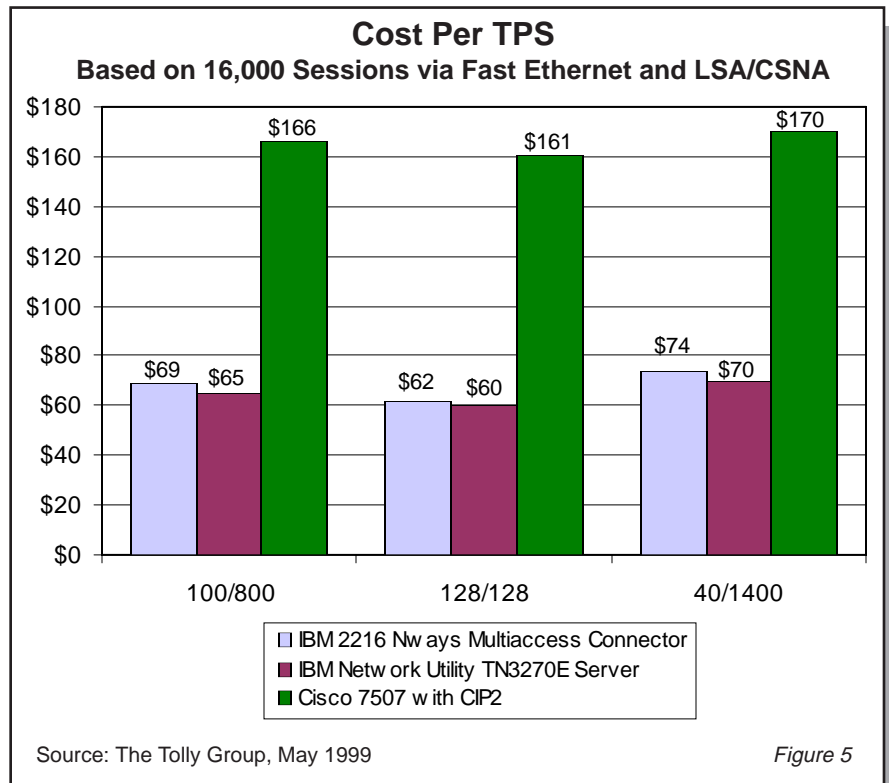
Lastly, The Tolly Group calculated a price per transaction cost for 16,000 sessions supporting HPR over IBM's MPC+ and Cisco's CMPC. (The



version of the 7507 tested does not support MPC+.) On average, the Cisco 7507 offered a tps cost nearly three times greater than comparable IBM costs. See figure 6.

TEST CONFIGURATION AND METHODOLOGY

For all TN3270E server performance tests, The Tolly Group tested the



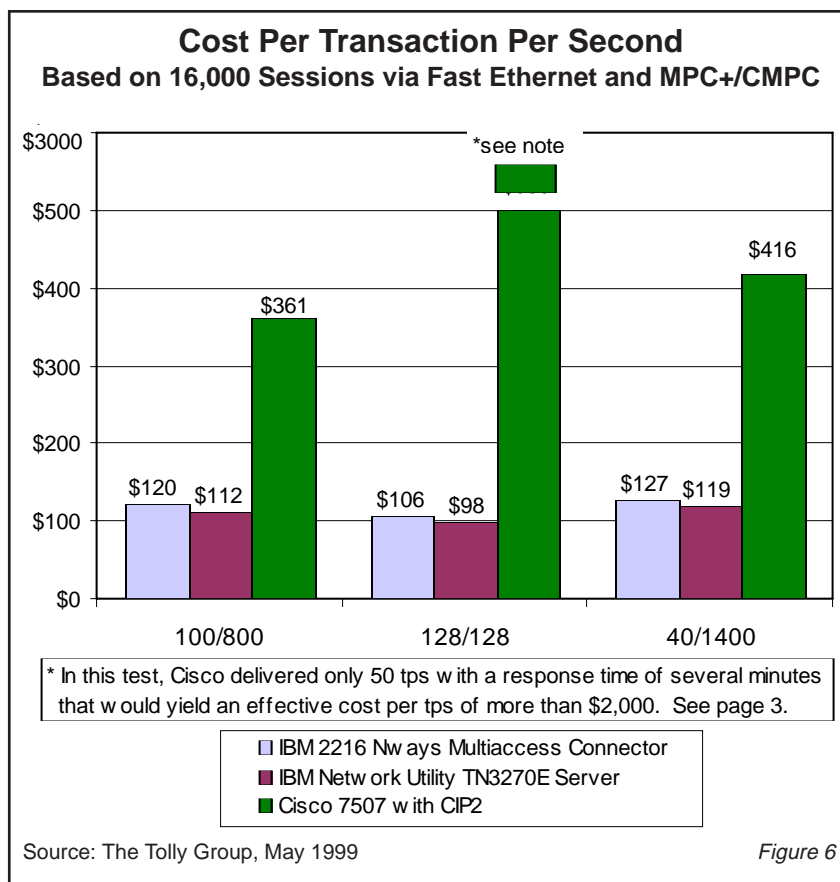
following devices: IBM Network Utility TN3270E Server, model TN1 channel-attached TN3270E server, and IBM 2216 Nways Multiaccess Connector model 400 channel-attached multiprotocol router, both running Multiprotocol Access Services (MAS) version 3.2 EPTF02T (cc4_32e) software. The Tolly Group also tested a Cisco Systems Model 7507/4 LAN/WAN router running IOS 11.1(8)CA1, Early Development Release fc1 software.

The Network Utility TN3270E Server was configured with a 233-MHz System Processor Card with 512 Mbytes RAM, an ESCON interface card, and a Fast Ethernet interface. The IBM 2216 was configured with a 233-MHz System Processor Card with 512 Mbytes RAM, an ESCON interface, a Fast Ethernet interface and dual power supplies.

The Cisco 7507 was configured with a single RSP4 containing 256 Mbytes of RAM and a CIP2 (one of two ESCON interfaces was used for all tests) containing 128 Mbytes. The 7507 also was configured with a Fast Ethernet Interface Processor with a single Fast Ethernet interface (VIP2-40-based). The devices were configured with the maximum allowable memory for each component.

The test environment consisted of the gateway(s) under test connected to an IBM 9672 Model Y56 Generation 5 (G5) mainframe (model CPC-15#67, CPC-30/B/2) running ITPECHO via a single 17 Mbyte/s ESCON channel and simulated TN3270 clients via a full-duplex Fast Ethernet link. See figure 7. During testing at IBM's Washington Systems Center/ Networking Systems Center – Gaithersburg, MD., The Tolly Group used one of five 150-MIPS processors on the host, which ran OS/390 V2R6 SNA Services (also referred to as VTAM).

On the downstream side, a Wandel & Goltermann, Inc. Domino-FastEthernet Analyzer DA-350



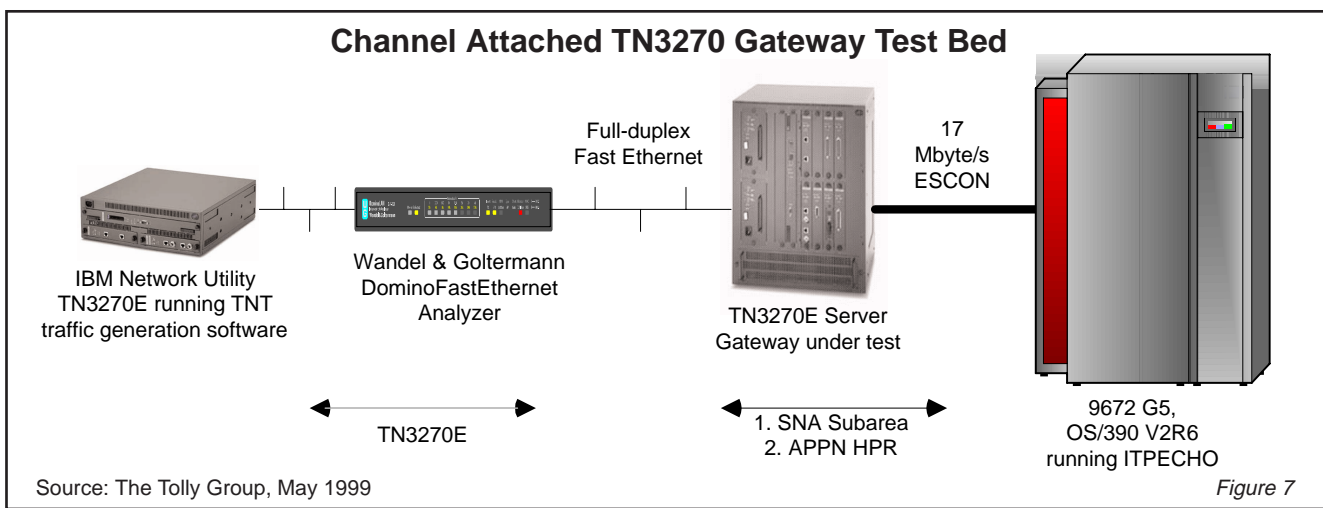
connected to the device under test via a full-duplex Fast Ethernet connection. The analyzer verified frame sizes and traffic flows. An IBM Network Utility, running IBM's Telnet 3270 Test (TNT) application, was also connected to the analyzer.

TNT software running on the IBM Network Utility simulated a large number of TN3270 users executing transactions against a mainframe running ITPECHO (part of Teleprocessing Network Simulator). TNT begins by attempting to activate a user-configurable number of sessions at a rate of 100 sessions per second. Once TNT activated all sessions, it transfers one of three traffic profiles: A 40 byte in/1,400 byte out profile approximated the activity of a screen refresh; a 128 byte in/128 byte out profile is similar to a credit inquiry with a short amount of data in and a short amount out; and the 100 byte in/800 byte out profile resembles an average data transaction in which

some fields are modified as data is returned to the user.

For each transaction, TNT transmitted a fixed quantity of data to the host, which then returned a fixed quantity of data. Once the transaction is complete, TNT waits for a user-configurable "think time" and repeats the above transaction. TNT then reports the number of complete transactions at one-minute intervals. At three-minute intervals, TNT also reports the average transactions per second rate, as well as the minimum, mean, and maximum response times. This process served to verify throughput results. (The margin of error of the methodology was 0.5 seconds of sleep time.)

Detailed configurations for this test are posted on The Tolly Group Web site at <http://www.tolly.com> and can be viewed by accessing document 199115.



EQUIPMENT ACQUISITION AND SUPPORT

For the purpose of this evaluation, IBM purchased the Cisco 7507 through normal product distribution

channels. The Tolly Group invited Cisco executives to provide a higher level of support than available through normal channels. Cisco declined to support the test beyond normal technical assistance available to customers. For a more complete understanding of the interaction

between The Tolly Group and Cisco, 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 199115.

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

Vendor	Product	Web address
IBM	Telnet 3270 Test (TNT)	http://www.ibm.com
Wandel & Goltermann, Inc.	DominoFastEthernet	http://www.wg.com



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PROJECT PROFILE

Sponsor: IBM Corp.

Document number: 199115

Product class: Channel-attached TN3270E Server

Products under test:

- IBM 2216 Nways Multiaccess Connector
- IBM Network Utility TN3270E Server
- Cisco Systems, Inc. 7507/4 with CIP2

Testing window: March through April 1999

Software versions tested: IBM 2216 and Network Utility: Multiprotocol Access Services (MAS) version 3.2 EPTF02T (cc4_32e) software; Cisco 7507: IOS 11.1(8)CA1, Early Development Release fc1 software and Unlimited CIP2 TN3270E Server and CSNA

Software status: All software generally available at time of testing

Additional information available:

- Technical Support Diary

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