

IBM Corp.

2216 Nways Multiaccess Connector and Network Utility TN3270E Server

TN3270E Channel-Attached Dual-Gateway Scalability/Fail-over 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. A TN3270E Server must also deliver a high level of resiliency to ensure sessions remain intact, even during system failures.

IBM Corp. commissioned The Tolly Group to evaluate the scalability and the fail-over performance of the TN3270E server function of its 2216 Nways Multiaccess Connector and its Network Utility TN3270E, in tandem with its 2216 Network Dispatcher.

Testing was performed in May 1999.

RESULTS

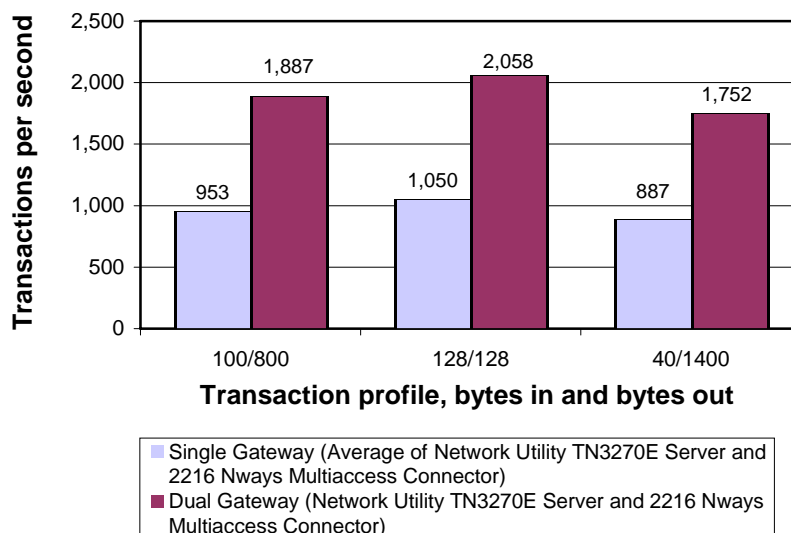
TN3270E SERVER SCALABILITY

The Tolly Group benchmarked the scalability of transaction per second (tps) throughput of the Network Dispatcher feature of the 2216 Nways Multiaccess Connector when load-balancing session traffic between the channel-attached TN3270E Server gateways on the 2216 and the Network Utility TN3270E Server.

Test Highlights

- Delivers double the aggregate throughput of a single gateway for both Subarea/LSA and HPR/MPC+
- Provides the ability for a 2216 or a Network Utility to "back-up" a failed TN3270E server/gateway, even while supporting sub-second response times across up to 16,000 users
- Demonstrates HPR's resiliency, providing zero session loss with sub-second response time even during a catastrophic ESCON failure
- Evenly balances 16,000 sessions between two servers while maintaining sub-second response time to each server

Load-Balanced TN3270E Throughput 16,000 Subarea/LSA Sessions with Network Dispatcher Providing Load Balancing



Source: The Tolly Group, June 1999

Figure 1

Tests were conducted across a session load of 16,000 active sessions. 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.

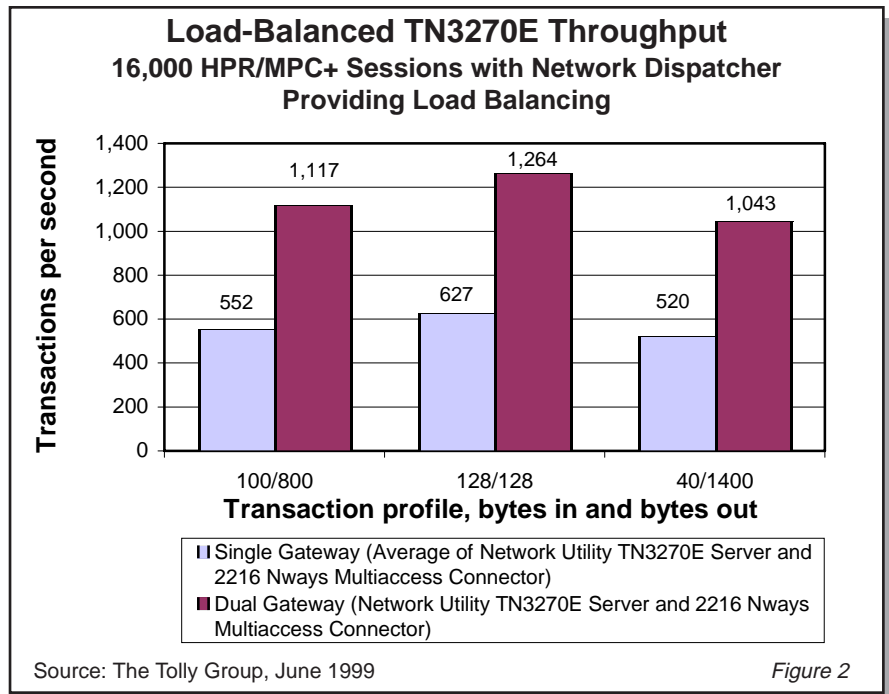
The tests revealed that a dual-gateway configuration consisting of a 2216 Nways Multiaccess Connector and Network Utility TN3270E Server operating in parallel, combined with a 2216 Network Dispatcher performing load balancing across the two gateways, delivers approximately double the aggregate throughput of a single-gateway for both Subarea/LSA and HPR/MPC+ without adding extra IP addresses or reconfiguring end stations to point to multiple gateways. In a Subarea/LSA environment handling a traffic profile of 128 bytes in/128 bytes out, the dual gateways delivered an average of 2,058 tps, versus 1,050 tps for a single gateway. This 2:1 tps advantage held up consistently across the other traffic profiles tested, demonstrating that the Network Dispatcher can load balance equally between the gateways; see figures 1 and 2. The difference in session loading across the two gateways in both cases was less than 7%.

CPU utilization of the Network Dispatcher host device ranged from 20% to 28% while providing 1,000 and 2,000 tps for HPR/MPC and subarea/LSA, respectively. The reason for this gap in tps performance is directly related to where SNA boundary processing occurs. With subarea/LSA, SNA boundary processing occurs in the mainframe, which uses host processing cycles. With APN/HPR, the boundary processing occurs in the gateway, which results in the lower tps rate.

TN3270E SERVER

FAIL-OVER

TN3270E gateways that operate by themselves, without the assistance of



a 2216 Network Dispatcher and its load-balancing capabilities, face the loss of sessions and the prospect of locating a backup server in the event of an outage. However, testing demonstrated that the 2216 Network Dispatcher can recognize a downed TN3270E Server and route the new session connections to the available TN3270E Server while maintaining sub-second response time for connected users. Moreover, testing shows that HPR proved to be more resilient than LSA in the ESCON fail-over scenario.

In the case of HPR over MPC+, engineers simulated an ESCON link failure by disconnecting one of the two gateways from the mainframe so that sessions would be rerouted over the remaining gateway. HPR provided automatic recovery in less than one second for all 8,000 sessions.

Since the link failure occurred between the two devices acting as HPR Rapid Transport Protocol (RTP) end points (i.e., the Network Utility and the host), HPR rerouting occurred with no measurable user delay. That is, both the Network Utility and the mainframe recognized the physical link failure and rerouted traffic around

the failure; for this reason, HPR timers never expired. In this test, the maximum response time across all transactions remained less than one second, indicating that no transaction was delayed for more than one second.

In the LSA test, the 2216 sustained the manual reactivation of sessions at an average rate of one new session every 164 mS. During this recovery process, existing sessions connected across the 2216 TN3270E Server maintained sub-second response time.

ANALYSIS

For customers that deploy TN3270E servers as channel-attached gateways and who demand sub-second transaction times, a dual-gateway/dual-ESCON system that includes any combination of Network Utility TN3270E Servers and/or 2216 TN3270E Servers, operating in conjunction with a Network Dispatcher that provides load balancing, can double the throughput of a single-gateway/single-ESCON system, while still appearing as a single gateway to the downstream clients.

Furthermore, in such a dual-gateway system, the 2216 with Network

Dispatcher (combined with a Network Utility 3270E Server or 2216 TN3270E Server) can "back-up" a failed TN3270E server/gateway, even while supporting sub-second response times across up to 16,000 users. That is, when 16,000 users are simultaneously executing 1 transaction per minute per user across each of two TN3270E gateways (approximately 8,000 users per gateway), the remaining 2216 TN3270E Server can maintain sub-second response time across all users, including both the users who are already active across the 2216 TN3270E Server and new users redirected to it by the Network Dispatcher.

Recovery from a failure in an APPN/ HPR MPC+ network can occur rapidly enough to ensure sub-second response times even for those sessions that are rerouted around the failure.

TEST CONFIGURATION AND METHODOLOGY

For all TN3270E server performance tests, The Tolly Group tested the following devices: IBM Network Utility TN3270E, model TN1 channel-attached TN3270E server, and IBM 2216 Nways Multiaccess Connector model 400 channel-attached multi-protocol router, both running Multi-protocol Access Services (MAS) version 3.2 EPTF02T (cc4_32e) software. IBM's Network Dispatcher is included with the base MAS version 3.2 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 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) via a single 17 Mbyte/s ESCON channel and simulated TN3270 clients via a full-duplex Fast Ethernet link. See figure 3.

On the downstream side, a Wandel & Goltermann, Inc. Domino FastEthernet Analyzer 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 TN3270E Server, running IBM's Telnet 3270 Test (TNT) application, was also connected to the analyzer.

TNT software running on a separate Network Utility TN3270E Server simulated a large number of TN3270 users executing transactions against an MVS host running ITPECHO (part of TPNS). Once TNT activated all sessions, it transferred one of three traffic profiles: A 40 byte in/1,400 byte out profile approximates 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.

In the case of Subarea/LSA, engineers created a system failure by powering-off the Network Utility. In this case, sessions were lost (TCP/IP has no automatic session recovery mechanism) and engineers reactivated sessions across the remaining active system (the 2216). Although the simulated users were forced to reconnect sessions, the Network Dispatcher automatically directed the new requests across the active gateway, effectively redirecting the traffic around the failed system.

Due to the operation of the test application (TNT), it is possible that the offered load of one transaction per minute per user resulted in all transactions aligning, such that none of the 16,000 transactions executed during the period that spanned the failure. For instance, if the failure

IBM Corp.

IBM 2216 Multiaccess Connector IBM Network Utility TN3270E Server

TN3270E Server Scalability/Failover



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

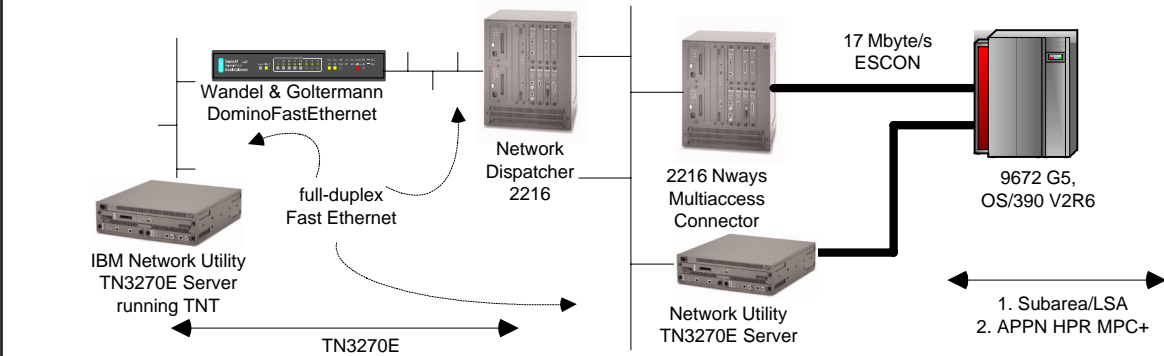
For more information contact:

Your local IBM sales representative or business partner.

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

* Vendor-supplied information not verified by The Tolly Group

Channel Attached TN3270E Dual Gateway Test Bed



Source: The Tolly Group, June 1999

Figure 3

occurred at 00:00:20 and lasted until 00:00:50 (an outage of 30 seconds), and if all of the 16,000 transactions in that one-minute interval occurred between 00:00:00 and 00:00:20 or between 00:00:50 and 00:01:00, then no transaction would have spanned the failure. For this reason, The Tolly

Group executed the test multiple times; each iteration revealed the same result.

Furthermore, since the test application only reports response times for those transactions that complete in the third one-minute interval of each three one-minute intervals, The Tolly

Group performed the failure in the first one-minute interval (one iteration), the second one-minute interval (one iteration) and the third one-minute interval. While this sample does not categorically prove that at least one transaction spanned the failure, it is highly likely that it did.

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

Vendor

IBM
Wandel & Goltermann, Inc.
Network Associates, Inc.

Product

Telnet 3270 Test (TNT)
DominoFastEthernet
NetXRay

Web address

<http://www.networking.ibm.com>
<http://www.wg.com>
<http://www.nai.com>



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PROJECT PROFILE

Sponsor: IBM Corp.

Document number: 199116

Product class: Channel-attached TN3270E Server gateway

Products under test:

- IBM 2216 Nways Multiaccess Connector
- IBM Network Utility TN3270E Server
- IBM Network Dispatcher

Testing window: May 1999

Software versions tested: IBM 2216 and Network Utility: Multiprotocol Access Services (MAS) version 3.2
EPTF02T (cc4_32e) software

Software status: All software generally available at time of testing

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