THE TOLLY GROUP

No. 202151 October 2002

ADTRAN, Inc.

NetVanta 3200 Access Router versus Cisco Systems, Inc. 1720/1751V

Competitive Performance Evaluation

Test Summary

Premise: *Customers who deploy branch office routers have come to expect line rate throughput and secure Internet connections in T1 WAN configurations. In such environments, customers need to be confident that these devices can provide consistent high-speed WAN throughput while handling various security functions. Furthermore, these devices should provide low latency at a variety of packet sizes, even when handling security functions and should provide interoperability with existing network infrastructure.*

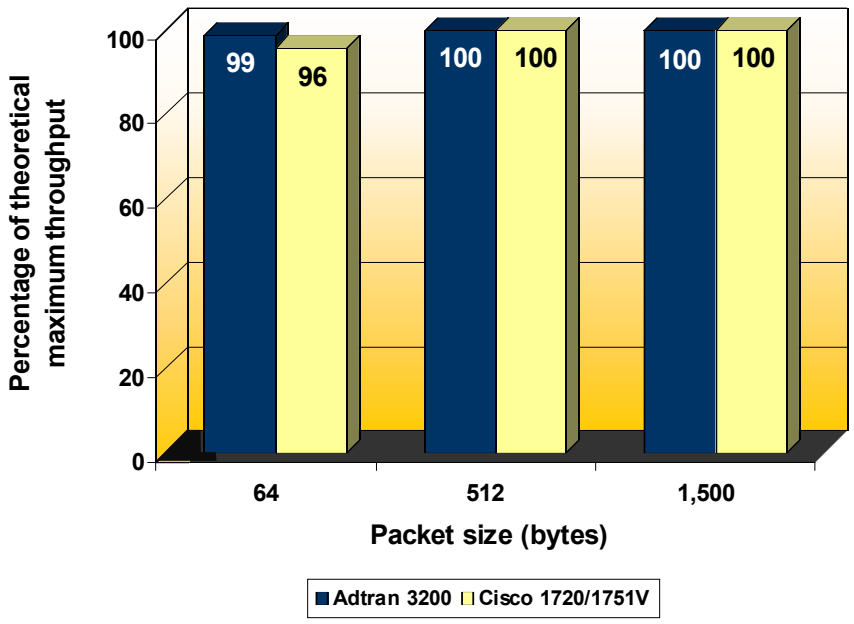
ADTRAN, Inc. commissioned The Tolly Group to evaluate the performance of its NetVanta 3200 Access Router, a modular access router integrated with stateful inspection firewall capabilities and designed for small and medium-sized businesses against a Cisco Systems, Inc. 1720/175lV access router equipped with firewall. The Tolly Group benchmarked each device for steady-state, zero-loss (≤0.001%) bidirectional throughput when transmitting data across T1 connections, handling a variety of standard Ethernet packet sizes. Engineers also tested each device's throughput and latency performance when configured as a 10-rule firewall. Testing was performed in October 2002.

Test Highlights

- Achieves 99% of the theoretical maximum throughput forwarding 64-byte packets in router mode
- Outperformed the Cisco 1720/1751V by 54% in bidirectional firewall throughput tests when handling 64-byte packets
- Delivers consistent wire-speed throughput with 512- and 1,500-byte packets with 10 active firewall rules even when the number of sessions increases from 2 on up to 500 sessions
- Maintains very low latency even with firewall enabled
- Demonstrates interoperability with the Cisco 1720 via RIP v.2

Zero-Loss (≤0.001%) Bidirectional Throughput across WAN

(Frame Relay over T1) as reported by SmartWindow



Source: The Tolly Group, October 2002 *Figure 1*

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In accordance with The Tolly Group's Fair Testing Charter (FTC), Cisco was invited to provide a higher level of technical support for this series of tests, but did not respond to several invitations during the course of testing. Also, in accordance with The Tolly Group FTC, upon completion of testing, test results were shared with Cisco executives who claimed they could neither acknowledge nor dispute their accuracy because they did not have the appropriate test tools to perform the tests themselves.

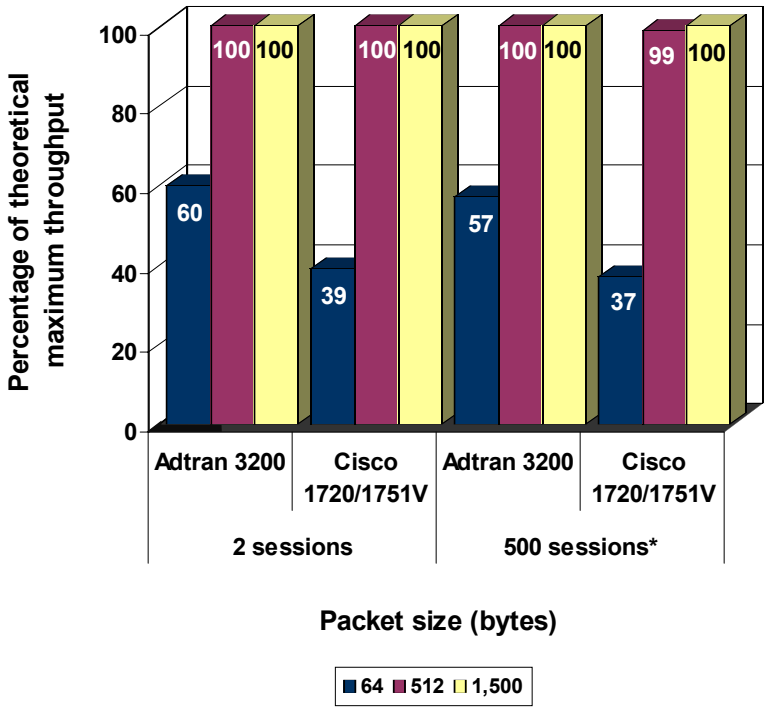
Test results show that the NetVanta 3200 outperformed the Cisco 1720/1751V by 54%, forwarding 20% more of the theoretical maximum when handling 64-byte packets in firewall tests and by 3% in zero-loss throughput tests with 64-byte packets in router tests. For larger packet sizes, the NetVanta 3200 and the Cisco 1720/1751V performed comparably in both zero-loss throughput and firewall performance tests. In latency tests, both devices again performed comparably, exhibiting low latency in a scenario that utilized 10 active firewall rules and 100 sessions bidirectionally.

Results

Zero-loss Throughput

The Tolly Group tested the NetVanta 3200 and Cisco 1720/1751V to determine the percent of theoretical maximum zero-loss (≤0.001%) throughput each device provided between a Fast Ethernet LAN and T1 WAN interface when processing 64-, 512- and 1,500-byte packets (including 14 bytes for Fast Ethernet header and four bytes for IP headers) with 30 dynamic RIP routes populated.

Zero-Loss (≤0.001%) Bidirectional Firewall Throughput across WAN with 10 Active Rules
(Frame Relay over T1) as reported by SmartWindow



* 200 Sessions were used for 1,500-byte frames

Source: The Tolly Group, October 2002 *Figure 2*

Test results show that when processing 64-byte packets, the NetVanta 3200 forwarded 99% of the theoretical maximum throughput compared to the Cisco devices which forwarded 96% of the theoretical maximum in the same scenario.

Test results show that the both the NetVanta 3200 and the Cisco devices forwarded 100% of the theoretical maximum throughput when handling 512- and 1,500-byte packets. (See Figure 1.)

Firewall Throughput – 10 Rules

Tolly Group engineers also tested the NetVanta 3200 and the Cisco 1720/1751V to determine zero-loss (≤0.001%) throughput performance when each device was configured as a 10-rule firewall, where the first nine rules deny traffic and the final rule allows all traffic in a full-duplex, Fast Ethernet environment with NAT enabled and 30 dynamic RIP routes populated. A flow of two on up to 500 UDP sessions was initiated by sending traffic to different ports bidirectionally.

Results show that when transporting 1,500-byte packets for all sessions tested, both devices operated at wire speed.

When forwarding 512-byte packets, the NetVanta 3200 forwarded 100% of the theoretical maximum regardless of the number of sessions while the Cisco devices forwarded 100% of the theoretical maximum with two sessions, and 99% of the theoretical maximum with 20, 100 and 500 sessions.

In tests utilizing 64-byte packets, the NetVanta 3200 forwarded 60% of the theoretical maximum throughput for 2, 20 and 100 sessions; when the number of sessions increased to 500, the NetVanta 3200 forwarded 57% of the theoretical maximum. In comparison, in tests of 64-byte packets, the Cisco devices were capable of forwarding only 39% of the theoretical maximum with two sessions, 38% with 20 sessions, and only 37% with 100 and 500 sessions running. (See Figure 2.)

Latency

Applications such as voice over IP and video are adversely affected by latency, or delay. The ITU-T Recommendation G.114 indicates 0 – 150 milliseconds as acceptable end-to-end delay for most user applications.

Engineers first conducted latency tests in a baseline configuration with two UDP sessions, 30 dynamic routes and firewall disabled. Results demonstrate that each device under test (DUT) exhibited low latency when forwarding 64-, 512- and 1,500-byte packets, with the NetVanta 3200 exhibiting a latency of 0.5 milliseconds for 1,500-byte packets and the Cisco 1720/1751V exhibiting a latency of 0.2 milliseconds in the same scenario.

Next, engineers conducted latency tests in which each device was configured as a firewall with NAT enabled, 30 dynamic RIP routes and running 100 UDP sessions. Results reveal that both the NetVanta 3200 and the Cisco devices exhibited low latency when forwarding 64-, 512- and 1,500-byte packets, with the NetVanta 3200 exhibiting latency of 0.5 milliseconds for 1,500-byte packets and the Cisco devices exhibiting 0.3 milliseconds latency in the same scenario. (See Figure 3.)

Interoperability

Tests demonstrate that the NetVanta 3200 can successfully interoperate with the Cisco 1720 via RIP v2. (See Figure 4.)

Analysis

User requirements for full line-rate support are not limited to high-end connections on the LAN, but include WAN connections, as well. Remote connections via frame relay and Internet connectivity via PPP or frame relay continue to be in demand even with the growth of DSL and cable modem connections. The access router market is price-sensitive and this has often resulted in a tradeoff of performance versus price.

With the NetVanta 3200, the user has a high function wide area router, delivering full line rate for all but the most processor-intensive packet sizes for frame relay and PPP, while performing as a firewall with NAT enabled.

Moreover, the NetVanta 3200 offers performance and functionality to rival the Cisco offering. Tests results show

ADTRAN, Inc.

NetVanta 3200

Competitive Performance Evaluation

ADTRAN, Inc.
NetVanta 3200
Product Specifications*

Physical Interface
- NIM: 56/64K, T1/FT1, T1/FT1 with DSX-1, and Serial
- DIM: Analog modem and ISDN BRI
- LAN: Auto-sensing 10/100BaseT Ethernet port (RJ-45)
- Console port

Firewall
- Stateful inspection firewall
- Denial of Service (DoS) protection

Processor and Memory
- 80 MHz, Motorola MPC 860
- RAM: 16 MB
- FLASH: 8 MB

Administration: SYSLOG logging, E-mail alerts (SMTP), access control policies, policy statistics

WAN Protocol
- Frame Relay
- PPP

Routing Protocol
- RIP v1 & v2
- Static

Routed Protocol
- IP
- Bridging (other protocols)

Frame Relay
- RFC 1490 Encapsulation (Multiprotocol over Frame Relay)
- LMI types: LMI, ANSI (Annex D), CCITT (Annex A) and Static

PPP
- LCP, IPCP, BCP

Network Address Translation
- Basic NAT (1:1)
- NAPT (many:1)

DHCP: Client and server, relay

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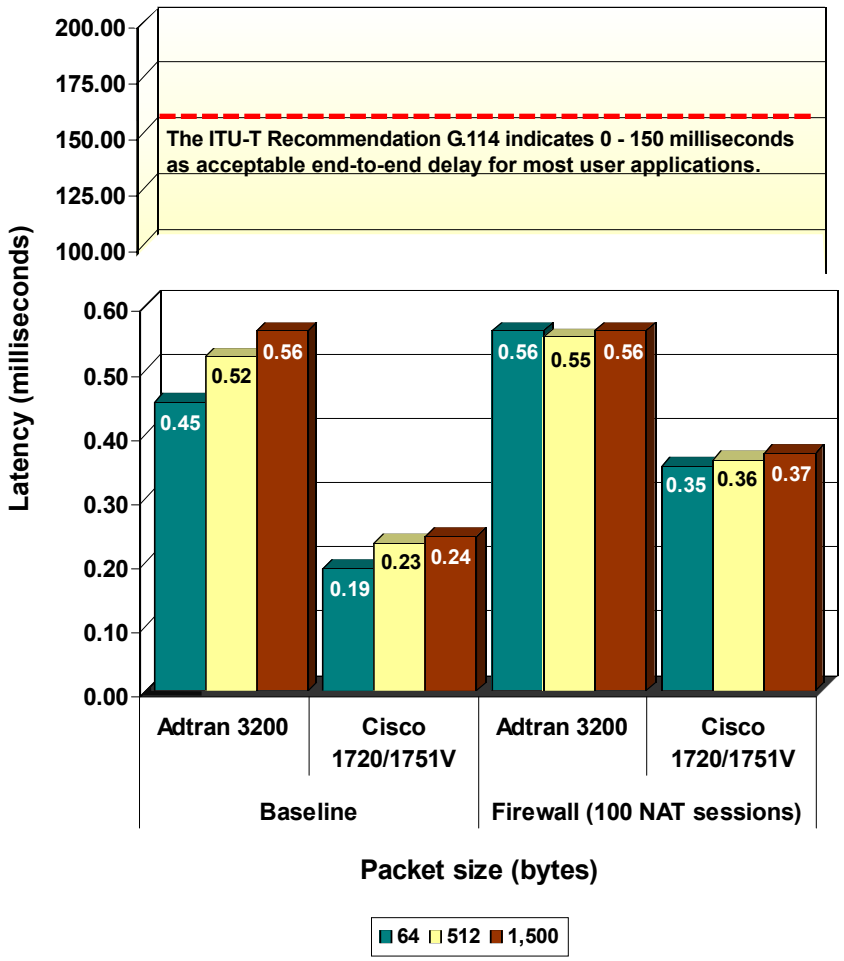
**Vendor-supplied information not verified by The Tolly Group*

that the NetVanta 3200 offers high firewall throughput, consistently high throughput and very low latency across frame relay networks comparable to that of the Cisco device.

While both devices performed at wire speed or near wire speed for the majority of throughput and firewall tests, it was in the firewall tests of the smallest packet sizes that the NetVanta 3200 excelled, outperforming the Cisco device by 54% when processing 64-byte packets. Throughput of small packets is an important factor when taking into consideration that most network management traffic and acknowledgements are relatively small sized.

Latency tests also reveal that both the NetVanta 3200 and the Cisco device sustain throughput with very low latency, at levels acceptable for the most latency-sensitive applications, such as voice. Latency results were well below the 150-millisecond threshold recommended by the ITU-T G.114 as acceptable end-to-end delay. In consideration of that parameter, latency under 1.0 milliseconds is almost negligible.

The NetVanta 3200's configuration architecture is similar to that of the Cisco 1720, thereby facilitating implementation for those familiar with Cisco products. Moreover, when comparing cost considerations for both products configured with a T1 interface, the NetVanta 3200 lists at a price of $995 U.S., and includes a stateful inspection firewall in its standard feature set, while the Cisco 1720 lists for $2195 U.S. not including the firewall feature which is an additional $900 option. This puts the NetVanta 3200 at roughly less than half the cost of the Cisco 1720.



Note: SmartBits generated traffic at 10% of the T1 line rate for all baseline tests and at 10%, 13% and 39% using 64-, 512- and 1,500-byte packets, respectively, for firewall tests.

Source: The Tolly Group, October 2002 *Figure 3*

Test Configuration and Methodology

For performance tests, The Tolly Group tested an ADTRAN, Inc. NetVanta 3200 Access Router, version 2.1.0 and a Cisco Systems, Inc. 1720/1751V, version 12.2(8)YJ that includes firewall capabilities.

Tolly Group engineers tested a NetVanta 3200 and the Cisco 1720 in tests of steady-state, zero-loss (≤0.001%) bidirectional throughput tests. For firewall performance tests, engineers tested a pair of NetVanta 3200s and the Cisco 1720 and 1751V pair.

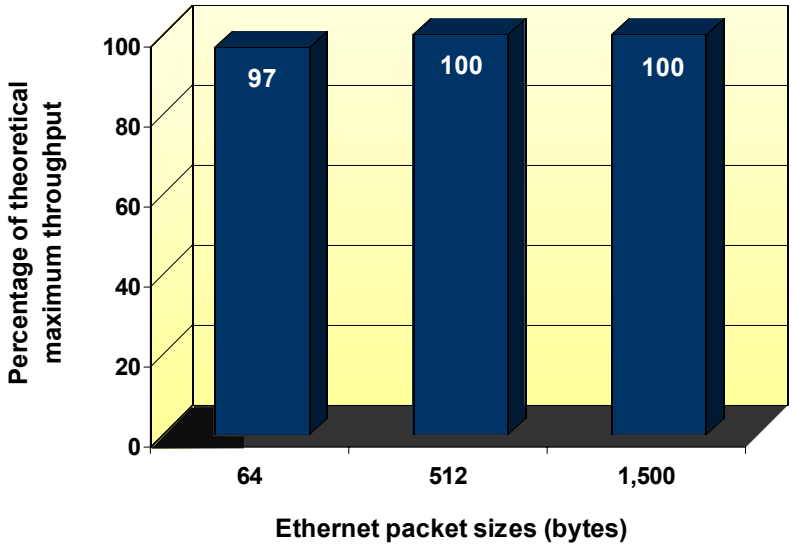
Two DUTs were connected back-to-back to each other across frame relay over a T1 connection. In turn, each DUT connected via Fast Ethernet to a SmartBits SMB-600 chassis that generated 64-, 512- and 1,500-byte packets.

For firewall tests, Tolly Group engineers first configured the DUT as a 10-rule firewall where the first nine rules are "deny" and the final rule is “allow all” traffic, with NAT enabled. Engineers first configured SmartBits to generate two sessions of bidirectional UDP traffic with a single client IP address on the public side of the network transmitting and receiving traffic from a single IP address on the private side. Engineers then configured SmartBits to generate 2, 20, 100 and 500 UDP sessions bidirectionally. The DUT configured as a firewall connected to SmartBits; one connection simulated the internal or trusted network and the other simulated an external or untrusted network. Engineers configured TeraRouting Tester to generate 30 dynamic RIP routes continuously for all tests. (See Figure 5.)

Latency testing was completed using the SmartBits SmartWindow and the latency test defined in the RFC 2544 test suite. Traffic was generated at 10% of T1 line rate with 2 sessions running for baseline latency tests. For firewall latency tests, traffic was generated at 10%, 13% and 39% of the T1 line rate, while using 64-, 512- and 1,500-byte packets, respectively. Latency calculations of the various packet sizes were obtained and reported. Latency calculations did not include T1 clocking time.

For all tests, engineers reset each DUT to its factory defaults, disabling Spanning Tree, flow control and all other ancillary features (in firewall tests, NAT was enabled). Engineers configured each port for the maximum speed and full duplex operation. Then they configured SmartBits for the correct packet size, correct packet rate and test duration. Engineers then initiated the test and recorded results. In the event of packet loss, engineers re-ran the test and lowered the packet rate until no packet loss occurred. Engineers conducted three iterations of each test for a duration of one minute and results were averaged.

Zero-Loss (≤0.001%) Bidirectional Throughput across WAN between Adtran NetVanta 3200 and Cisco 1720 Router
(Frame Relay over T1) as reported by SmartWindow



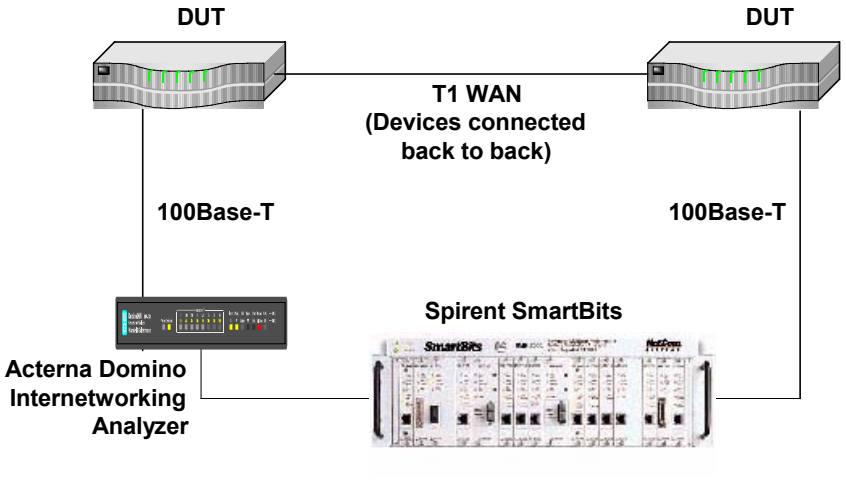
Source: The Tolly Group, October 2002 *Figure 4*

During prototype testing, an Acterna DA-360 Internetworking Analyzer was placed in line to validate traffic flow between the devices, but it was removed prior to performance testing. A Domino Plus (Domino Core 3.1) verified packet sizes and utilization.

Equipment Acquisition and Support

The Cisco Systems, Inc. 1720/1751V routers were acquired through normal product distribution channels. The Tolly Group contacted Cisco executives and invited them to provide a higher level of support than available through normal channels. Cisco executives did not respond to several invitations during the course of testing. The Tolly Group verified product release levels and shared test configurations with Cisco executives in order to give them an opportunity to optimize their device. Upon completion of testing, in accordance with The Tolly Group FTC, results were shared with Cisco executives who claimed they could neither confirm nor deny test results because they did not have appropriate test tools to complete tests themselves.

Test Bed



Source: The Tolly Group, October 2002

Figure 5

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

Vendor	Product	Web address
Acterna	Domino DA-360	http://www.acterna.com
Spirent Communications	SmartBits SMB-2000	http://www.spirentcom.com
Spirent Communications	TeraRouting Tester 1.20B	http://www.spirentcom.com

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For info on the Fair Testing Charter, visit: www.tolly.com/About/ftc.asp

Project Profile

Sponsor: ADTRAN, Inc.

Document number: 202151

Product Class: T1 access router

Products/versions under test:

- ADTRAN NetVanta 3200, version, 2.1.0
- Cisco Systems, Inc. 1720/1751V, version 12.2(8)YJ

Testing window: October 2002

Software status: Generally available

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