THE TOLLY GROUP

No. 206154 November 2006

ADTRAN®, Inc.

NetVanta® 3430

Competitive Performance Evaluation versus Nortel Secure Router 1004

TOLLY Up to Spec CERTIFIED Test Summary

Premise: *Local and remote routers that provide access for campus, branch office and other remote users to enterprise and service provider networks must be able to deliver high throughput, even with firewall, VPN or other security services active and vying for processor cycles.*

ADTRAN, Inc. commissioned The Tolly Group to evaluate the NetVanta 3430 Multi-service Access Router with integrated network services such as Quality of Service (QoS), VPN, and stateful firewall enabled.

Tolly Group engineers measured the Layer 3 bidirectional zero-loss throughput of the devices operating in Ethernet-to-Ethernet and Multilink Point-to-Point Protocol (MLPPP) scenarios against Nortel SR1004 router with stateful firewall and VPN services active.

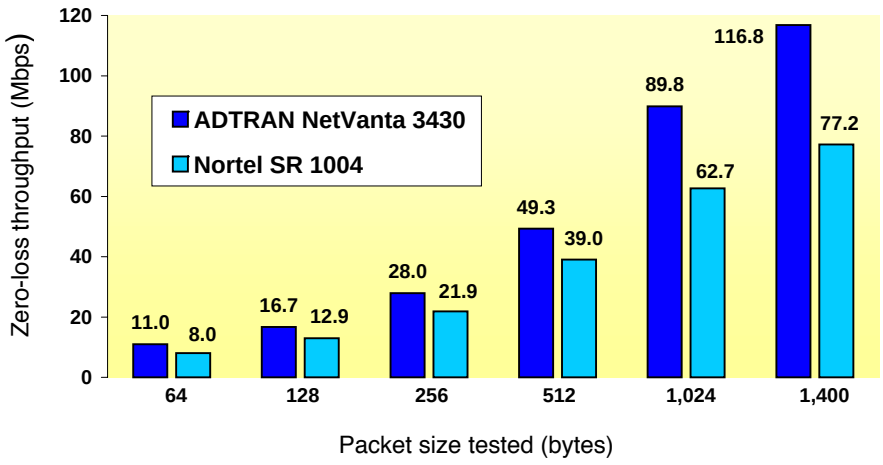
Testing was conducted in September 2006.

Test Highlights

- Outperforms Nortel SR1004 router in Layer 3 Ethernet bidirectional zero-loss throughput, achieving up to 36% more than the performance of competing device tested with firewall and VPN enabled
- Operated at wire-speed throughput across two simulated T1s in four of six packet scenarios with firewall and IPSec enabled, while Nortel SR1004 performed 5% lower than theoretical maximum throughput on 1,400-byte packets
- Achieves exceptional voice quality well beyond PESQ-LQ toll-quality thresholds due to low latency and intelligent QoS features, even when subjected to severe congestion

Zero-Loss Bidirectional Throughput Over a Simulated Fast Ethernet WAN, Firewall and VPN Services Enabled

as Reported by Spirent SmartFlow



Source: The Tolly Group, September 2006

Figure 1

Executive Summary

The ADTRAN NetVanta 3430 Multiservice Access Router demonstrated ample processing headroom to handle QoS and security services while constantly providing wire-speed throughput for most packet sizes tested.

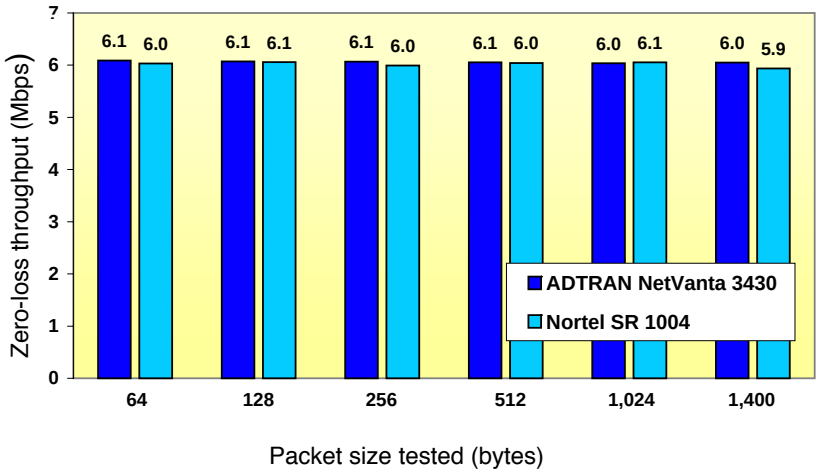
The router market is full of products designed to operate at wire speed under optimal conditions, but that sag under processing loads when security and other services are enabled and contend for available processor cycles.

In the real world, routers with wire speed should also perform well even when handling the overhead associated with security services such as IPSec VPNs, firewalls and other security and network services.

Tolly Group tests show that the NetVanta 3430 delivered 36% more Layer 3 zero-loss throughput of competing routers tested from Nortel during an Ethernet-to-Ethernet scenario with all packet size tested, including 64-byte packets — the most taxing packet size tested. In fact, the NetVanta 3430 delivered, on average, 36% greater throughput than the Nortel SR1004 with both firewall and VPN services enabled.

The results demonstrate that the NetVanta 3430 delivers VPN security services, firewalls and other security services for any central-office based platform.

Zero-Loss Bidirectional Throughput Across 2xT1 Multilink PPP WAN with Firewall and IPSec Enabled
as Reported by Spirent SmartFlow



Source: The Tolly Group, September 2006 *Figure 2*

While it is essential that a router is able to deliver high throughput in converged network environments, maintaining a recommended voice toll quality on a congested network is even more valuable.

In this test, the NetVanta 3430 offered compelling performance versus the rival Nortel device tested. When the NetVanta 3430 was handling double the traffic of two T1 links, the router was able to maintain superior voice toll quality.

This shows that ADTRAN has designed the NetVanta 3430 with the ability to handle voice bandwidth and provide high toll quality using Quality of Service queuing under a congested network.

By having the wire-speed throughput and toll-quality voice from NetVanta 3430, users can select and deploy it in converged service networks that require the best of both performance and voice quality.

Zero-Loss Throughput over Fast Ethernet

Tolly Group engineers tested the NetVanta 3430 against Nortel Secure Router 1004 router to measure the Layer 3 zero-loss throughput (≥0.001%) over an Ethernet-to-Ethernet link with firewall and VPN services active. This is analogous to a router transmitting data across the Internet while supporting VPN applications.

Engineers tested six packet scenarios ranging from 64 bytes to 1,400 bytes on the NetVanta 3430 and the SR1004.

Across all packet scenarios tested, the NetVanta 3430 outperformed the throughput of the SR1004.

In a 1,400-byte packet test, the NetVanta 3430 achieved 11 Mbps of zero-loss throughput, or more than 50% greater than the Nortel SR1004. When comparing an average throughput achieved across all packet scenarios, the NetVanta 3430 delivered up to 36% greater throughput than the Nortel SR1004.

Zero-Loss Throughput over Two T1s

Tolly Group engineers measured the Layer 3 zero-loss throughput of the NetVanta 3430 and the Nortel SR1004 across a back-to-back WAN connection using a group of two simulated T1 links (2xT1 MLPPP) with firewall and IPSec VPN services active.

With IPSec and stateful firewall enabled, the NetVanta 3430 achieved wire-speed throughput for four of six packet scenarios.

On the other hand, the Nortel SR1004 was able to offer wire-speed for two out of six packet sizes tested — it failed to keep up with the 1,400-byte packet size, which is typically used when running VPN traffic.

This shows that the NetVanta 3430 has the ability to deliver wire-speed performance across all packet sizes tested.

VoIP Call Quality

Tolly Group engineers tested the VoIP call quality across VPN connections supported by the NetVanta 3430 and the Nortel SR1004 with variable levels of background traffic, including congestion.

Engineers used an Agilent Voice Quality tester (VQT) to measure voice quality via the Perceptual Evaluation of Speech Quality - Listening Quality (PESQ-LQ) metric. PESQ-LQ scores are closer to the listening quality subjective opinion scale, which is standard in the industry and is defined in International Telecommunication Union-Telecommunication Standardizations Sector (ITU-T) P.800. It maps from a standard PESQ score to a well-known MOS scale ranging from 1 to 4.5, with a score of 4.0 or higher representing toll quality.

In this test, engineers ran voice traffic across a WAN (two simulated T1s) with QoS enabled and injected various levels (0% to 200%) of background traffic across the simulated WAN links.

Engineers first recorded a baseline call quality score of 4.33 for a direct phone-to-phone call.

During all five traffic scenarios, the NetVanta 3430 delivered PESQ-LQ scores ranging from 4.31 to 4.34 — superior voice quality just above the toll-quality threshold. (See Figure 3.)

Even with dual-T1 link oversubscription levels, the NetVanta 3430 demonstrated excellent handling of calls, with no adverse affect on call quality.

The Nortel device voice quality was on par with the NetVanta 3430.

ADTRAN, Inc.

NetVanta 3430

Zero-Loss Throughput, Exceptional Voice Quality

TOLLY Up to Spec CERTIFIED

Product Specifications

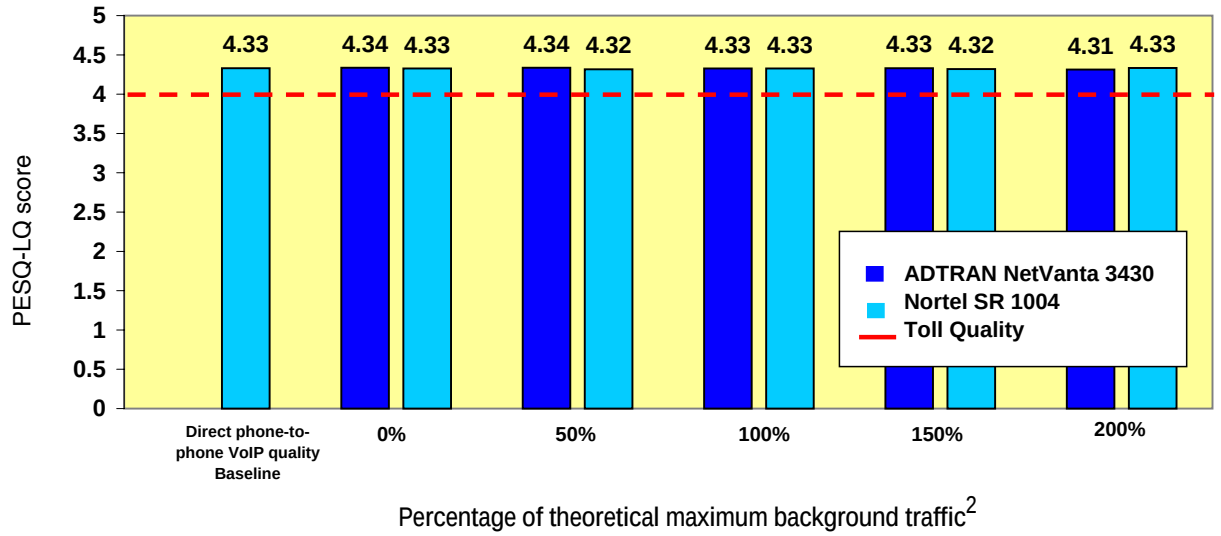
Vendor-supplied information not necessarily verified by The Tolly Group

ADTRAN, Inc. NetVanta 3430

- Modular WAN interfaces ranging from 56K up to two T1s
- Two 10/100Base-T Ethernet LAN ports (NetVanta 3448 includes an 8-port PoE switch)
- Wire-speed performance
- CompactFlash® slot
- 1U, metal chassis with auto-ranging AC power
- BGP, 000OSPF, RIP
- Stateful inspection firewall
- Hardware encryption accelerator
- 500 IPSec VPN tunnels
- TACACS+, RADIUS, SSL and SSH
- Low latency, Weighted Fair Queuing (WFQ), and class-based WFQ
- DiffServ Marking and Recognition
- Frame relay fragmentation
- Recognizable CLI and easy-to use Web GUI

For more information contact:
ADTRAN
901 Explorer Blvd.
Huntsville, AL 35806
Phone: (256) 963-8000
URL: http://www.adtran.com/routers

VoIP Call Quality Across Two Simulated T1 Links with Quality of Service Enabled
as Reported by Agilent Voice Quality



Note: 1. PESQ-LQ = Perceptual Evaluation of Speech Quality - Listening Quality. Scores range from 1 to 4.5, with a score of 4 or higher representing toll-quality voice. 2. As background traffic exceeds 100%, only high-priority voice traffic is delivered, while other traffic is dropped.

Source: The Tolly Group, September 2006

Figure 3

Methodology and Configuration

Tolly Group engineers tested a pair of ADTRAN NetVanta 3430 version 13.2E routers and a pair of Nortel SR1004 version 8.4.4 routers.

Engineers used Spirent SmartBits and SmartFlow 5.0 software to measure the Layer 3 throughput for simulated LAN and WAN connections between the various router pairs under test.

Regarding voice quality, engineers used an Agilent Telegra VQT 4.10 and a pair of ADTRAN IP 601 phones (SW Ver. 1.6.3.0067) supporting SIP.

For the LAN and WAN performance test, engineers measured the bidirectional zero-loss (< 0.001%) throughput with firewall and IPSec services enabled.

Two identical devices under test (DUTs) were connected back-to-back across Fast Ethernet connection or across two simulated T1 links using MLPPP for the WAN test. Then engineers set up a stateful firewall with two firewall rule sets. Each rule set was associated with the different security zones created and in turn different ports (LAN and WAN ports). Each rule set included 10 rules where the first nine rules were "deny" and the final rule was "allow all". Engineers also configured a single IPSec VPN tunnel between two DUTs using 3DES/SHA-1. SmartBits SmartFlow generated 100 symmetrical UDP flows, with unique addresses for each, to measure the throughput values for 64-, 128-, 256-, 512-, 1,024- and 1,400-byte packets. Each test was run for 60 seconds three times and the results were averaged to obtain the final throughput.

For measuring VoIP quality with QoS in a simulated Layer 3 VPN customer edge scenario, engineers measured PESQ-LQ scores for a single VoIP call using Agilent's Voice Quality Tester. For this test, firewall and VPN services were disabled and QoS was configured. Priority Queuing

and class-based Weighted Fair Queuing was invoked as the queuing algorithm.

Engineers configured QoS on the MLPPP interface as follows; DSCP: EF (Voice/ Real Time) = Priority Queuing at up to 50% of WAN bandwidth, AF41 (Video/Priority Data) = CBWFQ at up to 40% of remaining bandwidth, AF31 (Mission Critical Data) = CBWFQ at up to 40% of remaining bandwidth, AF21 (Standard Data) = CBWFQ at up to 16% of remaining bandwidth and BE (Best Effort) = CBWFQ at up to 4% of remaining bandwidth.

On the test tool side, engineers configured the SmartBits SmartFlow to generate 100 UDP flows from 100 source addresses to 100 destinations and assigned the DSCP values to the flows as follows; DSCP: AF41 = 25 flows, AF31 = 25 flows, AF21 = 25 flows, BE = 25 flows.

Engineers first obtained a baseline voice quality by directly connecting two VoIP phones, back-to-back. A G.711 codec was used for the test. Engineers created oversubscription scenarios by configuring SmartBits SmartFlow to generate bidirectional 512-byte background data traffic across the same test environment as the WAN throughput test above. The different background traffic rates included 0%, 50%, 100%, 150% and 200% of the theoretical maximum throughput on two T1 links. Actual traffic traversing WAN links cannot exceed 100% of the theoretical maximum but any background traffic over 100% creates oversubscription scenarios and causes QoS to drop lower priority packets at the WAN egress ports.

The Tolly Group is a leading global provider of third-party validation services for vendors of IT products, components and services.

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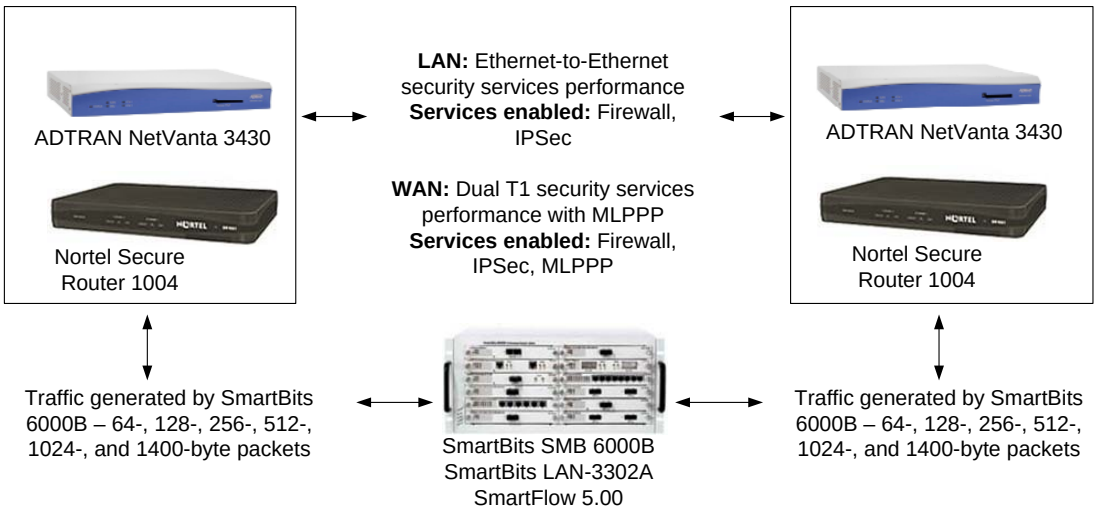
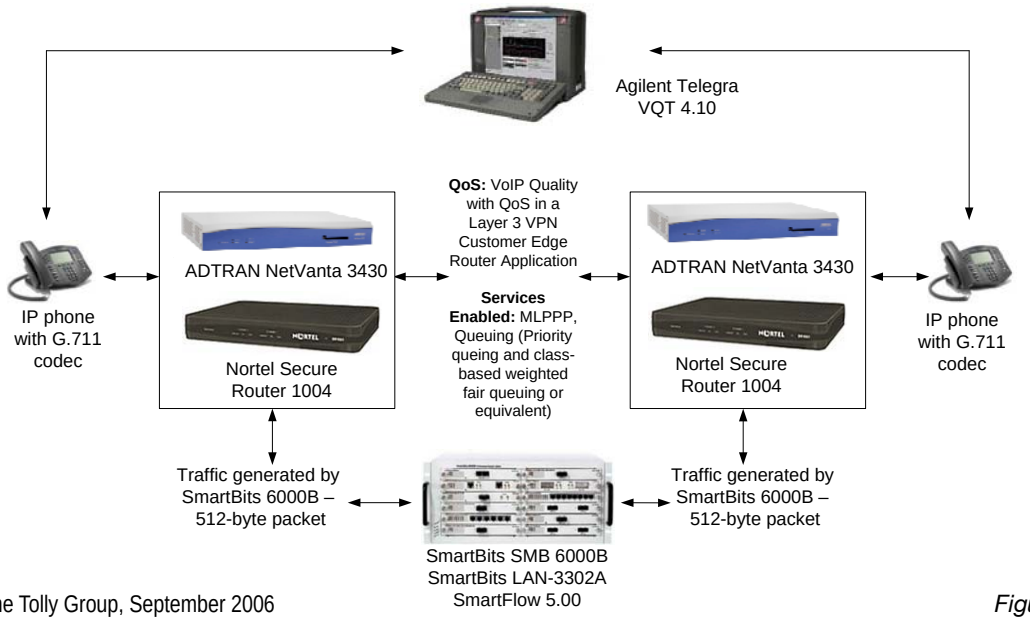
LAN & WAN Throughput Test Bed



Source: The Tolly Group, September 2006

Figure 4

QoS/VoIP Network Test Bed



Source: The Tolly Group, September 2006

Figure 5

Test Equipment Summary

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

Vendor	Product	Web
Agilent Telegra	• Voice Quality Tester 4.10	www.agilent.com
Spirent Communications	• SmartBits 6000B • SmartBits LAN-3302A • SmartFlow 5.0	http:www.spirentcom.com

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