THE TOLLY GROUP

No. 199113 July 1999

Altiga Networks, Inc.

Altiga VPN Concentrator Series (C50) versus Nortel Networks Contivity Extranet Switch 4000 and 4500

VPN Tunneling Competitive Evaluation

Test Summary

THE TOLLY GROUP 10 YEARS 1989-1999 A decade of testing

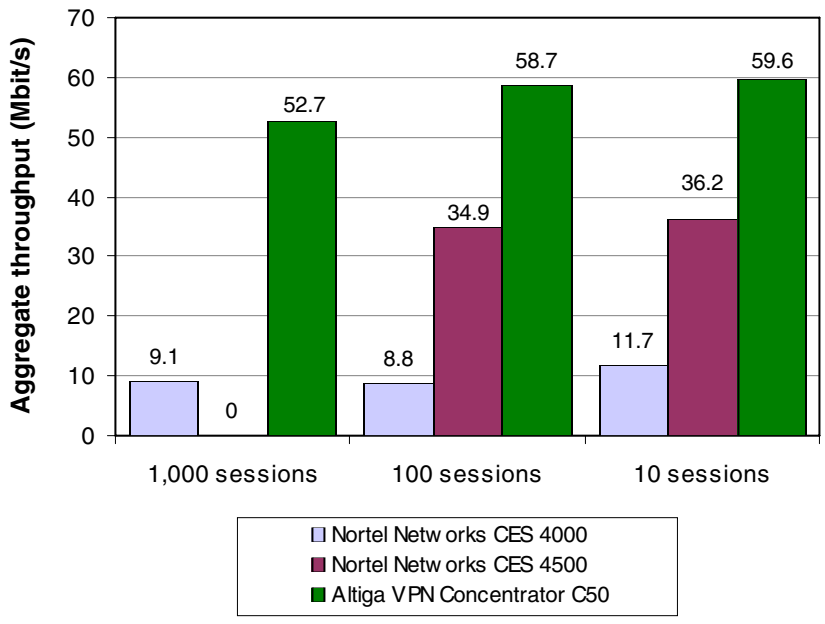
Premise: *Customers who choose to deploy virtual private networks (VPNs) across large campus installations require products that provide excellent throughput while simultaneously supporting hundreds of sessions. While it may be easier to support high throughput across a limited number of connections, networks face a challenge as the number of sessions increases. More sessions mean more processing overhead for maintenance. Excessive session loads could theoretically cripple the performance of some systems. Moreover, the extra processing required to produce Triple DES encryption could have a potentially catastrophic impact on IPSec performance. Users need a device that can support Triple DES without sacrificing performance.*

Altiga Networks, Inc. commissioned The Tolly Group to test its VPN Concentrator Series (C50) against Nortel Networks' Contivity Extranet Switch 4000 and an unreleased beta version of Nortel Networks' Contivity Extranet Switch 4500.

Test Highlights

- Delivers up to 620% greater throughput than Nortel's Contivity Extranet Switch 4000 and up to 120% greater throughput than Nortel's CES 4500
- Supports more than 50 Mbit/s of throughput across 1,000 secure VPN tunnels
- Routes 138,500 IP packets per second of 64-byte data payloads

IPSec Throughput
1,400-Byte Frames



Source: The Tolly Group, July 1999

Figure 1

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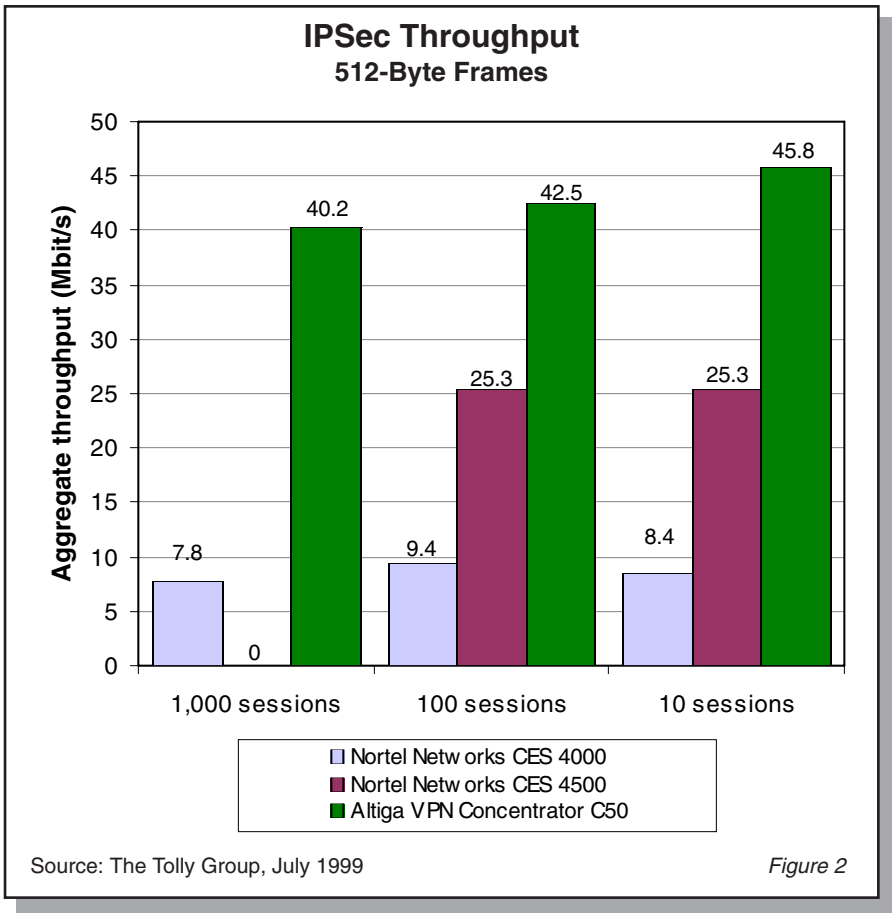
Altiga's VPN Concentrator delivered between 50% and 120% better IPSec throughput than Nortel's CES 4500, and up to 620% greater throughput than the CES 4000. In fact, in throughput tests of 10, 100, and 1,000 sessions, Altiga's VPN Concentrator delivered more than 50 Mbit/s of throughput in tests of 1,400-byte frames.

For the purpose of this testing, The Tolly Group used Security Associations (SAs), which are secure, authentication VPN sessions. In addition, The Tolly Group verified that Altiga's VPN Concentrator can handle a high number of packets per session when used to support traditional routing. Testing was performed in April 1999.



Source: The Tolly Group, July 1999 *Figure 2*

Results

Throughput (1,400-byte frames)

Altiga's VPN Concentrator C50 demonstrated superior forwarding performance of 1,400-byte frames, proving that it can maintain a high level of data throughput while forwarding data across 10, 100 and 1,000 IPSec sessions. The Altiga VPN Concentrator C50 achieved 52.7 Mbit/s of throughput versus 9.1 Mbit/s for Nortel Networks' CES 4000 across 1,000 sessions. Note: The CES 4500 was unable to activate 1,000 sessions during the test; Nortel said additional memory would have allowed support for 1,000 sessions.Even across 100 sessions, Altiga's VPN Concentrator C50 maintained higher throughput, delivering data at a rate of 58.7 Mbit/s versus 8.8 Mbit/s for the CES 4000 and 34.9 Mbit/s for the CES 4500. The VPN Concentrator C50 provided throughput of 59.6 Mbit/s when tested across 10 sessions versus 11.7 Mbit/s and 36.2 Mbit/s throughput for the CES 4000 and CES 4500. See figure 1.

Throughput (512-byte frames)

When engineers tested a frame size of 512 bytes, Altiga's VPN Concentrator sustained its excellent performance when forwarding frames across 10, 100 and 1,000 IPSec sessions. When faced with maintaining a high level of throughput across 1,000 sessions, Altiga's VPN Concentrator C50 forwarded data at 40.2 Mbit/s compared to 7.8 Mbit/s for Nortel Networks' CES 4000. At the 100-session level, the Altiga VPN Concentrator C50 forwarded 42.5 Mbit/s of throughput versus 9.4 Mbit/s for the CES 4000 and 25.3 for the CES 4500. And at 10 sessions, the VPN Concentrator C50 achieved throughput of 45.8 Mbit/s versus 8.4 Mbit/s for the CES 4000 and 25.3 Mbit/s for the CES 4500. See figure 2.

Throughput (64-byte frames)

With the high-level security of 1,000 IPSec sessions, the VPN Concentrator C50 efficiently forwarded 64-byte frame traffic at 7.4 Mbit/s versus 1.8 Mbit/s for Nortel Networks' CES 4000. Nortel Networks 4500 was unable to activate 1,000 sessions during testing. At 100 sessions, Altiga's VPN Concentrator C50 maintained a high-level of throughput at 9.4 Mbit/s versus 1.9 Mbit/s and 4.5 Mbit/s for the CES 4000 and CES 4500 respectively. Even when forwarding 10 sessions of 64-byte data, Altiga's VPN Concentrator C50 delivered data throughput of 10.8 Mbit/s versus just 1.5 Mbit/s for the CES 4000 and 4.9 Mbit/s for the CES 4500. See figure 3.

IP Routing

The Tolly Group also verified that the VPN Concentrator C50 can be utilized for traditional IP routing without IPSec authentication or encryption. When forwarding 64-byte frames, the VPN Concentrator C50 processed 138,500 pps, displaying its ability to route bidirectional traffic.

Analysis

Throughput

IPSec represents the most secure method for standards-based, multivendor, interoperable security available in the market today. To leverage all of the inherent security of IPSec, customers frequently forgo the less secure 56-bit DES encryption in favor of the more secure 168-bit Triple DES. Unfortunately, the extra processing required to produce Triple DES encryption could have a potentially catastrophic impact on IPSec performance. Customers who require both excellent security and high throughput need to select an IPSec gateway that delivers adequate throughput when using Triple DES.

Furthermore, larger installations must support potentially dozens, or even hundreds, of simultaneous connections. The burden of maintaining acceptable throughput while managing large numbers of SAs is likely to lower performance. That means the customers need to evaluate Triple DES performance in both medium- and large-scale network environments to ensure sufficient headroom as their IPSec environment grows.

The VPN Concentrator C50 delivered higher throughput than Nortel Networks gear at every frame size and at every session load tested. This means the performance of Altiga's VPN Concentrator C50 represents a scalable solution for networks, from the initial rollout stage to an increase of hundreds of users, even up to 1,000 sessions. Users should feel secure that

Altiga Networks, Inc.

Altiga VPN Concentrator Series C50

IPSec Gateway Performance

TOLLY Up to Spec CERTIFIED

Altiga Networks
VPN Concentrator Series C50
Product Specifications

Support for up to 5,000 simultaneous remote connections

Tunneling Protocols
- IPSec with IKE Key Management
- PPTP with MPPE Encryption
- L2TP
- L2TP (over IPSec)

Encryption Algorithms
- 56-bit DES (IPSec)
- 168-bit Triple DES (IPSec)
- 40-bit and 128-bit RC4 Microsoft Encryption (MPPE/PPTP)

Authentication Algorithms
- MD5
- SHA-1
- HMAC with MD5
- HMAC with SHA-1

Authentication and Accounting Servers
- Support for redundant external authentication servers:
  - RADIUS
  - Microsoft NT Domain authentication
  - Security Dynamics
  - LDAP
- X.509v3 Digital Certificates
- RADIUS accounting

Routing Protocols
- RADIUS accounting
- OSPF
- RIP v1, RIP v2
- Static routes

High Availability, Service Redundancy
- Transparent system redundancy (VRRP)
- Client transparency for fail-over and connection reestablishment
- Dual flash image architecture
- Redundant power supply optional

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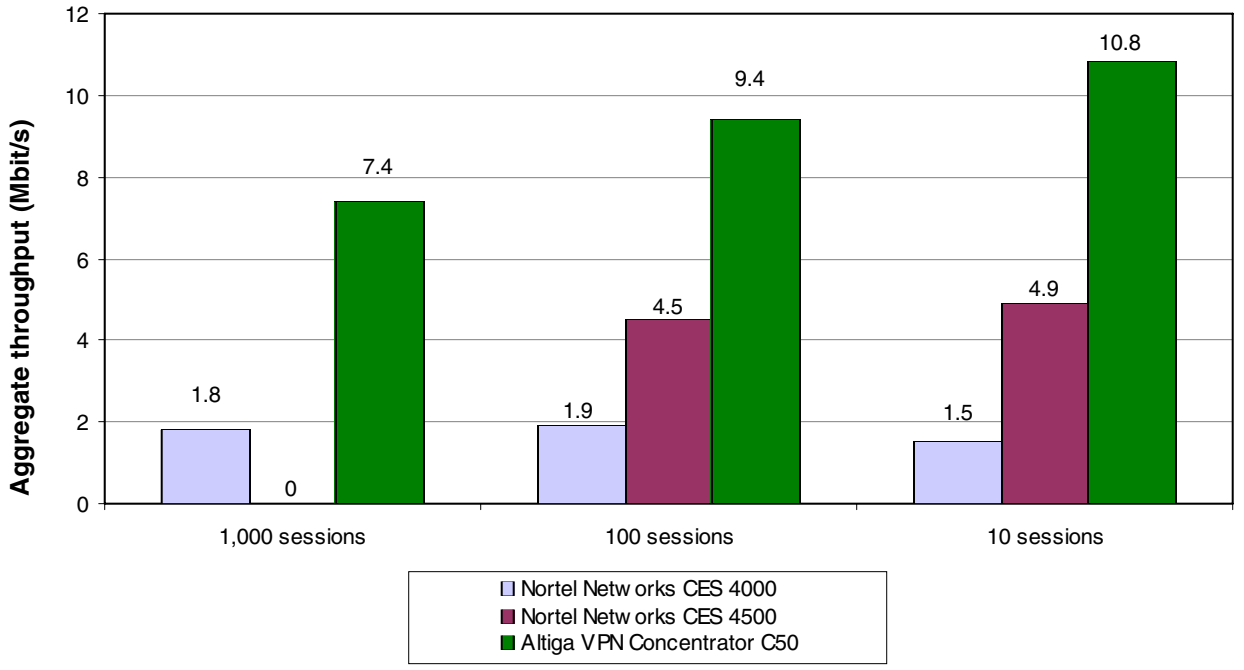
**Vendor-supplied information not verified by The Tolly Group*



Source: The Tolly Group, July 1999

Figure 3

the performance they experience during initial prototype will be the same performance they should experience as the system grows to support hundreds of users.

Test Configuration and Methodology

IPSec Performance

For performance tests, The Tolly Group measured the aggregate VPN performance of the systems under test across 10, 100 and 1,000 sessions of the Altiga Networks, Inc. VPN Concentrator Model C50, the Nortel Networks Contivity Extranet Switch Model 4000 and the Nortel Networks Contivity Extranet Switch Model 4500 beta version 1.0 (serial numbers 06782 and 00081).

Using a Ganymede Software, Inc. Chariot 2.2 filesndl.scr 0 for this script (representing bidirectional batch data transfer traffic), engineers measured the aggregate and per-session performance across up to 1,000 simultaneous IPSec connections. The testbed included a pair of IPSec gateways connected back to back, a pair of application traffic generators and at least one network analyzer. See figure 4. Tests were conducted with 64-, 512- and 1,400-byte frames. Tests were set to execute so that each session utilized a different Security Association, or set of security attributes.

When testing the CES 4000 and CES 4500, the devices initially were connected via a single crossover cable, which resulted in subsequent half-duplex connections and reduced throughput caused by collisions. When engineers inserted a Cisco Catalyst 2900 Layer 2 switch between the systems under test, the devices successfully negotiated a full-duplex connection and testing proceeded.

The systems under test were configured for IPSec and Triple DES. Systems under test were configured for the highest level of Triple DES support available on each system. Systems under test also were configured to assign/ create separate Security

Associa-tions (secure VPN tunnels) for each IP address pair.

Note: Nortel Networks describes its three-key 168-bit Triple DES encryption as having an effective encryption depth of 112 bits. Altiga describes its three-key, 168-bit Triple DES encryption as having an effective encryption depth of 168 bits.

Once the systems under test were configured, The Tolly Group verified the VPN protocol [i.e., IPSec] and encryption [i.e., Triple DES] through the user interface. Using the interface, The Tolly Group verified that the system under test creates separate SAs for each session. Application traffic was then simulated for a period of at least three minutes and results were then recorded for three iterations. The final results were derived by averaging each set of three test iterations. Packet size was verified through the Domino-FastEthernet during testing of the CES 4000 and CES 4500.

The Tolly Group measured the number of active sessions at test initiation and test completion; the aggregate system throughput in Mbit/s; the system throughput per session Kbit/s; and salient system features and anomalies.

IP Routing

While verifying the Altiga VPN Concentrator's ability to perform traditional IP routing, The Tolly Group measured the IP packet forwarding performance without the benefit of encryption or authentication. The Tolly Group used Chariot to transfer data across eight IP sessions using 64-byte data payloads.

Engineers used a Domino-FastEthernet analyzer to measure an average bidirectional packet rate of 138,500 pps on each side of the VPN Concentrator C50. The Tolly Group then verified the balance of inbound and outbound unidirectional traffic flows on each LAN based upon (a) effective data throughput (using Chariot) and (b) pps rates (based upon two 10 mS data captures with a Domino-FastEthernet).

The Tolly Group analyzed and filtered the data with a Network Associates, Inc. NetXRay. Unidirectional Chariot traffic loads on either side of the VPN Concentrator C50 differed by an average of 1.4% and a maximum of 2.8% across three test iterations. The pps rates differed by less than 1.1%.

Equipment Acquisition and Support

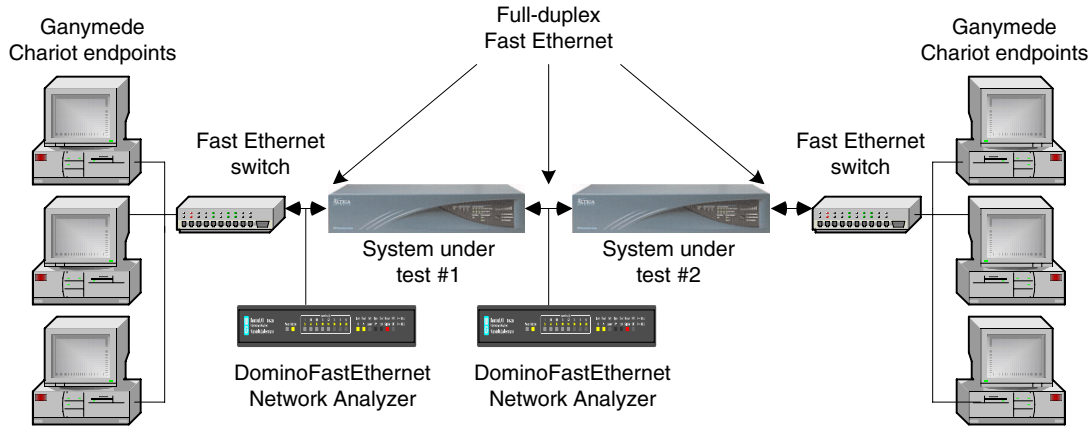
The Nortel Networks' Contivity Extranet Switch 4000 was acquired through normal product distribution channels. Nortel Networks supplied a beta version of its Contivity Extranet Switch 4500 for testing purposes.

The Tolly Group contacted executives at Nortel Networks and invited them to provide a higher level of support than available through normal channels. Nortel Networks accepted the offer. The software was tested as supplied and Nortel Networks telephone technical support was used to configure/tune the device for the test suites executed by The Tolly Group.

The Tolly Group verified product release levels and shared test configurations with Nortel Networks in order to optimize the devices for the tests. Results initially were shared with Nortel Networks, which disputed the data and then later acknowledged its accuracy after The Tolly Group explained the test methodology and configuration.

For a more complete understanding of the interaction between The Tolly Group and Nortel Networks, 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 199113.

Test Bed



Source: The Tolly Group, July 1999

Figure 4

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

Vendor	Product	Web address
Ganymede Software, Inc.	Chariot	http://www.ganymede.com
Network Associates, Inc.	NetXRay	http://www.nai.com
Wandel & Goltermann Technologies, Inc.	DA-350 DominoFastEthernet	http://www.wg.com

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: Altiga Networks, Inc.
Document number: 199113
Product class: IPSec gateway
Products under test:
- Altiga Networks, Inc. VPN Concentrator Series C50
- Nortel Networks Contivity Extranet Switch 4000 and CES 4500

Testing window: April 1999
Software versions tested:
- As noted above

Software status:
- Altiga Networks, Inc. VPN Concentrator Series and Nortel Networks Contivity Extranet Switch 4000 were generally available at the time of testing
- Nortel Networks Contivity Extranet Switch 4500 beta version 1.0

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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