

Ingate[®] Systems

Ingate Firewall[™] 1400

Functionality and Performance Evaluation

Test Summary

Premise: When considering the purchase of firewalls and security devices, network executives want to validate performance characteristics of available security products. With the growth in high-speed Internet access, network managers must grapple with the potential performance hit commonly associated with providing a secure data path and the viability of supporting the Session Initiation Protocol (SIP) to support voice over IP (VoIP) and other SIP-enabled applications across firewall boundaries.

Ingate Systems commissioned The Tolly Group to conduct a performance evaluation of its Ingate Firewall[™] 1400, a firewall designed for use in small- to medium-sized enterprises (SMEs) that supports standard functions plus incorporates a SIP proxy and a SIP registrar to handle SIP-based real-time communications such as VoIP, instant messaging and audio/videoconferencing.

Engineers subjected the Ingate Firewall 1400 to a volley of tests, including throughput benchmarks, an evaluation of the device's SIP functionality, VPN performance benchmark, and voice call quality capabilities. Results show that the Ingate Firewall 1400 delivers more than ample throughput to support T1/E1 connections at wire speed and multiple T1 and T3 connections at normal load levels. The Ingate Firewall 1400 passed every SIP test scenario and the firewall proved that it supports VPN connections with ample throughput.

RESULTS

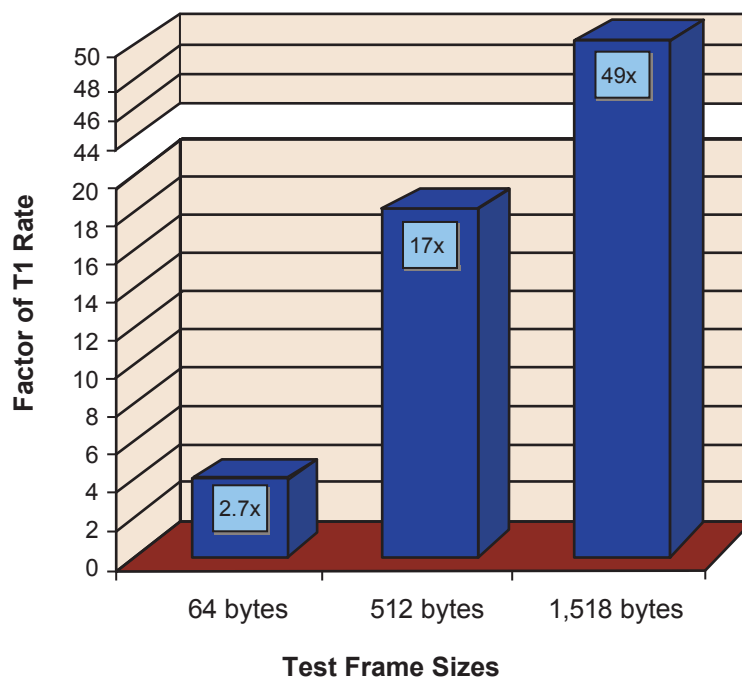
FIREWALL THROUGHPUT

The Tolly Group verified the firewall

Test Highlights

- Provides substantially more throughput than necessary to support a T1/E1 Internet connection
- Offers SIP proxy, registrar and NAT traversal functionality necessary to support VoIP and other SIP-enabled applications across firewall boundaries while maintaining voice quality
- Offers a VPN termination capability that successfully encrypts and decrypts packets at a rate suitable for most medium-sized businesses

Throughput as a Factor of T1 Circuit Rate



Source: The Tolly Group, September 2003

Figure 1

throughput of the Ingate Firewall 1400 when handling a variety of packet sizes ranging from 64 bytes to 1,518 bytes.

Tests show that when handling 64-byte packets, the Ingate Firewall 1400 generates half-duplex throughput of 4.2 Mbps, or almost 3X the capacity of a full T1 (1.544 Mbps) circuit typically used as the preferred WAN connection in SME networks. The Ingate Firewall 1400's rate provides almost double the capacity of an E1 circuit (2.048 Mbps) used outside the U.S.

At 512-byte packets, the Ingate Firewall 1400 delivered 26 Mbps of half-duplex throughput, or almost 17 times the capacity of a T1.

When tested with 1,518-byte packets, the Ingate Firewall 1400 delivered half-duplex throughput of 75 Mbps.

SIP VERIFICATION

Tolly Group engineers examined the Ingate Firewall 1400's SIP capabilities to ensure that the device is capable of adequately supporting traffic based upon the SIP standard.

The Ingate Firewall 1400 passed all the SIP scenarios, including tests for basic calls, call hold, call transfer, conferencing, call waiting, presence and instant messaging (see Figure 2).

VPN PERFORMANCE

Engineers measured the firewall's single-tunnel VPN throughput in a two-box back-to-back configuration. Engineers introduced the Ingate Firewall 1400 pairing it with a second Ingate Firewall 1400 to set up a single VPN tunnel. The Ingate Firewall 1400 VPN pair demonstrated that it successfully encrypts and decrypts packets at a full-duplex rate of 3.9 Mbps, 21.2 Mbps, 45.5 Mbps and 39.7 Mbps for 64-, 512-, 1,400- and 1,518-byte Ethernet packet sizes (See Figure 3).

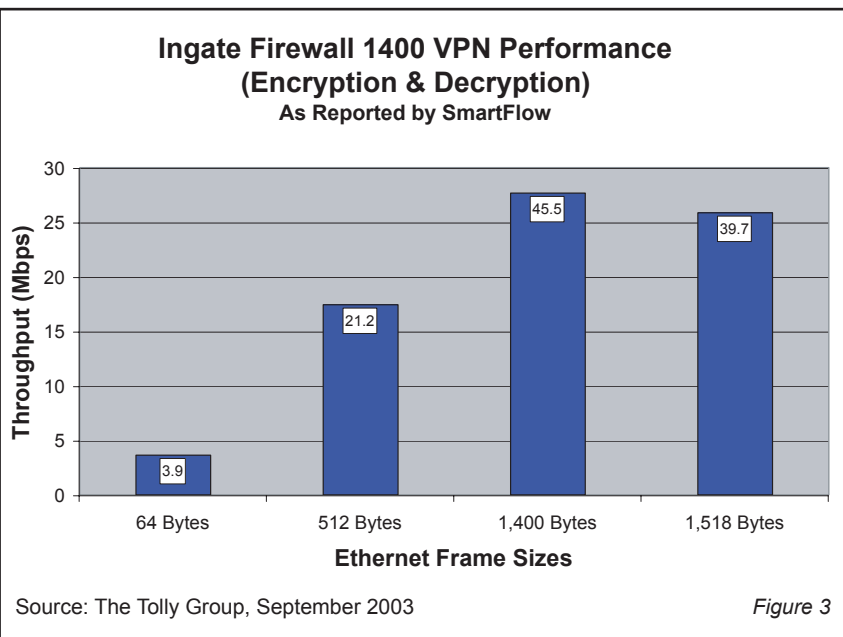
VOIP CALL QUALITY

Engineers proved that the Ingate Firewall 1400 does not introduce degra-

Ingate Firewall 1400 SIP Test Results		
SIP Functionality Test Cases		Firewall
<i>Basic Calls</i>		
1. Internal -> Internal		Pass
2. Internal -> External		Pass
3. External -> Internal		Pass
<i>Call Hold</i>		
4. Internal -> Internal		Pass
5. Internal -> External		Pass
6. External -> Internal		Pass
<i>Call Transfer</i>		
7. Internal -> Internal : Transfer to Internal		Pass
8. Internal -> Internal : Transfer to External		Pass
9. Internal -> External : Transfer to Internal		Pass
10. Internal -> External : Transfer to External		Pass
11. External -> Internal : Transfer to Internal		Pass
12. External -> Internal : Transfer to External		Pass
13. External -> External : Transfer to Internal		Pass
<i>Conference</i>		
14. Internal -> Internal : Conference Internal		Pass
15. Internal -> Internal : Conference External		Pass
16. Internal -> External : Conference Internal		Pass
17. Internal -> External : Conference External		Pass
18. External -> Internal : Conference Internal		Pass
19. External -> Internal : Conference External		Pass
20. External -> External : Conference Internal		Pass
<i>Call Waiting</i>		
21. Internal -> Internal : Call from Internal		Pass
22. Internal -> Internal : Call from External		Pass
23. Internal -> External : Call from Internal		Pass
24. Internal -> External : Call from External		Pass
<i>Presence and Instant Messaging</i>		
25. Presence support		Pass
26. Instant messaging (Text)		Pass

Source: The Tolly Group, September 2003

Figure 2



Source: The Tolly Group, September 2003

Figure 3

dation in VoIP call quality while serving a SIP proxy. In baseline tests using the Perceptual Evaluation of Speech Quality (PESQ) algorithm, the call quality of a phone-to-phone call was recorded as a 3.99 out of a possible score of 4.5 - such a score equates to excellent toll quality. When the call passed through the Ingate Firewall 1400, the call quality was recorded as a 4.0 score.

ANALYSIS

The Ingate Firewall 1400 is targeted for the SME market. The majority of the medium-sized business users utilize T1 or T3 circuits for their WAN connections - E1 circuits outside of the U.S. The maximum data rate of a T3 is 44.736 Mbps. In our tests, throughput for the Ingate Firewall 1400 ranged from 8.4 Mbps to 150 Mbps. Users should not solely look at individual frame sizes to draw performance conclusions. For instance, it would be unrealistic to examine, say, just 64-byte frame performance because it is highly unlikely users would send just 64-byte frames. On the contrary, large-sized frames consume the majority of the circuit bandwidth. As a result, a realistic combination of the small- and large-sized frames means that the Ingate Firewall 1400 could fully support up to a T3 data rate.

TEST CONFIGURATION AND METHODOLOGY

For performance tests, The Tolly Group tested an Ingate Firewall 1400 with Version 3.2.0 software equipped with four 10/100 100Base-T interfaces, plus firewall, SIP proxy and registrar.

For the firewall performance test, engineers measured the steady state, zero-loss (≤ 0.001) throughput using different Ethernet frame sizes (64, 512, and 1,518 bytes) on a 50-rule firewall with fully populated inter-

Engineers prepared for the test by connecting all appropriate networking infrastructure (firewall console, SmartFlow console, SmartBits interfaces, firewall interfaces). Engineers then configured the Ingate Firewall 1400 as a 50-rule firewall with 1,000 IP flows: 500 for "in-to-out" and 500 for "out-to-in." The first 24 rules denied traffic and the last rule allowed test traffic. The firewall also was configured as the SIP proxy server.

Engineers next configured SmartFlow to execute the test at the appropriate load and configurations as specified in test scenarios. SmartFlow recorded all results and used its binary search algorithm to find out the actual maximum zero-loss throughput.

Engineers used a Finisar Corp. Surveyor 5.0 network analyzer to confirm correct packet size and utilization during prototype testing. The analyzer was removed just prior to production testing.

For the SIP functionality test, Tolly Group engineers intended to verify that the firewall does not adversely impact real-time voice traffic passing through the device. Pingtel Corp. xpressa IP-based SIP phones and Zultys Technologies' ZIP IP phones were used to establish voice calls for SIP and voice-quality tests. Windows Messenger was used to establish presence and generate instant messages across the system under test. Tests were conducted on a pass/fail basis.

On the VPN testing front, engineers configured a single VPN tunnel between a pair of Ingate Firewall™ 1400s. The VPN tunnel was configured to use AES for encryption and MD5 for the authentication algorithm. SmartBits SmartFlow generated the bi-directional Ethernet frames of 64-, 512-, 1,400 and 1,518 bytes and received them across the VPN tunnel. SmartFlow reported the throughput performance across the VPN tunnel.

Ingate Systems

Ingate Firewall™ 1400

Performance and SIP Server Functionality



Ingate Systems Ingate Firewall 1400 Product Specifications*

Features

- 97,500 concurrent TCP sessions (maximum)
- Four 10/100 Fast Ethernet interfaces
- 160 Mbps maximum throughput
- Unlimited number of users
- Certifications: CE, FCC, UL
- Web GUI
- Secure VPN Management
- SNMP support

Management

- Web GUI
- Secure VPN Management
- SNMP support

Firewall Functionality

- Stateful inspection
- Packet filtering
- DHCP
- Proxies for TCP, UDP and FTP
- Network Address Translation
- Port Address Translation (PAT)
- Customizable Services
- Quality of Service
- RADIUS authentication
- DoS, DDoS
- Failover

SIP Functionality

- SIP proxy
- SIP registrar
- SIP NAT traversal
- TLS encryption
- SIP connection set up: < .15s
- RTP media delay: .19/.08ms
- Concurrent RTP sessions: 100
- Registered SIP users included: 10

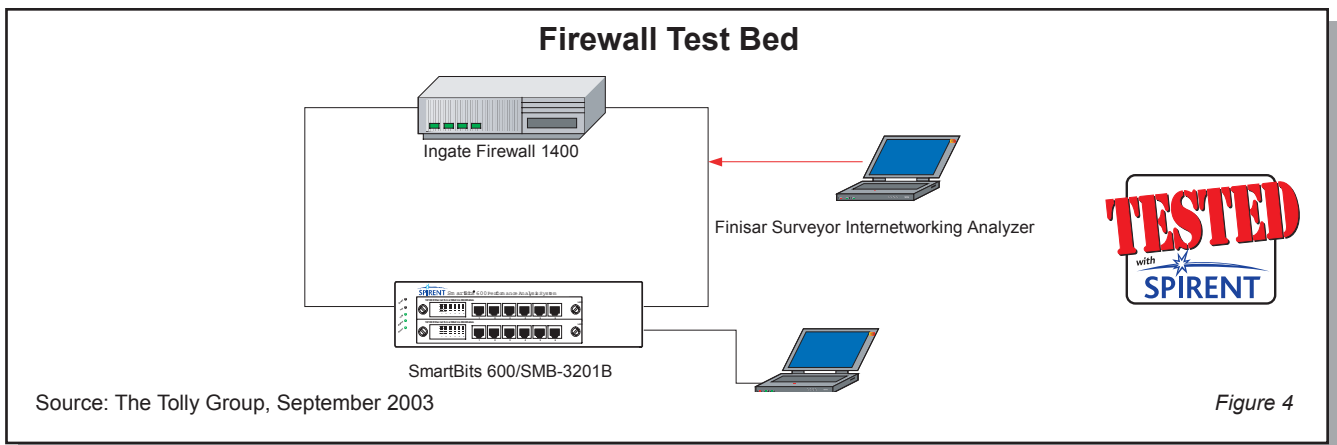
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*Vendor-supplied information not verified by The Tolly Group



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

Vendor	Product	Web address
Finisar Corp.	Surveyor 5.0	http://www.finisar.com
Broadband Telephony Systems	Pingtel xpressa IP Phone	http://www.bbtelsys.com
Raritan Computer	MasterConsole II	http://www.raritan.com
Spirent Communications	SmartBits 600	http://www.spirentcom.com
Spirent Communications	SmartFlow	http://www.spirentcom.com
Zultys Technologies	Zultys ZIP and ZIP 4x4	http://www.zultys.com

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PROJECT PROFILE

Sponsor: Ingate Systems

Document number: 203118

Product Class: Enterprise-class firewall with SIP

Products under test:

- Ingate Firewall 1400, Software Version 3.2.0

Testing window: July/August 2003

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