

Rapid City Communications

FIRST f1200 Routing Switch

Routing Performance

Test Summary

Rapid City Communications commissioned The Tolly Group to verify the routing performance of its FIRST™ f1200 Routing Switch. After validating all aspects of test setup, The Tolly Group conducted “live” testing at Rapid City’s booth at Networld + Interop (Las Vegas, NV, 6-8 May 1997). The Rapid City switch was configured to route packets between 60 Full Duplex Fast Ethernet ports. Additionally, the switch carried a live video stream from a server connected to one of the switch’s Gigabit Ethernet ports to a client connected to a 61st Fast Ethernet port.

RESULTS

The testing showed the f1200 is capable of routing IP packets at rates in excess of 7,000,000 pps among a mesh of 60 Fast Ethernet ports (see Figure 1). The Tolly Group recorded packets per second sent and received on each of the 60 ports. In total, the f1200 forwarded 7,007,811 pps. The performance was consistent over the eight-hour duration of the test.

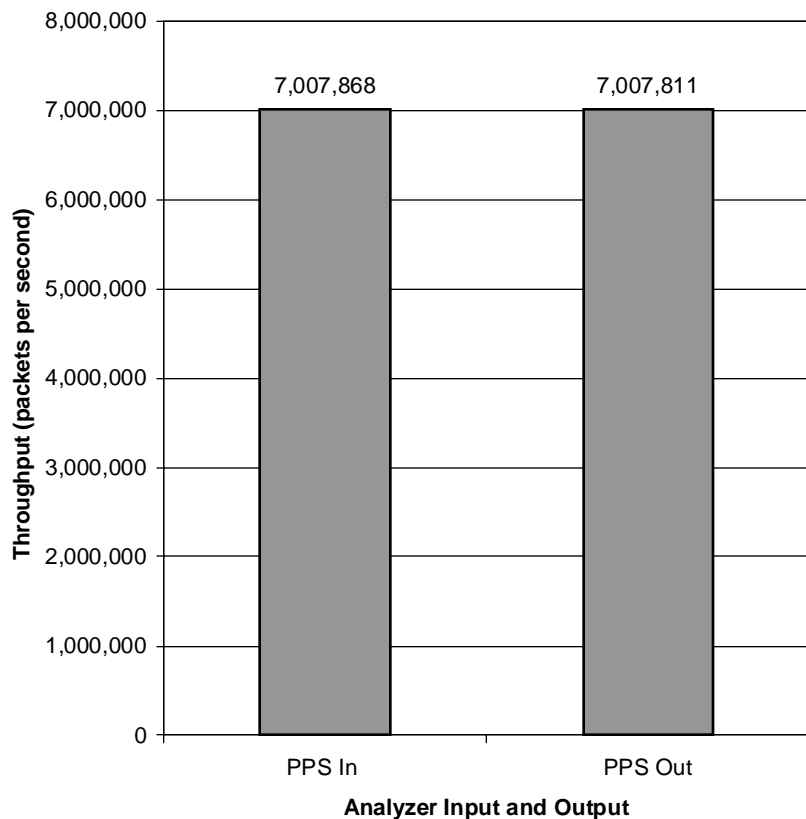
Figure 2 shows the rates for all input and output ports. Note that, because the packets are distributed to all output ports, it is possible for the output rate of a given port to exceed the input rate of the same port.

The f1200’s forwarding performance is consistent whether or not a port is configured as a member of a VLAN. The test configuration consisted of a combination of ports configured either as members of a ten-port VLAN with its own IP subnetwork or as a single port IP subnet. The Tolly Group ensured that all packets were processed at layer 3 by examining the IP TTL

Test Highlights

- Delivers over 7 million packets per second (pps) aggregate IP routing throughput
- Supports Gigabit Ethernet interfaces
- Supports simultaneous data and video streams

Aggregate Routing Performance 64-byte IP Packets 60 Fast Ethernet Ports



Note: The .001% difference between input and output are due to the high data rates and statistical variations encountered during data collection.
Source: The Tolly Group, June 1997

Figure 1

Test Results

Input Ports								
Ports 1-20			Ports 21-40			Ports 41-60		
Interface	Packets In (pps)	% Line Rate In	Interface	Packets In (pps)	% Line Rate In	Interface	Packets In (pps)	% Line Rate In
1	148,808	100.01%	21	117,925	79.25%	41	117,923	79.25%
2	104,166	70.00%	22	117,924	79.25%	42	104,166	70.00%
3	104,164	70.00%	23	117,924	79.25%	43	117,923	79.25%
4	148,806	100.00%	24	117,924	79.25%	44	117,922	79.25%
5	117,921	79.25%	25	117,926	79.25%	45	117,924	79.25%
6	117,920	79.25%	26	117,924	79.25%	46	148,810	100.01%
7	117,922	79.25%	27	117,924	79.25%	47	104,165	70.00%
8	104,164	70.00%	28	117,923	79.25%	48	104,166	70.00%
9	104,161	70.00%	29	117,923	78.48%	49	104,166	70.00%
10	117,922	79.25%	30	117,921	79.25%	50	117,923	79.25%
11	104,165	70.00%	31	148,808	100.01%	51	117,924	79.25%
12	119,047	80.00%	32	111,607	75.00%	52	117,924	79.25%
13	111,607	75.00%	33	111,607	75.00%	53	104,165	70.00%
14	111,605	75.00%	34	104,165	70.00%	54	117,923	79.25%
15	119,048	80.01%	35	117,924	79.25%	55	117,923	79.25%
16	148,808	100.01%	36	117,922	79.25%	56	117,922	79.25%
17	104,166	70.00%	37	117,925	79.25%	57	104,167	70.00%
18	111,607	75.00%	38	104,165	70.00%	58	117,924	79.25%
19	117,924	79.25%	39	117,923	79.25%	59	117,924	79.25%
20	117,924	79.25%	40	117,923	79.25%	60	117,922	79.25%

Total Input (pps) 7,007,868

Output Ports								
Ports 1-20			Ports 21-40			Ports 41-60		
Interface	Packets Out (pps)	% Line Rate Out	Interface	Packets Out (pps)	% Line Rate Out	Interface	Packets Out (pps)	% Line Rate Out
1	116,253	78.13%	21	116,777	78.48%	41	116,777	78.48%
2	117,013	78.64%	22	116,776	78.48%	42	117,013	78.64%
3	117,011	78.64%	23	116,780	78.48%	43	116,781	78.48%
4	116,252	78.13%	24	116,778	78.48%	44	116,778	78.48%
5	116,775	78.48%	25	116,775	78.48%	45	116,779	78.48%
6	116,775	78.48%	26	116,778	78.48%	46	116,257	78.13%
7	116,779	78.48%	27	116,719	78.44%	47	117,014	78.64%
8	117,011	78.64%	28	116,782	78.48%	48	117,016	78.64%
9	117,010	78.64%	29	116,775	78.48%	49	117,011	78.64%
10	116,778	78.48%	30	116,783	78.48%	50	116,785	78.48%
11	117,010	78.64%	31	116,253	78.13%	51	116,781	78.48%
12	116,767	78.47%	32	116,884	78.55%	52	116,782	78.48%
13	116,888	78.55%	33	116,884	78.55%	53	117,012	78.64%
14	116,885	78.55%	34	117,010	78.64%	54	116,780	78.48%
15	116,759	78.47%	35	116,779	78.48%	55	116,778	78.48%
16	116,254	78.13%	36	116,779	78.48%	56	116,779	78.48%
17	117,013	78.64%	37	116,779	78.48%	57	117,010	78.64%
18	116,886	78.55%	38	117,008	78.63%	58	116,781	78.48%
19	116,780	78.48%	39	116,779	78.48%	59	116,780	78.48%
20	116,780	78.48%	40	116,781	78.48%	60	116,779	78.48%

Total Output (pps) 7,007,811

Note: Because a port's input load is distributed to all output ports, output load values center around 78.50% regardless of input load values on the same ports.

Source: The Tolly Group, June 1997

Figure 2

(Time-To-Live) fields and modified destination MAC addresses of the packets. See Test Methodology for details on the verification of layer 3 forwarding.

While processing load from the 60 ports, the f1200 also carried a live video stream originating on a Gigabit Ethernet port and transmitted that stream to a client connected to a 61st Fast Ethernet port. Despite the variable bit rate of the video stream, the high video quality remained consistent.

TEST METHODOLOGY

The device under test was connected to three Netcom Systems SmartBits chassis (running SmartWindows version 6.1), via a total of sixty Fast Ethernet ports. The analyzer transmitted IP frames on each port to form a fully interconnected mesh, i.e. each port transmits to every other port, for a total of 3,540 logical streams.

The switch was configured with a combination of ports that were either part of a 10-port VLAN with its own IP subnet or its own single port

IP subnet. Only one configuration was tested that consisted of 40 ports configured in VLANs and 20 ports as single port IP subnetworks.

Each 64-byte IP packet was sent to the router interface MAC address for each VLAN or port. In general each port was operated at one of three rates: approximately 70%, 80%, or 100% of line rate. Line rate levels were chosen to achieve the 7 Mpps routing goal of the test using all available SmartBits interface cards to create the maximum size meshed traffic pattern possible. Using different line rates more closely approximates real-world variable network traffic then having all ports transmit at the same rate.

The Tolly Group verified the validity of the frame content, and that the router actually processed each packet at layer 3. This was performed during prototyping by connecting the NetXRay Fast Ethernet analyzer from Cinco Networks to various output ports and ensuring that the TTL field of packets from a random subset of output ports was decremented. The Tolly Group also

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Switch

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ensured the destination MAC address of each packet was modified (the destination address would not be changed if the packet were bridged).

An additional stream was configured to run between a Gigabit Ethernet port and a Fast Ethernet port not part of the IP routing mesh. This stream carried video data from a Silicon Graphics server outfitted with an SGI Gigabit Ethernet adapter to a Silicon Graphics O2 workstation through the integrated 100BaseTX adapter running Netscape with a Silicon Graphics media player plug-in.

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FIRST f1200

Product Specifications*

f1200 Highlights

- 15 Gbps shared memory fabric switch provides over 7 Gbit/s of throughput
- Over 7 Mpps aggregate packet forwarding whether routing, switching or a combination of both
- Eight-slot chassis with six I/O slots supporting 10/100/Gigabit Ethernet connections
- Up to 12 ports of Gigabit Ethernet for high-speed trunking or server connections
- Up to 96 ports of auto-sensing 10/100 Mbit/s Ethernet
- Wirespeed switching or IP routing at 10/100 and Gigabit speeds
- Up to 127 VLANs defined by port or policy provide broadcast control with flexible logical topologies

- Hot swappable modules and redundant power supplies
- SwitchSafe™ optional CPU module for protection against switch and processor faults
- LinkSafe™ option for Gigabit Ethernet cable faults

Protocols & VLANs

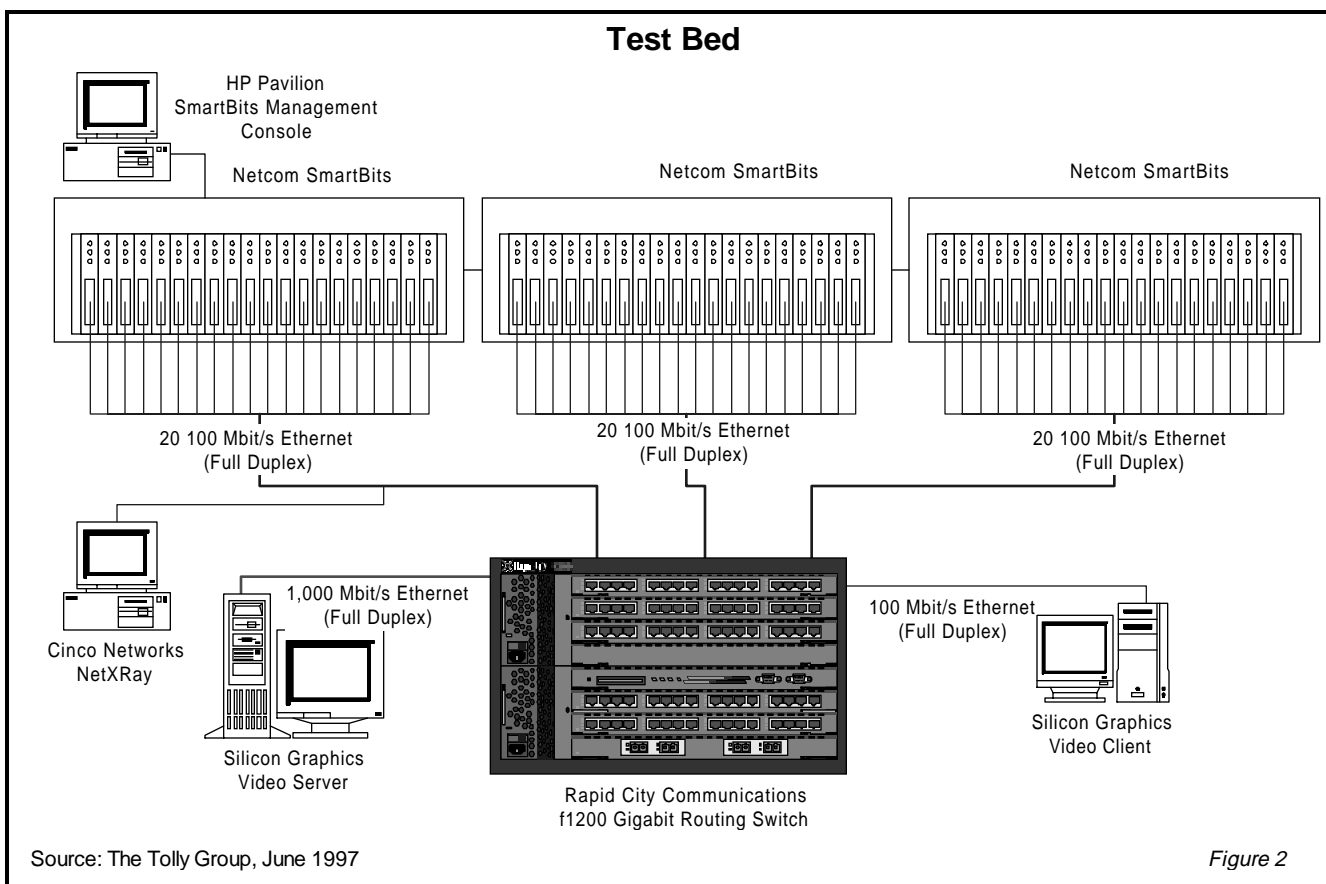
- IP Multicast support via IGMP for efficient multicast application deployment
- IEEE 802.1d spanning tree protocol (Multiple instances)
- RIPv1, RIPv2, OSPF and DVMRP
- Port, IP subnet and Protocol based VLANs
- 802.1q standards based VLAN trunking on any port
- SNMPv2c
- HTTP

Management

- FIRST view™ graphical Solaris/Windows NT/Windows 95/SNMP-based device and VLAN management
- Drag and drop style graphical VLAN manager allows simultaneous multi-switch configuration for easy administration
- Web-based configuration manager for easy visual access to the switch from web browsers
- Out-of-band management via PPP
- Four groups of RMON per port and port mirroring

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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
Cinco Networks

Product
NetXRay

Web address
<http://www.cinco.com>

ABOUT THE TOLLY GROUP

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The Tolly Group is recognized worldwide for its expertise in assessing leading-edge technologies. By combining engineering-caliber test methodologies with informed interpretation, The Tolly Group consistently delivers

meaningful analyses of technology solutions. The Tolly Group has published more than 100 product evaluations, network design features and columns in the industry's most prestigious publications.

Kevin Tolly is President and CEO of The Tolly Group. He is a leading industry analyst and is responsible for guiding the technology decisions of major vendor and end-user organizations. In his consulting work, Tolly has designed enterprise-wide networks for government agencies, banks, retailers, and manufacturers.

For more information on The Tolly Group's services, visit our World Wide Web site at <http://www.tolly.com>, email to info@tolly.com, call 800-933-1699 or 732-528-3300, or fax 732-528-1888.

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