



Lab Testing Summary Report

September 2004
Report 040902

Product Category:
Branch Router

Vendor Tested:
Cisco Systems

Product Tested:
**Cisco 2851
Integrated Services
Router**



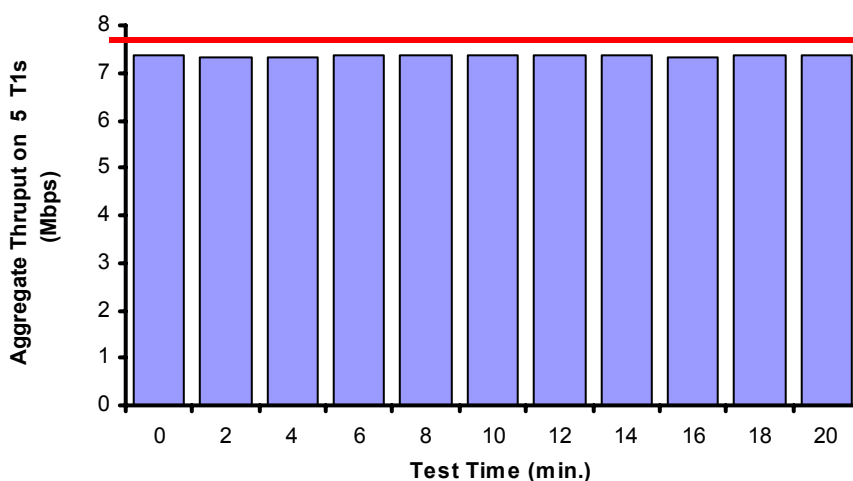
Key findings and conclusions:

- **New 2851 modular router can load 5 T1s with AES-encrypted, IP-WAN traffic**
- **Delivers high throughput while also running a mix of telephony, firewall, and IPS services**
- **Efficient multi-T1 link aggregation (via MLPPP), secured within Dynamic Multipoint VPN (DMVPN) tunnels**
- **Supports a broad array of plug-ins, including WAN-interfaces, voicemail, and switch modules**

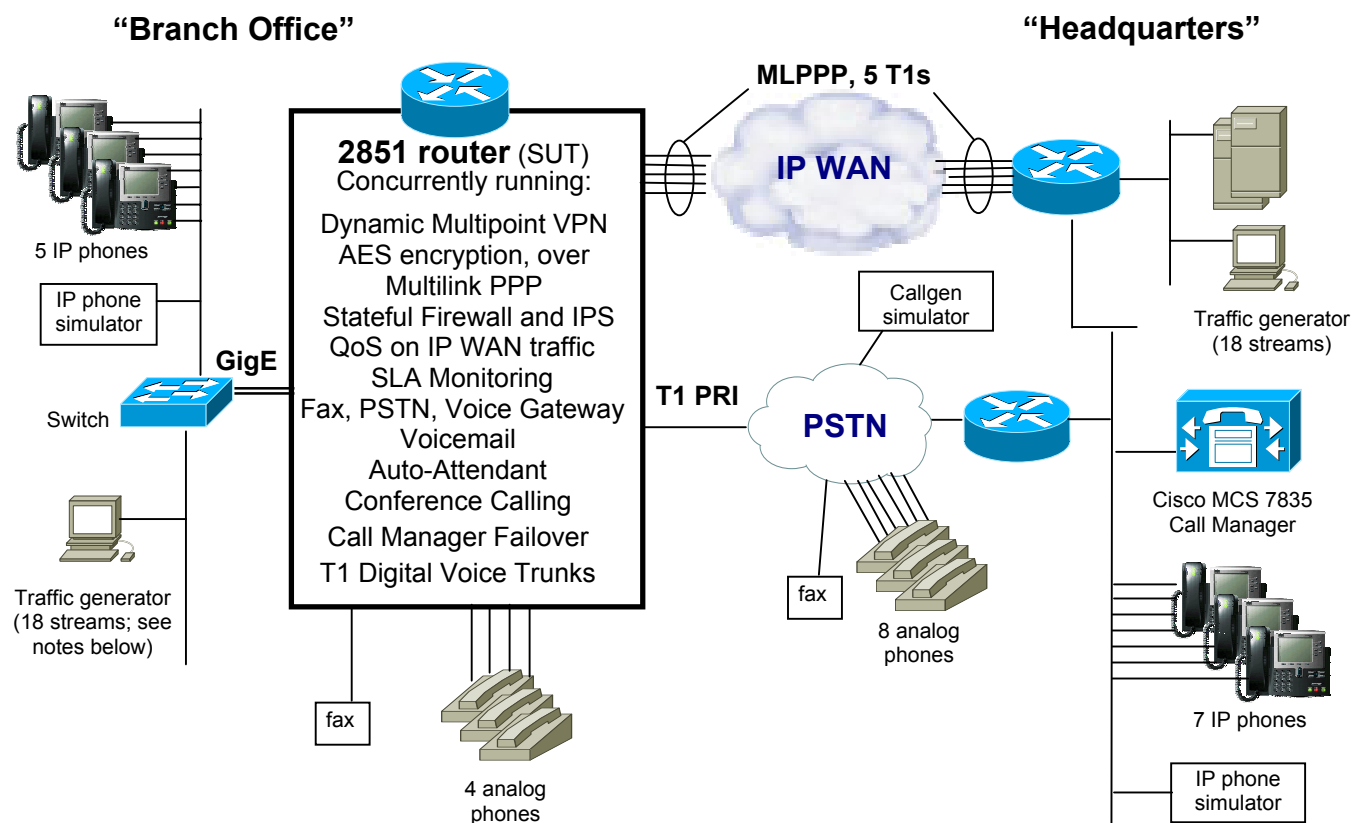
Cisco Systems engaged Miercom to independently verify configuration, operational and performance aspects of its new, modular 2851 Integrated Services Router.

This system, representing a next-generation evolution of Cisco's 2600 line, is designed to deliver multiple services – including stateful firewall, VPN tunneling and encryption, and intrusion prevention (IPS) – to a branch office in a single compact chassis. Also, various optional modules can further enhance the system's feature and service repertoire. For example, the 2851 in the test bed was equipped with optional telephony services, which added conference calling, auto-attendant, voicemail and survivable remote site telephony (SRST).

The 2851 ran a late-beta version of IOS 12.3(11)T in the test bed. Miercom verified that, while running a rich set of additional services (see table on page 3), the 2851 could sustain bi-directional traffic on a 5-T1 MLPPP link, with an AES-encrypted, mixed traffic load (see below).



Full T1s. The 2851 router delivered sustained aggregate throughput of more than 7.3 Mbps, over five logically grouped T1 IP-WAN links. The mix of VoIP and data streams was QoS-classified, AES-encrypted and secured through Cisco's Dynamic Multipoint VPN (DMVPN) tunnels by the 2851. The red line shows the 7.7 Mbps theoretical maximum aggregate capacity.



Mixed concurrent services, traffic flows. The SUT (System Under Test) was Cisco's new 2851 Integrated Services Router. A key objective was to verify that, with a rich assortment of services running on it, the 2851 could also still effectively sustain high throughput – filling multiple T1s of IP-WAN capacity. In the test bed 5 point-to-point T1s were established, which were logically combined between the Branch Office 2851 and the Cisco router at Headquarters using Multi-Link PPP (MLPPP), based on RFC 1990 (the PPP Multilink Protocol), which also load shares over the multiple physical channels. What's more, the 2851 also AES-encrypted all the IP-WAN traffic, sending it through VPN tunnels using Cisco's Dynamic Multipoint VPN capability.

A comprehensive mix of concurrent traffic streams were generated to exercise the services running on the 2851 while implementing QoS to process traffic according to the priority required for each service. All traffic received from the LAN that was headed out to the MLPPP IP-WAN had to be classified and queued, based on DSCP (DiffServe Codepoint) and TOS (IP Precedence) bits. DSCP classes were applied to voice, and to voice-call-setup traffic; TOS classes were applied to transactional data, routing-control (EIGRP) packets, and email. All else was assigned to a default no-priority class.

Assorted traffic flows were generated to provide QoS diversity, and to demonstrate maximum throughput over the MLPPP IP WAN, all of which was processed through AES-encrypted, DMVPN tunnels. To achieve maximum throughput over the multi-link IP WAN link (shown in the chart on page 1), an Ixia IxChariot system (v4.3) was used, generating 5 bi-directional FTP file transfers, 6 two-way G.729 VoIP RTP streams (24 kbps each), 1 HTTPS, 1 POP3, 1 SMTP, and 4 HTTP sessions, all over the MLPPP IP WAN.

In addition, numerous voice and VoIP streams were generated:

- Cisco's SimClient v6.2.2 software tool, running on Windows PCs, continually set-up and tore down 6 concurrent Cisco Skinny-based VoIP connections, each lasting 3 minutes, from the branch office to the HQ network, via the HQ CallManager.
- Cisco's Callgen v4.0.1T, an IOS router-based software tool, continually set-up and tore down 6 concurrent VoIP-analog calls.

With the full load of traffic and streams running, the testers then manually: established 2 real conference calls, with 4 participants in each conference session, comprising callers from a branch IP phone, branch analog phone, HQ IP phone and PSTN; placing secured-RTP (sRTP) branch to HQ VoIP calls; sent faxes over PSTN; interacted with the auto-attendant; and placed and retrieved voicemail from the branch router. These confirmed proper working of the services with high traffic loads.

See all the Miercom reports of the router models tested as part of Cisco's September 2004 new product roll-out:

Report 040901 : Cisco 3845 Integrated Services Router	Report 040903 : Cisco 2811 Integrated Services Router
Report 040902 : Cisco 2851 Integrated Services Router	Report 040904 : Cisco 1841 Integrated Services Router

Modules Installed in the 2851 (System Under Test)

Module	Description
HWIC slots 0, 1, 2: VWIC-2MFT-T1-DI	T1 (2 port) Multi-flex trunk WAN Card
HWIC slot 3: HWIC-4ESW	4-port Fast Ethernet switch
DSP slot 0: PVDM2-48	Voice DSP module
DSP slot 1: PVDM2-48	Voice DSP module
DSP slot 2: PVDM2-48	Voice DSP module
NM slot 1: NM-CUE	Cisco Unity Express network module (voicemail, auto-attendant)
EVM slot: EVM-HD-8FXS/DID	Base Enhanced Voice Module with 8FXS/DID

Concurrent Services Running and Verified on the Cisco 2851 Integrated Services Router While Processing 5 T1s of 128-bit, AES-encrypted, IP-WAN Throughput

Services / Features	How 2851 supports	How Tested/Verified
QoS processing, DMVPN and AES encryption at sustained 7+ Mbps rates	Integrated in IOS	Via multiple test systems, link monitors, CLI
Stateful Firewall	Integrated in IOS	On multilink IP WAN; viewed sessions via CLI
SLA Monitoring	Integrated in IOS	Receiver mode; output viewed via CLI
Routing and QoS	Integrated in IOS	EIGRP dynamic routing; CBWFQ, WRED
Inline IPS (Intrusion Prevention)	Integrated in IOS	On multilink IP WAN; launched four assaults; monitored alarms via CLI
Survivable Remote Site Telephony (SRST)	Integrated in IOS	Failed WAN link to remote CallManager; calls placed locally and via PSTN
Conference Calling	Integrated in IOS	Manually checked under load
Voicemail (stored locally on NM-CUE)	Part of NM-CUE module	Voicemail sent, received under load
Auto-Attendant	Part of NM-CUE module	Manually checked under load
Fax, PSTN, Voice gateway	Fax (EVM-HDV-8FXS) PSTN (VWIC-2MFT-T1-DI)	Fax and PSTN voice calls placed
Traffic Statistics, Load Monitoring	Integrated in IOS	Output viewed via CLI during testing

Modularity and Concurrency

The 2851 offers various slots for module plug-ins. These let the customer selectively add features and functions, as well as tailor the configuration, and modify it, to suit the network environment. Four smaller slots accept a mix of WAN, voice, and switching interface cards (WICs). There were three dual-T1 WICs in the 2851 tested. Another useful module occupied the fourth slot: a compact four-port 10/100 switch, which also conveniently delivers 802.3af or Cisco in-line power to IP phones.

In another slot we had an Enhanced Voice Module, which services eight analog stations. In yet another, larger slot we had an NM-CUE, which delivers a host of telephony services: voicemail and auto-attendant capabilities. SRST and conference calling capabilities are enabled in IOS software. A double-width module is alternately accommodated, such as the 36-port 10/100 switch blade, which also delivers in-line IP-phone power.

The heart of the 2851 is a powerful processor running IOS. And that brings with it ready access to features and services including a stateful firewall with NAT, VPN gateway, and intrusion prevention.

2851 Router's Max Firewall Throughput

Separately, we ran a "bench" test to see how much data the 2851 could route under ideal circumstances. Set-up: a single, bi-directional UDP flow between two Gigabit ports, big (1,460-byte) packets, and with firewall and NAT running and logging turned on. Using Spirent Smart-Flow v4.0, we saw over 534 Mbps total. Not a typical environment, but worth noting.

Our testing confirmed the 2851's ability to run an assortment of services – representative of the loads of a "typical" multi-service, branch-office environment, we believe – concurrent with considerable network-transport volumes. We confirmed that each service was active and running properly, concurrent with five T1s full of encrypted WAN traffic.

The bottom line: We found the 2851 to be a powerful, tailorable, and feature-rich platform.

Miercom Verified Performance

Based on Miercom's thorough workout of this system – and examination of its configuration, operation and features, as described herein – Miercom proudly attests to this system's performance, in particular:

- The 2851's ability to load 5 T1 links, AES-encrypting over 7 Mbps of WAN traffic via the system's embedded hardware encryption processor.
- Concurrent provision of key high-level network services to a busy branch office, including stateful firewall, IPS, VoIP and analog telephony services, while under heavy transport load. Service Level Agreement monitoring was also tested.
- Assurance of quality voice service under heavy data load, and smooth failover to local router for call processing during WAN failure (SRST). The branch router ensured smooth functioning of local voice calls over the LAN, voice calls to PSTN, and voicemail access.



Cisco 2851
Integrated Services Router



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About Miercom's Product Testing Services...

With hundreds of its product-comparison analyses published over the years in such leading network trade periodicals as *Business Communications Review* and *Network World*, Miercom's reputation as the leading, independent product test center is unquestioned. Founded in 1988, the company has pioneered the comparative assessment of networking hardware and software, having developed methodologies for testing products from SAN switches to VoIP gateways and IP PBX's. Miercom's private test services include competitive product analyses, as well as individual product evaluations. Products submitted for review are typically evaluated under the "NetWORKS As Advertised™" program, in which networking-related products must endure a comprehensive, independent assessment of the products' usability and performance. Products that meet the appropriate criteria and performance levels receive the "NetWORKS As Advertised™" award and Miercom Labs' testimonial endorsement.



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