



Lab Testing Summary Report

September 2004
Report 040903

Product Category:
Branch Router

Vendor Tested:
Cisco Systems

Product Tested:
**Cisco 2811
Integrated Services
Router**



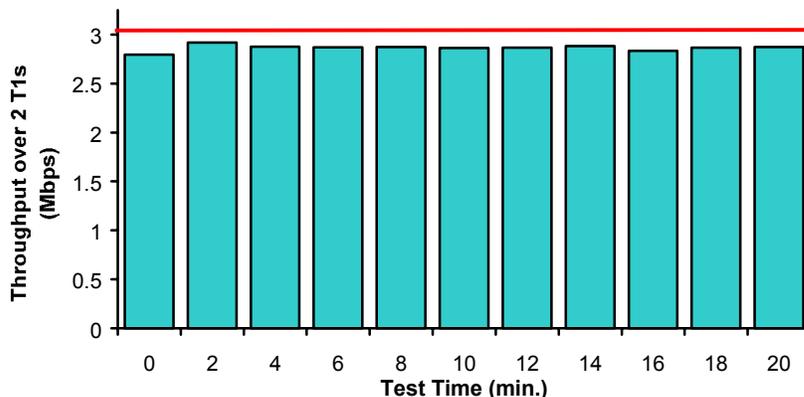
Key findings and conclusions:

- **New 2811 modular router concurrently runs IP-telephony, data, security, other services**
- **Sustains two T1s full of bi-directional WAN data traffic, along with all services**
- **Modular hardware design allows highly tailored multi-service mix**
- **Tested with fully-integrated IP-PBX, voicemail, hardware-based IDS, firewall, NAT, and other services running**

Cisco Systems engaged Miercom to independently verify configuration, operational and performance aspects of its new, modular 2811 Integrated Services Router, representing the next generation of Cisco's branch-office router line. The 2811, a compact platform, delivers multiple services – including stateful firewall, NAT and hardware-based intrusion detection (IDS) – along with high-capacity WAN transport, obviating the need for multiple separate appliances.

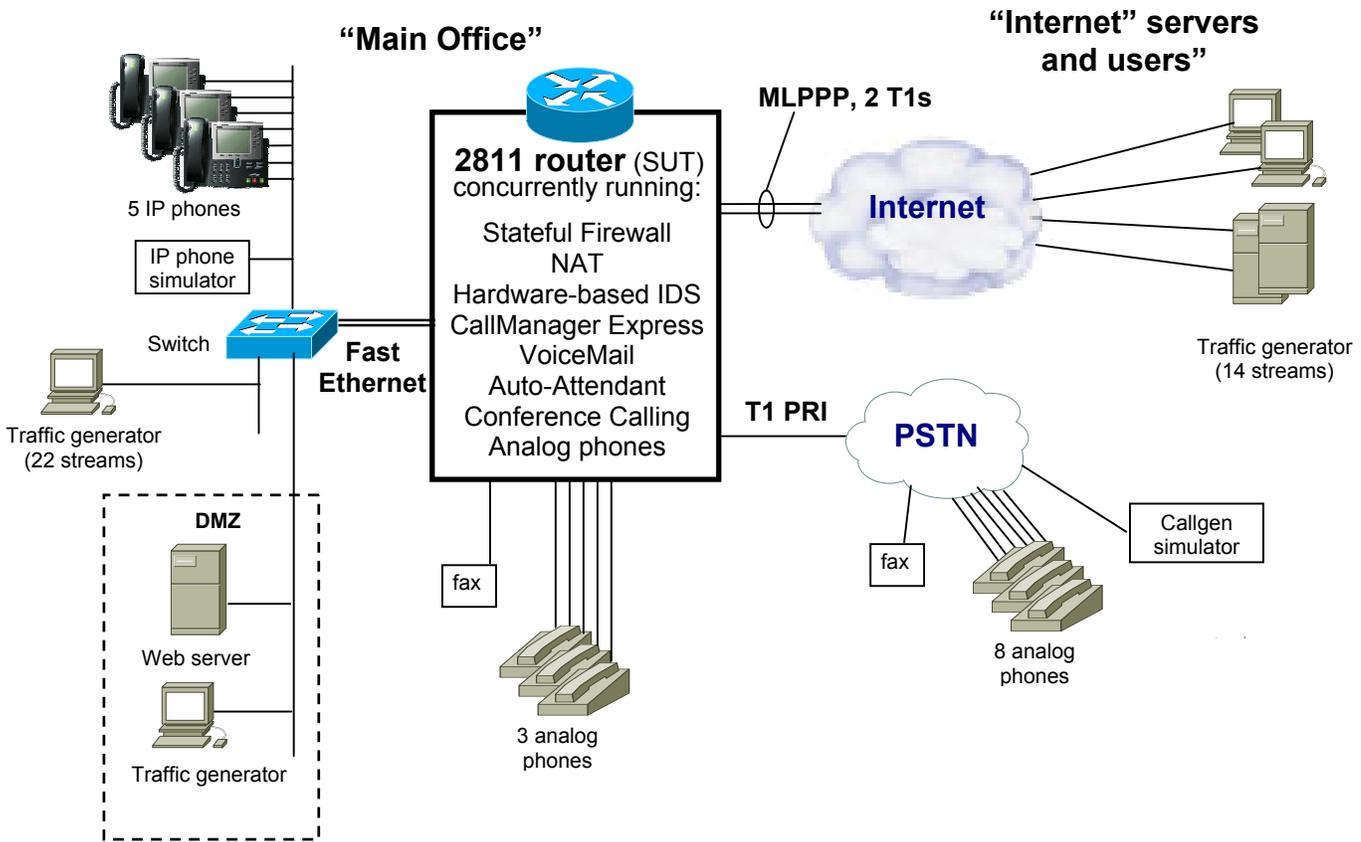
The 2811 system was tested delivering full telephony services to the local office, including CCME (Cisco CallManager Express, an IOS-software-based IP-PBX), voicemail, auto-attendant, conferencing, PRI T1 trunk to the PSTN, and analog-phone and fax services.

The 2811 ran a late-beta version of IOS 12.3(11)T in the test bed. Miercom verified that, while running this impressive array of additional services (see table on page 3), the 2811 could sustain bi-directional traffic over a two-T1-capacity MLPPP, IP-WAN link (see below). This router is designed to deliver security and data services at two-T1 or two-E1 rates.



Two full T1s. The chart shows the actual bi-directional link loads, that the 2811 router was processing over two T1s. These were aggregated via Multilink PPP, using bi-directional connectivity between the office and the ISP's access router.

Test-bed Setup



Mixed concurrent services, traffic flows. The SUT (System Under Test) was Cisco's new 2811 Integrated Services Router. A key objective was to verify that, while busy running an assortment of services, including full IP-PBX telephony, the router could also still effectively, and concurrently, sustain multiple-T1, IP-WAN throughput. In the test bed the 2811 supported a separate "DMZ" subnet, running the customer's web server. The 2811 managed Internet-DMZ and internal traffic via routing and VLANs.

A diverse mix of concurrent traffic streams was generated, to exercise the many services running on the 2811, while loading the IP-WAN connection. The T1s were combined using Multilink PPP (MLPPP), effectively yielding a 3-Mbps IP-WAN pipe between the 2811 ("Main Office") and the "ISP's" access router.

About 40 discrete, concurrent, traffic flows were generated:

- Three of Ixia's IxChariot traffic generators simulated the following, bi-directional protocol flows on the office LAN, DMZ, and Internet:
 - DNS (2), HTTPS (2), POP3 (1), SMTP (1), FTP (24), HTTP (6).
- Cisco's SimClient v6.2.2 software tool, running on Windows PCs, continually set-up and tore down concurrent Skinny-based VoIP calls via the 2811's CallManager Express.
- Cisco's Callgen v4.0.1T, an IOS router-based software tool, continually established four concurrent VoIP-analog calls between the local office LAN and the PSTN.

With the full load of traffic mixes and streams running, the testers then manually established and maintained a four-party conference call, transmitted faxes between a local fax machine and one on the PSTN, voicemail messages from two analog phones on the PSTN, and retrieved voicemail using two local IP phones. These operations confirmed proper working of all services, while high traffic loads were running.

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 2811 (System Under Test)

Module	Description
HWIC slot 0: VWIC-2MFT-T1-DI (drop and insert)	T1 (2 port) Multi-flex trunk WAN Card
HWIC slot 1: VWIC-2MFT-T1-DI (drop and insert)	T1 (2 port) Multi-flex trunk WAN Card
HWIC slot 3: VIC-4FXS/DID	FXS Voice Card (4 ports)
DSP slot 0: PVDM2-64	Voice DSP module
DSP slot 1: PVDM2-48	Voice DSP module
NM slot 1: NM-CIDS-K9	IDS network module (Intrusion Detection System)
AIM slot 0: AIM-CUE	Cisco Unity Express Advanced Integration Module (voicemail, auto-attendant)

Concurrent Services Running and Verified on the Cisco 2811 Integrated Services Router While Delivering Full Rate Throughput on dual-T1 IP-WAN Link

Services / Features	How supported by the 2811	How Tested / Verified
IP-WAN data transport, up to 3 Mbps; two T1s aggregated via Multilink PPP	Integrated in IOS	Via multiple test systems, link monitors, CLI
Stateful Firewall	Integrated in IOS	On dual-T1 "Internet" link; viewed via CLI
NAT	Integrated in IOS	On dual-T1 "Internet" link; viewed via CLI
Routing	Integrated in IOS	EIGRP traffic routing
Hardware-based IDS (Intrusion Detection)	Optional Network Module NM-CIDS-K9	On "Internet" link; conducted multiple assaults on the DMZ server; monitored alarms via the IDS Event Viewer
CCME (Cisco CallManager Express)	Integrated in IOS	Calls established, basic IP-telephony features exercised; IP-to-IP, IP-to-analog/PSTN
Voicemail (stored locally on 2811)	Optional AIM-CUE module	Voicemail delivered and received under load
Auto-Attendant	Optional AIM-CUE module	Manually checked under load
Conference Calling	Integrated in IOS	Manually checked under load
Fax, PSTN, Voice Gateway	Fax (VIC-4FXS/DID), PSTN (VWIC-2MFT-T1-DI)	Fax and analog voice calls placed to and from the "PSTN"
Traffic Statistics, Load Monitoring	Integrated in IOS	Output viewed via CLI during testing

Modularity and Concurrency

The 1RU size of the 2811 at first glance betrays the degree of modularity and customization that the system offers. The system we tested was designed to provide full telephony service to the local office, with a PRI T1 trunk to the PSTN, plus high capacity (in our case dual-T1) IP-WAN transport, along with a host of other services.

Two 10/100 Ethernet ports are integrated. Four HWIC (High-density WAN Interface Card) slots accommodate a mix from among a broad selection of available modules. Our 2811 had two dual-T1 VWICs, plus a four port analog FXS VIC.

2811 Router's Max Firewall Throughput

Separately, we ran a "bench" test to see how much data the 2811 could route under ideal circumstances. Set-up: a single, bi-directional UDP flow between two 10/100 ports, big (1,460-byte) packets, with firewall and NAT running and logging turned on. Using Spirent Smart-Flow v4.0 we saw 130 Mbps total. Not a typical environment, but worth noting.

A larger slot accommodates a full-width module option - in our case a hardware-based IDS network module (see above module list). This module, packaged with over 1,000 signatures for detecting known assaults and threats, delivers alerts to a very effective IDS Event Viewer interface.

Various slots in the main system board accept plug-in performance modules for specific tasks and services. We had two DSP modules, plus a Cisco Unity Express Advanced Integration Module that handled voicemail, and auto-attendant services.

The versatility and modularity of the latest version of IOS we tested cannot be overstated. Besides typical routing functions, the IOS in the test 2811 was also busily driving a stateful firewall, NAT – *plus* delivering a full range of IP-telephony services via the CCME (Cisco CallManager Express) optional IOS software.

The 2811 Integrated Services Router is a powerful package, highly customizable for myriad network topologies.

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 2811's ability to pack a dual-T1 IP-WAN link.
- Concurrent provisioning of key high-level network services for a busy office, including Firewall, NAT and hardware-based Intrusion Detection. All services running concurrently under heavy transport load.
- The ability to deliver a full array of telephony services, including a complete IP PBX. Compatibility via CallManager Express IP PBX, voicemail, auto-attendant, call conferencing, PSTN trunk, and analog-phone and fax services.



Cisco 2811
Integrated Services Router



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Report 040903