

Lab Testing Summary Report

October 2009
Report 091028

Product Category:

Integrated Services Router Generation 2

Vendor Tested:



Products Tested:

Cisco ISR 1941W
Cisco ISR 2911
Cisco ISR 2951
Cisco ISR 3945



Key findings and conclusions:

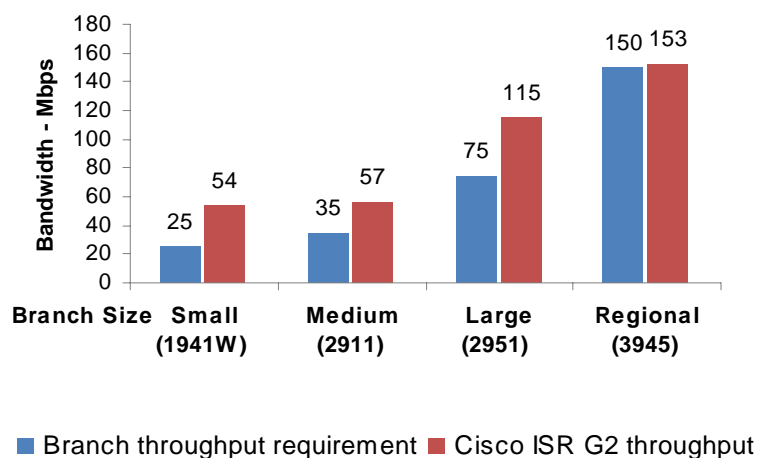
- Cisco ISR G2 platforms delivered 5 times improved performance compared to previous generation ISRs
- Cisco ISR 3945 delivered throughput of up to 150 Mbps with integrated services enabled
- ISR G2 platforms support bandwidth-optimized and scalable video including TelePresence and streaming
- Cisco ISR G2 platforms offer “Service Ready Engine” providing the flexibility to turn on services on demand
- EnergyWise allows automatic port shutdown during off hours (7PM to 7AM) enabling a 50% energy savings
- WAN bandwidth usage decreased a 100 times with integrated Cisco WAAS WAN acceleration module

Cisco’s Integrated Services Router Generation 2 platform models 1941W, 2911, 2951 and 3945 were evaluated by Miercom for performance feature validation while being used in branch office scenarios. The objective was to validate increased levels of voice, video, security, wireless, mobility and data service integration. While testing the features and services offered by the ISR G2 branch routers, performance and throughput was observed, to ascertain if the activated services affected the throughput.

Today’s branch routers must have the ability to serve the requirements of the current branch, and scale to the evolving needs of integrated services. This includes increased bandwidth requirements, supporting advanced security features and WAN and VPN technologies, with multi-media collaboration.

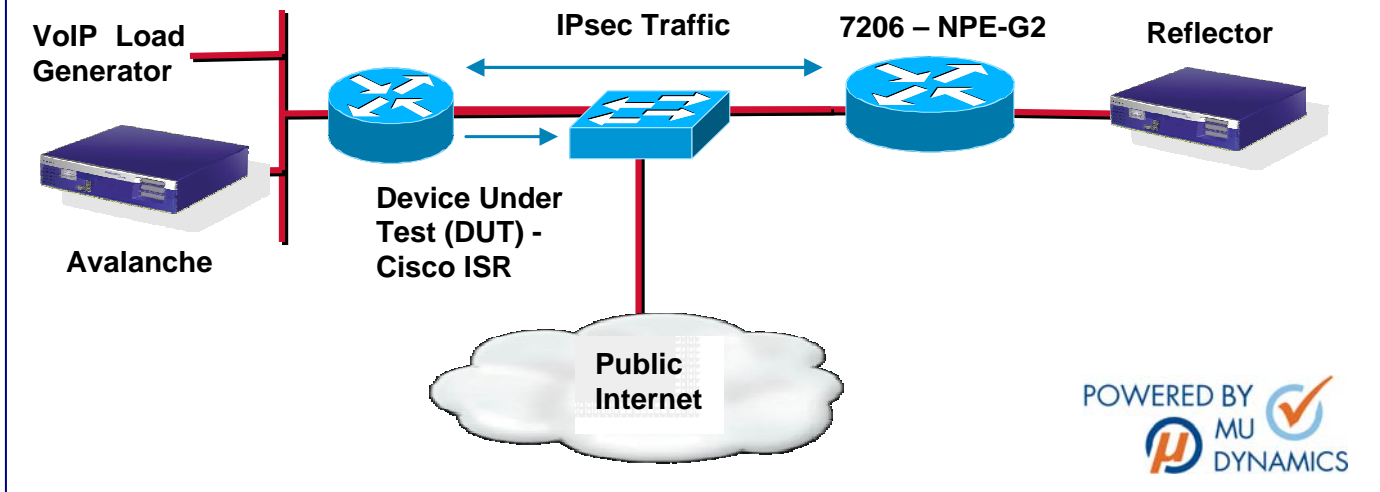
A solution that provides security, wireless capabilities, UC, and WAN optimization in a single box, while maintaining *(continued next page)*

Figure 1: Throughput compared to branch bandwidth requirements



Higher throughput was delivered than was needed to meet the bandwidth requirements for the branches, while integrated services and features were activated. While maintaining 75% CPU utilization, no frame loss was observed.

Test Bed Diagram



How We Did It

Similar network topologies were used for all branch office deployments with variations added to reflect the typical needs of the different branch sizes. Spirent TestCenter, Spirent Avalanche and Reflector were used for traffic generation. Spirent Abacus was used to generate voice traffic and simulate Skinny Client Control Protocol (SCCP) call activity. A custom Cisco traffic generation tool was used to simulate Telepresence sessions. This tool sends actual Telepresence video streams, monitors for any frame loss, jitter, and latency.

All traffic used for performance testing of the Cisco ISR G2 Device Under Test (DUT) were set to meet Service Level Agreement (SLA) of zero frame loss and acceptable latency or jitter values. The WAN interface of the ISR G2 DUT utilized a secure VPN connection as well as a backup connection specific to the size of the branch. For our tests, headquarters was represented by a Cisco 7200 Series router, terminating at the other side of the VPN connection and providing the core side connections for traffic generation and monitoring.

To simulate the various streams found in a typical branch setting, generic stateful HTTP data traffic consisting of 25K, 30K and 130K objects, with 10 objects per TCP session, were utilized. All performance testing was conducted with router CPU maintained in the 50-70% range, which is the recommended load that allows sufficient overhead and tolerance for real-world network activity.

To evaluate the effectiveness of the security features of the Cisco ISR G2 platforms, offensive security tests were conducted using Miercom Offensive Security Testing Suite and the Mu Test Suite (www.mudynamics.com). The Mu Test Suite distills information from the most recently discovered root-cause vulnerabilities into test cases that target the vulnerabilities that lie behind tens of thousands unique exploit vectors.

Miercom recommends customers conduct their own needs analysis and test for the specific environment for product deployment before making a selection. Contact reviews@miercom.com for additional details on the configurations applied to the system under test and test tools used in this evaluation.

existing performance and throughput is a true integrated solution. Integrated network based services are an effective way to reduce costs, while delivering new services to the end user. The ISR G2 platforms deliver these services and performance, while deployed in small to large remote branch office topologies.

Miercom tests the performance and validated the integrated features of the Cisco ISR G2 platforms. Tests were conducted with feature intensive branch office deployments, and considered actual branch settings currently used by ISR customers.

Branch Architecture

The architecture of the ISR G2 platforms enables richer media experience with video, voice and WAN evolution. Additions to the services available on the ISR G2 platforms include integrated security, unified communications, wireless, and application optimization services. Pay-As-You-Grow software licensing and Cisco IOS software packaging also reduces branch office expenses.

Branch offices are classified as small, medium, large and regional, with unique requirements for

each category. All test cases described were based on specific branch requirements. A typical small branch, such as a retail store with 10-25 users, would use the ISR 1941W. A bank with 25-40 users would use the ISR 2911. A corporate branch or large branch accommodating 40-75 users would use the ISR 2951. While a regional office with 75-150 users, would use the ISR 3945.

Performance Tests

Each class of branch routers was tested based on the typical application of the model with Dynamic Multipoint Virtual Private Network (DMVPN), Zone Based Policy Firewall (ZBF) and Intrusion Prevention System (IPS), and Hierarchical Quality of Service (HQOS) features enabled. We subjected the Cisco ISR G2 router platforms with integrated services and features enabled, to a traffic mix consisting of the data, voice and/or Telepresence traffic recommended for each deployment scenario.

All of the Cisco ISR G2 branch routers delivered throughput which exceeded by 102% to 214% the stated bandwidth requirements of the branch, while integrated features were activated. See [Figure 1](#) on page 1. All test results were observed without any frame loss and maintaining CPU utilization of 75%.

Offensive Security Assessment

We evaluated the effectiveness of the integrated security features of IPS, ZBF and DMVPN, on the Cisco ISR G2 platforms.

The platforms were evaluated as a “standalone security device” in an un-tuned IPS deployment. Penetration testing was conducted with over 1,450 updated and in-the-wild attacks. Loaded with 2,670 signatures, the platforms thwarted the majority of attacks, with IOS IPS firing signatures before the network security could be compromised. In addition, the zone based policy firewall was resilient against network and application layer attacks, viruses and worms, adding more flexibility and granularity to already existing IOS stateful inspection.

IOS Content Filtering

Cisco IOS Content Filtering, available on the ISR 1941W and 2911, demonstrated category blocking to static black and white lists with keyword blocking and security ratings to websites requested. This IOS integrated feature offers policy-based web content control to limit exposure

to web sites that could incur liability issues or contribute to lost productivity.

The Cisco IOS Content filtering utilizes a subscription-based service using an Internet-based reputation server. Policy-control parameters include keyword blocking, local black- and white-listing of up to 100 URLs, blocking and/or allowing by content categories by user credentials, and reputation-based content control. URL filtering was tested by selecting a category of permitted and non-allowed websites. It successfully blocked the web sites by category as requested. See [Figure 2](#) on page 4.

Unified Communications Trusted Firewall

The trusted firewall feature was evaluated to verify Unified Communications security. The UC firewall uses Trusted Relay Point (TRP), a software function which authorizes and inspects STUN messages. Once all checks are successful, a bidirectional pinhole is opened through the firewall for data flow. This prevents the need to blindly open media port ranges. This feature gives Cisco a competitive edge for Cisco router-based secure UC solutions.

Unified Survivable Remote Site Telephony

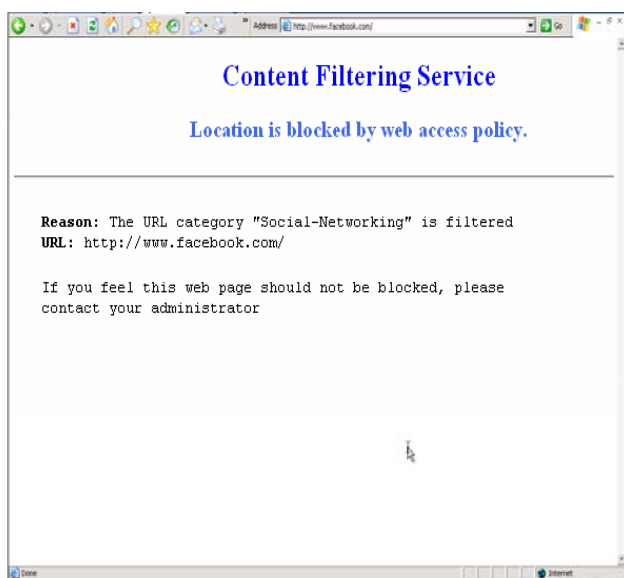
Call processing redundancy is critical for all branch offices. Unified Survivable Remote Site Telephony (SRST) is an integrated voice feature available on all Cisco IOS platforms. When activated, the Cisco Unified SRST acts as a call processing engine for the IP phones located in the branch office during a WAN blackout.

Once a WAN link fails, the Cisco SRST automatically detects the failure in the network and initiates the SRST services to provide call processing backup for the IP phones at the branch office. Once WAN connectivity is restored, the system automatically shifts the call processing back to the primary Cisco Unified Communications Manager at headquarters.

Video Capability

Video call capabilities were evaluated on an ISR 2911 using the Cisco Unified Video Advantage (CUVA). CUVA allows Cisco non-video IP phones to make video calls to other video endpoints. Connecting the access port of the video-enabled Cisco Unified IP Phone 7965 to a PC with a USB video camera allowed calls to be placed to the branch office. These calls were

Figure 2: Content Filtering by Category



URL category blocking message as displayed in a user's Web browser.

made using normal phone processes and were displayed successfully with video on the PC without any further actions. The ISR 2911 demonstrated the ability to make video calls using the H.263, H.264 and H.323 protocols.

Communications Manager Express

The Cisco CME (Communications Manager Express) provides call processing services at the branch office. This integrated feature adds call processing functionality at the Cisco ISR branch router itself for branch offices. All the necessary files and configurations for IP phones are stored internally on the appliance, providing a single-platform solution.

Calls were made using Cisco Unified IP Phones 7965 to test the call processing functionality of the CME. Voice mails were left to demonstrate the messaging features offered by the CME. Using the VoiceView express feature we could easily browse, listen, and manage voicemail from the Cisco IP phone display and soft keys. These functions were demonstrated on the ISR 2951.

SIP Trunking

SIP Trunking capabilities were demonstrated on the ISR 3945 platform. For this test scenario the CME was set and configured as the PBX that will interpret the SIP signal and pass the traffic. The Spirent Abacus was used to simulate SIP

Trunking traffic, generating 30 SIP sessions per second. We observed zero RTP packet loss and no out of order packets. Stable MOS scores of 4.55 were achieved for all calls. In addition, RTP jitter values of 0.233 ms and R-factor of 93.2 was achieved, which falls in the desirable range for VoIP quality.

Wireless LAN

Wireless LAN capabilities are available only on the Cisco ISR 1941W which includes a native 802.11n access point and security features available to support secure mobility.

During testing, the ISR 1941W proved to be able to deploy secure, manageable WLANs, with fast secure mobility, authentication and simplified management. The ISR router extends corporate networks, securing remote sites, allowing access to the applications found in the corporate offices. The Cisco ISR 1941W router meets WLAN needs with a single device, offering increased levels of services integration.

3G Wireless WAN

The Cisco 3G Wireless WAN HWIC (High-Speed WAN Interface Card) on the ISR 1941W successfully combines traditional enterprise router functionality, advanced IP services like VoIP and security with the mobility capabilities of 3G WAN access. The integrated HWIC 3G Wireless feature was tested on the Cisco ISR 1941W for primary and backup WAN link connectivity as an integrated feature offering.

As the primary WAN link, 3G WWAN was tested with IOS security feature DMVPN enabled. To test for multimedia traffic over 3G WAN link we placed voice calls and monitored the MOS scores and call quality. Voice could be heard with clarity, all sessions were maintained and no calls were dropped.

When configured as a backup link, the failover time to 3G WWAN was noted to be 15 seconds, an acceptable failover time. This included time for the EzVPN tunnel to establish and pings to reply.

Wide Area Application Services

Cisco Wide Area Application Services (WAAS) module, was demonstrated on the ISR 2911, 2951 and 3945. It provides integrated WAN optimization features on the ISR G2 platforms. Advanced Data Redundancy Elimination (DRE), Persistent LZ compression, and TCP Flow Optimization (TFO),

were among the WAAS functions tested, all of which accelerated application response times by alleviating WAN traffic loads and congestion.

We used the Spirent Avalanche/Reflector to generate real world HTTP traffic to traverse over the WAN link to the corporate network. Without the WAAS module providing integrated WAN optimization features, the bandwidth usage was recorded at 140 Mbps for HTTP traffic. With the integrated WAAS module, the bandwidth usage for the same HTTP traffic dropped to 1.4 Mbps decreasing it by 100 fold.

Multi Gigabit Fabric

The MGF is a new integrated solution added to the architecture of the ISR G2 platforms allowing high bandwidth module-to-module communications at speeds up to 1 Gbps without adding overhead to the router processor. The traffic between service modules is switched at line rate to one another without being forwarded to the router CPU, thereby improving LAN/WAN performance and scalability.

Two 24 port Cisco ESMs were used for testing, with Spirent Avalanche/Reflector used to generate traffic traversing from one Etherswitch module to the other. The log file for Cisco ISR 3945 recorded CPU utilization as zero, while 1Gbps of traffic passed through the Etherswitch modules. The receive bandwidth percentage utilization and transmit bandwidth percentage utilization for the port going to the platform CPU, recorded zero, indicating that router processing power was not used.

Cisco EnergyWise

Cisco EnergyWise technology allows users to measure the power consumption of network infrastructure and network attached devices (IP phones, PC and access points) and manage power consumption with specific settable policies.

This IOS feature was demonstrated on the ISR 3945 platform fitted with two 24 port Etherswitch modules. Power monitoring and management capabilities of the Cisco EnergyWise feature were tested for slots and interface power management on the router. With Cisco EnergyWise, the Service modules could be powered-up or turned-down using simple commands. Times of day policies were applied to extend EnergyWise functionality to control

power to certain ports. Based on this policy, PoE power to interfaces was set to automatically turn on/off at various times. These time policies could also be applied by device type, device location, priority of device and other settable parameters.

PoE Boost

When populated with dual power supplies, the Cisco ISR G2 platform routers can operate in a PoE boost mode configuration, in lieu of redundant power mode. In this PoE boost configuration, the power capacity of the platform is increased to almost twice the normal power to support additional PoE ports. See Figure 3 below.

Figure 3: Power available for POE ports in RPS and PoE boost mode

<i>Mode</i>	<i>RPS</i>	<i>PoE boost</i>
<i>Maximum Power</i>	520W	1000W
<i>Allocated Power</i>	6.3W	6.3W

IOS Software Licensing

With the new licensing and packaging process, Cisco ISR G2 platforms are shipped with a single universal IOS image, loaded during manufacturing, and containing all IOS features. All integrated service and features are now in four suites; previously offered in eight images and required a new software image every time.

The level of IOS functionality available depends on the licenses purchased. To unlock or upgrade to a suite of IOS functionality, only a new license needs to be applied. The four categories of licenses are IP base: Default packaging, Data, Unified Communications and Security (SEC).

Bottom Line

The value of an integrated solution shows its worth for enabling integrated services on a single platform, delivering WAN optimization all in one single box, while maintaining existing performance and throughput metrics. The Cisco ISR G2 models ISR 1941W, ISR 2911, ISR 2951 and ISR 3945 deliver these services with exceptional performance while deployed in branch office topologies scaling from small branch offices of a few users, to large remote branches with 100 clients. For additional details on this testing, contact Miercom at reviews@miercom.com.

Miercom Performance Verified

Based on Miercom's review of the performance during testing, the Cisco ISR G2 platforms – ISR 1941W, ISR 2911, ISR 2951 and ISR 3945 routers have earned the Performance Verified award.

The Cisco ISR G2 platforms provide security, wireless, UC, WAN optimization and energy management capabilities all in one box while meeting branch office performance and throughput requirements.



ISR 1941W



ISR 2911



ISR 2951



ISR 3945



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