Miercom

Lab Test Summary Report

May 2008
Report 080529

Product Category:

Aggregation Services Router

Vendor Tested:

CISCO

Product Tested:

Cisco ASR 1006 Aggregation Services Router

Miercom PERFORMANCE VERIFIED

Key findings and conclusions:

- **Cisco ASR 1006 proved 10 Gbps of throughput routing real-world traffic with no packet loss**
- **Excellent resiliency with no packet loss during primary route processor and forwarding processor fail-over tests**
- **System components in the ASR 1006 are hot-swappable and active failover was verified**
- **Cisco ASR 1006 provided excellent 4 Gbps of IPsec and VPN aggregation performance**

Cisco Systems engaged Miercom to validate the performance of the Cisco ASR 1006 Aggregation Services Router, the top-of-the line addition to the next-generation, 10 Gbps routing platforms from Cisco.

Cisco ASR routers are designed to deliver seamless integrated services and carrier-grade availability with exceptional performance throughput. The testing entailed validating the unit's 10 Gbps baseline throughput performance, as well as system High Availability (HA) performance and performance with security features enabled including Access Control Lists (ACL), firewall, IPSec and QoS

Miercom applied its standard methodology for testing secure routing products. We verified the performance for ASR 1006 matched or exceeded Cisco's published specifications by consistently providing up to 10 Gbps of throughput. We were impressed with the performance for the unit with advanced features enabled during peak load tests as shown in the figure below.

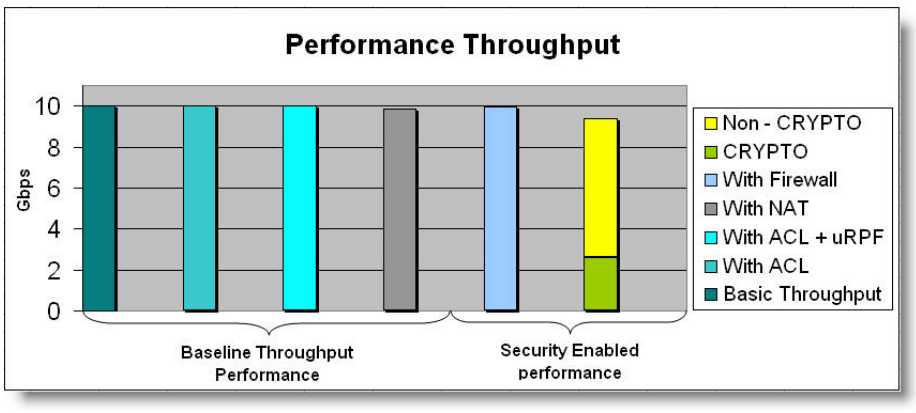
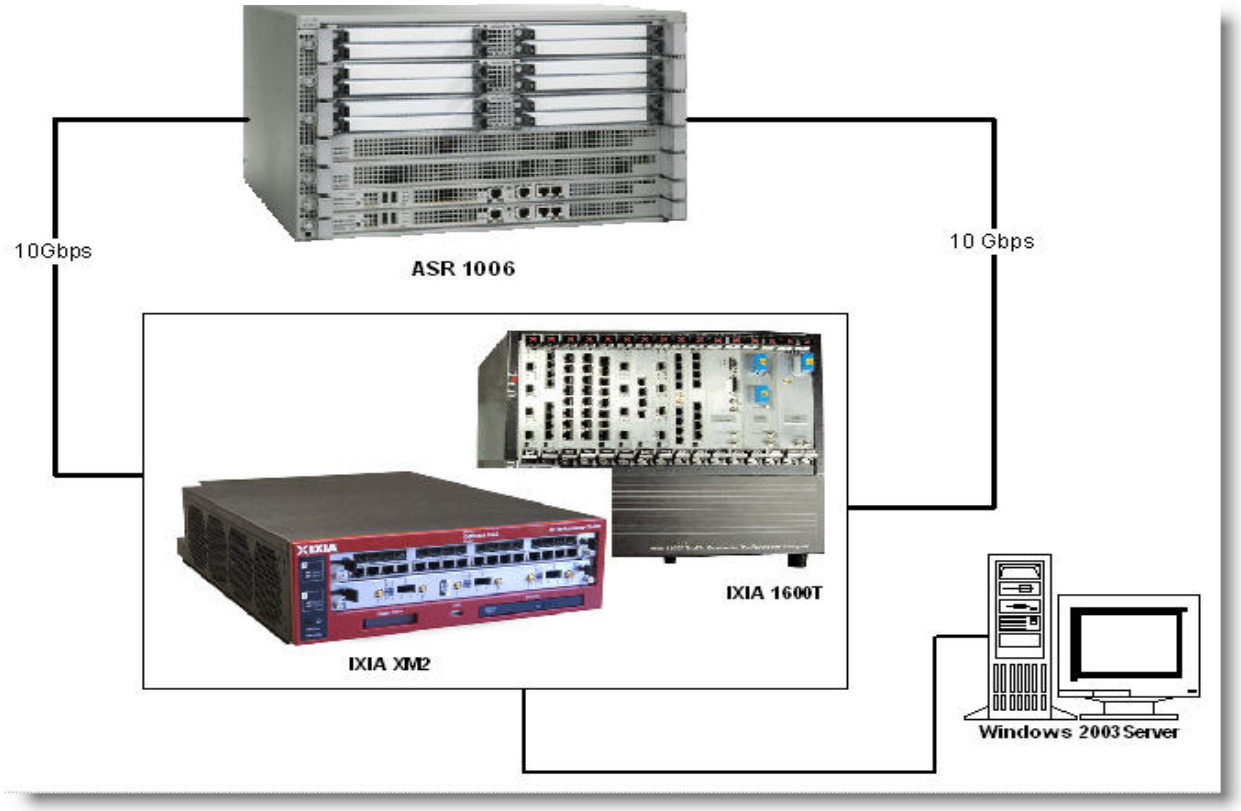


Figure One: Cisco ASR 1006 achieves close to 10 Gbps throughput, with no packet loss during performance tests even with advanced features enabled.

Test Bed Diagram



How We Did It

Layer 2 and Layer 3 traffic of encrypted and non-encrypted data using 64 byte through 1,518 byte frames was generated with Ixia 1600T and OptIxia XM2 traffic generators. Traffic was sent to the 10 Gigabyte ports of the ASR 1006 router. IxNetwork and IxLoad were used to measure throughput and to log the results. Power consumption was measured while the systems were running with heavy traffic loads designed to fully exercise the appliances. Test scripts are available upon request to repeat the tests represented in this report.

ASR 1000 Series Features

The routers in the Cisco ASR 1000 series are available in three form factors: the 2-rack ASR 1002, the 4-rack ASR 1004 and 6-rack ASR 1006. ASR 1002 can support three shared port adapter slots (SPAs) while the ASR 1004 can house eight and the ASR 1006 can support twelve SPAs.

Both the ASR 1002 and ASR 1004 come with a single route processor and a single forwarding processor.

The top-of-the-line ASR 1006 has the option of dual route and forwarding processors, making it the most reliable solution in the Cisco ASR 1000 Series.

The Cisco ASR 1000 Series supports the 10-Gbps Cisco ASR 1000 Series SPA Interface Processors (SIP) card. It is built into the Cisco ASR 1002 Router chassis and is available as a modular option for the Cisco ASR 1004 and Cisco ASR 1006 chassis. Additionally, the ASR 1000 series' SPAs are completely hot swappable.

All members of the ASR 1000 Series family routers are based on Cisco's new QuantumFlow Processor (QFP). Built with 40 multi-threaded cores, the processor is designed to handle the heavy work imposed by the Cisco IOS software security services. The QFP can perform 160 simultaneous processes, meaning existing and future services can be activated instantly with no impact on network performance, according to Cisco. Thanks largely to the new QFP, described by Cisco as the industry's first fully-integrated, programmable network processor, the ASR 1000 series routers are designed to leapfrog over Cisco's competitors in the router market in terms of raw horsepower and state-of-the-art features.

The units feature high-performance services, such as software-enabled multigigabit encryption and session border control. They also support cost-effective in-service software upgrades.

Test Procedure and Results

The testing was divided into two phases:

Phase One testing included analysis of the ASR 1006 baseline feature performance levels, including its ability to consistently perform up to 10 Gbps line rate and to give low-latency treatment of high-priority traffic, while dropping low-priority traffic, during bandwidth oversubscription periods.

Phase Two testing verified the unit's high availability (HA) capabilities. The ASR 1006 was designed to predictably prioritize and forward network traffic during induced failover of its route processor (RP) and embedded service processor (ESP).

Two test-beds were used to clearly differentiate the two testing phases. One entailed connecting the ASR 1006 to an Ixia 1600T while a Windows 2003 Server was used to administer the test and manage results through the Ixia IX Explorer.

The second test bed used another ASR 1006 connected to an Ixia XM2 and subsequently the Windows 2003 Server was used to administer and manage results using Ixia Load.

Baseline Performance

During Testing Phase One, Layer 2 and Layer 3 traffic totaling 10 Gbps was applied to the ASR 1006. Traffic was sent over two ports. The first port, TeGi0/0/0 received interleaved traffic, Best Effort, EF, CS4, and CS1, each at a rate of 1.25 Gbps using 64 Byte Frames. The second, TeGi1/1/0 was tested with Best Effort at 5 Gbps using 64 byte frames.

With no features applied, the results showed a total of 10 Gbps throughput traffic at 14.88 MPPS and no packet loss.

Performance with features

Using same configuration on port TeGi1/1/0 and changing the line rate on port TeGi0/0/0 with and aggressive profile (40%64B, 30% 1400B and 30% IMIX) with QoS, uRPF, ACL at 8Mpps. The Cisco ASR 1006 performance remained unchanged even after we enabled the ACL as well as ACL +uRPF, as shown on screen shot above (Figure Two).

Figure Two: The Cisco ASR 1610 achieves up to 10 Gbps of routed throughput with no packet loss during the performance test.

During test performance with oversubscription, four 64 byte frame streams worth of traffic were sent to port TeGig1/1/0 totaling 9.5 Gbps at 14.137 MPPS, and one “best effort” stream of 64 byte frames was sent through port TeGig0/0/0 totaling 8.5 Gbps at 12.6 MPPS. Both traffic streams combined for a total of 18 Gbps at about 26 Mpps.

Here, the system was being oversubscribed to almost double its capacity. As expected, the results showed drops of packets and all classes were being buffered. Higher latencies were shown as well. At this point, no traffic was being prioritized.

The traffic received was 13.83 Gbps at 20.58 MPPS. However, after configuring QoS on SIP for EF and CS4 streams of traffic, Miercom verified it was possible to prioritize traffic at the SIP level and the high latency was corrected once the Modular QoS CLI (MQC) policy was applied at the TenGig0/1/0 interface.

Even after having traffic oversubscribed, the Cisco ASR 1006 proved to be reliable and showed no packet loss of high priority traffic. Meanwhile, after enabling MQC policy on both EF and CS4 classes, the latency for high priority traffic was extremely minimal.

Throughput performance with NAT enabled on port TeGig0/0/0 showed traffic at 9.86 Gbps with no packet loss.

For the IPSec test, an additional ASR 1004 model was added to the test bed.

The ASR 1006, using port Te1/1/0 was connected to the ASR 1004 on port Te0/1/0. Tunneling was implemented between the two routers, while port Te0/3/0 of the ASR 1004 was connected to the Ixia XM2. A Windows 2003 server running Ixia's IxNetwork application was used to manage and collect test data.

The ASR 1006 can be deployed as a high-performance, secure router, which can do highly scalable IPSec aggregation at the WAN edge at multi-gigabit throughput.

A clear differentiating factor is that the ASR 1006 can still get 10 Gbps of total system bandwidth/throughput when encryption is enabled on the box.

Encryption can be used from 2.5 Gbps to 4 Gbps depending on the traffic type, and the remaining bandwidth can be used to send unencrypted text traffic through the system.

Test results showed a total throughput of 9.8 Gbps that included the CRYPTO and Non-CRYPTO stream mix. The streams were configured at different frame sizes and different line rates, utilizing only 96 percent of the total line rate, as shown in the screen shot below (Figure Three).

We are unaware of any other router platform on the market in this class that can handle this mix of encrypted traffic at these speeds. This is a clear differentiator for Cisco and the ASR 1000 Series.

The topology of the ASR router for firewall testing was a bit complicated due to the fact that 26 ports were utilized to verify throughput of up to 10 Gbps and PPS rates.

The ASR 1006 had no trouble handling large traffic loads without losing data.

A traffic rate of 20,000 connections per second was utilized for the testing and the router performed at an outstanding 9.98 Gbps throughput rate. The test was performed for ten minutes, to fully demonstrate its consistent throughput and performance, during which time no packet loss was reported as shown in Figure Three.

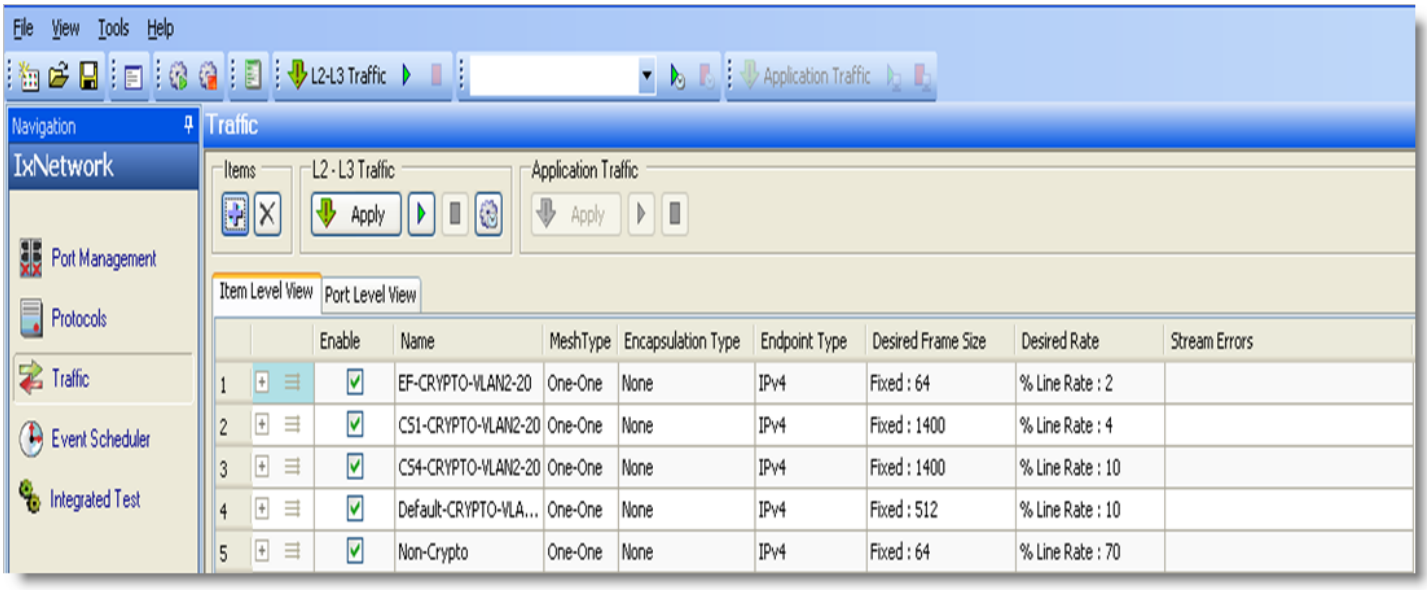


Figure Three: The IPSec load configuration for testing included a mix of encrypted and non-encrypted traffic streams applied on the Cisco Systems ASR 1006. The aggregate unidirectional load applied was 96 percent line rate for this traffic mix. The ASR 1006 proved it could effectively handle 9.8 Gbps of this traffic load with no loss.

High Availability Testing

During the In-Service Software Upgrade (ISSU) test, Miercom verified the full redundancy capabilities of the ASR 1006 router. No packet loss during the RP synchronization and switchover was observed.

The ASR 1006 demonstrated excellent results during the synchronization/upgrade of multiple firmware packages pertaining not only to the route processors, but the SIP and SPA as well. Once again, there was no packet loss.

Testing Phase Two verified the unit's HA infrastructure capabilities. The ASR 1006 was designed to predictably prioritize and forward network traffic during induced RP and ESP failover.

On the RP and ESP failover test, the equipment was configured the same way as in Testing Phase One. An Ixia XM2 was used here, providing a total 64 Byte Frame traffic of 10 Gbps at 14 MPPS over two ports.

During this test, Miercom found the ASR 1006 fully reliable while capable of keeping the full 10 Gbps throughput traffic rate with no packet drop during the Route Processor failover.

The final test was for ESP failover. Here, our results found no packet loss and just a minimal fluctuation on traffic throughput.

As shown on the accompanying screenshot (Figure Five), this was observed at minute 7:24 of the test. Presented with this information, Cisco stated that 8 out of 10 times there was a packet loss of less than 100, which is well below 1 ms worth of the total traffic.

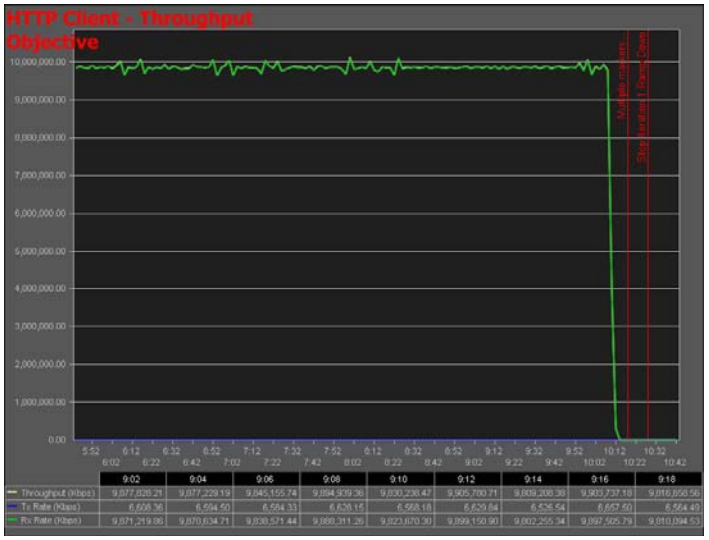


Figure Four: The Cisco ASR 1006 acquired an outstanding 9.98 Gbps throughput traffic, with no packet loss, with firewall enabled.

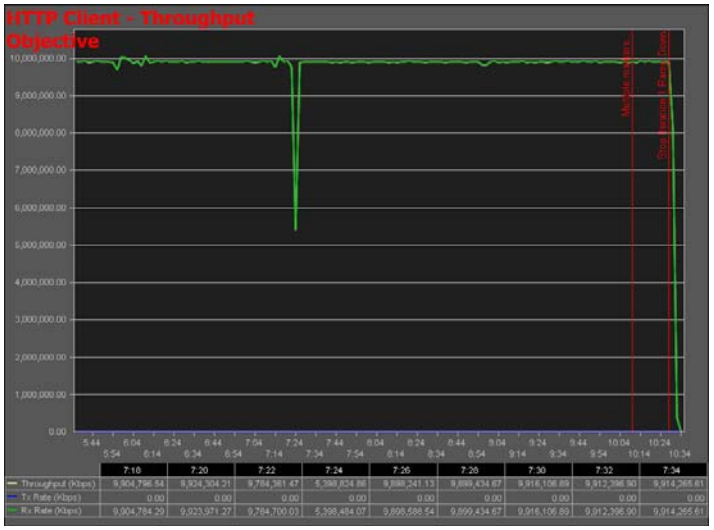
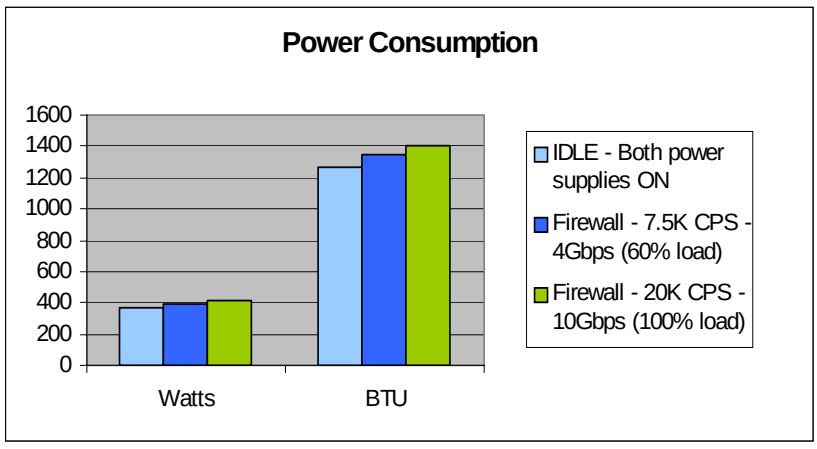


Figure Five: A minimal fluctuation on throughput traffic is shown at minute 7:24 during ESP failover.



Environmental Impact

The ASR 1006 can cleanly handle data at extremely high rates, but also showed itself to be an energy efficient product by virtue of product performance efficiency.

Power consumption and heat dissipation are shown in the graphic on the left, the ASR 1006's power-draw and heat-generation are within industry average expectations for a modular chassis. However the superior performance of the product factors into the overall efficiency of the unit.

Miercom Performance Verified

Based on these tests, Miercom verifies that the Cisco ASR 1006 attained 10 Gbps throughput out of the box and continued to provide 10 Gbps throughput with all its features enabled.

The tests confirmed the ASR 1006 deftly delivered high-priority traffic during periods of purposeful oversubscription. Additionally, Miercom verifies the functionality of the Cisco ASR 1006's features including its High Availability performance during test lab-induced failover states.

Based upon this extensive validation testing in real-world configurations, Miercom certifies the Cisco ASR 1006 router clearly lives up to Cisco's representations for the product and its new QuantumFlow Processor. The Cisco ASR 1006 thereby earned the Miercom Performance Verified Certification

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