



Lab Testing Summary Report

January 2009

Report 090101

Product Category:

Aggregation Services Router - Power Efficient

Vendor Tested:



Products Tested:

Cisco ASR 1002,
ASR 1004, and
ASR 1006



Key findings and conclusions:

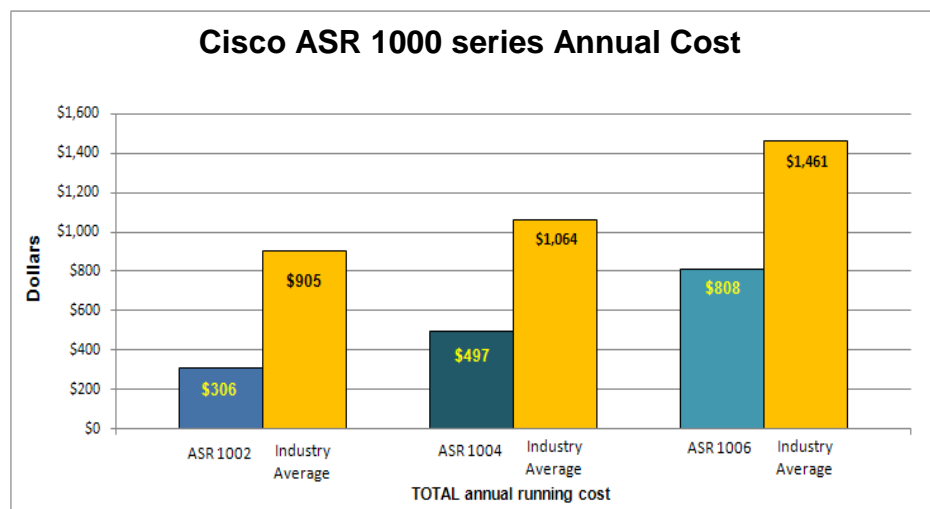
- Cisco QuantumFlow Processor enhances overall throughput with minimal power consumption
- Provides consolidation of services without sacrificing performance or throughput
- Minimal impact on power consumption when firewall, and QoS services tested at 100% throughput load
- CLI and GUI interfaces provide detailed environmental measurements and remote management
- Variable speed fans allows system to operate between 41°F to 104°F reduces need for external cooling

Cisco ASR 1002, ASR 1004, and ASR 1006 Aggregation Services Routers were evaluated by Miercom under the Certified Green Test Program for power consumption and efficiency. We analyzed the overall environmental impact and business enabling green benefits of utilizing the Cisco ASR 1000 series Aggregation Services Routers.

The Cisco ASR 1000 series family proved in testing and by analysis to afford customers a routing solution with superior value, effectiveness, and energy efficiency. Cisco's technology and its holistic approach to reduce environmental impact helps its customers to significantly improve their ROI (Return on Investment).

Cisco ASR 1002, ASR 1004, and ASR 1006 are 2U, 4U, and 6U multi-slot chassis routers. Replaceable and upgradeable components include Power Supply Unit (PSU), Route Processor Card (RP), Embedded Services Processor (ESP), SPA Interface Processor (SIP), fans, Shared Port Adapters (SPA), USB memory, DRAMs, and Hard disk drive on the RP. The Cisco ASR 1000 series are capable of housing up to two energy efficient power supplies.

Figure 1



Based on testing conducted, the annual operational costs for the ASR 1000 series reflect an overall savings of 54% in comparison to the industry average.

Test Bed Diagram



How We Did It

The Cisco ASR 1000 series Aggregation Services Router was evaluated for environmental impact by looking at the individual components as well as features and capabilities. Testing focused on the power consumption and efficiency of the product. A full audit was conducted to analyze the overall product-specific environmental impact.

Lab testing of each feature was conducted for power consumption under load as well as verifying measurements and audit results with site survey assessments. The Cisco ASR 1002 was configured with the following components: ASR1002-SIP10, ASR1000-ESP10 module, ASR1002-RP1 module, three SPA-1X10GE-L-V2 modules, SPA-2X1GE-V2 module and dual PSU. The Cisco ASR 1004 was configured with the following components: two ASR1000-SIP10, ASR1000-ESP20 module, two ASR1000-RP1 modules, three SPA-1X10GE-L-V2 modules, SPA-10X1GE-V2 module, and dual PSU. The Cisco ASR 1006 was configured with the following components: two ASR1000-SIP10, ASR1000-ESP20 module, two ASR1000-RP1 modules, three SPA-1X10GE-L-V2 modules, SPA-10X1GE-V2 module, SPA-4XOC3-POS module, SPA-2XCT3/DS0 module, and dual PSU.

Measuring Power Consumption: The power consumption of Cisco ASR 1000 series Aggregation Services Router was measured by enabling features such as Firewall, GETVPN, DMVPN/QoS, and WAAS based WAN optimization. Power consumption was measured with a Dranetz Encore 61000 Power Analyzer from Dranetz-BMI (www.dranetz-bmi.com) We also used the Ixia XM12, the Ixia 1600T, and the Ixia 400T traffic generators from Ixia (www.ixiacom.com) to obtain a full environmental reading spectrum with a mix of traffic at different processor utilization rates. Miercom recognizes Ixia as an industry leader in energy efficiency testing of networking equipment. Ixia's unique approach utilizes coordination of energy measurements with network traffic load – allowing energy consumption to be graphed against network traffic volume. Real-world traffic is generated by Ixia's test platform and test applications, principally IxNetwork, and IxLoad for layer 2-3 routing and switching traffic and IxLoad for layer 4-7 application traffic.

Power consumption of each of the Cisco ASR 1000 series Aggregation Services Router chassis were taken during system boot-up time, with one power supply until it reached an idle state. Measurements were also taken with additional power supplies as well as with additional SPA modules added. Additionally, measurements were taken while running the throughput traffic and stressing the features that the product supports.

Environmental Analysis: Miercom's environmental review of the Cisco ASR 1000 series Aggregation Services Router entailed an examination of the Cisco company-wide and product-specific environmental impact reduction efforts. We interviewed Cisco personnel regarding the environmental-related features of the equipment and applications. Overall Analysis includes comparisons to industry averages for competitive products that were tested.

The annual cost savings is shown in Figure 1 On the first page Based on the testing metrics, the Cisco ASR 1002 can provide a cost savings of up to 66%, the Cisco ASR 1004 up to 53%, and Cisco ASR 1006 up to 45% as compared to other Aggregation Services Router solutions.

Power Efficiency

Figure 2 below illustrates the power profile of the Cisco ASR 1002, ASR 1004 and ASR 1006 routers. An analysis was performed measuring the idle power consumed by the device during different stages, i.e., one power supply, two power supplies, operating at 110V, and adding different modules and processors. The initial system boot power consumption is 108W. The wattage increased to 330W once all processors and modules were connected. Only an increase of 117W occurred with the addition of the ASR1000-ESP20 module, the highest power consuming module. Minimal increase in power usage was observed when the units were operating at 70% and 100% capacity.

Although the Cisco ASR 1000 series router requires two in-chassis power supplies for cooling purposes and redundancy, only one active power supply is required to run the chassis.

The Cisco ASR 1000 series are equipped with fans that operate at variable speeds. The fan can run at lower speeds when the router is not fully utilized thus conserving energy.

We tested the new ASR1000-ESP20 module on

the Cisco ASR 1006 router with firewall enabled and applied maximum traffic throughput of 20 Gbps. An increase of only 709.1W was observed and is 48% lower than other routers in its class. This proves the energy efficiency of the router even at maximum utilization.

Product Efficiency

Cisco focuses not only on power efficiency but the ability to consolidate tasks in one device without compromising the network and its availability. The number of appliances the Cisco ASR 1000 series router can replace varies depending on the required services. In general, it can replace various combinations of standalone WAN routers, third party firewalls, VPN concentrators, standalone session border controllers, and a routing analytics appliance. This consolidation of services can save an estimated 18,000 kilowatts of electricity by utilizing a Cisco ASR 1006 router solution rather than multiple devices and without compromising speed or performance.

Consolidation provides the Cisco ASR 1000 series router the ability to perform broadband, Layer 3 VPN, aggregation routing, managed services, Internet Peering, and route reflector services, providing an overall power savings of up to 47% in comparison to similar grouped solutions.

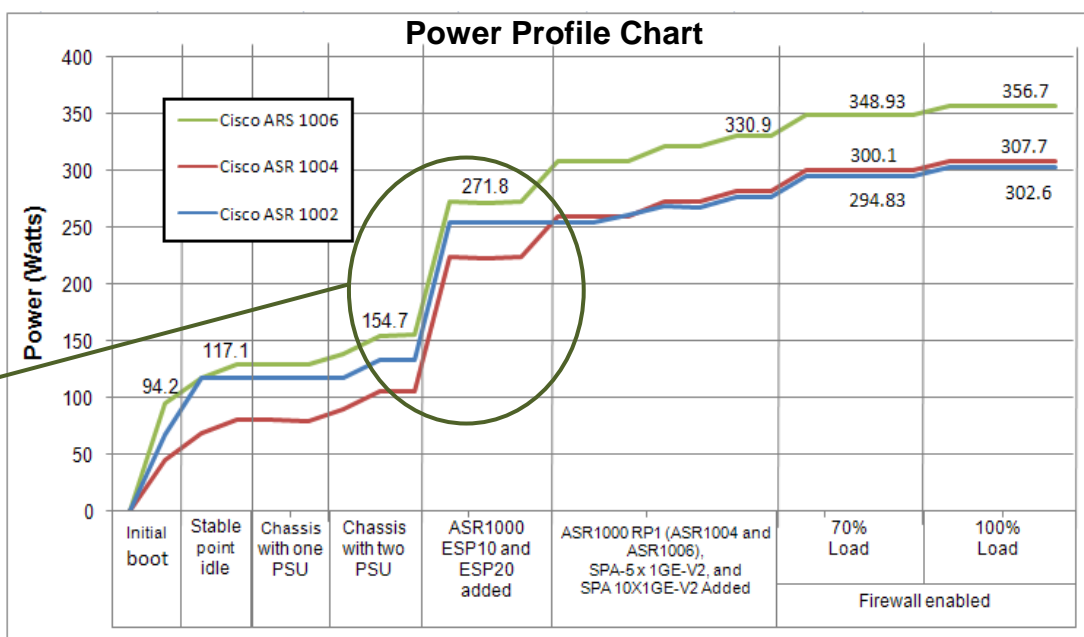
Figure 4 on page 5 shows the management interface on the Cisco ASR 1006. Information on

Figure 2

The Power Profile chart shows characteristics of the Cisco ASR 1000 Series. Details show Watts used from initial boot-up, one PSU and the addition of a PSU and other modules.

We observed a power increase of 117W when the ASR1000-ESP20 module was added.

Power utilization on a non-redundant, partially populated chassis at maximum line rate with firewall enabled did not surpass 360W.



power and temperature, as well processor and module status is also provided. Alarms can be programmed to alert IT personnel to any environmental related event. This flexibility in management allows customers to effectively manage Cisco ASR 1000 remotely, including enabling and configuring services such as firewall, SBC, and Network Base Application recognition (NBAR); thereby reducing the need to travel to maintain this equipment.

The Cisco ASR 1000 Aggregation Services Routers are powerful appliances that perform multi-device functions, which create power savings by using only one device, while still providing outstanding service.

Cisco Business Processes

The Cisco Technology Migration Program (TMP) is an example of Cisco's commitment to the environment. Customers can trade in their old equipment, which Cisco recycles, which reduces the accumulation of non-biodegradable materials and toxic substances. Cisco's recycling initiative is designed to remove valuable metals and components from old equipment for reuse in new products.

Green Innovation

Cisco accomplished an optimum balance of performance, capability, power economy and reduction of e-waste with the innovative design of the Cisco ASR 1000 Aggregation Services

Router, powered by the Cisco Quantum Processor (QFP). This processor combines attributes and functionalities of both application-specific integrated circuits (ASICs) and general purpose network processors, which in return provides the ability to implement new services without the need for additional modules or external devices.

The Cisco ASR 1000 series router uses a Cisco QuantumFlow Processor, which is the first networking chip with a large number of integrated core processors.

The 40 packet processing engines enable the Cisco ASR 1000 series router to handle up to 160 threads at once with 4 threads per processor. More functions can run with higher performance and scaling. Overall power savings are obtained since more tasks can be performed on the same appliance without compromising speed.

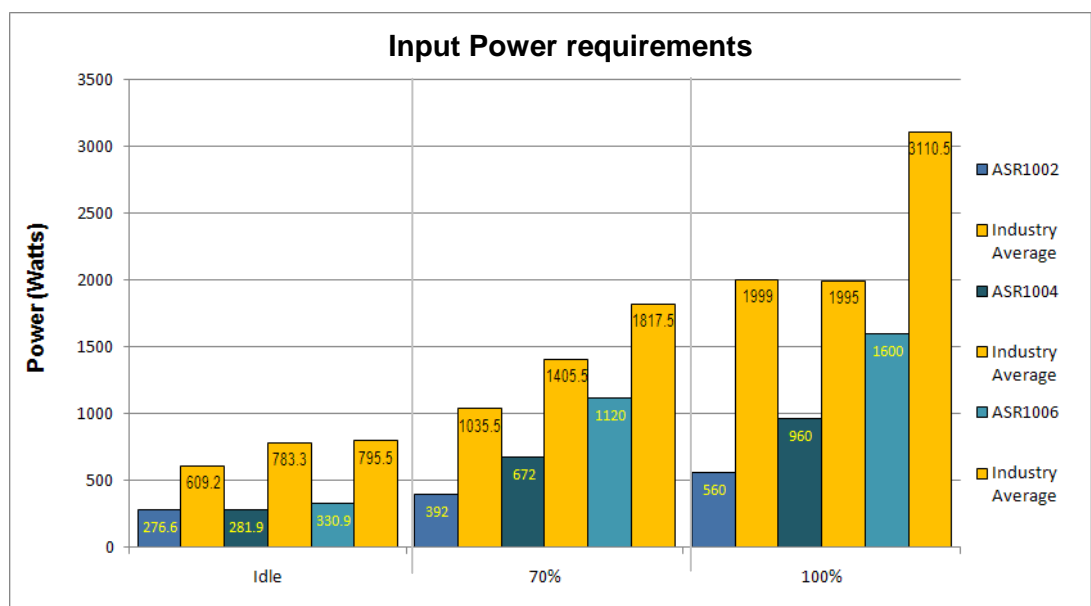
In addition, the Cisco ASR 1000 series router's hot-swapping flexibility allows the ease of upgrading or replacing of components and modules without disrupting the network which allows for efficient specific component replacement. Cisco is actively involved in driving "Green" innovation and standards for even more energy efficient designs.

Affiliations and Standards

As an active member of the Green Grid, Cisco is working to raise the standards on power efficiency. Cisco is also saving energy by

Figure 3

This chart shows input power requirements of the Cisco ASR 1000 Series with a fully redundant, fully populated chassis running at 100%, and 70% traffic load, as well as at idle. Results based on specifications were then compared to the industry average for products in this class.



providing electronic manuals for devices, which reduces paper consumption. Additionally, Cisco's process enhanced standards reduce the amount of packaging used on the product. Furthermore, the distribution of products from worldwide locations reduces carbon emissions during product delivery.

Cisco is fully compliant with both the Waste Electrical and Electronic Equipment (WEEE) and European Union Restriction of Hazardous Substances (RoHS).

Business Case

In Figure 1, the Cisco ASR 1000 series Aggregation Services Routers can save customers \$600 or more per year compared to using other comparable products. This calculation is based on annual running cost calculated for router power consumption utilization at a range varying from idle-state to the maximum line rate. Cost per KW/hr is 12.5 cents. The annual usage is based on the router being used 16 hours per day each week. Idle time is considered weekends, holidays and the remaining 8 hours per day/week. Using this scenario, a router typically would be running at

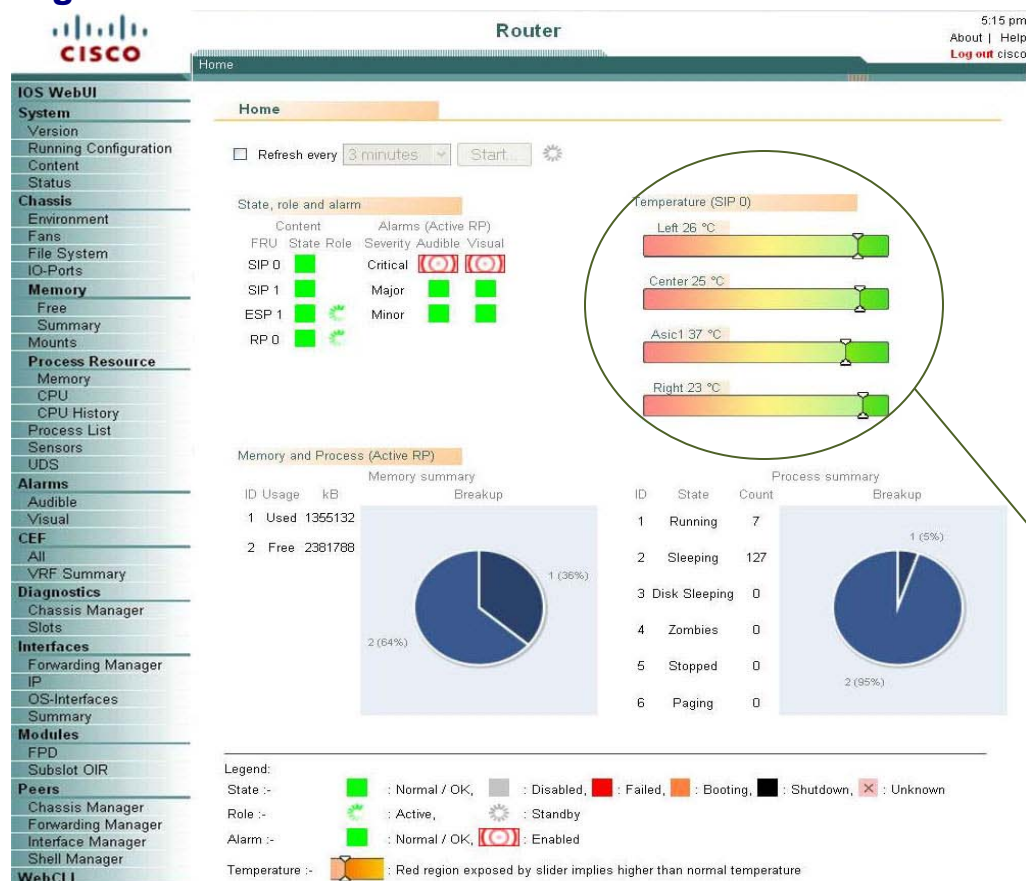
about 70% of capacity for 50% of the year. Maximum usage of 100% line rate would equate to a 20% annual usage. The remaining 30% of the year represents the switch being at near idle or steady state.

Companies can also save money with the competitive buy back and upgrade program Cisco offers. The Cisco Technology Migration Program (TMP) previously mentioned allows customers a monetary return when they turn their old equipment resulting from an upgrade to Cisco for recycling.

With an all-in-one product design, companies save money with consolidated features and services that would cost more if acquired separately. The Cisco ASR 1000 series routers include consolidation of six devices; a security device, a Deep Packet Inspection (DPI), a firewall, a Session Border Controller (SBC), a router, and a broadband aggregation device.

Companies that employ the Cisco ASR 1000 series solution are better equipped for conducting business in a global market knowing their technology investment is in compliance with international regulatory standards such as RoHS.

Figure 4



Cisco ASR 1006 GUI interface shows detailed information on internal chassis temperature and power being used.

The program has the ability to issue warnings for power failure, temperature, and other event based activities.

The graphical display provides internal temperature readings for a SIP module in use that is a host for four SPAs.

Miercom Certified Green

The energy-saving attributes of the Cisco ASR 1000 Aggregation Services router series were evaluated by Miercom in accordance with the Certified Green Testing Methodology. The product achieved sufficient scores in each of the rated criteria to achieve the Miercom Certified Green distinction Award.

Based on our hands-on testing and the verified representations made by Cisco, Miercom confirms that the Cisco ASR 1000 series Aggregations Services Routers are designed to provide enterprise customers effective and environmentally friendly networking and datacenter solutions.



**Cisco ASR 1002,
ASR 1004. and ASR 1006**



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