Miercom

Lab Testing Summary Report

June 2010

Report 090520B

Product Category:

Power Efficient Ethernet Switches

Vendor Tested:

hp

Product Tested:

HP A7506 Ethernet Switch

Miercom CERTIFIED GREEN™

Key findings and conclusions:

- **24% more efficient than comparable products based on Industry Average (Watts/Gbps)**

- **Enhanced redundant management features; provides traffic control and advanced security**

- **Hot swappable fan, power supplies and management modules; easily replaced or upgraded**

- **Multi-layer switch design provides 384 Gbps crossbar switching**

Hewlett-Packard* A7506 Ethernet Switch was evaluated by Miercom under the Certified Green Test Program for power consumption and efficiency. We evaluated the overall environmental impact and business enabling green benefits that the A7506 provides to customers.

The A7506 proved in hands-on testing and by independent audit, to afford customers with an energy efficient switching solution. HP delivers a standards-based network solution, providing energy-efficient products that reduce costs and minimize the environmental impact.

The A7506 is a 12U chassis type switch, designed with a modular blade configuration. The chassis has eight slots, two dedicated for management modules, and six slots supporting 48-port modules providing up to 288 10/100/1000 Base-T ports. Dual external and/or internal power supplies and an external fan tray complete the chassis. Replaceable and upgradeable components include internal/external power supplies, fan tray module, and management modules, providing enhanced scalability and redundancy to enterprise switch networks.

The A7506 provides 24% annual savings, as shown in *Figure 1.* The annual cost of the A7506 is $962 vs. $1,271 Industry Average. An explanation of the cost calculation is on
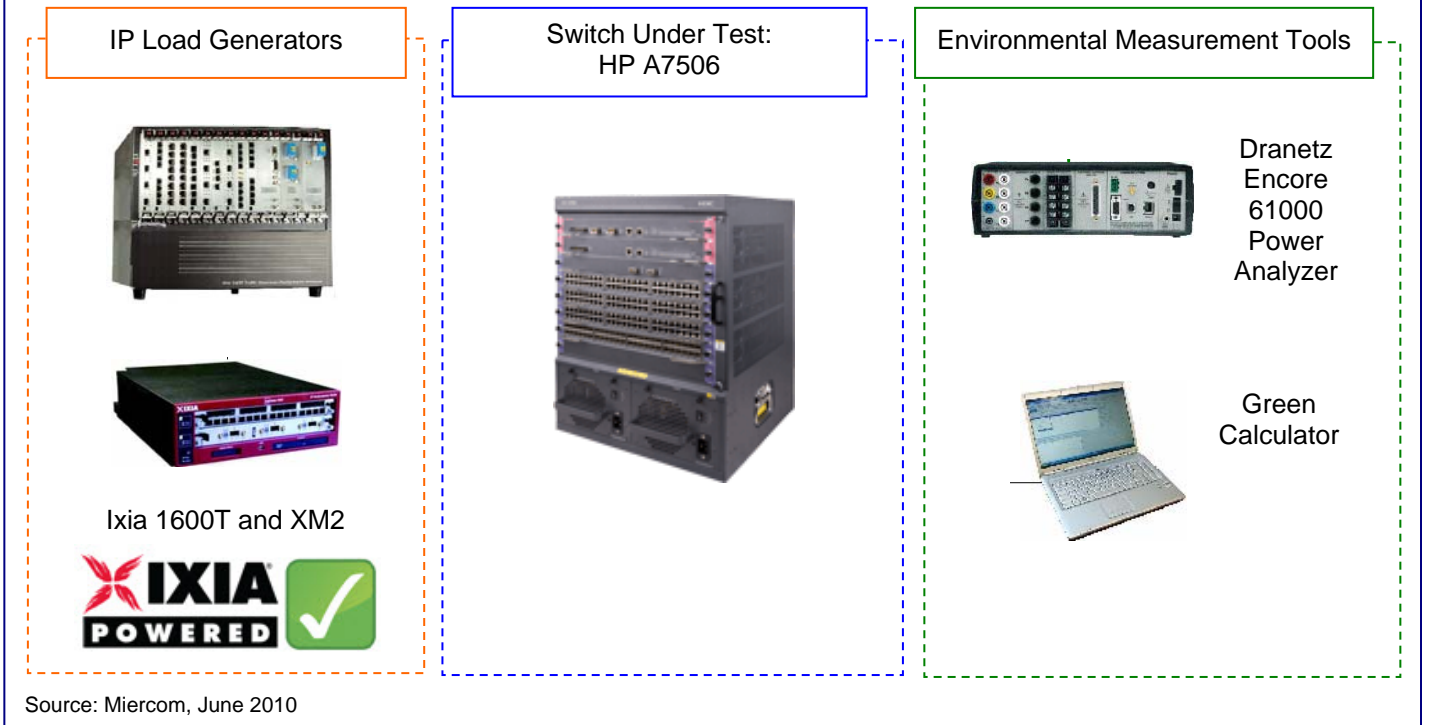
Figure 1: HP A7506 Annual Cost
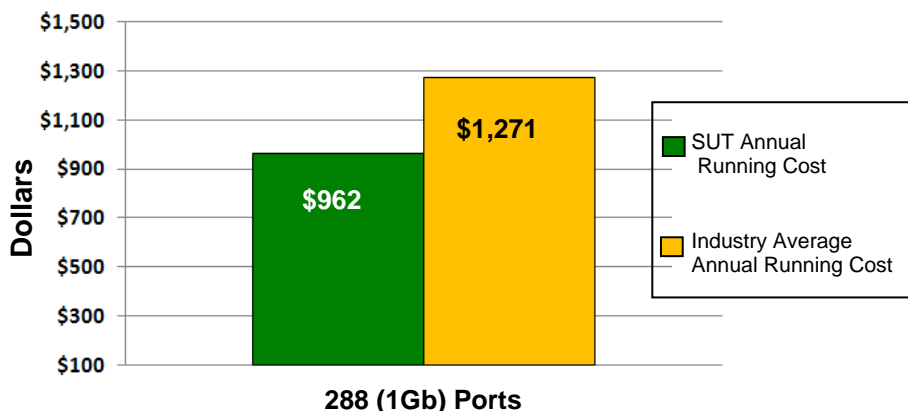
Source: Miercom, June 2010

Annual cost for the HP A7506 is $962. When compared to the Industry Average of $1,271, there is an average savings of 24%, based on typical usage of 12.5 cents per Kw/hr. Chassis equipped with fully redundant power supplies. For more details, see the Business Case on page 7.

*The HP products referred to in this publication were developed and sold by 3Com, which was acquired by HP in April 2010. The original report, *3Com Switch 7906E*, can be found under 3Com at www.miercom.com.

Test Bed Diagram

IP Load Generators	Switch Under Test: HP A7506	Environmental Measurement Tools

Ixia 1600T and XM2

Dranetz Encore 61000 Power Analyzer

Green Calculator

Source: Miercom, June 2010

How We Did It

Hewlett-Packard A7506 was evaluated for environmental impact by looking at the individual components as well as features and capabilities. Testing was performed at HP offices in Marlborough, MA and focused on the power consumption and efficiency of the product. A full audit was additionally 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 audit results with site survey assessments. The A7506 was configured and tested with dual power supplies, each at 1400W AC, a hot-swappable nine fan tray module, two LSQ1SRPB0 management modules on slots one and two, and six LSQ1GV48SC0 modules with 48 10/100/1000 Base-T ports each, totaling 288 ports.

Measuring Power Consumption: The power consumption of the A7506 was measured by varying the traffic load and CPU utilization. Power consumption was measured with a Dranetz Encore 61000 Power Analyzer from Dranetz-BMI (www.dranetz-bmi.com). The SUT was loaded with traffic at various rates and packet sizes in accordance with RFC 2544 Benchmarking Methodology for Network Interconnect Development.

Power consumption measurements were taken during system boot-up, with two power supplies until it reached an idle state. Power consumption of the A7506 chassis was measured, while running Layer 2 and Layer 3 traffic with an XM2 and 1600T traffic generators from Ixia (www.ixiacom.com), to obtain a full environmental reading spectrum with a mix of traffic at different processor utilization rates. Additional power supplies were incrementally added. Measurements were taken at both 110 and 220 volts. Frequency was also tested at 50Hz and 60Hz to test actual power provided in other countries. All measurements were taken under Normal conditions which signify a temperature of 24 degrees Celsius, atmospheric pressure in the range of 850 to 1070 mbar, and relative humidity from 30 to 75 percent.

Ixia is 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 for Layer 2-3 routing and switching traffic and IxLoad for Layer 4-7 application traffic.

Environmental Analysis: Miercom's environmental review of the Hewlett-Packard A7506 also entailed an examination of the Hewlett-Packard company-wide and product-specific environmental impact reduction efforts. Analysis includes comparisons to industry averages for competitive products that were also tested.

page 7, under Business Case. HP A7506 is designed with flexible, resilient architecture for deployment at the enterprise core, with distribution to edge applications.

The A7506 provides a total of eight slots, supporting 48 10/100/1000 Base-T ports, which are upgradeable to PoE. Up to 16 10G SFP ports can be supported, but without PoE. Two slots are dedicated for use by the redundant management modules. Four power supplies, two each of external and internal, are provided for redundancy.

The HP A7506 has a 2.4 Tbps backplane, providing scalable and enhanced performance and for future expansion capability.

Power Efficiency

Figure 2 below illustrates the power profile for the A7506. Measurements of power consumption were monitored and recorded for the A7506 while in various operational states – boot-up, idle, and with 70% and 100% loads. Both 110V and 220V were measured and as expected a 5 to 10 watt improvement resulted with 220V at 50Hz, compared to 110V at 60Hz. The total boot-up cycle took 5 minutes, 24 seconds. The chassis

uses 28.3 watts with no activity and increases to 845.7 watts at idle. With 100% maximum load applied, 889.7 watts was recorded.
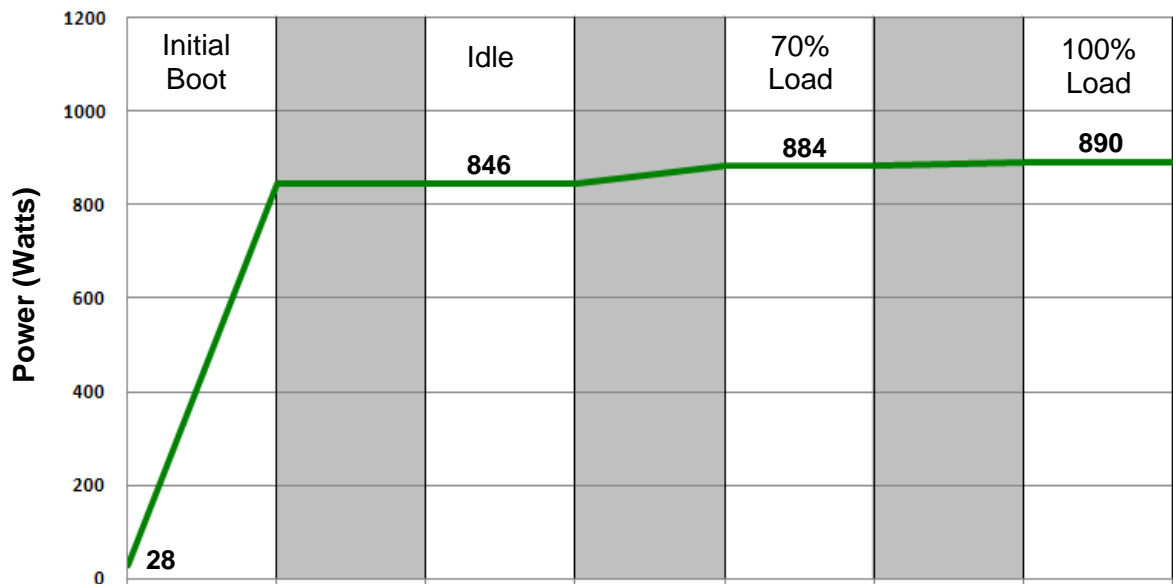
For continuous network operation, the A7506 is designed with redundant load sharing included in management modules, a hot swappable and redundant fan module, and four power supplies (DC or AC). There are nine variable-speed cooling fans on the switch, in a 3x3 configuration. If one fan fails, an alarm is displayed, and the remaining two fans will continue cooling on that row. In addition, when device utilization is minimal, the A7506 will automatically lower the fan speed thereby using less power.

The A7506 is configured with two internal power supplies, and also supports two external power supplies which provide redundant power to switch ports and PoE to limited external devices.

Power Consumption

During the power profile test for the HP A7506, shown in *Figure 2* below, we recorded the power measurements, with links connected. When both power supplies and all modules were turned off, 28.3 watts usage was recorded. Each power supply requires 14.1 watts while

Figure 2: HP A7506 Power Profile

	Initial Boot		Idle		70% Load		100% Load

Power (Watts) — axis: 1200, 1000, 800, 600, 400, 200, 0

846   884   890

28

Source: Miercom, June 2010

Power Profile shows the power draw as the HP A7506 is brought on line through maximum throughput, with uplink modules enabled. Results are based on 120V supply, between 70% and 100% loads.

dormant. Once all modules were loaded on the chassis, and both power supplies were turned on, the boot-up cycle took 5 minutes and 24 seconds to achieve idle state, without power spikes. Using 120V at 60Mhz, once idle state was reached, the power gradually increased to 845.7 watts and the maximum CPU utilization of 45% registered during the boot-up cycle.

While using 220V at 60Hz, 838.7 watts was recorded during idle. When we used power equivalent to the European standards of 220V at 50Hz, power consumed increased to 839.8 watts.

Figure 3 below compares the energy used by the A7506 to the Industry Average (IA) when applying various levels of Layer 2 traffic. The A7506 consistently used less power. With 100% load, 889.7 watts was used, compared to 1,140.7 watts for IA, a 23% reduction. At 70% load 884.2 watts was recorded compared to an IA of 973.0 watts, equaling 10% less. While at idle, a 10% reduction was noted, with 845.7 watts for HP vs. 931.2 watts for IA.

Figure 4 on page 5 shows the comparison of Watts/Gbps on different size frames. The A7506 uses 22% to 24% less Watts/Gbps when compared to the IA. Since small frames require more header activity, switching of small (64 Byte) frames requires more watts than the large (1519 Byte) frames.

Product Efficiency

The Hewlett-Packard A7506 GUI interface provides remote administration of basic network switch functions. Traffic port status, port configuration, firmware version, as well as, power and fan status can be monitored by the administrator. *Figure 5* on page 6 shows a sample screen shot of the GUI. Tabs allow choice of views and filtering options to facilitate management of the network and underlying switches.

Management of devices is now consolidated and centralized with Intelligent Management Center (IMC). IMC Enterprise Edition supports up to 10,000 managed devices. While managing and monitoring traffic, IMC is capable of detecting network problems including CPU issues, memory, and bandwidth utilization. It can be configured to generate alarms based on customizable events and rules. Status reports are available for all network devices. Downloadable reports are available in many common formats: CSV, PDF, Excel and others.

Administrators can deploy network configuration changes to multiple devices while using the bulk configuration function through IMC. Used in conjunction with bulk backup and restore feature, IMC offers enhanced control for firmware and configuration upgrade processes. Other features include Access Control List (ACL) management, which provides effective policy-base security, and QoS; and network traffic analysis which delivers a clear view of network usage including NetStream and SFlow data.

Encrypted management capability is included by SSH for Command Line Interface (CLI) access, HTTPS for web access, and SNMPv3 for secure

Figure 3: HP A7506 Power Consumption

Source: Miercom, June 2010
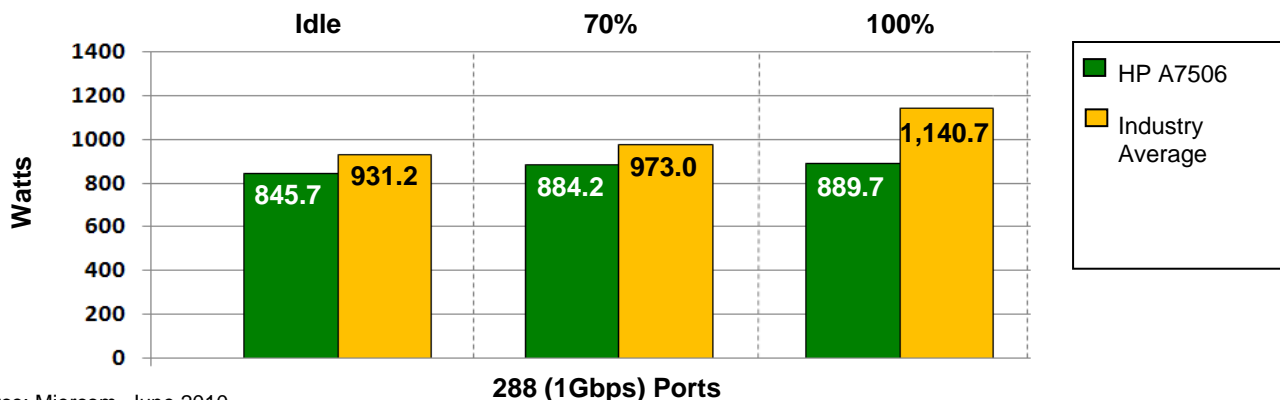
Power consumption was measured at idle, 70% and 100% throughput with Layer 2 traffic. The results for the A7506 are compared to the Industry Average on the graph. A decrease of 23% was recorded for the HP A7506.

access to the IMC management application. Processor queuing mechanisms prevent denial of service (DoS) attacks, and ACL restricts users to authorized areas on the network.

The HP A7506 delivers advanced security including user and device authentication, policy-based Access Control Lists (ACLs), encrypted protocol headers and system management access. The switch supports IEEE 802.1X Network Login and RADIUS, allowing the administrator to control access to a single port, and manage VLAN and MAC address authentication for enhanced network security.

With its modern ASICs, the A7506 provides distributed switching technology for demanding applications. Using high-reliability technologies such as non-stop forwarding (NSF) and ring network protection, the A7506 can improve productivity and ensure maximum uptime, thereby reducing total cost of ownership (TCO).

The HP A7506 has a hot swappable fan module that spans the full height of the chassis, holds nine variable speed fans in a 3x3 configuration. Each row of fans has the ability to provide cooling to the

respective section of the chassis, as well as to provide cooling even with one fan out on a single row. This allows maximum redundancy, easy replacement and maintenance, minimizing costs.

The internal and external power supplies on the HP A7506 are hot swappable and upgradeable and provide power redundancy; reducing operational costs and power consumption, while extending the service life of the equipment.

LEDs are located on the front of the internal power supply. Each power supply has LEDs which indicate input power, power status, and a display for Redundant Power Supply (RPS) status. Even when the power is set to "off," power continues to be supplied to the A7506. Management module LEDs provide throughput traffic status on crossbar switching.

Each Management module also provides 384 Gbps crossbar switching. The secondary management module, in addition to providing redundancy, can double bandwidth and provide load balancing. We verified that the A7506 can operate with a single management module, in the event the primary module fails.

Figure 4: Power Efficiency Watts/Gbps HP A7506
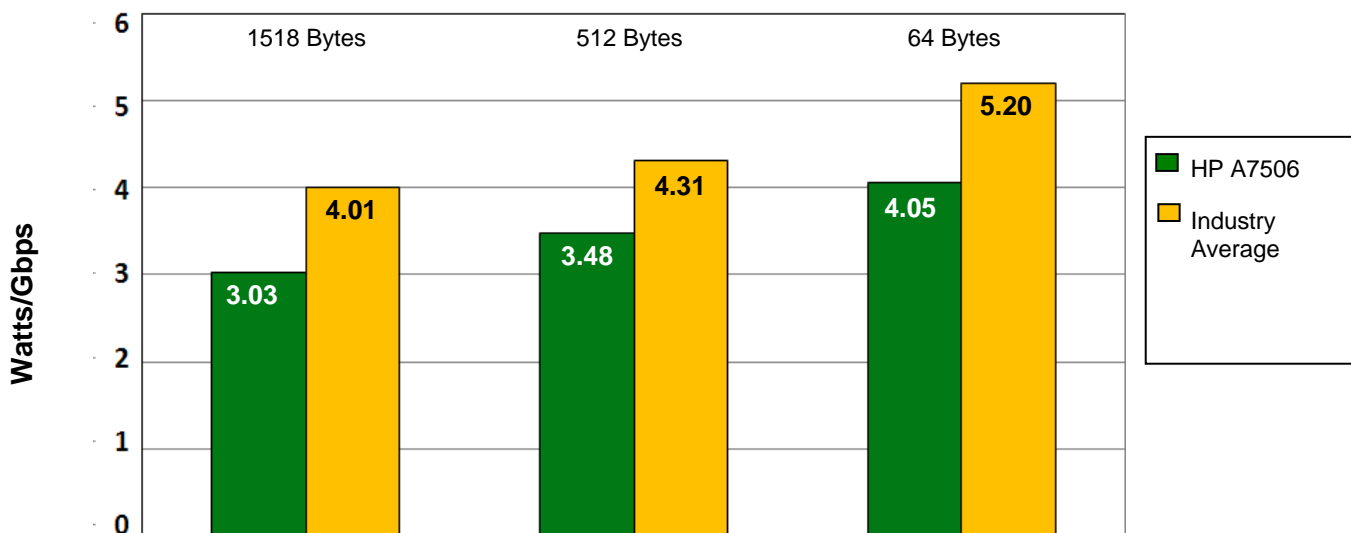
Source: Miercom, June 2010

A comparison of Watts/Gbps on different size frames, the A7506 uses 22% to 24% less Watts/Gbps when compared to the Industry Average.

Manufacturing

All Hewlett-Packard products are designed with the latest silicon technology. The A7506 uses 90nm technology (90 billionths of a meter transistors), providing enhanced performance without increasing power usage. Innovations in reducing current leakage enable processors to support a 35% increase in speed that is counter-balanced by a 60% reduction in active power needs.

Hewlett-Packard uses texture mapping rather than printing, electroplating or bronzing, to reduce materials used. Recyclable materials are utilized whenever possible in component manufacturing. Additionally, sea rather than air transportation is HP's preferred choice for global distribution of products, which reduces overall impact on the environment.

HP has a one year warranty, providing coverage for the complete unit including power supplies and fans during the warranty period.

Business Processes

By reducing the physical dimensions of their products, Hewlett-Packard strives to reduce landfill waste. Package simplification design, as well as paperless documentation is now available online, further reducing materials used and facilitating recycling activities.

HP demonstrates their commitment to the environment when planning and designing HP facilities and operations. Hewlett-Packard implements recycling and waste reduction programs, energy management systems for controlling light and heat, a global print-on-demand system for marketing and sales materials, eliminating and reducing waste. HP employs technologies that enable employees to work remotely, reducing travel and damaging emissions.

IMC, by controlling multiple devices remotely from a central location, allows the management and administration of all devices on the

---

Figure 5: GUI and Central Manager Interfaces
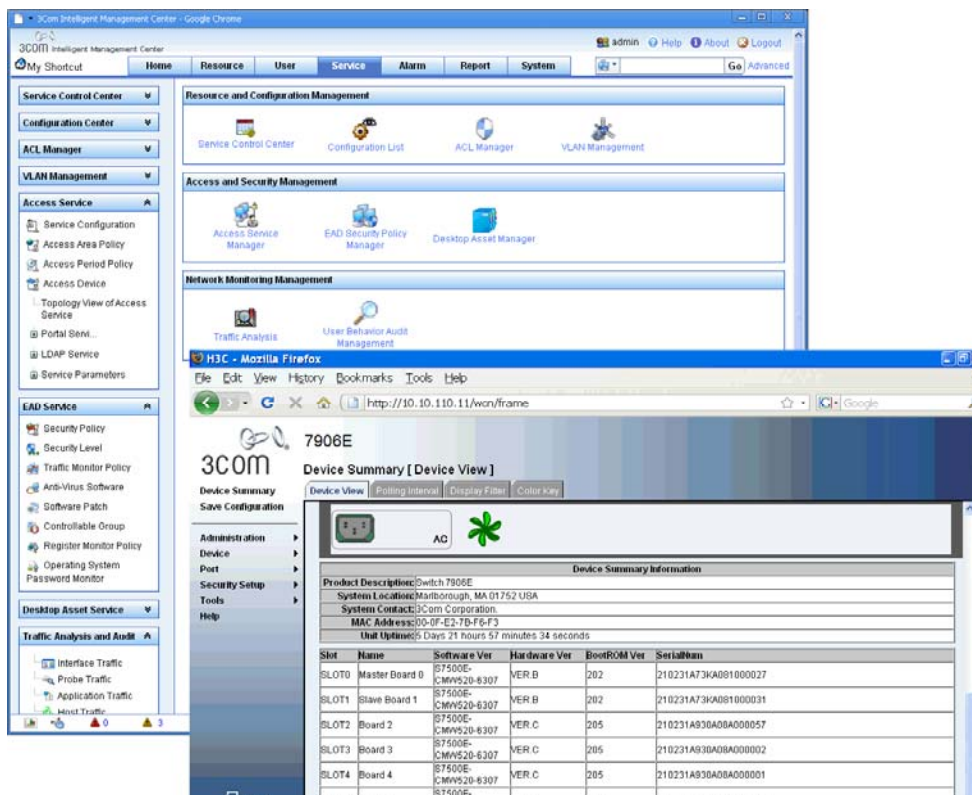
IMC provides centralized management to multi-switch networks. The upper screen shot shows IMC service applications such as ACL manager, VLAN management, User Behavior Audit management, EAD security policy manager and traffic analysis.

Lower screen shows status of power and fans. Other information on this tab includes specific product information such as up-time, hardware version, device and serial number, physical location and MAC address.

Source: Miercom, June 2010

---

network. Remote backup, mass configuration deployment and other similar functions can all be performed without traveling to various locations. Carbon foot print is again being reduced.

Green Innovation

The HP A7506 complies with Restriction of Hazardous Substances (RoHS) directives that restrict the use of certain hazardous substances in electrical components such as cadmium, hexavalent chromium, lead, and others.

Furthermore, HP products that ship to China comply with the China Ministry of Information Industry Order #39, Administrative Measures on the Control of Pollution Caused by Electronic Information Products, referred to as China-RoHS.

Hewlett-Packard enforces guidelines for removing hazardous substances and complies with the Waste Electrical and Electronic Equipment (WEEE) initiative. WEEE ensures that manufacturers are responsible for the disposal and recycling of their products.

In addition to reducing power consumption, heat generation and cooling requirements, the built-in dual speed cooling fans run at a lower speed and reduce the amount of energy that fans consume. The switch is capable of supporting 104°F or 40°C. The dual speed fans operate at higher temperatures and the system detects when fans are needed at lower speeds, thereby reducing power usage.

Affiliations and Standards

As an active member of Energy Efficient Ethernet, Hewlett-Packard drives the standards for more energy efficient design and development. Hewlett-Packard is the founding sponsor and member of Green Grid. Hewlett-Packard is a strong proponent of standards based design, utilizing standards based Link Layer Discovery Protocol (LLDP), supporting dynamic power allocation, resulting in increased energy efficiency.

Hewlett-Packard products are compliant with RoHS and exceed the international standards. The affiliations mentioned help Hewlett-Packard to innovate based on "standards based design"

and point to the credibility Hewlett-Packard products and solutions have in the industry.

Business Case

Figure 1 on page 1 shows a $309 or 24% savings when compared to the Industry Average of other vendor switches tested.

Data from *Figure 2* on page 3 is used to calculate the average cost, since idle, 70% and 100% loads use more watts as the load increases.

The HP A7506 chassis is deployed in high-end enterprises and data center environments. They are also used for data storage and back-up. The estimated use is about 28 hours with a 100% load, 112 hours with a 70% load and will be in an Idle/Ready State for 28 hours per week.

To calculate the annual cost, multiply the kilowatts by total yearly hours, and multiply this result by the annual cost factor of 12.5 cents kWh. Watts are obtained from *Figure 2.*

Certified for Green

Miercom conducts environmental analysis on products using a holistic view, considering power efficiency and manufacturing. Power consumption and power efficiency are very important metrics for comparing products and are typically all that are discussed in other organizations' green reports. We believe a more comprehensive approach, which reveals true business case savings to customers for the other environmental benefits that a vendor's product may afford, is a better approach.

Competitive index with industry average is achieved by comparing measured results from products in a given class. The significance of this comparison is that it allows a single view of annual cost for power consumption of a product, and comparison information that will help the consumer understand if the evaluated product affords an overall advantage for power efficiency.

Vendors with similar products that are included in the Industry Average for this report include Extreme Networks, Foundry Networks, Juniper Networks, Cisco Systems and other manufacturers.

Miercom Certified Green

The energy-saving attributes of the Hewlett-Packard A7506 was 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 Hewlett-Packard, Miercom confirms that the HP A7506 is designed to provide enterprise customers effective and environmentally sound networking and datacenter solutions.

HP A7506

Hewlett-Packard Company
3000 Hanover Street
Palo Alto, CA
www.hp.com
1-650-857-1501

About Miercom's Product Testing Services

Hundreds of product-comparison analyses have been published over the years in such leading network trade periodicals as Network World, Business Communications Review - NoJitter, Communications News, xchange, Internet Telephony and other leading publications. Miercom's reputation as the leading, independent product test center is unquestioned.

Miercom's private test services include competitive product analyses, as well as individual product evaluations. Miercom features comprehensive certification and test programs including: Certified Interoperable, Certified Reliable, Certified Secure and Certified Green. Products may also be evaluated under the NetWORKS As Advertised program, the industry's most thorough and trusted assessment for product usability and performance.

Before printing, please consider electronic distribution