Lab Testing Summary Report

May 2009

Report 090521

Product Category:

Power Efficient Ethernet Switches

Vendor Tested:

3Com

Product Tested:

3Com Switch 4800G 24-Port and 48-Port

and

H3C 5500-EI

Key findings and conclusions:

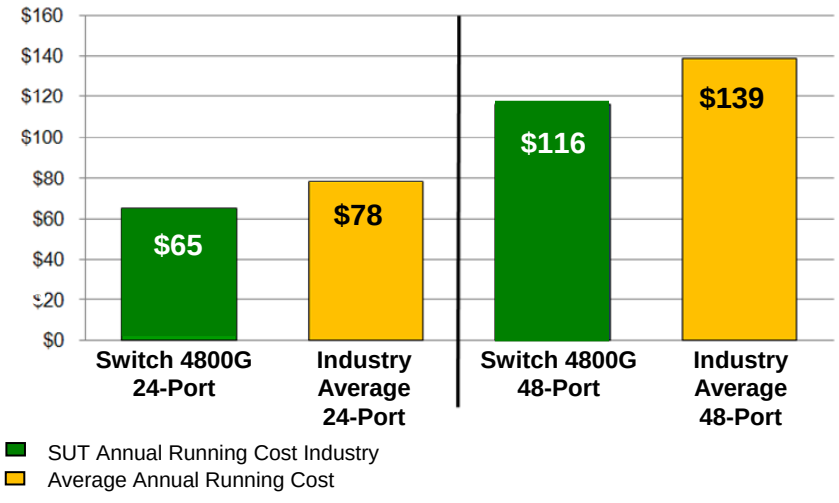
- **Up to 40% more efficient, depending on model, than comparable products based on Industry Average (Watts/Gbps)**
- **IMC management module reduces travel costs by providing centralized remote administration**
- **Operates in environments up to 45ºC or 113ºF; requires little or no AC, reduces energy cooling costs**
- **Provides enhanced security using ACLs and queuing mechanisms; prevents Denial of Service (DoS) attacks**

3Com Switch 4800G/H3C 5500-EI 24-Port and 48-Port switches were 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 Switch 4800G provides to their customers.

Switch 4800G models proved in hands-on testing and by an independent audit to afford customers an energy-efficient switching solution. 3Com delivers a standards-based network solution, providing energy-efficient products that help to reduce costs, and minimize the environmental impact.

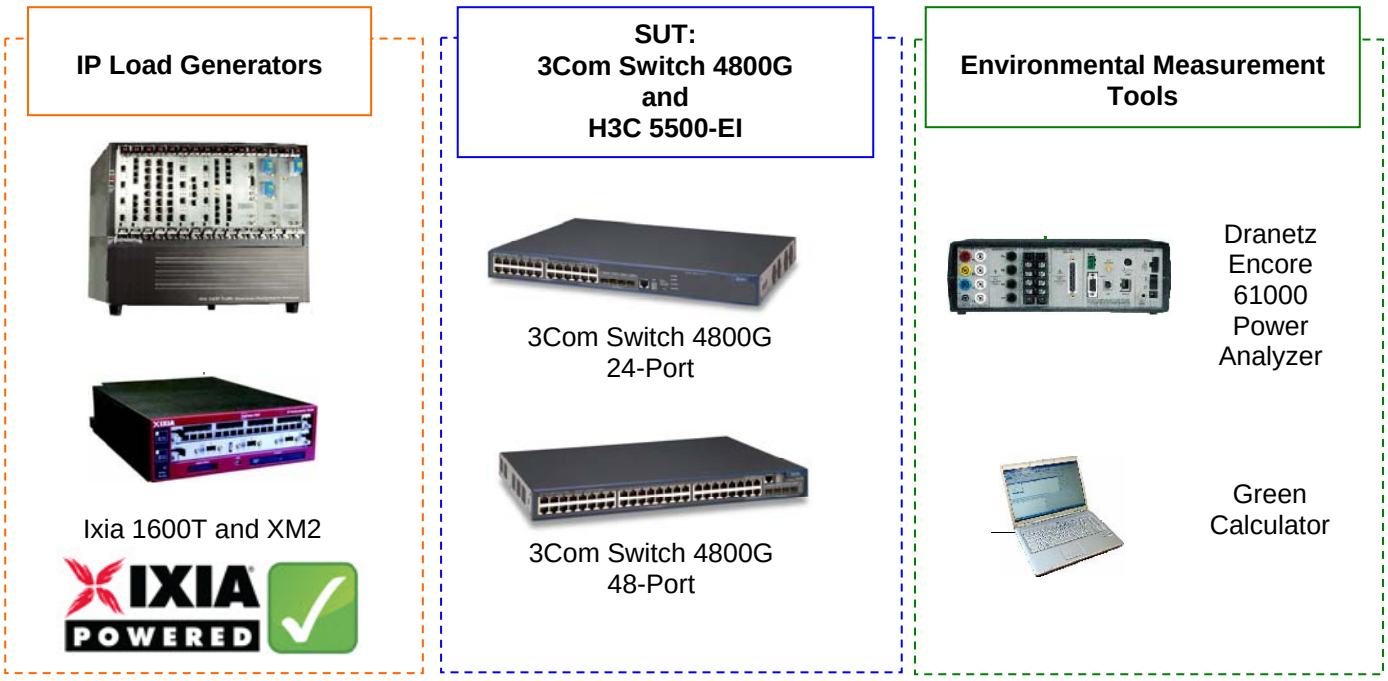
Both 3Com Switch 4800G models are 1U stackable switches, designed with a fixed 24 or 48 port configuration, four dual personality ports, and up to four optional 10G uplink ports. The Switch 4800G are designed with one internal power supply and built-in dual-speed fans. Switch 4800G can provide savings of 17% per year, as shown in Figure 1. The annual cost of the 3Com switch is $65 for 24 ports, and only $116 for the 48 port model. *(continued on page 3)*

Figure 1: 3Com Switch 4800G 24-Port and 48-Port Annual Cost



Annual cost for the Switch 4800G 24-Port is $65 and $116 for 48-Port. When compared to the Industry Average of $78 and $139, there is an average savings of 17%, for the 24-Port and 48-Port models, based on typical usage of 12.5 cents per kWh. For more details, see the Business Case on page 7.

Test Bed Diagram



How We Did It

The 3Com Switch 4800G/H3C 5500-EI 24-Port and 48-Port models were evaluated for environmental impact by looking at the individual components as well as features and capabilities. Testing was performed at 3Com headquarters in Marlborough, MA and 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 device was conducted for power consumption at idle and under load, as well as verifying audit responses with actual observations. The Switch 4800G models were configured and tested using the 24 10/100/1000 and 48 10/100/1000 Base-T ports. We also tested power consumed by the four dual personality ports, which can increase the capacity of the switch to 52 ports. Additionally, we tested the four 10G uplink ports, located on the back of the switch.

Measuring Power Consumption: The power consumption of the Switch 4800G models 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, idle, and with throughput. Power consumption of the Switch 4800G models was then measured, while running Layer 2 throughput traffic with an XM2 and 1600T traffic generators from Ixia (www.ixiacom.com). Traffic was applied to each of the 1 Gbps ports while stressing the product with the features it supports. Power measurements were taken at both 110 and 220 volts. Frequency was also regulated at 50Hz and 60Hz to test actual power provided in other countries.

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 3Com Switch 4800G models also entailed an examination of the 3Com company-wide and product-specific environmental impact reduction efforts. Analysis includes comparisons to industry averages for competitive products in the same class that have been previously tested.

(continued from page 1) Explanation of the metrics used is on page six, under Business Case.

3Com Switch 4800G/H3C 5500-EI models are designed for maximum flexibility and reliability, supporting 48 or 24 10/100/1000 port configurations, with four additional dual personality ports for expansion, and up to four 10G (XFP) uplinks or 10G (CX4) ports, for copper and fiber core network connectivity.

Power Efficiency

Figure 2 below illustrates the power profile for 3Com Switch 4800G 24 and 48 port models. Measurements of power consumption were monitored and recorded for the Switch 4800G while in various operational states – boot-up, idle, and connected to active links. 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 initial system boot power consumption is 0 watts for both Switch 4800G models. The power for Switch 4800G 24-Port increases to 58.8 watts as idle state is reached, and once maximum throughput is applied, power consumption increases to 60.9 watts.

The initial boot-up power consumption for the Switch 4800G 48-Port increases to 104.3 watts as idle state is reached. The total boot-up cycle took two minutes, 13 seconds. Power consumption increases to 108.5 watts, once maximum 64-Byte traffic load throughput is applied. Total power usage reached 88.9 watts on the Switch 4800G 24-Port and 136.5 watts on the 48-Port model. This measurement was recorded after the uplink modules were connected and all four 10G (XFP adapters) ports were in use. Each of the uplink modules consumed 14 watts.

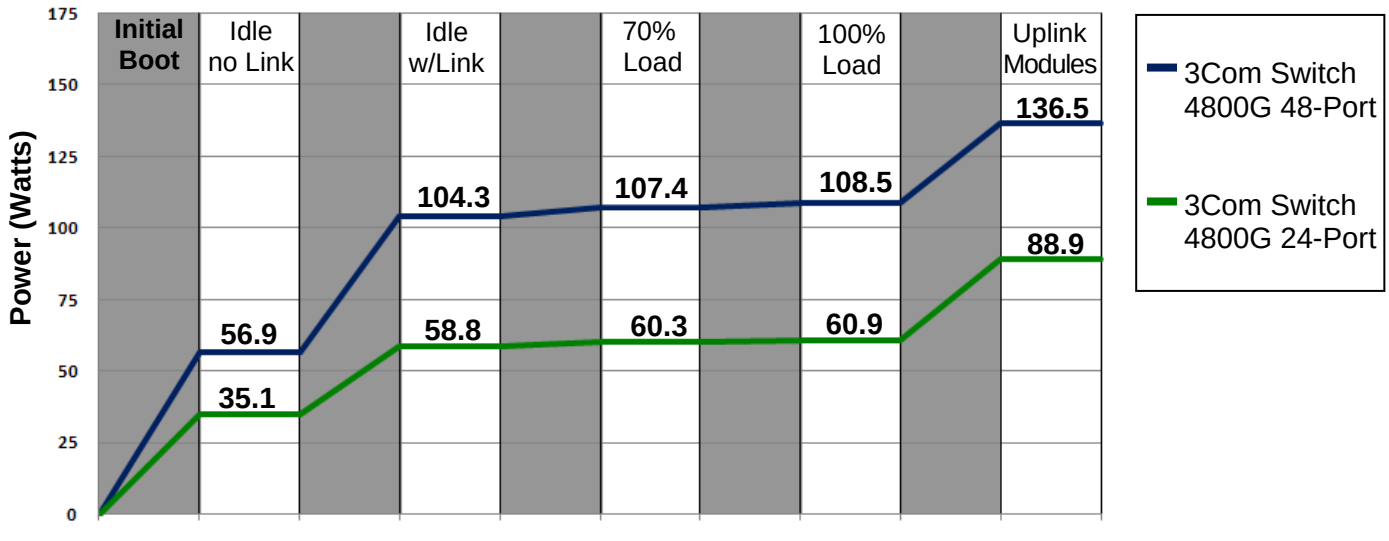
3Com Switch 4800G/H3C 5500-EI) models have the ability to use an external redundant DC power supply. An adapter or brick is required to use this feature. 3Com switches can use adapters from Eaton Powerware, 3Com and H3C RPS.

There are three built-in dual-speed cooling fans on the switches. When device utilization is minimal, Switch 4800G will automatically adjust the fan speed thereby using less power.

Power Consumption

During the power profile test for the Switch 4800G 24-Port and 48-Port switches, shown in Figure 2, we also recorded the power measurements, with no links. Using 120V at 60Hz, the boot-up cycle on both switches took two minutes and 13 seconds to achieve idle state, without power spikes. A maximum CPU utilization of 12% registered during the boot-up cycle. The power gradually increased to 35.1 watts for the 4800G 24-Port switch and 56.9 watts for the 4800G 48-Port switch, for idle with no links. When port link was established, idle state was reached. Once connectivity was established to each 1-Gbps port, power increased to 58.8 watts for the 24-Port model and 104.3 watts for the 48-Port model. When both uplink modules were connected

Figure 2: 3Com Switch 4800G 24-Port and 48-Port Power Profile



Power Profile shows the watts as the 24-Port and 48-Port switches are brought on line through maximum throughput, with uplink modules enabled. Note the power usage remains relatively static and increases when uplink modules, (two uplinks and one 10G XFP) were connected. Results are based on 120V supply, between 70% and 100% loads.

to the switch, power consumption increased by 19.1 watts and after the four SFP adapters were added to the uplink modules, power increased an again by 8.6 watts, for a total of 27.8 watts. When the SFP adapters were interconnected, power increased only by an additional 0.06 watts.

When 220V at 60Hz was used, power increased 0.64 watts compared to idle state at 120V, 60Hz. When using power equivalent to European standards of 220V at 50Hz, power consumption increased by 0.01 watts compared to idle state at 220V at 60Hz.

Figure 3 below and Figure 4 on page 5, compares the energy used by 3Com switches to the Industry Average (IA) when applying various levels of Layer 2 traffic.

With the 24-port Switch 4800G consistently used less power. With 100% load 60.9 watts was used, compared to 83.9 IA, a **27%** reduction. At 70% load 60.3 watts was recorded compared to 74.6 watts IA equaling **20% less.** While at idle, a **12%** reduction was noted, with 58.8 watts for 3Com vs 67.2 watts IA.

Reduced power consumption was similarly recorded for the 48 port model. At idle, 3Com used 104.3 watts, while IA was 109.9 watts – for a **5%** decrease. 70% utilization provided **21%** reduction with 107.4 watts compared to 135.6 watts. With maximum throughput, 3Com used 108.5 watts and IA is 176.3 watts, an amazing **38%** reduction.

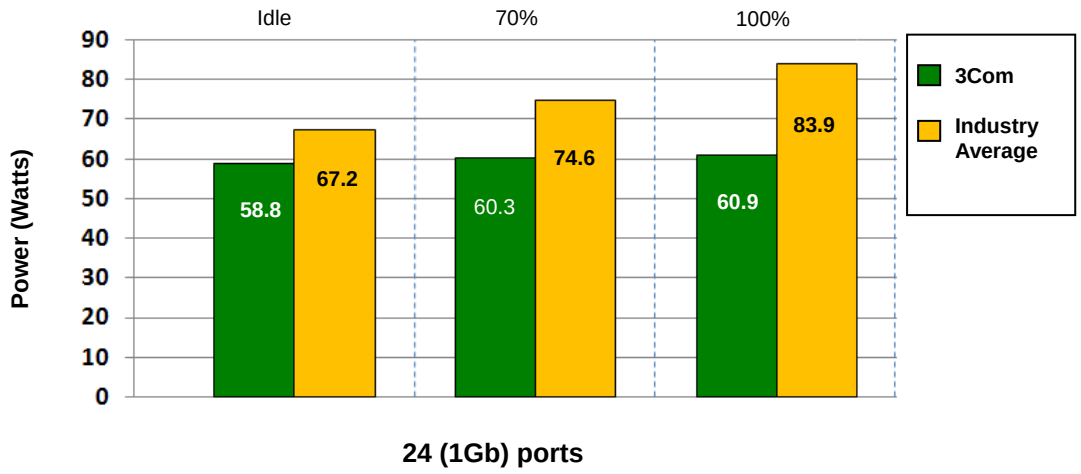
Product Efficiency

The Switch 4800G GUI interface provides basic network switch functions which can be administered remotely. Traffic port status, port configuration, firmware version, as well as power and fan status are monitored by the administrator. Figure 5 on page 5 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) from 3Com. 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 for the 3Com Switch 4800G. Status reports are available, including any devices connected to the switch. The reports are downloadable in many common formats, CSV pdf, Excel and others.

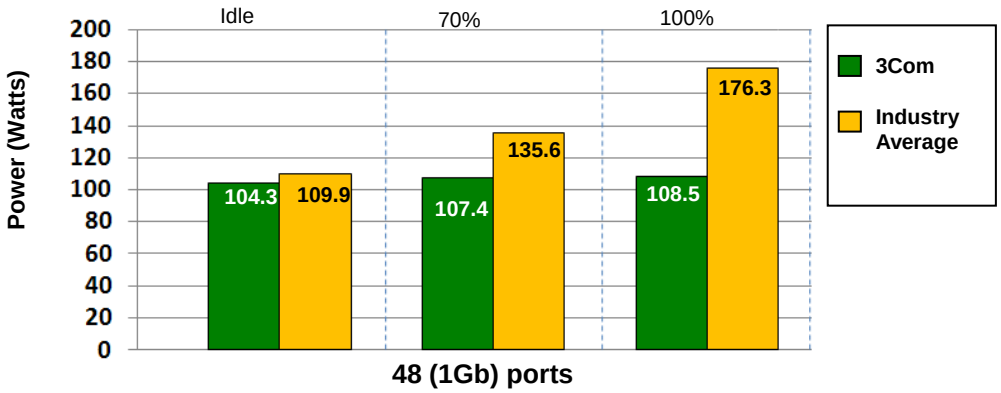
Bulk configuration function provides administrators with the ability to deploy network configuration changes to multiple devices. When used with bulk backup and restore feature, it offers enhanced control for firmware and configuration upgrade processes. Other features of IMC include Access Control List management, which provides effective policy-base security, and QoS; and network traffic

Figure 3: 3Com Switch 4800G 24-Port Power Consumption



Power consumption was measured at idle, 70% and 100%, throughput with Layer 2 traffic. 3Com results are compared to the Industry Average on the graph. A 20% decrease was recorded for Switch 4800G 24-Port model.

Figure 4: 3Com Switch 4800G 48-Port Power Consumption



Power consumption was measured at idle, 70% and 100%, throughput with Layer 2 traffic. The results for 3Com are compared to the Industry Average on the graph on the right. A decrease of 21% was recorded for Switch 4800G 48-Port model.

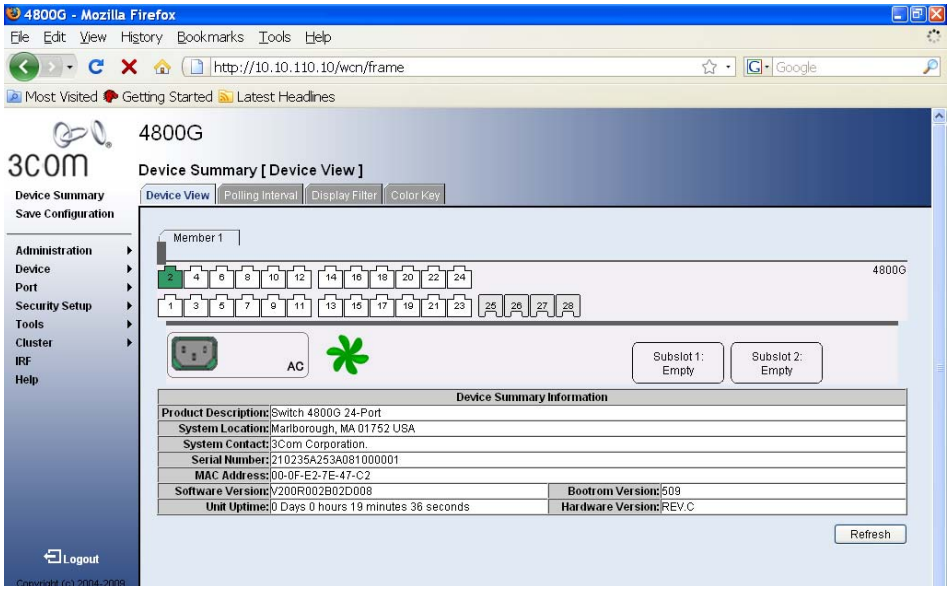
analysis which delivers a clear view of network usage including NetStream and SFlow data.

Encrypted management capability is included by SSH for Command Line Interface (CLI) access, HTTPS for web access, and SNMPv3 for secure access for the IMC management application. Processor queuing mechanisms prevent denial of service (DOS) attacks, and ACL restricts users to authorized areas on the network.

With three dual-speed built-in fans, 3Com Switch 4800G regulates the heat generated when the switches are operating at varying speeds, reducing energy costs. Additionally, as explained on page 3, the Switch 4800G features a redundant external DC power supply, providing continuous power operation to the switch, in the event the primary power supply fails.

In addition to reducing cooling requirements, the Switch 4800G models are designed with four dual personality ports, offering a flexible switch network solution. The last four ports on the 48-port range can be used as an RJ45 connection or a 1GE SFP for fiber connectivity. Both switches can have two uplink modules. Each module can support two 10GE adapters for fiber connectivity.

Figure 5: 3Com Network and Switch Management GUI



GUI 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.

A multifunctional LED indicator displays power and switch status. An additional Locate LED indicator shows the device number of the stackable group, used for troubleshooting. There is also a Redundant Power Supply (RPS) status indicator.

Manufacturing

All 3Com products are designed with the latest silicon technology. The Switch 4800G 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.

3Com also uses texture mapping rather than printing, electroplating or bronzing to reduce materials used product manufacturing. Recyclable materials are utilized whenever possible in component manufacturing. Additionally, sea rather than air transportation is 3Com's preferred choice for global distribution of products, which reduces overall impact on the environment.

3Com has a Limited Lifetime Warranty, providing coverage for the complete unit including power supplies and fans during the warranty period.

Switch 4800G is designed and manufactured with the 90nm silicon technology increasing performance without increasing power usage. The silicon technology delivers a 35% increase in processor speed, while reducing active power needs by 60%.

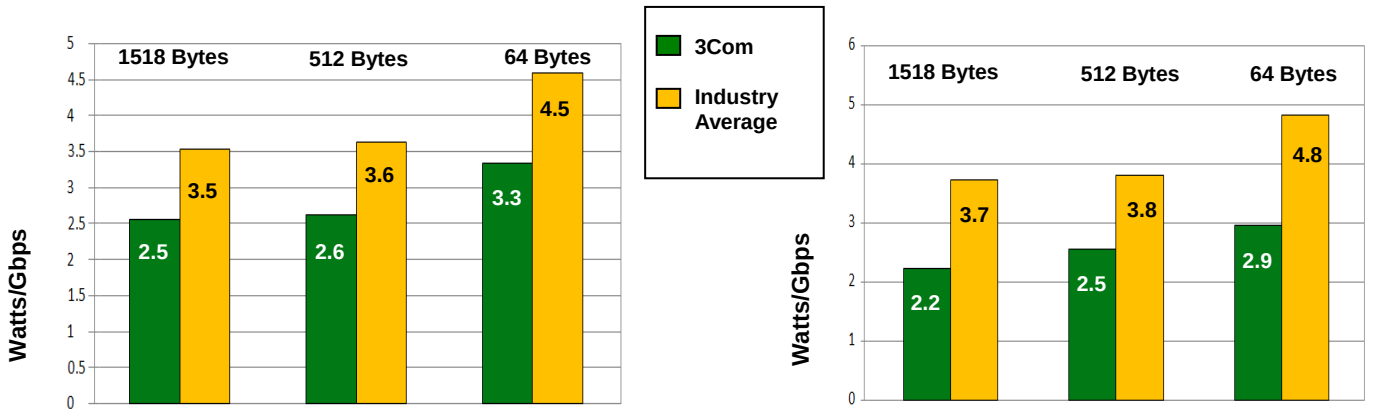
Business Processes

3Com strives to reduce landfill waste, by reducing the physical size of their products and simplified packaging. Paperless documentation is now available online, further reducing materials used and facilitating recycling activities.

3Com demonstrates their commitment to the environment when planning and designing 3Com facilities and operations. 3Com 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. 3Com employs technologies that enable employees to work remotely, reducing travel and damaging emissions.

IMC controls multiple devices from a central

Figure 6: Power Efficiency Watts/Gbps 3Com Switch 4800G



A comparison of Watts/Gbps on different size frames, 3Com Switch 4800G 24-Port uses 28% less Watts/Gbps when compared to the Industry Average. Results are based switch power consumption without uplink modules installed.

A comparison of Watts/Gbps on different size frames, 3Com Switch 4800G 48-Port uses 40% less Watts/Gbps when compared to the Industry Average. Results are based switch power consumption without uplink modules installed.

remote location, allows the administration of all devices on the network. Remote backup, mass configuration changes and other similar functions can all be performed without traveling to various locations. Carbon foot print is again being reduced.

Green Innovation

3Com Switch 4800G/H3C 5500-EI 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, 3Com 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.

3Com enforces guidelines for removing hazardous substances and comply with the Waste Electrical and Electronic Equipment (WEEE) initiative. WEEE ensures that manufactures 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 113^{o}F or 45^{o}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 a Contributing Member of the Green Grid, 3Com is involved in efforts to standardize methods for measuring energy efficiency. Through membership, 3Com is able to vote on initiatives that compliment participation in the IEEE 802.3 Ethernet working group's activities, especially its IEEE P802.3az Energy-efficient Ethernet Task Force. As an ENERGY STAR partner, 3Com is part of a global effort to help customers realize money savings and protect the environment through energy-efficient products and practices.

3Com products comply with both the European Union's RoHS and China-RoHS directives, which regulates and restricts the use of hazardous materials in the manufacturing of electrical and electronic products.

Business Case

In Figure 1, there is an annual savings of $13 for the 3Com Switch 4800G 24-Port and $23 for the 3Com Switch 4800G 48-Port annually, as compared to the Industry Average which is based on other vendor switches previously tested. A 17% cost savings was realized for both models.

Data from Figure 2 is used to calculate the average cost, since idle, 70% and 100% loads use more watts as the load increases. These numbers are used in the IA and 3Com comparison.

The annual running cost is based on the assumption that the switch will be used 16 hours/five days per week. During those 80 hours, approximately 16 hours will be running at 100% load, while the remaining 64 hours run at 70% load. Weekends and the remaining eight week day hours are considered as Idle/Ready State, for a total of 88 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 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 that a more comprehensive approach, which reveals true business case savings to customers for the other environmental benefits 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 to 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 (IA) for this report include Extreme Networks, Hewlett-Packard, Foundry Networks, Juniper Networks, Cisco Systems and other manufacturers.

Miercom Certified Green

The energy-saving attributes of the 3Com Switch 4800G/H3C 5500-EI 24-Port and 48-Port was evaluated by Miercom in accordance with the Certified Green Testing Methodology. These products 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 responses provided by 3Com, Miercom confirms that the 3Com Switch 4800G/H3C 5500-EI are designed to provide enterprise customers effective and environmentally sound networking and datacenter solutions.

3Com Switch 4800G 24-Port/
H3C 5500-EI

3Com Switch 4800G 48-Port/
H3C 5500-EI

3Com
www.3com.com
350 Campus Drive
Marlborough, MA 01752-3064

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.

Product names or services mentioned in this report are registered trademarks of their respective owners. Miercom (Mier Communications, Inc.) makes every effort to ensure that information contained within our reports is accurate and complete, but is not liable for any errors, inaccuracies or omissions. Miercom is not liable for damages arising out of or related to the information contained within this report.