Network Energy Efficiency: Cisco Review and Results

Overview

In today's business, when considering energy efficiency and power consumption in the context of networking and communications equipment, two areas are in sharp focus:

- The effects on overall expense
- The resulting environmental footprint

The path to green IT begins with devices that operate efficiently. But what is more important is how these devices work together to create systems and environments that result in lower greenhouse gas emissions. At Cisco®, the approach to green IT is to design and build best-in-class energy-efficient networking devices that support multiple services. This helps ensure that individual devices—and the network as a whole—operate efficiently through service and device consolidation. From there, these devices and networks are used to create communications systems that promote even greater energy efficiencies and green rewards by changing business behavior and creating opportunities for sustainable operations.

Energy Efficiency

The concept of energy efficiency evolves as new standards are established in the industry and regulatory compliance is enacted. At the most basic level, power utilized or watts consumed are the basic factors. More advanced and comprehensive analysis measures power consumed in relation to such factors as throughput capacities and service capabilities. By both basic and advanced measures, Cisco is fully committed to providing networking solutions that lead the industry in energy efficiency. In fact, Cisco switches were the first switches designated Miercom "Certified Green."

Confusion and distorted claims occur because there is no standard way in the industry to measure, report, and compare energy efficiency and power consumption across networking equipment—and even network-connected devices. Many companies, including Cisco, favor a conservative, responsible approach and report maximum power supply ratings. This approach helps ensure that planners are provided the worst case power-related guidance, including the appropriate safeguards. It is important to note these power maximums are rarely achieved during real deployments. As a result, the numbers are much higher than the actual power consumption of the installed and working device.Without measurement and reporting standards in place and full transparency of test scenarios, comparisons can lead to flawed conclusions.

Table 1 provides an example of an analysis comparing Cisco switches to Nortel switches under similar circumstances. A real-world deployment test scenario was used to simulate a typical day and night in Cisco's labs:

1. Switch installed, all links connected and operational; no traffic for 12 hours
2. Switch installed, all links connected and operational; 10 percent traffic applied to all ports for 12 hours

Table 1 Products Used for Comparison

Parameters	Cisco Model	Nortel Model
Core/distribution configuration: 24 ports 10GE, 48 ports GE SFP and 96 ports 10/100/1000 with redundant supervisors and power supplies	Cisco Catalyst® 6509	Nortel ERS 8610
Modular wiring closet Ethernet Switches: 2 Ports 10GE, 240 Ports 10/100/1000 PoE with redundant power supplies	Cisco Catalyst® 4507R-E	Nortel ERS 8310
Fixed Layer 2/Layer 3 wiring closet switches: 48 port 10/100/1000 PoE switch with 4 GE SFP uplinks supporting stacking	Cisco Catalyst® 3750E-48PD	Nortel ERS 5520-48T-PWR Nortel ERS 4548GT-PWR

Because the Nortel fixed switches only support a total of 48 ports, Cisco tested the same number of ports on all fixed switches for a true comparison. However, if you were to activate more ports in the above test scenario, you would see even better results for Cisco, since the tested switch with its single efficient power supply supports additional ports. A matching port configuration that requires either a second power supply or, worse yet, a second switch increases network power consumption dramatically.

It should also be noted that the Cisco Catalyst 3750E-48PD switch supports both GE or 10GE for uplink connectivity. When customers want to upgrade to 10 GE uplinks, they can easily do so without replacing their switches. This lowers the total cost of investment and minimizes waste through platform reuse.

Table 2: Product Comparison Results:

Model Switch	Power (Watts) Consumption as Tested	
	Links Enabled (idle)	Under Load
Cisco Catalyst® 6509E	**2,259**	**2,279**
Nortel ERS 8610[1]	1640.8[2]	-
Cisco Catalyst® 4507R-E	**658**	**658**
Nortel ERS 8310[1]	845[3, 4]	915[3, 4]
Cisco Catalyst® 3750E-48PD	**116.1**	**138.2**
Nortel ERS 5520-48T-PWR	137.0	137.1
Nortel ERS 4548GT-PWR	96.6	97.7

As shown in Table 2, the power consumption varies by switch. For example, the Cisco Catalyst 4507R-E uses less power than the Nortel ERS 8610 or Nortel ERS 8310. In addition, the Cisco Catalyst 3750E-48PD uses significantly less power than the Nortel ERS5520-48T-PWR when idle, and only 0.9 watts more with traffic. As a result, in a typical 24-hour period, the Cisco Catalyst 3750E-48PD will consume 237 fewer watts than the Nortel ERS 5520-48T-PWR. For an accurate assessment, comparisons need to be made between products with like usage as shown in Table 1.

Power Consumption Analysis

Cisco is continually innovating to achieve optimal energy efficiency and this effort shows in most real-world deployment scenarios. When looking for the most energy-efficient networking solution, you should also pay attention to the following considerations:

- Optimized power supplies—efficient and right-sized for the deployment
- Intelligent power management
- Maximizing of the number of PoE devices supported per switch
- Optimized use of power across the entire network
- Power consumption as it relates to networking services provided
- Features that can foster sustaining behaviors and operational practices

In some cases, a switch or router might draw more power but support more services that would otherwise need multiple devices and power supplies. For example, where Cisco uses more power is on the full-featured Cisco Catalyst 6509 Switch, which offers many additional services such as integrated security, application fluency, and resilience. However, even if those incremental services are not taken into consideration, the difference between operating a Cisco Catalyst 6509 Switch versus a Nortel ERS 8610 amounts to $1.01 per day using the US Department of Energy industrial average energy cost of $0.0684/kilowatt hour or €2.45 per day in Germany using the German average energy cost of €0.1654/kilowatt hour[5].

1 The power numbers for the corresponding Nortel ERS 8600 and ERS 8300 were derived by using Nortel's published power consumption numbers are per configuration manuals referenced in notes, 2, 3, & 4
2 Reference ERS 8600 Power: http://www142.nortelnetworks.com/techdocs/ERS8600_5_0/pdf/NN46205-303_02.01_INS.pdf
3 Reference ERS 8300 Fan Power: http://www142.nortelnetworks.com/techdocs/ERS8300_4_1/pdf/NN46200-309_01.01_CFG.pdf
4 Reference ERS 8300 Module Power: http://www142.nortelnetworks.com/techdocs/ERS8300_4_1/pdf/NN46200-305_04.01_INS.pdf
5 Calculation based on consumption: 4000 MWh/year maximum demand: 4000 kW, annual load: 6000 hours as derived from the Energy. EU web site, which showcases electricity cost comparison across Europe http://www.energy.eu/#industrial.

Beyond Power Consumption

While focusing on power consumption is a first step in evaluating the energy efficiency of networking devices, it is also important to take a holistic approach when using the network to achieve green practices and goals. Here, the services provided by the network—and networking devices—provide substantially higher gains by enabling sustainable operations and driving environmentally responsible business behaviors.

"When you are analyzing energy efficiency, it's not a strictly-by-the-numbers game. You need to also look at what you're trying to accomplish," explains Yankee Group's Zeus Kerravala, Senior Vice President, Global Enterprise Research. "The feature-rich Cisco switches deliver more functionality using the same or less power. This lets you get more done and rely on fewer add-on resources. And that adds up to greater efficiency."

For example, across the Cisco Catalyst switching portfolio there is a capability called Embedded Event Manager. This intelligent and programmable feature lets you power down parts of the network based on time of day. It can be used to shut down either ports or entire interface modules, which reduces the amount of power consumed by the switch during off hours. Additionally, it can report on clients that remain up during off hours, which allows for a change in culture to match the change in power. When coupled with Cisco's strategy of integrated services on routing and switching platforms, the energy savings start significantly adding up.

Green Business Behavior

Ultimately, business behavior will make or break the success of green IT. Technology will be the enabler; but it will be the change in people behavior and process that will result in the most gain. Using technologies such as Cisco TelePresence™ will dramatically reduce travel time, related energy consumption, and carbon footprint significantly. And, technologies such as the Cisco Virtual Office enable secure teleworking to help further reduce the employee carbon footprint. This results in less road congestion and fewer idle car engines—while offering employees more flexibility—with no loss in productivity.

As businesses embrace new, more responsible approaches to environmental sustainability, the likely outcomes are a positive overall effect, as well as a positive environmental effect. And to that effort, Cisco is committed to developing not only technologies that deliver best-in-class energy efficiency, but also systems that transform the way green IT is used to achieve higher-level, operational and environmental efficiency gains.

For more information, visit:

Network Systems: Enabling Green Practices: www.cisco.com/en/US/solutions/ns726/netsol_generic_enabling_green_practices.html

The Energy Efficient Data Center: www.cisco.com/en/US/solutions/ns708/networking_solutions_products_genericcontent0900aecd806fd493.html

The Green Grid: www.thegreengrid.org/home

Appendix

Tested comparative configurations

Qty	Description	Qty	Description
1	Cisco Catalyst 6509E chassis	1	DS1402001 Nortel ERS 8010 chassis
2	Supervisor 720-3C	2	DS1404066 Supervisor 8692SF w/SuperMezz*
2	WS-X6716 16 port 10GE module	2	8612XLRS 12 port 10GE modules
1	WS-X6708 8 port 10GE module		
1	WS-X6748-SFP 48 port GE SFP module	1	8648GBRS 48 Port GE SFP module
2	WS-X6748-GE-TX 48 port 10/100/1000 module	2	8648GTRS 48 Port 10/100/1000 module
2	WS-CAC-6000W 6000 watt power supply	3	8005DI AC 1,462 watt power supply
1	Cisco Catalyst 4507R-E chassis	1	DS1402007-E5 Nortel ERS 8310 chassis
1	DS1402007-E5 Nortel ERS 8310 chassis	1	DS1404099-E5 Supervisor 8394SF w/2 – 10GE
5	WS-X4548-GB-RJ45V-E 48 port 10/100/1000 PoE module	2	DS1404094-E5 48 port 10/100/1000 PoE module
2	PWR-C45-4200ACV 4,200 watt power supply	1	8301 AC power supply
1	Cisco Catalyst 3750E-48PD	1	AL1001*05-E5 Nortel ERS 5520-48T-PWR**
1	Cisco Catalyst 3750E-48PD	1	AL1001*05-E5 Nortel ERS 4548GT-PWR**

*Since the Cisco Catalyst 6500 Supervisor 720 supports IPv6, a decision was made to provide like functions within the Nortel ERS 8600 for a true comparison. Nortel modular switches require dual supervisor modules to provide full switching performance.
**Nortel ERS 5520-48T-PWR and ERS4548GT-PWR switches support 44 ports of 10/100/1000 and 4 combination ports capable of either 10/100/1000 or GE SFP for a total of 48 ports.

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