# TOLLY GROUP

# No. 208298

Nortel

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Test

Summary

# Converged Data Network Solution Evaluation of Energy Consumption and Projected Costs for a Converged LAN Campus, Data Center and WAN

**Premise:** With the growing emphasis on energy efficiency within enterprise networks, network managers need to understand the energy consumption of network switches, WAN routers and even IP phones at the desktop, and the related costs of operating that equipment in a network over an extended period.

Nortel commissioned The Tolly Group to evaluate a converged network infrastructure for enterprise users utilizing a wide array of Nortel switches, routers and IP phones to determine the energy usage at critical areas of deployment and to project the energy costs of operating the equipment over a five-year span.

Tolly Group engineers compared the energy consumption of the Nortel products, in terms of the power to operate the devices, as well as the power consumed in relation to heat dissipation. Results were compared with products from Cisco Systems, Inc.

Tolly Group engineers measured the energy usage (in terms of watts) for switch operation and heat dissipation for switches deployed in large- and medium-sized enterprise networks, in mid-sized companies, and enterprise branch offices. Engineers also tested IP phone endpoints from both companies.

Tests were conducted in May 2008.

# **Test Highlights**

Users can pay as much as 64% more in electricity costs to operate a Cisco core switch versus a comparable Nortel device:

- Nortel ERS 8600 uses 39% less energy than comparable Cisco Catalyst 6500s, helping to reduce data center operation costs
- Nortel IP Phone 1140E uses up to 40% less energy than the comparable Cisco Unified IP Phone 7961G-GE
- Branch offices can reduce network energy consumption by 25% with Nortel Secure Router versus Cisco ISR





Notes: 96 copper ports (48 Gigabit Ethernet ports and 48 Fast Ethernet ports) were connected. Cost projection is based on the 2006/2007 Average Commercial Electric Price of US\$0.0946 per kilowatt hour.

Source: The Tolly Group, May 2008

Figure 1

# Executive Summary

Nortel's Converged Data Solution, consisting of ERS 8600, 8300, 5520-48T-PWR, 4548GT-PWR switches and Nortel Secure Router 4134 consistently demonstrated that they use as much as 40% less energy than comparable Cisco devices tested and deliver considerable energy cost savings over a five-year deployment.

The Tolly Group's handson evaluation of Nortel's Converged Data Network Solution demonstrates that Nortel ERS switches and routers consistently consume less energy than Cisco devices tested.

Engineers measured the power consumed (watts) in an idle state with no ports active, and in an idle state with all ports active. No data traffic passed through the switches.

In a scenario with chassis-based switches used in large network cores, the Nortel ERS 8600 used an average of 1,072 watts, or 39% fewer than a Cisco Catalyst 6506 in both test scenarios with the devices running at idle state with and without cables connected. (See Figure 1.)

Nortel's advantage becomes more dramatic as the cost savings accrue over time. Engineers utilized the average energy usage to compute a projected five-year electric cost, using the 2006-2007 average U.S. commercial electric price. The Cisco large core switches tested cost US\$7,288 to power and cool over that five-year period, versus US\$4,444 for the Nortel devices — meaning users would spend almost 64% more to operate the Cisco switches.

The operational cost discrepancy really hits home when buyers begin to examine the Nortel savings applied across a broad enterprise network.

#### RESULTS

#### **CORE SWITCHES**

Tolly Group engineers measured the average watts consumed to operate a network

Five-Year Operational Costs for Nortel and Cisco Devices Tested								
Network Type	Product/Model	Idle state with no copper ports active			Idle state with copper ports active			
		Power consumption & heat dissipation (Watts)	Five-year operational cost (US\$)	Nortel power savings (%)	Power consumption & heat dissipation (Watts)	Five-year operational cost (US\$)	Nortel power savings (%)	Number of active ports
Large core	Nortel ERS 8006 with 8692SF, 8648GTR, 8648TX, two units of 8630GBR, two units of 8005AC power supply, fan tray	1,017.23	4,214.87	40.09	1,072.46	4,443.71	39.03	96 copper ports (48 GbE ports & 48 FE ports)
	Cisco Catalyst 6506 -E with two units of WS-SUP720-3B, WS-X6748-GE-TX, WS-X6248-RJ-45, WS-X6724-SFP, WS- X6748-SFP, 2 units of WS-CAC-2500W power supplies, fan tray	1,697.94	7,035.40		1,759.01	7,288.42		
Medium core	Nortel ERS 8300 with 2 units of 8348TX, 8324GTX, 8394SF, 2 units of 8301AC, fan tray	426.64	1,767.79	14.29	494.93	2,050.72	10.33	120 copper ports (24 GbE & 96 FE ports)
	Cisco Catalyst 4506-E with WS-X4516-10GE Supervisor Engine V-10GE, WS-X4424-GB-RJ45, two units of WS-X4148-RJ, 2800ACV power supply, 1300ACV power supply, fan tray	497.78	2,062.54		551.94	2,286.96		
Wiring closet switches	Nortel ERS 5520-48T-PWR	123.35	511.11	16.02	181.54	752.21	3.97	48 GbE copper ports
	Cisco Catalyst 3750-E PoE-48	146.87	608.57		189.04	783.28		
	Nortel ERS 4548GT-PWR	85.73	355.22	42.77	127.98	530.28	32.65	
	Cisco Catalyst 3560-E PoE-48	149.90	621.09		190.03	787.39		
Enterprise branch offices	Nortel Secure Router 4134 (two GbE copper ports and two GbE fiber ports) with MM-811E1 (total of eight 11/E1 ports), MM-21E-PoE (total of 24 FE ports), MM-1D53/CT3 (one T3/E3 port), PS-SR4K-600W-AC-POE, FAN-SR4K	140.82	583.49	27.76	151.51	627.79	25.48	8 T1/E1, 24 FE, 2 GbE, 1 T3/E3 ports
	Cisco 3845 Integrated Services Router (2 GbE copper ports and 1 GbE fiber port) with Cisco 3845-MIB (connected with four units of VWIC 2MFT-T1: total of eight T1 ports), NME- XD-24ES-1S-P (total of 24 FE ports and 1 GbE fiber port), MM-1DS3/E3 (one T3/E3 port), one power supply)	194.93	807.67		203.31	842.41		
IP phone	Nortel IP Phone 1140E				6.59	27.31	40.04	Two GbE
	Cisco Unified IP Phone 7961G-GE				10.99	45.54		copper ports

Detailed Analysis of Power Consumption and Projected Five-Year Operational Costs for Nortel and Cisco Devices Tested

Note: IP phone data was directly reported by the power measurement tool without including additional power to cope with heat dissipation. Source: The Tolly Group, May 2008 Figure 2

switch and to drive heat dissipation.

In a test of core switches used in "medium" size network cores, engineers found that a Nortel ERS 8300 used almost 495 watts versus 552 watts for a Cisco Catalyst 4506-E. In an idle state scenario with no cables connected, the ERS 8300 consumed 427 watts. In both scenarios, Nortel used from 10% to 14% less energy than the Catalyst 4506-E. (See Figures 2 & 3.)

The cost implications also swing in favor of Nortel. The ERS 8300 would cost US\$2,051 to operate over five years, or about US\$236 less per switch than the Catalyst 4506-E, which cost US\$2,287 to operate over five years.

The cost advantage of moving to Nortel becomes clear when users begin to multiply the Nortel cost savings across the number of network core switches.

#### WIRING CLOSET SWITCHES

Next, The Tolly Group examined a series of wiring closet switches designed to support midsize organizations and enterprise branch offices.

Engineers tested a Nortel ERS 4548GT-PWR and a Nortel ERS 5520-48T-PWR versus a Cisco Catalyst 3560-E PoE-48 and a Cisco Catalyst 3750-E PoE-48, respectively.

The Nortel energy savings was 16% to 43% less energy used when compared to Cisco, depending on the device and the scenario. (See Figs. 2 and 4.)

The five-year energy cost savings of the Nortel solution also is apparent. At idle state with no ports active, the Nortel ERS 4548GT-PWR costs just over US\$355 to operate over a fiveyear period, versus almost US\$621 to operate a Cisco Catalyst 3560-E PoE-48 over the same time period — or 75% more to power the Cisco device.

#### ENTERPRISE BRANCH OFFICES

Tolly Group engineers measured the power consumption of the Nortel Secure Router 4134 and the Cisco 3845 Integrated Services Router. Here, too, the Nortel energy and cost advantage was apparent.

The Nortel Secure Router 4134 consumed almost 152 watts, on average, versus almost 203 watts for the Cisco ISR 3845 meaning the Nortel Secure Router consumes about 25% less energy than its Cisco rival.

The five-year operational cost for the Nortel Secure Router was US\$628, while the Cisco ISR cost almost US\$842 — a savings of US\$214 for the Nortel router. While that may seem small on a per-switch basis, in the 5,000-user network example, with 25 WAN routers in use, the Nortel Secure Router 4134s cost US\$15,700 to operate over five years, versus US\$21,050 for the Cisco ISR 3845s, or about a 25% savings.

#### **IP PHONES**

Tolly Group engineers also measured the power consumed by Nortel IP Phone 1140E compared to Cisco Unified IP Phone 7961G-GE. Both devices drew power over Ethernet.

Both devices were measured in an idle state; the IP phone's external GbE switch ports were connected to the PoE GbE switch and a client PC.

Results showed that the Nortel 1140E used 6.59 watts while the Cisco 7961G-GE used 10.99 watts. (See Figure 2.)

Nortel

Nortel Converged Data Solution



Energy Efficiency and Five-Year Projected Energy Cost Savings

# Nortel makes "Green" a goal with customers

Energy-efficient network products can save significant amounts of money in annual energy costs based on the reduction in kilowatts/hours to power and cool user networks – which in turn reduces overall carbon emissions – helping to keep user environments clean.

It is rare that IT departments can make such a significant contribution to the environment. At Nortel we are working hard to provide value-add products and solutions to customers that address users ever-changing business and technology mandates.

Another innovative tool that is helping customers with this planning is the Nortel Energy Efficiency Calculator (NEEC).

NEEC provides network planners with a power consumption/ cooling modeling capability – this helps model the impact of current or planned network infrastructure deployments.

It enables network planners to plot "what-if" scenarios using different equipment in realworld deployments, enabling them to determine exactly what the trade-offs are in terms of energy consumption. Learn more at:

www.nortel.com/getthefacts

Source: Nortel, July 2008

### Average Power Consumption of Medium Core Switches with All Copper Ports Active, Plus Projected Five-Year Operational Costs in U.S. Dollars



Notes: 120 copper ports (24 Gigabit Ethernet ports and 96 Fast Ethernet ports) were connected. Cost projection is based or 2006/2007 Average Commercial Electric Price of US\$0.0946 per kilowatt hour.

Source: The Tolly Group, May 2008

# TEST SETUP & METHODOLOGY

Tolly Group engineers measured the power consumption on the Nortel ERS 8606 series running software 4.1.3 (with two units of 8692SF switch fabric, a total of four line cards (one 8648GTR, one 8648TX and two 8630GBR units), two units of 8005AC power supply and a fan tray).

Engineers also measured the power consumption of the ERS 8306 series running software 4.0.0.0 (one switch fabric of 8394SF, plus three line cards [one 8324GTX and two 8348TX units] plus two 8301 AC power supplies and a fan tray), and measured the ERS 5500 series running software 5.1.0, ERS 4548GT-PWR running software 5.0.1, Secure Router 4134 running software version 10.0 (one unit of each module: MM-8T1E1, MM-24FE-PoE, NM-1T3/E3, PS-SR4K-600W-AC-POE and FAN-SR4K). In addition, tests focused on the Nortel IP Phone 1140E (Ver. 02.00.06.00).

These Nortel devices were measured against comparable Cisco offerings: Cisco Catalyst 6506-E series running software 12.2(18) SXF7 (two WS-SUP720-3B supervisor engines. a total of four line cards: one WS-X6748-GE-TX, one WS-X6248-RJ-45, one WS-X6724-SFP, and one WS-X6748-SF, plus two WS-CAC-2500W power supplies and a fan tray), Catalyst 4506-E running software 12.2(37)SG (a WS-X4516-10GE Supervisor Engine V-10GE, a total of three line cards: one WS-X4424-GB-RJ45 and two WS-X4148RJ units, one 2800AC power supply, one 1300AC power supply and a fan tray).

Tests also focused on the Catalyst 3750-E PoE-48 running software 12.2(35)SE5, and the Catalyst 3560-E PoE-48 running software 12.2 (35) SE2, plus the Cisco ISR 3845 running software Cisco 3845-MIB IOS: 12.4(16) and NME-XD-24ES-1S-P IOS: 12.2(25)SEE3 (Cisco 3845-MIB with four units of VWIC 2MFT-T1, NME-XD-24ES-1S-P, NM-1T3/ E3 and a power supply), Cisco Unified IP Phone 7961G-GE (Firmware ver. SIP 41.8-2-2SR2S).

Figure 3

In the tests, engineers measured the power consumption of both vendor products at idle mode without cables plugged in and idle mode with all available ports connected.

For the power measurement of Nortel ERS 8600 series and Cisco Catalyst 6500 series, engineers used 96 copper ports (48 GbE ports and 48 Fast Ethernet ports). In tests of the ERS 8300 versus a Catalyst 4500, engineers used 120 copper ports (24 GbE and 96 Fast Ethernet ports). For tests with



the ERS 4500 and ERS 5500 series versus Catalyst 3560 and 3750 series, testers used 48 GbE ports.

Finally, for the Nortel Secure Router 4134 versus Cisco 3845 Integrated Services Router, engineers used eight T1/E1, 24 Fast Ethernet, two GbE and one T3/E3 ports. Engineers used an Amprobe ACD-14 FX Clamp Multimeter and P3 International Corporation P4400 Kill A Watt power measurement tools to record the power consumed.

Engineers calculated the estimated heat dissipation (or cooling) obtained from an article titled "Power and Storage: The Hidden Cost of Ownership – Storage Management," at:

#### Average Power Consumption of Secure WAN Routers & Projected Five-Year Operational Costs in U.S. Dollars



#### http://findarticles.com/p/articles/m i\_m0BRZ/is\_10\_2%203/ai\_11106 2988.

Engineers used the national average retail price of commercial electricity, sourced from Energy Information Administration of the Official Energy Statistics from the U.S. Government (US\$0.0946 cents per kilowatt hour, 1995 to 2006) to calculate the cost of operating a switch over five years.



The Tolly Group is a leading global provider of thirdparty valida-

tion services for vendors of IT products, components and services.



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#### Fair Testing Charter™ Interaction with Competitors

The Tolly Group invited representatives from Cisco Systems to participate in the test as per The Tolly Group's Fair Testing Charter. Representatives from Cisco did not respond to the invitation.



Nortel supplied the products under test to The Tolly Group; Cisco products were acquired through normal distribution channels. Default configurations were used for all tests since only power consumption was measured.

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