TEST REPORT

Tolly.

#210110
March 2010
Commissioned by Avaya Inc.
Testing conducted May 2008

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.

Avaya commissioned The Tolly Group to evaluate a converged network infrastructure for enterprise users utilizing a wide array of Avaya 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.

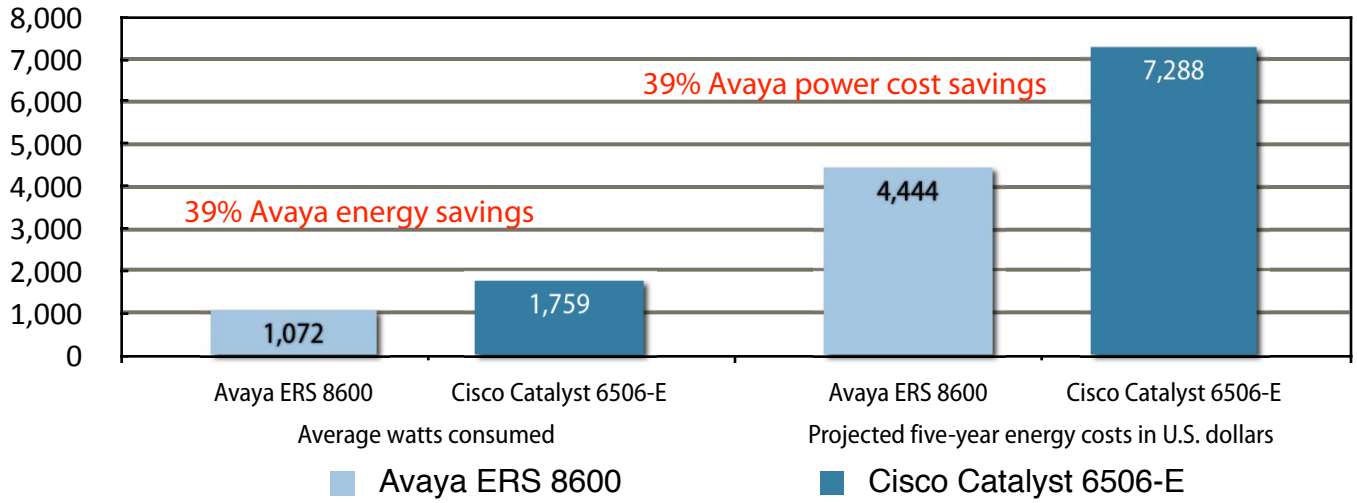
Tolly engineers compared the energy consumption of the Avaya products, in terms of the power to operate the devices, as well as the power consumed in relation to heat dissipation. Results were compared with products from Cisco Systems, Inc.

The Bottom Line

Users can save as much as 43% in electricity costs when operating Avaya switches versus comparable Cisco devices

1. Avaya ERS 8600 saves as much as 40% on power consumption versus comparable Cisco Catalyst 6500s, helping to reduce data center operation costs
2. Avaya IP Phone 1140E uses up to 40% less energy than the comparable Cisco Unified IP Phone 7961G-GE
3. Branch offices can save as much as 28% on power consumption with Avaya Secure Router versus Cisco ISR

Average Power Consumption & Five-Year Energy Costs of Core Switches with All Copper Ports Active (U.S. Dollars)



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

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.

Avaya's Converged Data Solution, consisting of ERS 8600, 8300, 5520-48T-PWR, 4548GT-PWR switches and Avaya 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 hands-on evaluation of Avaya's Converged Data Network Solution demonstrates that Avaya ERS switches and

Avaya Inc.

Avaya Converged Data Solution

Energy Efficiency and Five-Year Projected Energy Cost Savings

Tolly. Certified

Tested May 2008

Detailed Analysis of Power Consumption and Projected Five-Year Power Costs (U.S. 2006/2007 cost data) for Avaya and Cisco Devices Tested

Network Type	Product/Model	Idle state with no copper ports active			Idle state with copper ports active			Number of active ports
		Power consumption & heat dissipation (Watts)	Five-year power cost (US$)	Avaya power savings (%)	Power consumption & heat dissipation (Watts)	Five-year power cost (US$)	Avaya power savings (%)	
Large core	Avaya ERS 8006 with 8692SF, 8648GTR, 8648TX, 2 units of 8630GBR, 2 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 & 48 FE)
	Cisco Catalyst 6506 -E with 2 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	Avaya 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)
	Cisco Catalyst 4506-E with WS-X4516-10GE Supervisor Engine V-10GE, WS-X4424-GB-RJ45, 2 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	Avaya 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		
	Avaya 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	Avaya 4134 Secure Router (2 GbE copper and 2 GbE Fiber ports) with MM-8T1E1 (total of eight T1/E1 ports), MM-24FE-PoE (total of 24 FE ports), NM-1T3/E3 (total of 2 T3/E3 ports), PS-SR4K-600W-AC-POE, FAN-SR4K	140.82	583.49	27.76	151.51	627.79	25.48	8 T1/E1, 24 FE, 2GbE, 1 T3/E3 ports
	Cisco 3845 Integrated Services Router (2 GbE copper ports and 1 GbE Fiber ports) with Cisco3845-MIB (connected with four units of VWIC 2MFT-T1: total of 8 T1 ports), NME-XD-24ES-1S-P (total of 24 FE ports and 1 GbE fiber port), NM-1T3/E3 (total of two T3/E3 ports), one power supply	194.93	807.67		203.31	842.41		
IP phones	Avaya IP Phone 1140E	Not Applicable			6.59	27.31	40.04	Two GbE copper ports
	Cisco Unified IP Phone 7961G-GE				10.99	45.54		

Source: The Tolly Group, May 2008

Note: IP phone data was directly reported by the power measurement tool without including additional power to cope with heat dissipation.

Figure 2

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 Avaya 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.)

Avaya'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 Avaya devices — meaning users would spend almost 64% more to operate the Cisco switches.

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

Results

Core Switches

Tolly Group engineers measured the average watts consumed to operate a network switch and to drive heat dissipation.

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

The cost implications also swing in favor of Avaya. 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 Avaya becomes clear when users begin to multiply the Avaya 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 mid-size organizations and enterprise branch offices.

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

The Avaya 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 Avaya solution also is apparent. At idle state with no ports active, the Avaya ERS 4548GT-PWR costs just over US$355 to operate over a five-year 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 Avaya Secure Router 4134 and the Cisco 3845 Integrated Services Router. Here, too, the Avaya energy and cost advantage was apparent.

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

Avaya 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 Avaya we are working hard to provide value-add products and solutions to customers that address users ever-changing business and technology mandates.

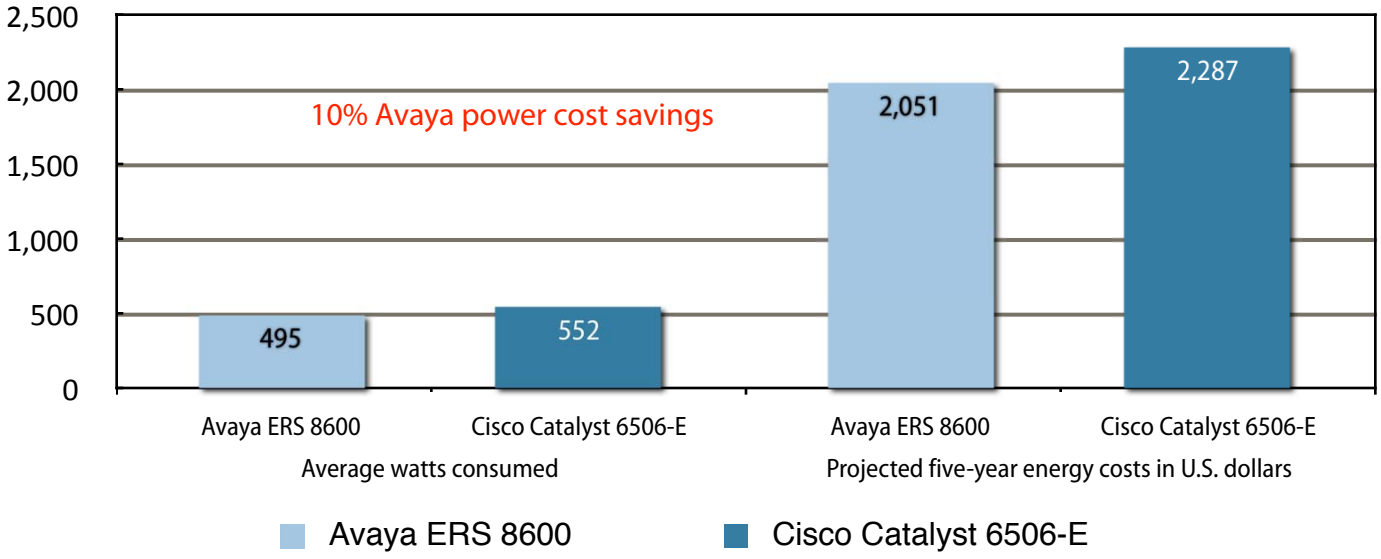
Another innovative tool that is helping customers with this planning is the Avaya Energy Efficiency Calculator.

This calculator 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 real-world deployments, enabling them to determine exactly what the trade-offs are in terms of energy consumption.

Source: Avaya, Inc

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



Notes: 120 copper ports (24 Gigabit Ethernet ports and 96 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 3

The five-year power cost for the Avaya Secure Router was US$628, while the Cisco ISR cost almost US$842 — a savings of US $214 for the Avaya 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 Avaya 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 Avaya 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 Avaya 1140E used 6.59 watts while the Cisco 7961G-GE used 10.99 watts. (See Figure 2.)

Test Methodology

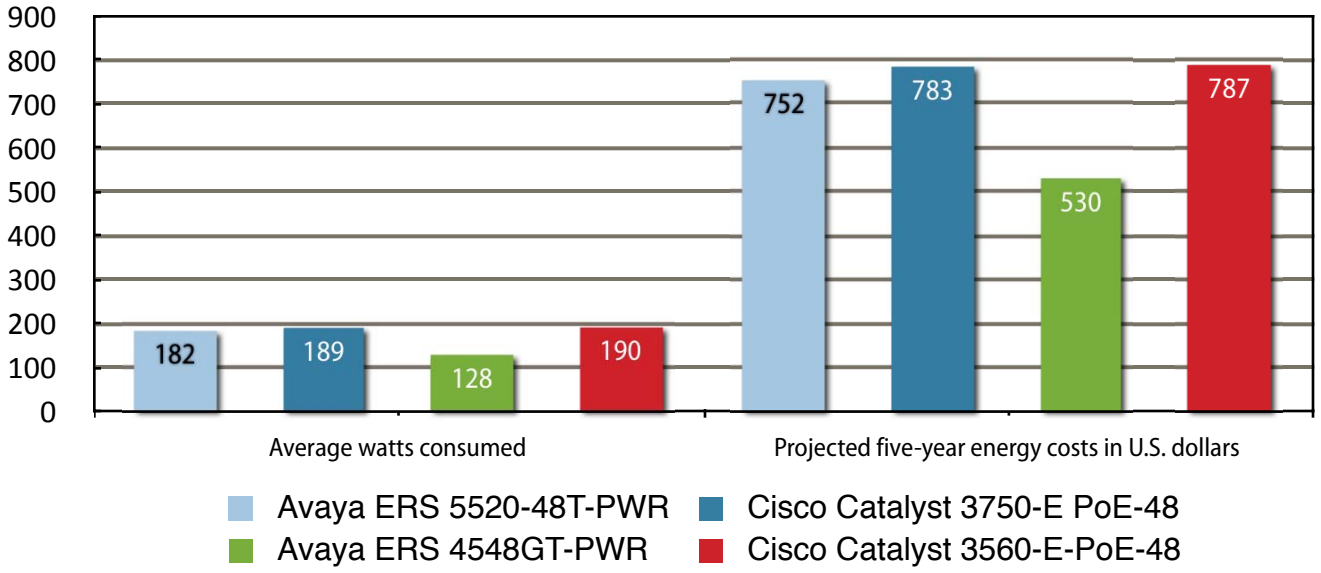
Tolly Group engineers measured the power consumption on the Avaya ERS 8606 series running software 4.1.3 (with two units of 8692SF switch fabric, a total of four line cards (one 8648GTR, one 8648TX and two 8630GBR units), two units of 8005AC power supply and a fan tray).

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 Avaya IP Phone 1140E (Ver. 02.00.06.00).

These Avaya 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

Average Power Consumption of Enterprise Wiring Closet Switches with All Coopper Ports Active Plus Projected Five-Year Power Costs in U.S. Dollars



Note: 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

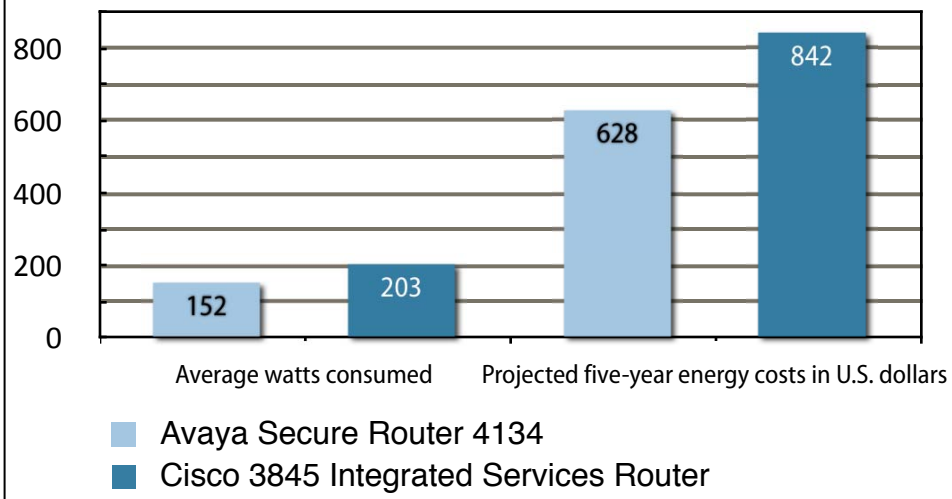
Figure 4

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).

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 Avaya 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

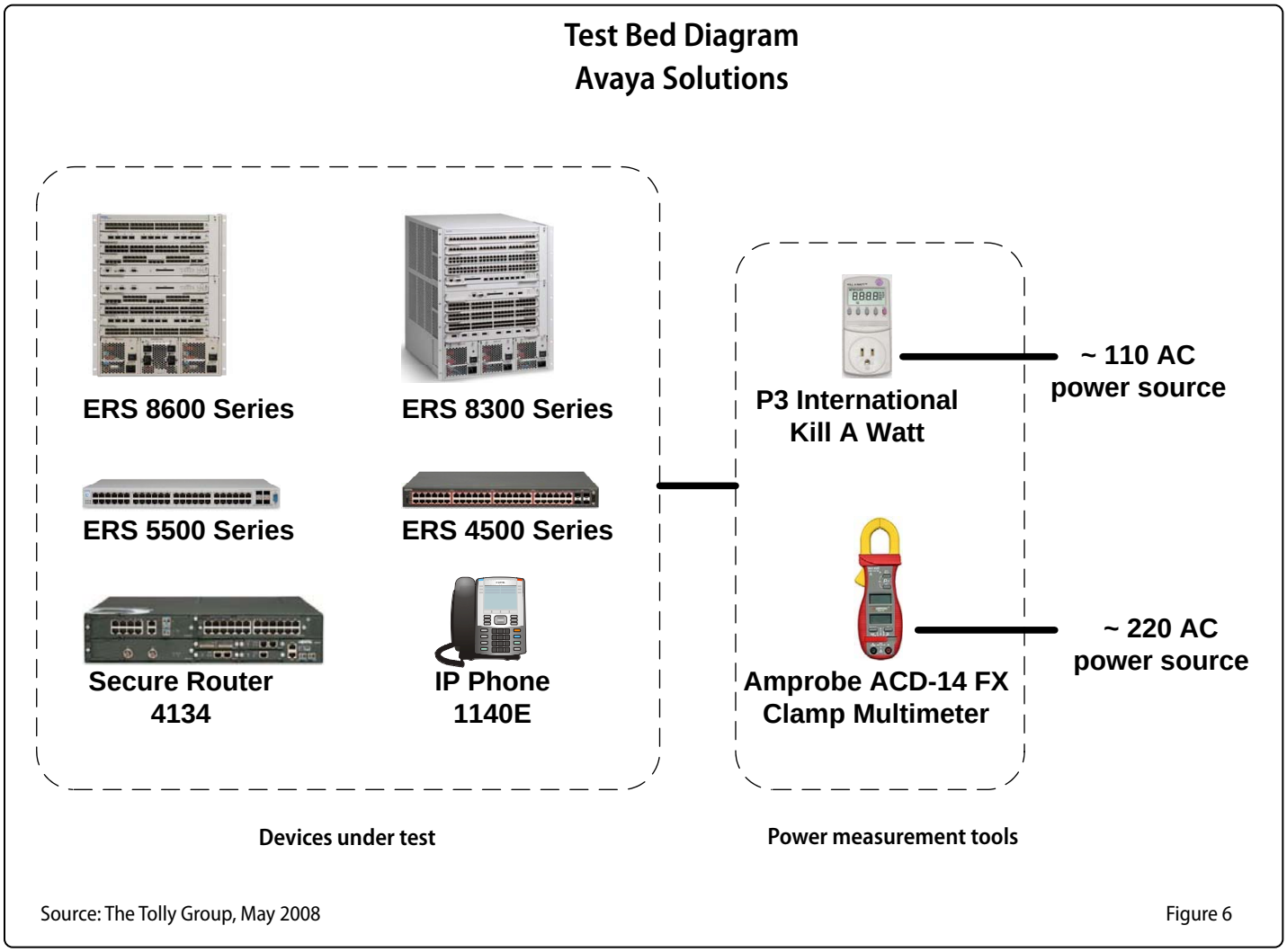
Average Power Consumption of Secure WAN Routers & Projected Five-Year Power Costs in U.S. Dollars



Note: All FE ports active, WAN ports idle. 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 5



Source: The Tolly Group, May 2008

Figure 6

Catalyst 3560 and 3750 series, testers used 48 GbE ports.

Finally, for the Avaya 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," that was published in October, 2003 in Computer Technology Review. The article discusses the importance of factoring in the power required to cool data center equipment. While the article is focused on storage, the discussion is directly relevant to data networking. The article can be found by searching on the title at:

http://findarticles.com

The author notes a high-efficiency air conditioning system would require .33 BTU to cool 1 BTU of heat. Thus, engineers used that number in the equations. (The author also notes that older air conditioning units will consume more power. Readers should reference the K-value of their units and modify the calculation accordingly.)

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 powering and cooling a switch over five years.

About Tolly

The Tolly Group companies have been delivering world-class IT services for more than 20 years. Tolly is a leading global provider of third-party validation services for vendors of IT products, components and services.
You can reach the company via E-mail at sales@tolly.com, or via telephone at +1 561.391.5610.

Visit Tolly on the Internet at:
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Competitive Interaction

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. Avaya 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.

For more information on the Tolly Fair Testing Charter, visit:
http://www.tolly.com/FTC.aspx

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