TEST REPORT

Tolly.

#209134
September 2009
Commissioned by Nortel

Nortel CS 1000 VoIP Solution: Power Consumption Evaluation versus Cisco MCS 7835 VoIP Solution

EXECUTIVE SUMMARY

As traditional phone systems continue to be replaced or migrated and VoIP systems become more and more prevalent, IT directors need to be sure their strategic investment decisions will benefit the company in both the short and long term.

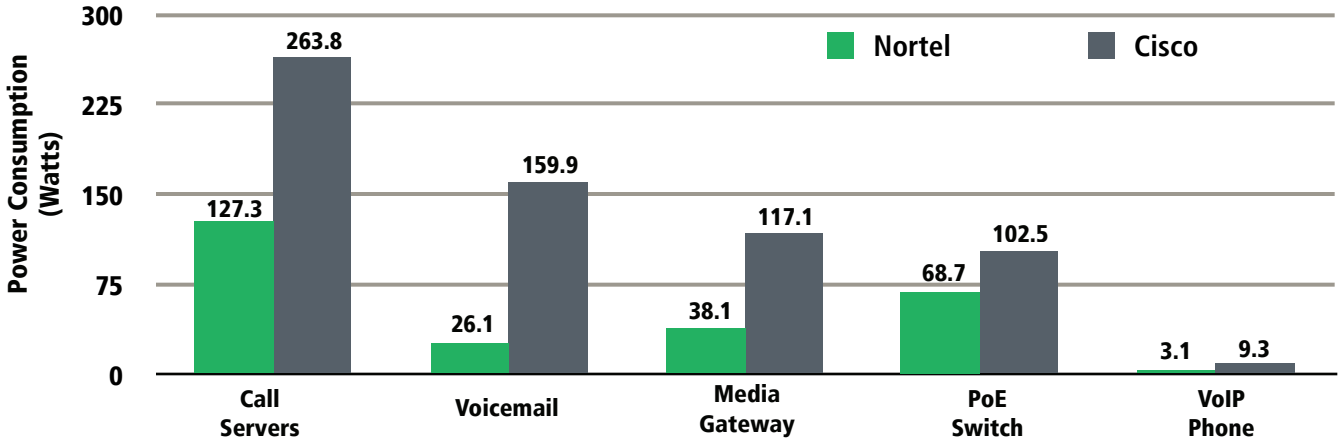
Nortel's VoIP solution components draw significantly less power than equivalent offerings from Cisco, while minimizing overall hardware needed on the infrastructure side. Lower power consumption has a cascading effect on HVAC, UPS systems, building CO_2 output and lowers overall operating costs.

THE BOTTOM LINE

1. Nortel IP Phone series is 3X more efficient than similar offerings from Cisco in an 'as-shipped' configuration
2. Nortel infrastructure components consume about 60% less energy than comparable offerings from Cisco
3. Nortel's chassis-based approach allows for hosting many features in a small, energy-efficient footprint
4. Nortel CS 1000 VoIP solution delivers significantly better energy efficiency than the comparable Cisco MCS 7835 VoIP solution

Average Power Consumption of VoIP Components by Function

Lower bars are better



Note: Idle power consumption reported. VoIP phone power draw averaged from four devices used in testing. High Availability configuration requires two redundant call servers and a voicemail server for Cisco, while Nortel's call server hosts voicemail.

Source: Tolly, June 2009

Figure 1

Test Results

Many elements of a VoIP solution remain dormant for the majority of the day, springing into action only when a call is made. For this reason, Tolly engineers monitored and recorded the power draw of all critical infrastructure components of of the Solutions Under Test (SUTs) in an idle state. These observations were then extrapolated to obtain the operational costs, power savings, and the resultant CO_2 emission savings for a 1,000-user deployment. See Figure 2 below for the key results.

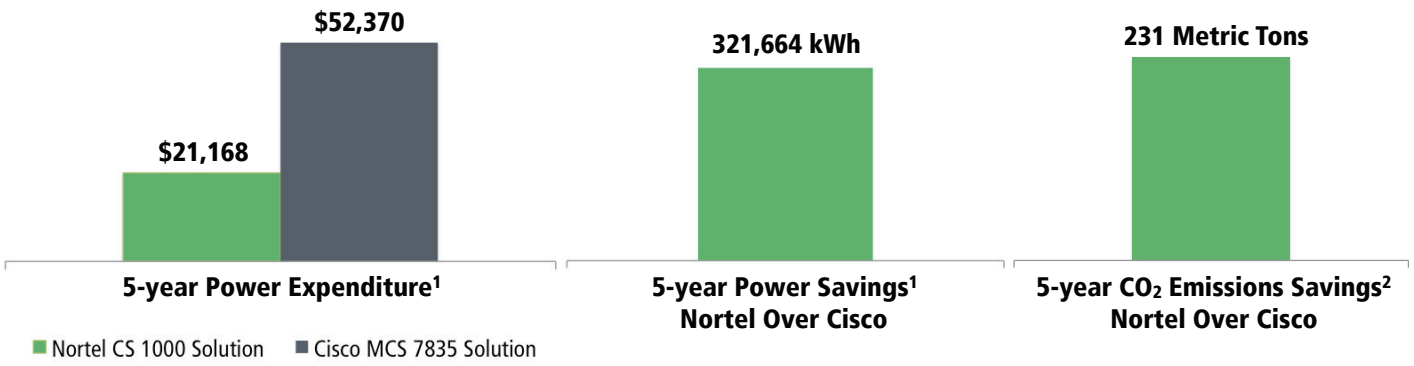
Nortel's line of IP Phones tested drew an average of 3.14 watts, about a third of the 9.33 watts consumed by comparable offerings from Cisco. Over a 5-year period, this

Nortel CS 1000 VoIP Solution Environmental Performance versus Cisco MCS 7835 VoIP Solution

Tolly Certified

Tested June 2009

Projected Five-Year Operational Cost of VoIP Solutions Serving 1,000 Users



VoIP Solution Component	Qty	Average Component Power Draw (watts)		Total Solution Power Draw (watts)		5-year Power Expenditure		5-year Nortel Savings Over Cisco	
		Nortel	Cisco	Nortel	Cisco	Nortel	Cisco	Power Savings (kWh)	CO_2 Savings (Metric Tons)
Media Gateway	1	38.1	117.1	38.1	117.1	$162	$498	3,464	2.5
48-port PoE Switch	24	68.7	102.5	1,649.3	2,460.5	$7,007	$10,454	35,531	25.5
IP Phones	1,000	3.1	9.3	3,141.7	9,325.0	$13,348	$39,618	270,830	194.5
Primary Call Server	1	63.6	131.9	63.6	131.9	$270	$560	2,990	2.1
Secondary Call Server	1	63.6	131.9	63.6	131.9	$270	$560	2,990	2.1
Voice Mail	1	26.1	159.9	26.1	159.9	$111	$679	5,860	4.2
			Total	**4,982.4**	**12,326.3**	**$21,168**	**$52,370**	**321,664**	**231.0**

Notes:

[1] 1,000 user scenario extrapolated to contain all critical infrastructure components to handle 1,000 users, as per the breakdown provided in the table above. Power consumption of all devices measured at idle. Power consumption of IP phones obtained from average power consumption of four different IP phone models tested from each vendor. Cost projection based on the 2009 National Average Retail Price of Commercial Electric Power @ $0.097 per kilowatt-hour, as per the U.S. Energy Information Administration, as of April 2009. Power consumption estimates do not include energy expended by cooling systems. All prices are in USD. Lower bars are better.

[2] CO_2 emissions saved were calculated as the equivalent volume of CO_2 emissions averted due to the power savings (kiloWatt-hours, kWh) from using Nortel solution over Cisco solution. The calculations were based on the US EPA's Greenhouse Gas Equivalencies Calculator, available online at http://www.epa.gov/cleanenergy/energy-resources/calculator.html

Source: Tolly, June 2009

Figure 2

translates to a savings of $25 per phone in energy in idle state alone. Please see figure 3 below for the comparison of power draw of individual IP phone models tested.

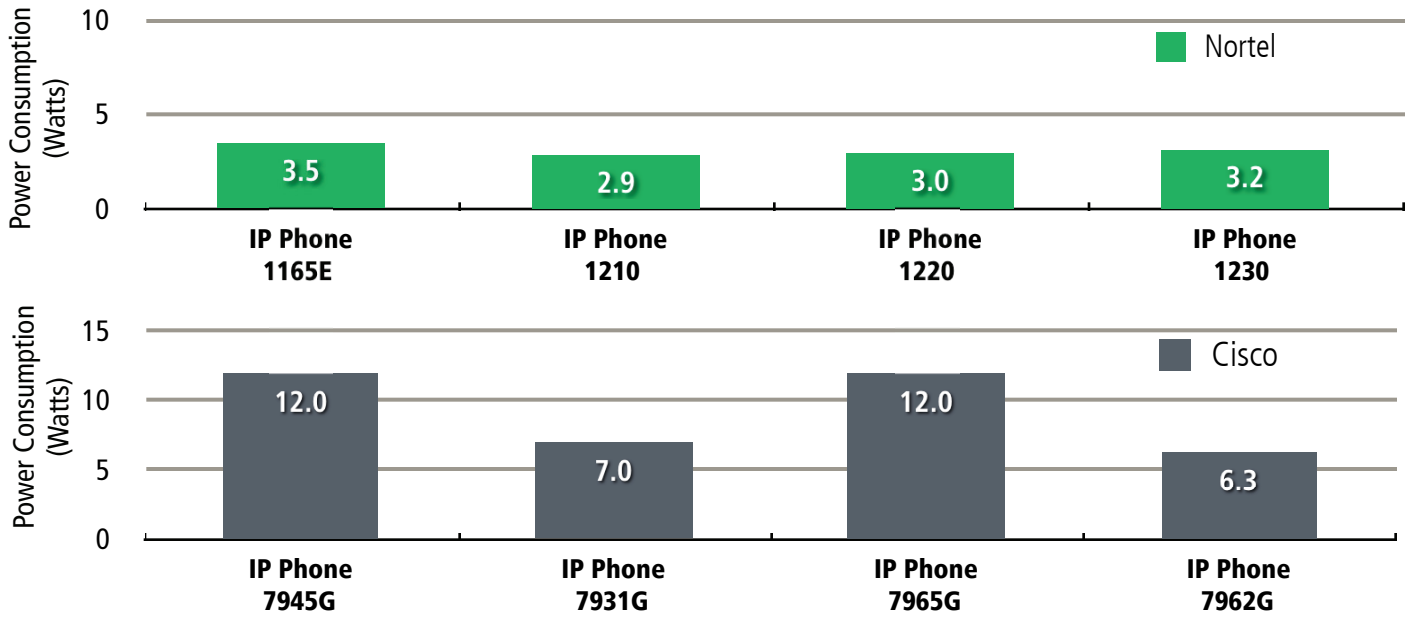
On the infrastructure side, Nortel once again excelled in efficiency. All things considered, Cisco's solution weighs in at 12,326 watts, including two call servers, voicemail server, media gateway, 24 48-port 10/100/1000 PoE switches, and 1,000 VoIP phones. Nortel, with similar hardware, required just about 4,982 watts, about 60% less when compared to Cisco.

The Call Servers, perhaps the most important aspect of the VoIP solution, were deployed to form a redundant, High Availability (HA) environment. The Nortel CS 1000 call server is chassis based so that IT managers can add or remove modules to fit their needs in a single, small energy footprint.

In this case, the HA configuration from Nortel consisted of two CS 1000 chassis, one with two call server modules and a voicemail card, and a second CS 1000 chassis with just the call server cards.

The HA environment on Cisco's side used two MCS 7835 Unified Communications Manager Appliances for redundant call servers, with an additional appliance needed to host voicemail. These three appliances were based on 2U rack mounted servers and taxed Cisco significantly in terms of power consumption. See figure 2 on the previous page for the detailed breakdown of power consumption and costs.

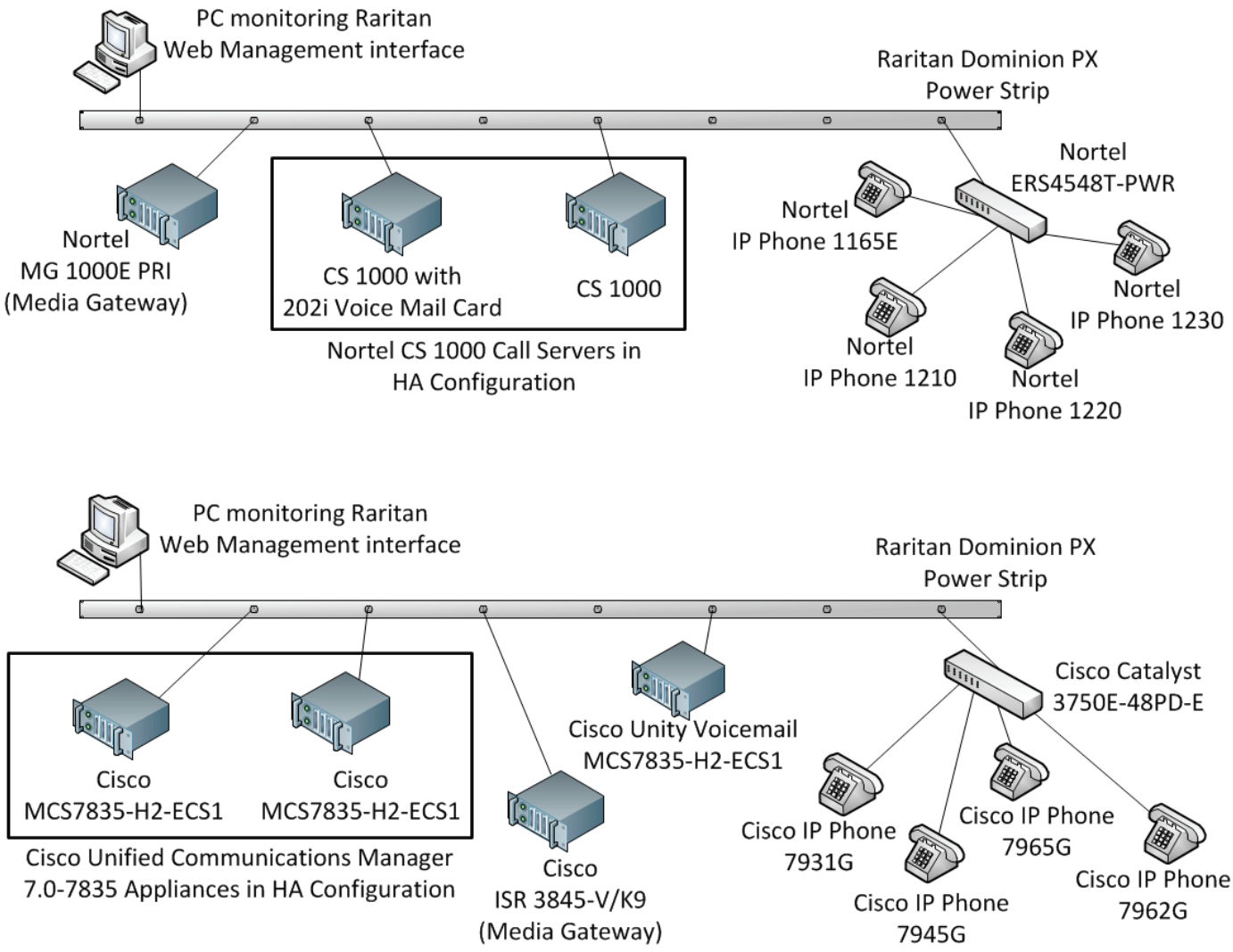
Engineers calculated that the 1,000 user Cisco environment as outlined, would incur a cost of about $10,474 annually on electricity alone, whereas Nortel's solution uses a mere $4,211 worth of electricity. This equals to a saving of 321,664 kWh of electricity over a 5-year deployment period. The power thus saved equals 231 Metric Tons of CO_2 emissions saved, as per the U.S. EPA's Greenhouse Gases Equivalency Calculator. At today's costs, this is a savings of $31,312 in power costs over the span of a typical five-year deployment.



Source: Tolly, June 2009

Figure 3

Test Bed for the Nortel CS 1000 and Cisco MCS 7835 Solutions



Source: Tolly, June 2009

Figure 4

Test Setup & Methodology

The environment for this test consisted of a representative sample of each component found in the VoIP solution of each vendor. Each test bed consisted of a call server, voicemail server, media gateway, a PoE switch, and a variety of IP Phones in a high availability configuration. The IP phones tested were chosen to have a range of features: grayscale, color, and color/GigE, etc.

The IP Phones were plugged into the Ethernet switches and connected to the call server and voicemail appliances from the respective manufacturers, in their "as shipped" power management configuration. No additional steps were taken to tune the power management features.

These test criteria were inspired by the new EPA Energy Star program blueprints developed for Servers (ENERGY STAR Version 1.0 Program

Requirements for Computer Servers) which state:

"manufacturers must ensure that the only power management techniques and/or power saving features enabled on systems under test are those which are also enabled on shipment."

Although the Energy Star does not currently specify guidelines to evaluate IP Phones, we have co-opted their guidelines to test server hardware as a good starting point.

Nortel's test bed included two CS 1000 Unified Call Server chassis, each with a single power supply. One CS 1000 chassis was equipped with a 202i voice mail card, 2X CP-PM cards, and one MGC card, allowing the device to function as a call server and voicemail server. The other CS 1000 chassis was configured identically, except that it lacked the 202i voicemail card. In addition, the environment contained a ERS4548T-PWR switch, which provided power over Ethernet (PoE) for the IP Phones, upcoming model 1165E, and available models 1210, 1220, and 1230.

Cisco's test environment, though functionally similar to the equipment described above, required two physically separate MCS 7835-H2 appliances to produce a redundant call server, and one additional MCS 7835-H2 appliance was configured to act as the voicemail server. A 48-port Cisco Catalyst 3750E (WS-3750E-48PD-E) switch was then used to power the four IP Phones, models 7945G, 7931G, 7965G, and 7962G.

A Raritan Dominion PX (DPCS12-20) was used to obtain the power consumption of the various devices in the test configuration. However, to measure the usage of the IP Phones, engineers relied on the management console of the PoE switch in each test bed.

To measure idle power consumption of the DUTs, engineers connected the power supply to the test tool, and powered on the device. Once the DUT had reached an idle state, records were taken and averaged over a span of two minutes.

To measure the power consumption of the phones, engineers connected each to the PoE switch, and let the devices boot up. Once a steady state was established, measurements were taken from the switches' CLI. In both cases, engineers repeated the tests two additional times and averaged the results.

Five-Year operational costs were calculated using the U.S. National average retail price of $0.097 per kilowatt-hour of commercial electricity as of April 2009, as per the U.S. Energy Information Agency's Electric Power Monthly, available on the Internet at http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_b.html

Devices Under Test

Device	Model	SW/HW Level
NORTEL CS 1000 Solution		
Call Server	CS 1000	Release 6.0
Media Gateway	MG 1000E PRI	Release 6.0
Voicemail	202i voicemail card	CallPilot 5.0
48 port PoE Switch	ERS4548T-PWR	HW:02, FW: 5.2.0.3
10/100/1000 IP Phone	IP Phone 1165E	Model NTYS07
10/100 IP Phone	IP Phone 1210	Model NTYS18
10/100 IP Phone	IP Phone 1220	Model NTYS19
10/100 IP Phone	IP Phone 1230	Model NTYS20
Cisco MCS 7835 VoIP Solution		
Call Server	MCS-7835-H2-ECS1	UNIFIED-CM-7.0 7835
Media Gateway	3845-V/K9	IOS 12.4 S384UESK9-12420T
Voicemail	MCS-7835-H2-ECS1	UNITY-WIN2K-ENG
48 port PoE Switch	WS-3750-48PD-E	12.2(35)SE5
10/100/1000 IP Phone	IP Phone 7945G	SCCP45.8-4-1S
10/100 IP Phone	IP Phone 7931G	SCCP31.8-4-1S
10/100/1000 IP Phone	IP Phone 7965G	SCCP45.8-4-1S
10/100 IP Phone	IP Phone 7962G	SCCP42.8-4-1S

Source: Tolly, June 2009 Figure 5

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Visit Tolly on the Internet at:
http://www.tolly.com

Interaction with Competitors

In accordance with Tolly's Fair Testing Charter, Tolly personnel invited representatives from Cisco Systems, Inc. to review the testing but received no response. All products were configured to use default settings.

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

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