

ShoreTel, Inc.

Unified Communications Systems

Evaluation of Power Consumption vs. Cisco Unified Communications Systems



Test Summary

Premise: Enterprises of all sizes are becoming increasingly conscious of the energy consumption of their business tools, including communications systems. Not only does lower energy consumption decrease the total cost of ownership, it has a net positive impact on CO2 emissions. Buyers are advised to factor in the “green” footprint, as well as the features and functionality of a unified communications system.

ShoreTel, Inc. commissioned The Tolly Group to evaluate its Unified Communications (UC) System for its power consumption when running critical IP Telephony components in campus headquarters, regional office and branch-office locations.

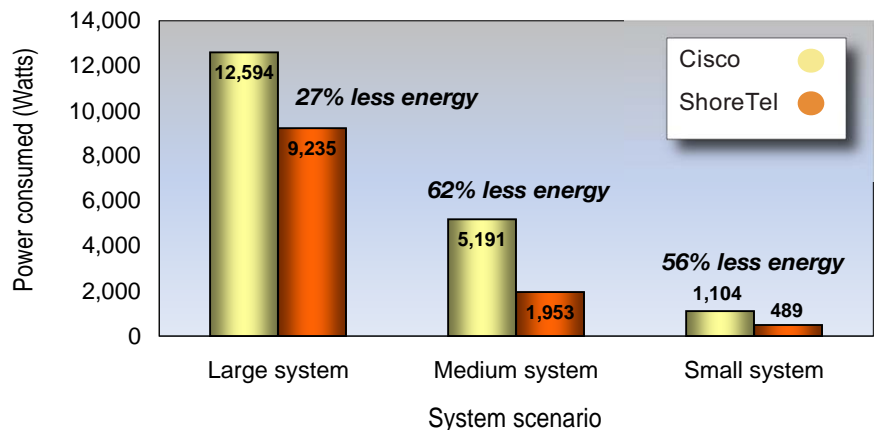
The Tolly Group measured the power consumed (total watts) by a variety of ShoreGear® IP voice switches and ShorePhone® IP phones. Engineers then computed the energy requirements to support three enterprise scenarios — a large-scale network with headquarters (HQ), a medium network with a central HQ and 19 remote offices, and a self-contained single-site small office. The computations considered all ShoreGear voice switches, phones and associated servers and the power required to support them.

The Tolly Group compared the ShoreTel Unified Communications System’s energy consumption to a Cisco Systems, Inc. solution used for a comparable deployment. A representative sample of Cisco equipment was tested for power consumption and those results were used to extrapolate the data for the three enterprise scenarios.

Test Highlights

- ▶ Uses 27% less power — 9,235 watts versus 12,594 watts versus a Cisco solution in a large enterprise scenario
- ▶ Uses 62% less power — 1,953 watts versus 5,191 watts versus a Cisco solution in a medium-sized multi-site deployment
- ▶ Uses 56% less power — 489 watts versus 1,104 watts versus a Cisco solution in a small-office deployment
- ▶ ShoreTel’s monochromatic GbE IP phone consumes 37% less power than a Cisco equivalent in idle state

Energy Consumption of ShoreTel and Cisco Unified Communications Systems for Different System Scenarios As extrapolated from key power measurements



Note: Large system was comprised of ~1,500 users across a main headquarters site, a remote office (200 users) and a satellite office (50 users). Medium scenario included 350 users across one headquarters site and 19 branch offices. Small scenario included 65 users at a single site.

Source: The Tolly Group, September 2008

Figure 1

Executive Summary

ShoreTel's Unified Communications (UC) System and its ShoreGear voice switches and ShorePhone telephones used up to 62% less energy across three enterprise-class scenarios than a solution based upon Cisco Unified Communications Manager.

This evaluation showed that ShoreTel's Unified Communications System, which is comprised of the company's ShoreGear IP voice switches and IP phones, uses up to 62% less energy than Cisco's comparable Cisco Unified Communications Manager.

The Tolly Group measured key VoIP components and calculated the energy consumption of the solutions under test for three enterprise-class scenarios — a large multi-site business with ~1,500 users, a medium-sized multi-site distributed business with 350 users, and a small office with 65 users. (Note: the wired LAN/WAN infrastructure was not included in the configuration except where that infrastructure contained VoIP components such as T1 cards.)

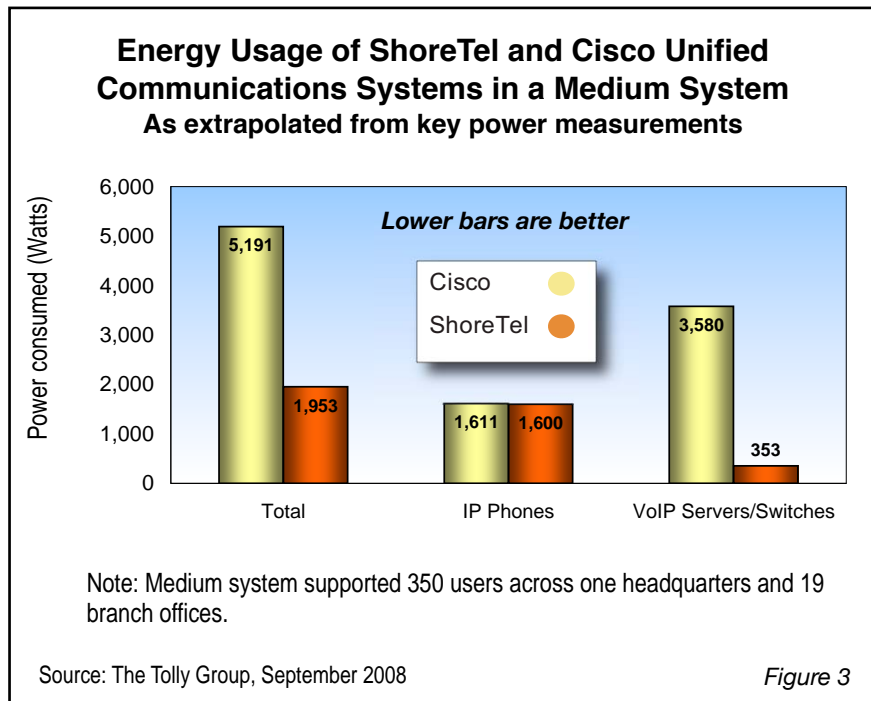
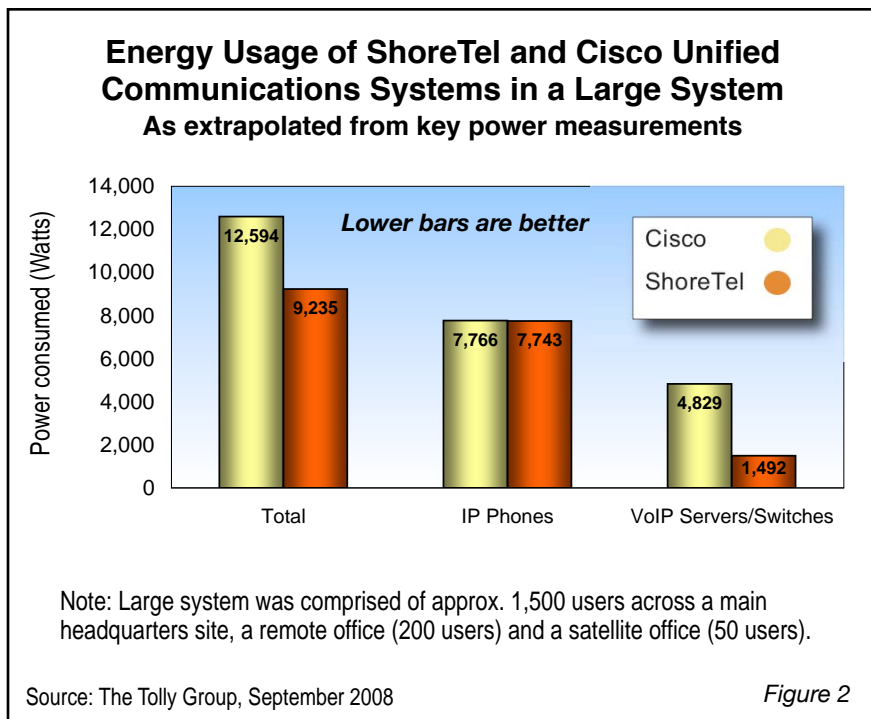
The large system configurations was based on RFP responses each vendor submitted to the VoiceCon 2008 Telephony RFP. Minor modifications, noted below, were made to Cisco's large configuration to provide a consistent number of VoIP devices for

comparison. (Please see sidebar on page 8 for more information on the RFP.) In every scenario, the ShoreTel Unified Communications System required less energy to power VoIP communications than the Cisco solution.

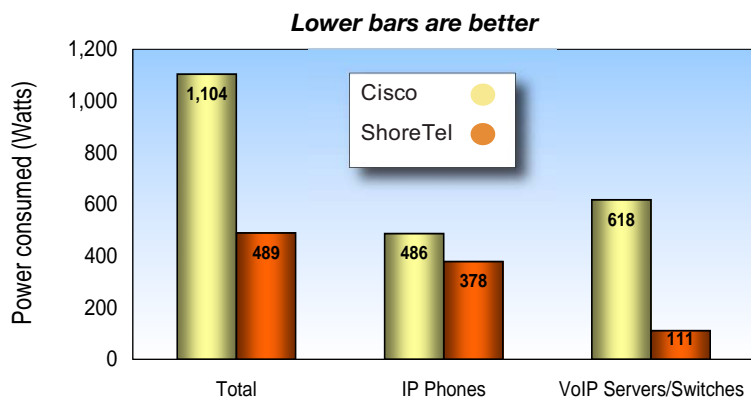
RESULTS

ENERGY CONSUMPTION: LARGE SYSTEM

The Tolly Group evaluated a representative sample of voice switches and IP phones, and then



Energy Usage of ShoreTel and Cisco Unified Communications Systems in a Small System As extrapolated from key power measurements



Note: Small system supported a single site with 65 users.

Source: The Tolly Group, September 2008

Figure 4

used those measurements to generate a projection of energy consumption across a large-scale deployment of 1,500 users — approximately 1,250 stationed at a central headquarters location with two equipment rooms, about 200 users at a remote office location and approximately 50 users at a branch office. The system was fully UC-enabled with voice, voice messaging, IM and converged conferencing. It also had a contact center.

Redundancy was assumed for call control, voicemail and for the contact center.

The large system configuration was based on ShoreTel and Cisco's response to a VoiceCon RFP, but the small and medium system configurations were based on typical real-world deployment scenarios for the small and medium Enterprise environments.

The Cisco solution specified 725 GbE "worker" phones, whereas ShoreTel specified 850. For the purposes of the calculations, 125 phones

and one server were added to Cisco's configuration.

Test results show that a single ShoreGear-90 voice switch (SG-90) used 10.9 watts during the 40-second test in both idle state, and active state with traffic flowing across ports (voicemails recorded, voice connections made, etc).

An IBM System x3250 server, used by ShoreTel for system management and voicemail applications, required 80.7 watts of energy.

The Cisco MCS 7825-H2 appliance, on the other hand, consumed 115 watts during the same test, which translates into about 42% more power consumed.

On the IP phone front, Tolly Group engineers tested four models each from ShoreTel and from Cisco. (See *Setup & Methodology* section.)

The ShoreTel phones used 6.05 watts each during idle state (just the phone powered, no traffic) while the Cisco IP phones required 6.3 watts. During active state (with an open voice connection), the ShoreTel phones used 6.8 watts each, on average, while

ShoreTel Inc.

Unified
Communications
System



Enterprise VoIP Networks:
Energy Consumption

Calibration Caveat

Testers note that an inconsistent relationship exists between the maximum power consumption figures published on vendor data sheets and the actual power consumption measured under test.

To date, experience has shown that actual power consumption is typically less than or equal to the stated power draw. The range, as seen in the current test, can be anywhere from 25% to 100% of the published figures.

Engineers based the calibration factors used in this evaluation both on measurements made specifically for this study, as well as on previous experience with measuring network infrastructure components.

As the calibration factor will impact the overall results, the reader should make their own determination of power consumption by benchmarking their specific requirements.

Source: The Tolly Group, Sept. 2008

the Cisco phones required 7.05 watts each, on average.

Users who deploy Gigabit Ethernet to the desktop should note that ShoreTel's monochrome Gigabit Ethernet ShorePhone IP 560G IP phone consumed 4.9 watts in the idle state with backlight off versus 7.8 watts for a comparable Cisco Unified IP Phone 7961G-GE. This shows that this ShoreTel IP phone uses 37% less power than the comparable Cisco IP phone in the idle state. With the same IP phones serving an active voice call, the

ShoreTel phone consumed 25% less power than the Cisco phone by measuring 6 watts for ShoreTel and 8 watts for Cisco.

Using those results, Tolly Group engineers then computed the energy costs for a large-scale configuration that covered ~1,300 IP phones, 60 ShoreGear voice switches, seven ShoreTel servers, a conference bridge and a third-party speech engine. Both Cisco and ShoreTel assumed that approximately 200 of the phones in the large configuration were traditional analog phones. Those were not counted for the power consumption.

For the Cisco configuration, engineers factored in four Cisco Unified Communications Manager appliances, a

Unified Operations Manager and Provisioning Manager, eight IP Contact Center and IP IVR, two Presence servers, one Unity, one MeetingPlace, one Mobility server, six Cisco 2821 Integrated Services Routers (three at each HQ site), plus a Cisco 2821 ISR at the remote office and a Cisco 3825 ISR at the regional office.

Test results show that the ShoreTel UC solution would use 9,235 watts versus 12,594 watts for the Cisco solution. (See Figure 1 & 2.) This proves that the ShoreTel UC system consumes 27% less energy than the comparable Cisco UC solution in the large system configuration.

ENERGY CONSUMPTION: MEDIUM SYSTEM

Tolly Group engineers also projected the energy costs to support a medium-sized business configura-

tion supporting 350 users across 20 sites (One headquarters and 19 branch offices). The scenario for the ShoreTel solution consisted of a single headquarters site with 65 users supported by three SG-50 voice switches providing N+1 redundancy, a VoIP application server, conference bridge and an SG-T1 to support T1/PRI trunks.

Each of 19 branch offices was supported by an SG-30 voice switch and 15 users with IP phones. (See Figure 10.)

ShoreTel's ShoreGear voice switches and IP phones would require 1,953 watts to support the HQ and 19 branch office sites. A comparable Cisco solution would require 5,191 watts, meaning users would need 2.7 times more energy to power the comparable Cisco VoIP solution. (See Figures 1 and 3.)

ShoreTel - System Component Power Consumption Summary

Description	Model	Published power consumption (Watts)	Power consumed as measured (Watts)	Calibration factor	Power consumption value used for calculations (Watts)
Basic phone	IP 115	3.7	N/A	0.75	2.8
Worker phone (Mono, FE)	IP 230	4.4	3.5	N/A	3.5
Worker phone (Color, FE)	IP 265	5.9	6	N/A	6
Worker phone (Mono, FE)	IP 560	6.4	N/A	0.75	4.8
Worker phone (Mono, GbE)	IP 560G	7.1	6	N/A	6
Executive color phone (Color, GbE)	IP 565G	6.9	6	N/A	6
Conference phone	IP 8000	8.2	7.3	N/A	7.3
VoIP switch	SG T1	18	N/A	0.35	6.3
VoIP switch	SG 30	23	N/A	0.35	8.05
VoIP switch	SG 50	23	N/A	0.35	8.05
VoIP switch	SG 90	31	10.9	N/A	10.9
VoIP switch	SG 120	63	16.2	N/A	16.2
VoIP switch	SG 220T1A	29	11.3	N/A	11.3
Administration/Messaging server	IBM System x3250	475	80.75	N/A	80.75
Speech recognition server	IBM System x3250	475	N/A	0.17	80.75
Converged Conference bridge	IBM System x3250	475	N/A	0.17	80.75

Source: The Tolly Group, September 2008

Figure 5

ENERGY CONSUMPTION: SMALL SYSTEM

This test scenario involved a small self-contained office with 65 users.

The single site with the ShoreTel solution would use three SG-50 voice switches for N+1 redundancy for call control, 66 IP phones including a conference IP phone and an SG-T1 for PRI trunking.

The small office Cisco configuration would consist of two Cisco Call Managers for redundancy, a Unity voice-mail server, a Cisco 2821 WAN gateway with T1 access, and 66 IP phones. ShoreTel's small office UC solution would need 489

watts to power the equipment. The comparable Cisco solution would require 1,104 watts. The results show that the ShoreTel small office configuration provides 56% greater energy efficiency than the Cisco small office solution. (See Figure 1 and 4.)

SETUP & METHODOLOGY

Engineers tested the ShoreTel ShoreGear-90 (SG-90) voice switch connected to an IBM System x3250 rack-mount server loaded with Windows Server 2003 and ShoreTel 8 Software.

For Cisco, engineers measured the power consumption of the Cisco MCS 7825-H2 Unified Communication Manager Appliance equipped with a pre-installed Linux operating system

and Unified Communications Manager Business Edition 6.1 software suite.

Engineers also tested eight IP phones with a mix of display and connection types connected to a GbE switch via a PowerDsine 3100G single-port PoE injector:

- ShorePhone IP 230 and Cisco IP 7941G (no PoE capability, tested with AC adaptor), monochrome display and Fast Ethernet connection;
- ShorePhone IP 560G and Cisco IP 7961G-GE, monochrome display and GbE connection;
- ShorePhone IP 265 and Cisco IP 7970G, color display and Fast Ethernet connection;

Cisco - System Component Power Consumption Summary

Description	Model	Published power consumption (Watts)	Power consumed as measured (Watts)	Calibration factor	Power consumption value used for calculations (Watts)
Basic phone	7906G	5	3.2	N/A	3.2
Worker phone (Mono, FE)	7941G	6.3	3.2	N/A	3.2
Worker phone (Mono, FE)	7962G	6.3	N/A	0.5	3.2
Worker phone (Mono, GbE)	7961G-GE	12	8	N/A	8
Worker phone (Color, GbE)	7965G	12	N/A	0.5	6
Executive phone (Color, GbE)	7975G	12	6.5	N/A	6.5
Conference phone	7937G	18.2	N/A	0.5	9.1
Call processing/application server	MCS 7835-H2	450	N/A	0.25	115
Call processing/application server	MCS 7845-H2	800	N/A	0.25	200
Call processing/application server	MCS 7816-H3	420	N/A	0.25	105
Call processing/application server	MCS 7825-H2	450	115	N/A	115
Call processing/application server	MCS 7845-I2	835	N/A	0.25	208.8
Integrated Service Router (Call server)	3825 Router w/ SRST	360	N/A	1	360
Integrated Service Router (PSTN gateway)	2821 Router w/ T1	280	N/A	1	280
Integrated Service Router (PSTN gateway & Call server)	2801 Router w/ SRST	150	N/A	1	150
Analog voice gateway	VG248	72	N/A	1	72

Source: The Tolly Group, September 2008

Figure 6

ShorePhone IP 565G and Cisco IP 7975G, color display and GbE port.

The ShoreTel Call Manager was connected to an SG-90 voice switch, which provided ShoreTel IP phones with connection across the GbE network, and the Cisco MCS 7825-H2 Unified Communication Manager connected to Cisco Unified IP phones in the same manner.

Before measuring the amount of power drawn by the IP phones, engineers measured the power drawn by the PowerDsine 3100G PoE injector (1.6 watts) as a baseline. Engineers then subtracted the baseline from the overall power consumption of each IP phone to

derive the power consumed purely by the IP phone alone.

Tolly Group engineers measured the power consumption of the various VoIP components and extrapolated the measured data into the small, medium and large system configurations. The key VoIP components included voice switches, VoIP servers and IP phones. Engineers used an Extech 380801 Power Analyzer to measure the watts consumed by the devices.

ShoreTel's and Cisco's RFP responses for the large system scenario matched with respect to number of VoIP phones.

In the case of the large system scenario, the ShoreTel response called for 1290 total VoIP phones and the Cisco response called for 1165 phones. They differed in the number of so-called "Worker

phones with Gigabit Ethernet" by 125. In order to make a more apples-to-apples comparison, Tolly Group engineers increased the Cisco GbE phone count to match ShoreTel. As Cisco's original response called for one server for approximately 100 phones, one server was added to the Cisco configuration.

The extrapolated data was calculated using a calibration factor derived from the difference between the measured power consumption of each device and the official published power consumption found in each vendor's Web site official data sheet for each component. The calibration factor enabled engineers to derive an effective value, representing the likely power consumed by the device. The component summary tables provide details of the val-

System Component Summary in a Large System VoiceCon 2008 RFP for 1500-user VoIP System

Vendor	Category	Model	HQ 1 & 2	Remote office	Satellite office	Sub total	Total
ShoreTel	VoIP gateway	SG-90	6	3	4	13	60
		SG-120	13	4	2	19	
		SG-220T1A	25	3	-	28	
	IP phone	IP 115	50	15	5	70	1,337
		IP 560	75	15	5	95	
		IP 560g	850	120	25	995	
		IP 565g	110	15	5	130	
		IP 8000	34	8	5	47	
	VoIP server	ShoreTel Servers	5	1	1	7	9
		IncendoNet Speech Bridge	1	-	-	1	
Converged Conf. Bridge		1	-	-	1		
Cisco	VoIP gateway	3825 Router w/ SRST	-	1	-	1	11
		2821 Routers	6	-	1	7	
		VG248	3	-	-	3	
	IP phone	7906G	50	15	5	70	1,337
		7962G	75	15	5	95	
		7965G	850	120	25	995	
		7975G	110	15	5	130	
		7937G	34	8	5	47	
	VoIP server	MCS 7835-H2	10	-	-	10	17
		MCS 7845-H2	2	-	-	2	
MCS 7816-H3		2	-	-	2		
MCS 7825-H2		1	-	-	1		
MCS 7845-I2		2	-	-	2		

Source: The Tolly Group, September 2008

Figure 7

System Component Summary in a Medium System 350 Users across a Headquarters Site and 19 Branch Offices

Vendor	Category	Model	HQ (1)	Branch offices (19)	Sub total	Total
ShoreTel	VoIP gateway	SG-T1	1	-	1	23
		SG-50	3	-	3	
		SG-30	-	19	19	
	IP phone	IP 115	6	38	44	351
		IP 230	-	171	171	
		IP 265	-	76	76	
		IP 560g	52	-	52	
		IP 565g	7	-	7	
	VoIP server	ShoreTel Servers	1	-	1	2
		Converged Conf. Bridge	1	-	1	
Cisco	VoIP gateway	2821 Router w/ T1	1	-	1	20
		2801 Router w/ Analog Trunk	-	19	19	
	IP phone	7906G	6	38	44	351
		7941G	-	171	171	
		7961G-GE	52	-	52	
		7965G	7	76	83	
		7937G	1	-	1	
	VoIP server	MCS 7825-H2	2	-	2	4
		MCS 7816-H3	1	-	1	
		MCS 7835-H2	1	-	1	

Note: See Figure 10 for graphical representation.

Source: The Tolly Group, September 2008

Figure 8

System Component Summary in a Small System 65 Users at a Single Site

Vendor	Category	Model	Small office (1)	Total
ShoreTel	VoIP gateway	SG-T1	1	4
		SG-50	3	
	IP phone	IP 115	6	66
		IP 560g	52	
		IP 565g	7	
IP 8000		1		
VoIP server	ShoreTel Servers	1	1	
Cisco	VoIP gateway	2821 Router w/ T1	1	1
	IP phone	7906G	6	66
		7961G-GE	52	
		7965G	7	
		7937G	1	
	VoIP server	MCS 7825-H2	2	3
MCS 7835-H2		1		

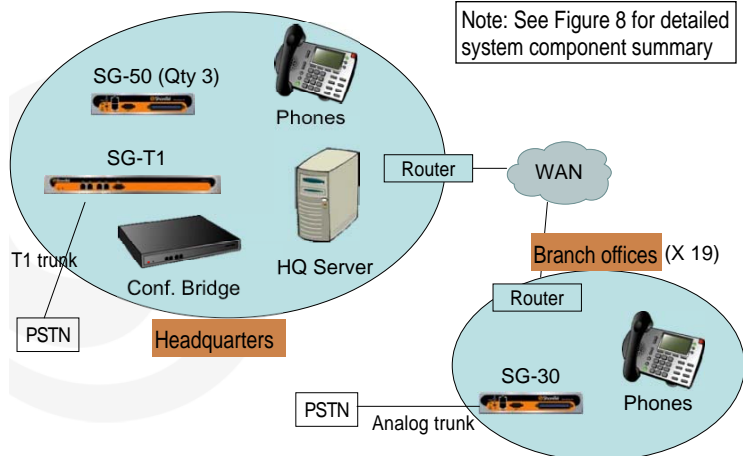
Source: The Tolly Group, September 2008

Figure 9

ues used. (See Figures 5 & 6.)

Given this approach, Tolly Group engineers could extrapolate a close estimate to the total power consumed from all unmeasured devices for the final results. After applying the calibration factor an effective value of maximum power consumed by the devices was derived. Using the effective values for power consumption of the various components tested, Tolly Group engineers estimated the total power consumption from all devices in the three network scenarios.

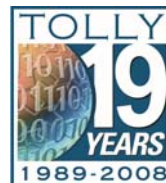
ShoreTel Medium System Configuration



Source: ShoreTel, Inc., 2007

Figure 10

The Tolly Group is a leading global provider of third-party validation services for vendors of IT products, components and services.



The company is based in Boca Raton, FL and can be reached by phone at (561) 391-5610, or via the Internet at:
 Web: <http://www.tolly.com>,
 E-mail: sales@tolly.com

VoiceCon® RFP

Allan Sulkin of TEQConsult Group developed a comprehensive VoIP system RFP in conjunction with the VoiceCon Orlando 2008 conference held in March 2008. The results were unveiled at a conference workshop and subsequently published.

The time frame for the product information contained in the RFP responses was Fall 2007. The

RFP and responses can be found on the VoiceCon Web site at:

http://www.voicecon.com/orlando/about/real_world_rfp.php

As both Cisco Systems and ShoreTel responded to this RFP request, the gear outlined in those responses was used as a basis for this comparison.

Both Cisco and ShoreTel assumed that approximately 200 of the phones in the large configuration

were traditional analog phones rather than VoIP phones.

The Tolly Group referred to VoiceCon RFP for the large system configuration only. The small and medium configurations were derived by ShoreTel, Inc.

(Note: The Tolly Group is not affiliated with the VoiceCon conference, the TEQConsult Group and had no part in the creation of the RFP and makes no claims of any kind with respect to the RFP.)

Test Equipment Summary

Vendor	Product	Web URL
Extech Instruments	Extech 380801 Power Analyzer	http://www.extech.com

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