Miercom

# Lab Testing Summary Report

August 2011

Report 110829

Product Category:

**Plug and Play Switches**

Vendor Tested:

AVAYA

Products Tested:

**Avaya ERS 4548GT-PWR**

**HP E4500-48G-PoE**

**Cisco WS-3750X-48P-S**

**Juniper EX4200-48P**

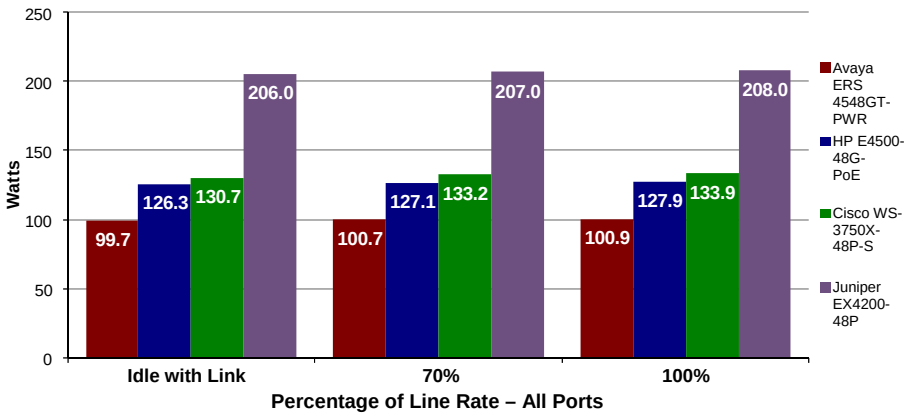
## Key findings and conclusions:

- Fast and seamless provisioning is delivered through the plug 'n' play features of the Avaya ERS 4548GT-PWR edge switch
- ERS 4548GT-PWR uses less energy and has lowest Three Year Cost of Ownership than other models tested
- Auto Detection/Auto Configuration (ADAC) automatically configures VLAN and QoS settings for both Avaya and third-party phones
- Avaya Energy Saver (AES) provides automatic energy savings of 25% during periods when full line speed is not needed

Avaya engaged Miercom to evaluate the plug and play features and ease of configuration of the ERS 4548GT- PWR Edge Switch. The energy efficiency of the ERS was compared to similar switches and is discussed in this report as well.

The Ethernet Routing Switch (ERS) 4548GT-PW was used since the size and feature set of this switch is most common across enterprise implementations. Although there are seemingly no exact comparisons among other vendors, the switches that were selected by Avaya were based upon the features and size that most closely matched the ERS 4548GT-PWR.

**Figure 1: Power Consumption of Switches using 1518-byte Frame Size Traffic**




Source: Miercom, August 2011

*Power usage was measured at idle and with 70 and 100% traffic. Using 1518-byte frames, Avaya's measurement at 100% load was less than the other switches' usage at idle.*

# Plug and Play

## Automatic Device Provisioning

Plug and Play provisioning of IP phones and other attached devices is important for enterprise environments that have frequent add/ move/change requests. Plug and Play enables a new user to be set up by simply plugging a phone into the switch, and a desktop computing device into the phone. All pertinent information needed for the phone to become operational is automatically set up without manual intervention. Avaya simplifies the process of configuring the switch to provide this plug and play connectivity. For IP phones to plug and play, they need four key pieces of information: the voice VLAN ID, the QoS settings to be used, the IP address of the file server, and the IP address of the call server.

The Avaya switches fully utilize LLDP to provide all four pieces of information. This reduces the complexity and departmental interaction required to configure the switch. Avaya ERS 4548GT-PWR also uses Auto Detection/Auto Configuration, or ADAC. ADAC is a networking protocol developed by Avaya to automatically configure the switch to support and prioritize traffic for IP phones. When ADAC is enabled and a phone is connected to the switch, the switch automatically configures the VLAN, port, and QoS settings necessary to support voice communication between the phone and the switch.

Miercom validated each of the steps required for a phone to receive dial tone and become operational. In all tests, the phone automatically retrieved the four pieces of information and was operational around the one minute mark.

## Automatic Unit Replacement

Avaya switches feature advanced stacking capabilities. Stacking offers improved resiliency in the event of a link or unit failure, as well as simplified installation, reduced network complexity, and centralized management. Some of the features in the Avaya stacking configuration include automatic configuration, updating, and the maintenance of switches. Any individual switch that fails in a stack will not affect any operation that is taking place on the rest of the stack. This includes phone calls or data traffic that might be active on other switches in the stack. When a new switch is placed into the stack, all updates and configurations of the switch is performed automatically. This stacking capability allows a network to have a high availability even when replacing a broken or failed switch.

In our testing we pulled the 4548GT-PWR switch from the stack and replaced it with another unit using the factory default configuration, simulating an out-of-the-box replacement. The switch was able to boot up, load the configuration, and become operational in 2 minutes and 11 seconds.

## Automatic Off-Peak Power Savings

Avaya switches include a power saving feature called Avaya Energy Saver (AES). This feature throttles down the speed on individual ports from 1000Mbps to 10Mbps. This option can be set to a schedule and timer allowing a system administrator to reduce port speeds when the office is closed or during weekends. At this reduced port speed, connected phones remain fully functional and calling features are unaffected. Desktop computers connected through the phones to the switch will experience reduced data speeds. In the case of the Avaya 9640G PoE phones used in this test, we were able to measure a 25% reduction in energy consumed when the AES feature was enabled and compared to full line rate. In an enterprise environment running thousands of phones and multiple switches, a 25% reduction in energy consumption would provide significant utility cost savings.

## Power Consumption

To determine the power efficiency of the Avaya ERS 4548GT-PWR and how it compared to similar switches, the power consumed was analyzed at various load levels and with a variety of frame sizes. Testing was performed at frame sizes of 64, 512 and 1518 bytes at rates of 70% and 100% line speed. We also measured power consumed by the switches at idle with link up on all interfaces. The other switch models provided for our testing included the HP E4500-48G-PoE,

the Cisco WS-3750-X-48P-S, and the Juniper EX4200-48P switches.

The Avaya ERS 4548GT-PWR consumed the least amount of power of the switches tested, while the Juniper EX4200 consumed the most. The HP and Cisco switches were in the middle of the range. As shown in *Figure 1* on page 1, at maximum load, the Avaya 4548GT-PWR consumed only 99.7 watts at idle with link up on all ports. As shown in *Table 1*, at maximum load, the switch consumed 102.1 watts at the 64-byte frame size, and 100.9 watts at 1518-byte frames. The HP E4500 was next, consuming 126.3 watts at idle. At maximum capacity, HP power draw was 127.9 watts when handling 1518-byte frames.

The Cisco 3750-X switch consumed 130.7 watts at idle with link, and 133.9 watts at 100% line rate with 1518-byte frames.

The Juniper EX4200 used the most power. Idle consumption with link on all ports was 206 watts and 208 watts at 100% of line rate with 1518-byte frames.

Layer 2 traffic was used for testing according to RFC 2544 benchmarking testing specification.

The Avaya ERS consumed less power at 100% load than the competitive switches consumed in an idle state.

## Three Year Energy Expense

Using the test data above, we used the following assumptions to calculate energy and cooling costs:

| Energy Calculation Assumptions | |
|---|---|
| Average Cost Per Kilowatt Per Hour | $.10 |
| Days in a Year | 365 |
| Switch Uptime Hours Per Day | 24 |
| Heat Dissipated in BTUs for Each Watt | 3.41 |
| Watts Consumed in cooling 1 BTU | 0.105 |

Applying the factors above for a 10,000 port enterprise, with a 70% load, and a 512-byte packet size, the following outlines the full energy costs for each switch over a 3-year time frame:

| 3 Year Energy Cost Comparison | | |
|---|---|---|
| | **Per Switch** | **10,000 Ports** |
| Avaya ERS 4548GT-PWR | $359 | $74,874 |
| HP E4500-48G-PoE | $454 | $94,652 |
| Cisco WS-3750-X-48P-S | $476 | $99,262 |
| Juniper EX4200-48P | $742 | $154,655 |

### Table 1: Switch Power Consumption at Relative Traffic Loads

| | Avaya ERS 4548GT-PWR | HP E4500G-48G-PoE | Cisco WS-3750-X-48P-S | Juniper EX4200-48P |
|---|---|---|---|---|
| **Idle with Link** | 99.7 | 126.3 | 130.7 | 206.0 |
| **70% Traffic Load and Various Frame Sizes** | | | | |
| **64-byte** | 101.2 | 128.1 | 135.3 | 210.0 |
| **512-byte** | 100.7 | 127.3 | 133.5 | 208.0 |
| **1518-byte** | 100.7 | 127.1 | 133.2 | 207.0 |
| **100% Traffic Load and Various Frame Sizes** | | | | |
| **64-byte** | 102.1 | 129.1 | 136.4 | 212.0 |
| **512-byte** | 101.2 | 128.1 | 134.6 | 208.0 |
| **1518-byte** | 100.9 | 127.9 | 133.9 | 208.0 |

*Watts consumed at various traffic loads for the Plug and Play switches that were tested.*

Source: Miercom, August 2011

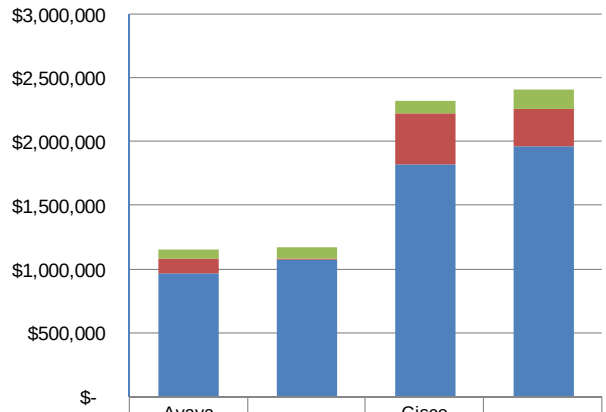
Based on the low energy consumption rates from the tests, the Avaya switch had the lowest energy cost of the competitive set. When compared to the other switches, Avaya is 36% lower.

## Total Cost of Ownership

As a percentage of a network, the edge represents the vast majority of network devices and a significant percentage of network cost. For this analysis, the measurable components of TCO are: energy expense, maintenance cost and purchase price. We calculated the three year cost of ownership for a network of 10,000 ports based upon energy consumption results.

*Figure 2* shows an estimated Three Year Total Cost of Ownership. The ERS 4548GT-PWR cost and energy savings produces the lowest TCO. HP's aggressive support price brings the 3-year TCO within $20,000 while Cisco and Juniper are roughly twice the TCO of Avaya's number.

### Figure 2: Three Year Total Cost of Ownership

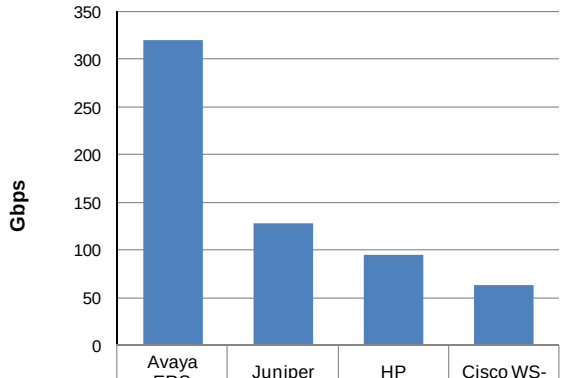



| | Avaya ERS 4548GT-PWR | HP E4500-48G-PoE | Cisco WS-C3750X-48P-S | Juniper EX4200-48P |
|---|---|---|---|---|
| Energy | $74,874 | $94,652 | $99,262 | $154,655 |
| Maintenance | $108,153 | $7,124 | $404,223 | $292,800 |
| Product | $974,552 | $1,075,503 | $1,824,275 | $1,967,122 |

Source: Miercom, Ethernet Switch Industry Assessment 2011

*Estimated pricing includes product, maintenance, and energy costs over five years for a 10,000 port network for these switches.*

### Figure 3: Stacking Backplane Capacity




| | Avaya ERS 4548GT-PWR | Juniper EX4200-48P | HP E4500-48G-POE | Cisco WS-C3750X-48P-S |
|---|---|---|---|---|
| Stacking Backplane Capacity (Gbps) | 320 | 128 | 96* | 64 |

Source: Miercom, Ethernet Switch Industry Assessment 2011

*Backplane and switch fabric capacity of each edge switch tested. * 96Gbps is the stacking capacity for the HP E5500-48G-PoE switch, a larger capacity model in the same switch family. Capacity of the HP E4500 model is not published.*

These product prices and support costs are based on open source research and manufacturer published list prices. For more information, contact reviews@miercom.com for a specific TCO analysis on your products and applications.

## Capacity

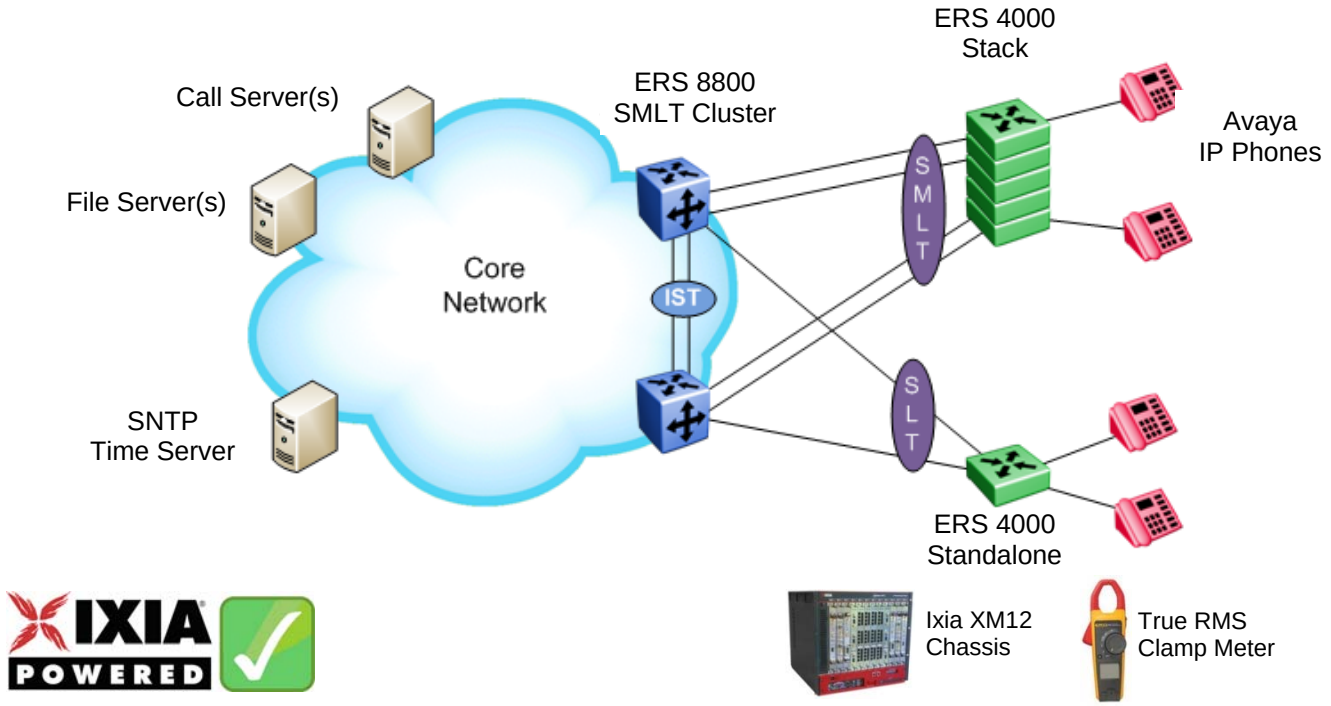
Another TCO factor to consider is a solution's readiness for future capacity.

*Figure 3* shows the maximum backplane capacity for each edge switch, taken from publically available vendor data sheets. The larger the bandwidth number, the more traffic the switch can handle. A large enterprise would want as much bandwidth as possible for scalability as it grows in the future.

Avaya ERS 4548GT-PWR can handle almost three times the amount of traffic as the Juniper switch, its nearest neighbor in this report's capacity comparison.

As more and more bandwidth will be required for enterprise applications, the backplane of the Avaya switch will have the necessary capacity to handle the requirements.

## Test Bed Diagram




## How We Did It

The test bed consisted of an Avaya ERS 8800 SMLT cluster, which provided active-active edge switch termination to the core.

The Avaya switch under test was the 4548GT-PWR model using 5.5.0.003. Testing of the switch was conducted in a standalone configuration, while installed as part of a three-switch stack.

Avaya 9640G IP phones were utilized for provisioning testing and call resiliency during stack maintenance/upgrade tests.

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Other switches used in the power consumption tests were HP E4500-48G-PoE with 3Com OS version 5.02.00s168p19, Cisco WS-3750X-48P-S with IOS version 12.2, and Juniper EX4200-48P with JUNOS version 10.0r3.10. These products were selected by Avaya.

Power consumption testing was performed using a True RMS Clamp Meter and a Power Panel Inline PoE Tester.

Ixia XM12 with LSM1000-XMV16 load modules were used to drive RFC2544 Layer 2 traffic for the power consumption testing. Miercom recognizes Ixia (www.ixiacom.com) as an industry leader in energy efficiency testing of networking equipment. Ixia's unique approach utilizes coordination of energy measurements with network traffic load – allowing energy consumption to be graphed against network traffic volume. Real-world traffic is generated by Ixia's test platform and test applications, principally IxNetwork for layer 2-3 routing and switching traffic and IxLoad for Layer 4-7 application traffic.

Competing vendors were not invited to this testing however all vendors are afforded the opportunity to demonstrate performance to challenge these results. The tests in this report are intended to be reproducible for customers who wish to recreate them with the appropriate test and measurement equipment. Vendors, current or prospective customers interested in challenging or repeating these test results may contact reviews@miercom.com for details on the configurations applied to the system under test and test tools used in this evaluation. Miercom recommends customers conduct their own needs analysis study and test specifically for the expected environment for product deployment before making a selection.

## Miercom Tested

Based on our hands-on testing, the Avaya 4548GT-PWR switch provides:

- Simplified plug and play provisioning of endpoints because the switch fully utilizes LLDP protocol
- Auto Detection / Auto Configuration (ADAC) which automatically configures VLAN and QoS settings for both Avaya and third-party phones
- Avaya Energy Saver (AES) that provides automatic energy savings of 25% during periods when full line speed is not needed
- Avaya stacking that delivers high availability during maintenance or upgrades with no impact to phone service

**ERS 4548GT-PWR**

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