

Power Efficiency Comparison: Cisco UCS 5108 Blade Server Chassis and Dell PowerEdge M1000e Blade Enclosure

White Paper

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Executive Summary

Rising energy prices and a drastic increase in computing solution density have made energy management a critical component of efficient data center operations. In addition to availability and scalability, data center managers must address power utilization to deliver cost-effective solutions for their businesses. Cisco is dedicated to the advancement of energy efficiency in the data center ecosystem. This document compares the power efficiency of similarly configured Cisco UCS[®] 5108 Blade Server Chassis and Dell PowerEdge M1000e Blade Enclosure solutions.

Cisco compared power and performance characteristics of equivalently configured Cisco UCS 5108 Blade Server Chassis and Dell PowerEdge M1000e Blade Enclosure. The Cisco[®] solution was configured with Cisco UCS B200 M3 blade servers, and the Dell solution was configured with equivalent Dell PowerEdge M620 G12 blade servers. Both solutions are based on the Intel Xeon processor E5-2600 product family. An industry-standard benchmark, SPECpower_ssj2008 which measures the performance-to-power ratio, was run on both solutions to evaluate performance, power consumption, and power efficiency.

The results demonstrate that the Cisco Unified Computing System[™] (Cisco UCS) configured with Cisco UCS B200 M3 blade servers, consumes less power and is more efficient than a Dell solution configured with Dell PowerEdge M620 G12 blade servers.

Main Findings

- Performance
 - Cisco UCS and Dell PowerEdge solutions achieved equivalent performance as expected when configured with comparable hardware, firmware, and OS settings and running the same workload.
 - Average performance across all target loads varied less than 0.2 percent.
- Power
 - At maximum target load, the Cisco UCS chassis consumed 294 watts (W) less power than the equivalently configured Dell PowerEdge enclosure: a difference of 11.3 percent less power.
 - In the active-idle state, the Cisco UCS chassis consumed 43W less power than the equivalently configured Dell PowerEdge enclosure: a difference of 5.1 percent less power.
- Efficiency
 - The Cisco UCS chassis achieved a 9.3 percent higher performance-to-power ratio than the Dell PowerEdge enclosure using similarly configured hardware, BIOS, OS, and benchmark settings.
 - At 70 percent target load, the Cisco UCS chassis consumed 12.5 percent less power while providing equivalent performance to the Dell PowerEdge enclosure.
 - Cisco Fabric Extender Technology (FEX Technology) scales to 20 chassis within a single unified system, eliminating the power incurred from dedicated chassis management and blade switch modules as the solution expands beyond a single blade enclosure.

SPEC Fair Use Rule disclosure condition:

At 100 percent target load, the Cisco UCS 5108 blade chassis with eight Cisco UCS B200 M3 servers installed achieved 11,252,295 ssj_ops using 2,311W (Figure 8), and the Dell PowerEdge M1000e blade enclosure with eight Dell PowerEdge M620 G12 servers installed achieved 11,269,813 ssj_ops using 2,605W (Figure 14).

At 70 percent target load, the Cisco UCS 5108 blade chassis with eight Cisco UCS B200 M3 servers installed achieved 7,947,925 ssj_ops using 1,665W (Figure 8), and the Dell PowerEdge M1000e blade enclosure with eight Dell PowerEdge M620 G12 servers installed achieved 7,964,801 ssj_ops using 1,902W (Figure 14).

Test Method Overview

To make relevant power efficiency comparisons, all solution variables that affect performance and power consumption must be equivalent. The Cisco UCS 5108 and Dell PowerEdge solutions were equivalently configured. The BIOS parameters affecting performance and power consumption were set consistently across each blade solution (see <u>Appendix B</u> for BIOS parameter configuration details). The same workload was run on each solution while operating in the same environmental conditions.

The workload provides a basis for comparing equivalent computing solutions. SPECpower_ssj2008 is a benchmark developed by the Standard Performance Evaluation Corporation (SPEC), a nonprofit group of computer vendors, system integrators, universities, research organizations, publishers, and consultants. The benchmark is designed to provide a view of server system power consumption while the system runs Java server applications. The results from each SPECpower_ssj2008 benchmark are listed in <u>Appendix C</u>. The analysis contained in this document is based on the data obtained from these results.

Hardware Configuration 1

The first solution evaluated was a single blade chassis configured with eight blades. The Cisco and Dell blade enclosures were configured similarly (Table 1). Individual power analyzers measured the power consumption of the blade enclosures and the redundant pair of Cisco UCS 6248UP 48-Port Fabric Interconnects.

Enclosure	1 Cisco UCS 5108 1 Dell PowerEdge M1000e					
Blade slots available and installed	Available: 8	Available: 16				
per chassis	Installed: 8 Installed: 8 Installed: 8					
Enclosure management modules	Cisco UCS 6248UP 48-Port Fabric Interconnect (2) ¹	ort Fabric Interconnect (2) ¹ Dell Chassis Management Controller (2)				
Internal I/O modules per chassis	Cisco UCS 2204XP Fabric Extender (2)	DUCS 2204XP Fabric Extender (2) Dell Force10 MXL 10/40 GbE switch module (2)				
Power supplies per chassis	2500W Platinum rated (4)	0W Platinum rated (4) 2700W Platinum rated (4) ²				
Fan slots available and installed	Available: 8	Available: 9				
per chassis	Installed: 8	Installed: 9				
Blade Model	Cisco UCS B200 M3	Dell PowerEdge M620 G12				
Form factor	Half width	Half height				
Processor	Intel Xeon E5-2660 (2)	Intel Xeon E5-2660 (2)				
Physical and logical cores	Physical: 16	Physical: 16				
	Logical: 32 Logical: 32					
Memory	32 GB (4X 8-GB DDR3 RDIMM PC3L-12800)	32 GB (4X 8-GB DDR3 RDIMM PC3L-12800)				
Hard disk drive	300 GB 10K RPM 6 Gbps with RAID 0 (1)	300 GB 10K RPM 6 Gbps with RAID 0 (1)				
Network	Cisco UCS VIC 1240 10-Gbps 4-port adapter (1)	Broadcom 57810-k 10-Gbps 2-port adapter (1)				
Storage controller	LSI Logic SAS 2004 (1)	PERC H310 Mini (1)				

 Table 1.
 Solution Details (Configuration 1)

¹ The Cisco UCS 6248UP 48-Port Fabric Interconnect provides the management and communication backbone for the Cisco UCS B-Series Blade Servers and C-Series Rack Servers. A single redundant pair of fabric interconnects supports up to 20 blade enclosures in a single highly available management domain. The benchmark was run with and without the power consumed by the redundant pair of fabric interconnects included in the measurement (Figures 8 through 10).

² Dynamic Power Supply Engagement and Max Power Conservation Mode were enabled, which turns power supplies on or off based on power consumption, optimizing energy consumption for the entire chassis.

The available system firmware at the time of testing was installed; see Appendix A for additional details.

Microsoft Windows Server 2008 R2 Enterprise with Service Pack 1 (SP1) was installed on each server. The same OS power management settings were used for each solution; see the OS section of the test procedure in <u>Appendix B</u> for additional details.

A Cisco UCS service profile was used to update all Cisco UCS blades simultaneously using a common BIOS policy. Each BIOS parameter was manually duplicated on Dell blades; see the BIOS section in <u>Appendix B</u>.

The blade enclosure power supply management policy was set to grid redundant or AC redundant for each solution. The additional power management features Dynamic Power Supply Engagement and Max Power Conservation Mode were enabled on the Dell solution. External networking components were not included in the power measurements.

Results: Hardware Configuration 1

At maximum target load conditions, the Cisco UCS chassis consumed 294W less power than the equivalently configured Dell PowerEdge enclosure: a difference of 11.3 percent less power consumption. In the active-idle state, the Cisco UCS chassis consumed 43W less power than the equivalently configured Dell PowerEdge enclosure: a difference of 5.1 percent less power consumption.

The Cisco UCS chassis consumed less power while providing equivalent performance compared to the Dell solution. The Cisco UCS chassis achieved a 9.3 percent higher performance-to-power ratio than the Dell PowerEdge enclosure (Figure 1).



Figure 1. Power Efficiency Comparison (Configuration 1)

SPEC Fair Use Rule disclosure condition:

At 100 percent target load, the Cisco UCS 5108 blade chassis with eight Cisco UCS B200 M3 servers installed achieved 11,252,295 ssj_ops using 2,311W (Figure 8), and the Dell PowerEdge M1000e blade enclosure with eight Dell PowerEdge M620 G12 servers installed achieved 11,269,813 ssj_ops using 2,605W (Figure 14).

Power efficiency is computed by dividing the number of operations performed by the average power consumption. The performance-per-watt ratio for each target is shown in Figure 2. The Cisco UCS chassis has greater power efficiency than the Dell enclosure: an advantage of 2.9 to 14.0 percent across all target loads.





Figure 3. Average Power Comparison at 70% Target Load



Power Consumption at 70% Target Load Lower Is Better

SPEC Fair Use Rule disclosure condition:

At 70 percent target load, the Cisco UCS 5108 blade chassis with eight Cisco UCS B200 M3 servers installed achieved 7,947,925 ssj_ops using 1,665W (Figure 8), and the Dell PowerEdge M1000e blade enclosure with eight Dell PowerEdge M620 G12 servers installed achieved 7,964,801 ssj_ops using 1,902W (Figure 14).

A general rule used by many industry professionals is to compare solution power consumption at a specific utilization rate. The typical values range from 50 to 70 percent utilization. For this comparison, the average power consumption at 70 percent target load is shown in Figure 3. At this target load, the Cisco UCS chassis consumed 12.5 percent less power while providing equivalent performance to the Dell PowerEdge enclosure.

Another method used by many industry professionals is to compare solution power consumption in the idle state. The average power consumed by the Cisco UCS chassis in the idle state was 43W less than the equivalently configured Dell PowerEdge enclosure: a difference of 5.1 percent less power consumption, as shown in Figure 4.





SPEC Fair Use Rule disclosure condition:

At 100 percent target load, the Cisco UCS 5108 blade chassis with eight Cisco UCS B200 M3 servers installed achieved 11,252,295 ssj_ops using 2,311W (Figure 8), and the Dell PowerEdge M1000e blade enclosure with eight Dell PowerEdge M620 G12 servers installed achieved 11,269,813 ssj_ops using 2,605W (Figure 14).

Hardware Configuration 2

Enterprise customers generally deploy multiple blade enclosures to maximize the power density and management advantages of a typical blade solution. Compared to traditional blade architectures, Cisco UCS extends these advantages using Cisco FEX Technology. This architecture supports up to 20 chassis in a single unified system without additional complexity, providing uniform access to both networks and storage and eliminating the additional power overhead incurred from dedicated chassis management and blade switch modules for each blade chassis.

Configuring multiple large-scale solutions, consisting of hundreds of blade servers, to measure power efficiency is not practical. A simple example in which the Cisco UCS solution is scaled from one to two chassis demonstrates Cisco's power efficiency advantage over traditional blade architectures such as the Dell PowerEdge solution.

An identical Cisco UCS chassis with eight blades, from Configuration 1 (Table 1), was added to the Cisco solution. Eight blades were added to the Dell solution (Table 2). The same test methodology was used to measure performance and power usage. Individual power analyzers measured power consumption of the blade chassis and redundant pair of Cisco UCS 6248UP fabric interconnects.

Table 2. Solution Details (Configuration 2)

Enclosure	2 Cisco UCS 5108 1 Dell PowerEdge M1000e					
Blade slots available and installed per chassis	Available: 8 Available: 16 Installed: 8 Installed: 16					
Enclosure management modules	Cisco UCS 6248UP 48-Port Fabric Interconnect (2) ¹	CS 6248UP 48-Port Fabric Interconnect (2) ¹ Dell Chassis Management Controller (2)				
Internal I/O modules per chassis	Cisco UCS 2204XP Fabric Extender (2)	Dell Force10 MXL 10/40 GbE switch module (2)				
Power supplies per chassis	2500W Platinum rated (4)	2700W Platinum rated (6) ²				
Fan slots available and installed per chassis	Available: 8 Installed: 8	Available: 9 Installed: 9				
Blade Model	Cisco UCS B200 M3	Dell PowerEdge M620 G12				
Form factor	Half width	Half height				
Processor	Intel Xeon E5-2660 (2)	Intel Xeon E5-2660 (2)				
Physical and logical cores	Physical: 16 Logical: 32	Physical: 16 Logical: 32				
Memory	32 GB (4X 8-GB DDR3 RDIMM PC3L-12800)	32 GB (4X 8-GB DDR3 RDIMM PC3L-12800)				
Hard disk drive	300 GB 10K RPM 6 Gbps with RAID 0 (1)	300 GB 10K RPM 6 Gbps with RAID 0 (1)				
Network	Cisco UCS VIC 1240 10-Gbps 4-port adapter (1)	Broadcom 57810-k 10-Gbps 2-port adapter (1)				
Storage controller	LSI Logic SAS 2004 (1)	PERC H310 Mini (1)				

¹ The Cisco UCS 6248UP 48-Port Fabric Interconnect is a core part of Cisco UCS. Typically deployed in redundant pairs, the Cisco UCS 6248UP provides uniform access to both network and storage. The Cisco UCS fabric extender architecture provides management for 20 blade enclosures in a single unified system without additional complexity, thus eliminating dedicated chassis management and blade switches and reducing the number of cables required.

² Dynamic Power Supply Engagement and Max Power Conservation Mode were enabled on the Dell solution, which turns power supplies on or off based on power consumption, optimizing energy consumption for the entire chassis.

Results: Hardware Configuration 2

As seen with the first configuration, performance for the Cisco and Dell solutions varied less than one percent.

As expected, the power consumed by the redundant pair of fabric interconnects did not increase with the addition of a second Cisco UCS chassis (Figure 5). The power consumed by the redundant pair of fabric interconnects remained constant at 521W for each Cisco configuration (see Figures 10 and 13 for detailed power measurement data). The fabric interconnects power per chassis for the first configuration was 521W. The fabric interconnects power per chassis for the second configuration was 261W. The fabric interconnects have more capacity remaining to support another 18 blade chassis, or 160 total blades. As the number of blades in the domain increases, the fabric interconnects power is amortized across more Cisco UCS chassis.

The additional chassis did not require another set of dedicated chassis management or blade switch modules. At 70 percent target load, the two Cisco UCS chassis consumed 3,348W, and the Dell PowerEdge enclosure consumed 3,729W (Figure 6). The Cisco UCS chassis used 381W less power. The detailed power measurement data for the Cisco and Dell solutions is shown in Figures 13 and 15.

SPEC Fair Use Rule disclosure condition:

At 70 percent target load, the two Cisco UCS 5108 blade chassis with 16 Cisco UCS B200 M3 servers installed and two Cisco UCS 6248UP fabric interconnects achieved 15,936,381 ssj_ops using 3869W (1,669W for chassis 1, 1,679W for chassis 2, and 521W for two fabric interconnects; see Figures 12 and 13), and the Dell PowerEdge M1000e blade enclosure with 16 Dell PowerEdge M620 G12 servers installed achieved 15,944,659 ssj_ops using 3,729W (Figure 15).

Using power consumption data for the chassis and fabric interconnects; reasonable power estimates for solutions expanding beyond 16 blades can be generated. Although tempting, the SPEC Fair Use Rule considers estimates to be non-compliant, and non-compliant results cannot be published publicly for any SPECpower_ssj2008 metric.





Figure 6. Average Power Comparison at 70% Target Load



Blade Enclosure

SPEC Fair Use Rule disclosure condition:

At 70 percent target load, the two Cisco UCS 5108 blade chassis with 16 Cisco UCS B200 M3 servers installed and two Cisco UCS 6248UP fabric interconnects achieved 15,936,381 ssj_ops using 3,869W (1,669W for chassis 1, 1,679W for chassis 2, and 521W for two fabric interconnects; see Figures 12 and 13), and the Dell PowerEdge M1000e blade enclosure with 16 Dell PowerEdge M620 G12 servers installed achieved 15,944,659 ssj_ops using 3,729W (Figure 15).

Conclusions

Both blade solutions were configured with similar hardware and firmware running an identical workload. The results yielded comparable performance across each blade. Performance for the Cisco and Dell solutions varied less than one percent.

The first configuration measured the power efficiency of the blade enclosure. The Cisco UCS chassis was 9.3 percent more power efficient than the Dell PowerEdge enclosure. At 70 percent target load, the Cisco UCS chassis consumed 12.5 percent less power than the Dell PowerEdge enclosure. In the active-idle state, Cisco UCS consumed 5.1 percent less power than the equivalent Dell PowerEdge enclosure.

The second configuration showed that the power consumption for the fabric interconnects did not increase when a second Cisco UCS blade chassis was added to the solution. At 70 percent target load, the two Cisco UCS chassis consumed 381W less power than the Dell PowerEdge enclosure. As the number of blades in the domain increases, the fabric interconnects power is amortized across more and more Cisco UCS chassis.

Over the years, computing solutions have become less expensive to purchase and maintain, delivering more computing capacity at lower equipment costs. At the same time, the cost of energy has continued to rise. In some cases, operating expenses for data center solutions can exceed capital expenses. Cisco UCS is a more efficient architecture that scales to 20 chassis in a single unified system, eliminating the additional power incurred from dedicated chassis management and blade switch modules for each blade enclosure.

SPEC Fair Use Rule disclosure condition:

At 100 percent target load, the Cisco UCS 5108 blade chassis with eight Cisco UCS B200 M3 servers installed achieved 11,252,295 ssj_ops using 2,311W (Figure 8), and the Dell PowerEdge M1000e blade enclosure with eight Dell PowerEdge M620 G12 servers installed achieved 11,269,813 ssj_ops using 2,605W (Figure 14).

At 70 percent target load, the Cisco UCS 5108 blade chassis with eight Cisco UCS B200 M3 servers installed achieved 7,947,925 ssj_ops using 1,665W (Figure 8), and the Dell PowerEdge M1000e blade enclosure with eight Dell PowerEdge M620 G12 servers installed achieved 7,964,801 ssj_ops using 1,902W (Figure 14).

At 70 percent target load, the two Cisco UCS 5108 blade chassis with 16 Cisco UCS B200 M3 servers installed and two Cisco UCS 6248UP fabric interconnects achieved 15,936,381 ssj_ops using 3,869W (1,669W for chassis 1, 1,679W for chassis 2, and 521W for two fabric interconnects; see Figures 12 and 13), and the Dell PowerEdge M1000e blade enclosure with 16 Dell PowerEdge M620 G12 servers installed achieved 15,944,659 ssj_ops using 3,729W (Figure 15).

For More Information About Cisco UCS

Cisco UCS: http://www.cisco.com/en/US/products/ps10265/index.html

Cisco UCS Case Studies: http://www.cisco.com/en/US/solutions/ns340/ns517/ns224/dc_case_studies.html

Cisco UCS White Papers: http://www.cisco.com/en/US/prod/ps10265/ucs_white_paper.html

Appendix A: Solution Firmware and Driver Details

Table 3 provides firmware and driver details for the Cisco UCS 5108 and Dell PowerEdge M1000e solutions.

 Table 3.
 Installed Firmware and Driver Revisions

Component	Cisco	Dell
Enclosure model	Cisco UCS 5108	Dell PowerEdge M1000e
Enclosure management firmware	5.0(3)N2(2.11f)	4.31
Internal I/O module firmware	2.1(1f)	8.3.16.2
Blade model	Cisco UCS B200 M3 Dell PowerEdge	
System BIOS	B200M3.2.1.1a.0.121720121447	1.7.6
Management controller firmware	2.1(1f)	iDRAC7 1.40.40 (Build 17)
Integrated KVM switch firmware	-	01.00.01.01
Network adapter firmware	2.1(1f)	4.1.450.5
Storage controller firmware	20.10.1-0100	20.10.1-0084
Network adapter driver	2.20.13	7.6.51.0
Storage controller driver	5.1.112.64	5.1.112.64
Display adapter driver	6.1.7600.16385	6.1.7600.16385

Appendix B: Test Procedure

This appendix describes the test procedure used to collect performance and power consumption data.

Hardware and System Firmware

Each solution was configured with comparable hardware components; see Tables 1 and 2 for specific hardware details. The available system firmware at the time of testing was installed; see <u>Appendix A</u> for details.

BIOS

The available BIOS parameters differ between the Cisco and Dell blade solutions. The BIOS parameters were set as equivalently as possible to ensure comparable performance and power management; see Table 4 for the BIOS settings for each blade solution.

Table 4.	BIOS Settings
----------	---------------

Component	Cisco UCS B200 M3	Dell PowerEdge M620 G12	
Processor Configuration			
Intel Hyper-Threading Technology	Enabled	Enabled	
Number of Enabled Cores	All	All	
Execute Disable	Disabled	Disabled	
Intel Virtualization Technology	Enabled	Enabled	
Processor Performance Configuration			
Hardware Prefetcher	Disabled	Disabled	
Adjacent Sector Prefetcher	Disabled	Disabled	
DCU Streamer Prefetcher	Disabled	Disabled	
Processor Power Management Configuration			
Enhanced SpeedStep Technology	Enabled	-	
Intel Turbo Boost Technology	Enabled	Enabled	

Component	Cisco UCS B200 M3	Dell PowerEdge M620 G12	
Processor Power State C1 Enhanced	Enabled	Enabled	
Processor Power State C6	Enabled	Enabled	
Energy Performance Policy ¹	OS Controlled	System DBPM (DAPC)	
Memory Configuration			
Select Memory RAS Configuration ²	Maximum Performance	Optimizer Mode	
Low Voltage DDR Mode ³	Performance Mode	Auto	
DRAM Refresh Rate	1X	1X Maximum Performance	
DDR Speed ⁴	Auto		
Patrol Scrub	Disabled	Disabled	
QPI Configuration			
QPI Link Frequency Select	6.4 GT/s	6.4 GT/s	
USB Configuration			
All USB Devices	Enabled	All Ports On	

¹ Dell Advanced Power Control (DAPC) mode allows the BIOS to manage the processor power states for the best performanceper-watt ratio for all utilization levels and workload types while still meeting performance requirements. The equivalent Cisco BIOS parameter allows the OS to manage processor power states for best performance.

² Dell Memory Operating Mode set to Optimized (or Independent Channel) allows memory channels to run independently of each other without lockstep or mirroring. The equivalent Cisco BIOS parameter is Cisco RAS Configuration set to Maximum performance.

³ Dell Memory Frequency set to Auto directs the BIOS to configure the system to operate at the lowest voltage supported for the given memory configuration and memory frequency. Cisco Low Voltage DDR Mode set to Performance Mode prioritizes highfrequency operations over low-voltage operations.

⁴ Dell Memory Frequency set to Maximum Performance sets the memory frequency to the highest supported frequency. The equivalent Cisco BIOS parameter DDR Speed set to Auto in combination with LV DDR Mode set to Maximum Performance helps ensure that memory is operating equivalently in the Cisco and Dell solutions.

For a complete list of available BIOS settings for the Cisco UCS B200 M3 and Dell PowerEdge M620 G12, see the following links:

- <u>Cisco UCS Manager GUI Configuration Guide, Release 2.0: Configuring BIOS Settings</u>
- Dell PowerEdge 12th-Generation Server BIOS Configuration Tech Brief

Operating System

The same Microsoft Windows Server 2008 R2 Enterprise with Service Pack 1 (SP1) image was installed on each blade server.

The same operating system power management settings were used for each solution. The power management plan was set to Balanced. The specific settings are shown in Figure 7.





To improve Java performance, the local security policy was modified to enable the Administrator account to lock pages in memory. The security setting determines which accounts can use a process to keep data in physical memory, which prevents the system from paging data to virtual memory on disk.

Benchmark

The latest SPECpower_ssj2008 version (1.12) was installed on each blade and the control system. The Standard Performance Evaluation Corporation (SPEC), a nonprofit group of computer vendors, system integrators, universities, research organizations, publishers, and consultants, developed the SPECpower_ssj2008 benchmark. It was designed to provide a view of a server system's power consumption running Java server applications.

SPECpower_ssj2008 consists of three main software components:

- Server-Side Java (SSJ)-Workload
 - SSJ-Workload is a Java program designed to exercise the CPUs, caches, memory, scalability of sharedmemory processors, Java Virtual Machine (JVM) implementations, just-in-time (JIT) compilers, garbage collection, and other aspects of the operating system of the system under test (SUT).
 - For more information, see <u>http://www.spec.org/power/docs/SPECpower_ssj2008-Design_ssj.pdf</u>.
- Power and Temperature Daemon (PTDaemon)
 - PTDaemon offloads the work of controlling a power analyzer or temperature sensor during measurement intervals to a system other than the SUT.
 - For more information, see <u>http://www.spec.org/power/docs/SPEC-PTDaemon_Design.pdf</u>.
- Control and Collect System (CCS)
 - CCS is a multithreaded Java application that controls and enables the coordinated collection of data from multiple data sources such as a workload running on a separate SUT, a power analyzer, and a temperature sensor.
 - For more information, see <u>http://www.spec.org/power/docs/SPECpower_ssj2008-Design_ccs.pdf</u>.

All results discussed in this document are from compliant runs. Although the tests have not been submitted to SPEC for review, Cisco can disclose the results for the purpose of this study. The comparisons comply with the required conditions outlined in the SPEC Fair Use Rules and SPECpower_ssj2008 Run Rules. All details required to reproduce these results are listed in the appendixes. The sections from each complaint run referenced in this document are included in <u>Appendix C</u>.

Java Virtual Machine (JVM)

The same JVM version was installed on each server and control system. The JVM version installed was IBM J9 Virtual Machine (VM): Build 2.6, Java Run Environment (JRE) 1.7.0, Microsoft Windows Server 2008 R2 amd64-64 20120322_106209, JIT enabled, and ahead-of-time (AOT) compilation enabled.

The same JVM command-line options were used on all blades:

```
-Xaggressive -Xcompressedrefs -Xmx1024m -Xms1024m -Xmn800m -XlockReservation
-Xnoloa -Xlp -XtlhPrefetch -Xthr:minimizeusercpu -Xgcthreads2
```

A complete list of JVM command-line options and their functions can be found in the <u>IBM user guides for Java V7</u> on <u>Microsoft Windows</u>.

Each blade server was configured with two Intel Xeon processor E5-2660 CPUs, with eight cores per socket and two threads (logical processors) per core. Sixteen JVM instances were started on each server. Each JVM instance was bound to two logical processors. The following CPU affinity commands were used:

```
start /affinity (3,C,30,C0,300,C00,3000,C000,30000,C00000 ...
30000000,C0000000)
```

Power and Temperature Measurements

Yokogawa WT210 and WT500 Digital Power Meters were used to collect power measurements. The Yokogawa WT210 and WT500 units used were within calibration limits.

The enclosures were mounted in adjacent racks. The inlet temperature was measured at the front of each blade enclosure during testing. A Digi International Watchport/H probe was used to collect temperature and humidity data.

Appendix C: SPECpower_ssj2008 Results

Figure 8 through 15 show SPECpower_ssj2008 full disclosure report (FDR) for the Cisco and Dell solutions. Figure 8. SPECpower_ssj2008 FDR: 1 Cisco UCS 5108 Chassis with 8 Cisco UCS B200 M3 Servers (Configuration 1)

SPECpower_ssj2008										
Cines Systems Inc. 11		Copyright © 200	7-2013 Stand	ard Perfor	rmance Evaluation Corporation					
Cisco Systems, inc. U	Cisc	o Svstems.							ssj_ops/watt	
Test Sponsor	Inc.	Inc. SPEC Licer		cense #:	9019		Test Metho	<u>pd:</u> P	Multi Node	
Tested By	Cisc Inc.	o Systems,	Test Location:		San Jose USA	, CA,	<u>Test Da</u>	te: [Dec 24, 2013	
Hardward Availability	Mar	-2012	Ava	Software allability:	Jun-2013		Publicatio	<u>on:</u> (Jnpublished	
System Source	Sing	le Supplier	Desi	System gnation:	Server		Pov Provisionii	ng: p	ine- oowered	
Set B200M3 WARNING:	For poin	t 0, elapsed nanc	Time=2413386	56331 ns, e	elapsed curre	entTimel	Villis=240022 ms			
			Benchma	ark Results	Summary					
Performance		Power	D (Performance to Pow	er Rati	0	
TargetActualLoadLoad	j ops	Average Active Power (W)	Performanc Power Rat	io	0	1	000 2,000 3,000 3,896 overall ssj o	4,0 ps/watt	000 5,000	
100% 98.6% 11,2	252,295	2,311	4	1,869	100%	4,869				
90% 89.3% 10,1	84,249	2,093	2	1,866	90% -	4,866			1	
80% 79.6% 9,0	076,315	1,872	4	4,847	80%	4,847				
70% 69.7% 7,9	47,925	1,665	4	1,775	70%	4,775				
60% 59.9% 6,8	33,366	1,481		1,613	*08 Og	4,613	, ji			
40% 40.0% 4	69 305	1,344		3 668	to 50%	4,248	<i>,</i>			
30% 30.0% 3,4	23,329	1,156		2,961	5ug 40%	3,668				
20% 20.0% 2,2	285,510	1,072	1	2,132	30%	2,961				
10% 10.0% 1,1	39,300	988	2	1,153	20%	2,132	_			
Active Idle	0	793		0	10%	1,153				
	∑ssj_	ops/∑power=		3,896	Active		-			
0 500 1,000 1,500 2,000 Average Active Power (W) Aggregate SUT Data										
# of Nodes # of C	hips	# of Cores	# of Threads	Total	RAM (GB)	# o	f OS Images # o	f JVM	Instances	
8	16	128	25	6	25	6	8		128	
			Sys	tem Under	Test					
			Sh	ared Hardv	ware					
			Sha	red Hard	ware					
			Enclosure:	UCS 510	8 Server Cl	hassis				
	_	F	orm Factor:	6U						
Power	Supply	Quantity and	Rating (W):	4 x 2500	11000 50			-		
		Power Sup	pry Details:	CISCO P/I	NUCSB-PS	0-2500	IAUPL			
		Network Swi	tch Detaile	20-Port 1	0240UP	Interco	nnect			
		K	VM Switch:	None		mercu				
		KVM Swi	tch Details:	N/A				_		
		Othe	r Hardware:	2X UCS	2204XP Fal	bric Ext	ender			
			Comment:	2X UCS	6248UP po	wer not	included in measurer	nent		
			5	Set: 'B200N	13'					
			Set Identi	fier: B20	DOM3					
			Set Descript	ion: Sys	stem Under	Test				
		<u># of</u>	Identical No	des: 8						

Figure 9.	SPECpower_ssj2008 FDR: 1 Cisco UCS 5108 Chassis with 8 Cisco UCS B200 M3 Servers Including 2 Cisco UCS
-	6248UP Fabric Interconnects (Configuration 1)

SPECpower_ssj2008											
	Copyright © 2007-2014 Standard Perfor						rmance Evaluation Corporation				
Cisco Sy	vstems, In	c. UCS	B200	M3			SPECpower_ssj2008 = 2,866 overall ssj_c				
Ţ	est Spor	nsor:	Cisco Systems, Inc.		SPEC Lice	ense #:	9019	Test	Method:	Multi Node	
	Tested	By:	Cisc Inc.	o Systems,	Test Lo	cation:	San Jose, USA	CA, <u>I</u>	est Date:	Jan 26, 2014	
	Hard Availab	ware ility:	Mar-	2012	So Avai	oftware ability:	Jun-2013	Pub	lication:	Unpublished	
Sy	stem Sou	urce:	Sing	le Supplier	Desig	System nation:	em Server Power Provisioning:			Line- powered	
Set B200M	13 WARNI	NG: For	point	t 0, elapsed nan	oTime=241126514	4452 ns,	elapsed currer	ntTimeMillis=240085 ms			
					Benchmar	k Results	s Summary				
P P	Performa	nce		Power				Performance t	o Power R	atio	
Target Load	Actual Load	<u>ssj c</u>	ops	Average Active Power (W)	Performance Power Ratio	<u>to</u>	100%	1,000 2,00 2,866 overall ss	0 3,0/ sj_ops/watt	00 4,000	
100%	98.3%	11,224	,776	2,826	3,9	972	0.0 %	995	10	1	
90%	89.0%	10,161	,929	2,609	3,8	895	80% -3	,000			
80%	79.4%	9,065	,792	2,396	3,7	784	80% 3	,784		1	
70%	69.7%	7,959	910	2,190	3,0	635	70% 3	,635	9		
50%	59.9%	5 705	,019	2,000	3,4	3,410 e 60% -3,410 3,056 50% -3,056 2,579 50% -3,056 2,040 e					
40%	40.0%	4.562	.592	1,769	2.5						
30%	30.0%	3,427	.304	1,680	2.0						
20%	20.0%	2,285	,984	1,596	1,4	433	30% 2				
10%	10.0%	1,143	,883	1,511	1	757 20% 1433		20% 1,433			
A	ctive Idle		0	1,318		0	10% <mark>757</mark> Active				
		Σ	ssj_c	ops/∑power=	2,8	866					
							Idle				
							0	500 1,000 1,5 Average Activ	00 2,000 re Power (N	2,500 N)	
					Aggre	gate SU	r Data				
# of No	des #	of Chir)s	# of Cores	# of Threads	Total	RAM (GB)	# of OS Images	# of JV	/M Instances	
	8	or only	16	128	256		128				
	5				Svste	em Unde	Test				
					Shar	ed Hard	ware				
	Г	Shared Hardware									
	- F				Enclosure:	UCS 5	108 Server C	hassis			
					Form Factor:	6U	4 x 2500 Cisco P/N UCSB-PSU-2500ACPL 2X UCS 6248UP 20-Port 10Gb Fabric Interconnect None				
	F	ower	Supp	ly Quantity ar	nd Rating (W):	4 x 250					
	E F			Power S	upply Details:	Cisco I					
				Ne	twork Switch:	2X UC					
				Network S	witch Details:	20-Por					
					KVM Switch:	None					
				KVM S	witch Details:	N/A					
				Ot	her Hardware:	2X UC	S 2204XP Fa	abric Extender			
	L				Comment:	2X UC	S 6248UP po	ower included in meas	surement		
	. 18				Se	t: 'B200M	13'				
					Set Identifi	er: B2	00M3				
-					Set Descriptio	n: Sv	stem Under 1	lest .			
				# of	f Identical Node	es: 8					

				Ē			Tempe	rature Se	nsor tem	p1					
					Ha	ardware	Vendor:	Digi Inter	mational						
							Model:	Watchpo	ort/H						
						Driver	/ersion:	Watchpo	ort Virtual I	Port 5	5.10.26.0				
						Conn	ectivity:	USB							
				F	TDaem	on Host	System:	same as CCS							
				Ē	PTD	aemon H	lost OS:	same as	CCS						
					Se	tup Desc	cription:	n: 25 mm in front of SUT main airflow intake							
								Notes	5						
None															
							Power	Details for	Devicepv	vr1					
	Volt	200 00	Cur	rent (A)	Aug	Avg	Bou	ior l			- Average Power				
Target	Voit	age (v)	Cui		Power	Active	Measure	ement		Г					
Load	Avg	Range	Avg	Range	Factor	(W)	Uncertai	nty (%)	2	.250	B-B-B-Q				
Calibration	206	300.0	11.4	20.0	0.983	2,314		0.4%	2	.000					
Calibration	200	200.0	44.0	200.0	0.000	2 2 2 2		0.40/	1	,750					
2	206	300.0	11.6	20.0	0.983	2,339		0.4%	51	,500 -	· · · · · · · · · · · · · · · · · · ·				
Calibration 3	205	300.0	11.6	20.0	0.983	2,346		0.4%	ver ()	.250 -					
100%	206	300.0	11.4	20.0	0.982	2,305		0.4%	10d	.000					
90%	206	300.0	10.4	20.0	0.979	2,088		0.5%		750 -	a la companya da series a companya da la companya da series da series da series da series da series da series 📜 da se				
80%	207	300.0	9.32	20.0	0.974	1,875		0.5%		500 -					
70%	207	300.0	8.33	10.0	0.968	1,669		0.4%							
60%	207	300.0	7.46	10.0	0.962	1,485		0.4%		250 -					
50%	207	300.0	6.79	10.0	0.956	1,346	-	0.4%		0					
40%	207	300.0	6.34	10.0	0.951	1,249		0.5%		2	Ner Jer Jor of the of the of the of the state				
30%	207	300.0	5.92	10.0	0.945	1,159		0.5%		alip	all all a petry				
20%	200	300.0	5.55	10.0	0.937	1,075		0.5%		0.0	o, o,				
Activo Idlo	207	300.0	1 27	5.0	0.920	990	-	0.3%			Target Load				
7 ACLIVE TOTO	200	000.0	7.27	0.0	0.000	101		0.470							
	_		_				Power	Details for	Device pv	vr2					
Target	Volt	age (V)	Cur	rent (A)	Avg	Avg Active	Pow	er		-	Average Power				
Load	Avg	Range	Avg	Range	Factor	Power	Uncertai	nty (%)	5	00	**********				
Calibration	207	300.0	2.61	5.0	0.965	520		0.5%	4	150					
1 Calibration	-								4	00					
2	206	300.0	2.61	5.0	0.965	521		0.5%	s ³	50					
Calibration 3	206	300.0	2.61	5.0	0.965	521		0.5%	ver (V	00					
100%	207	300.0	2.61	5.0	0.965	521		0.5%	how	00					
90%	207	300.0	2.61	5.0	0.965	521		0.5%	- 2						
80%	207	300.0	2.61	5.0	0.965	521		0.5%	1	50					
70%	207	300.0	2.61	5.0	0.965	521		0.5%	1	00					
60%	207	300.0	2.61	5.0	0.965	521		0.5%		50					
50%	207	300.0	2.60	5.0	0.965	521		0.5%		0					
40%	207	300.0	2.61	5.0	0.965	521		0.5%			_૨ ૨ ૨ ૨ ૨ ૨ ૨ ૨ ૨ ૨ ૨ ૨ ૨ ૨ ૨ ૨ ૨ ૨ ૨				
30%	207	300.0	2.60	5.0	0.965	521	-	0.5%		alibiat	in alle a letter				
20%	207	300.0	2.60	5.0	0.965	521		0.5%		0. 0.	· · · · ·				
Active Idlo	207	300.0	2.01	5.0	0.905	521		0.5%			Target Load				
Active rule	201	0.00.0	2.00		Convrice	1@ 2007	.2014 Sta	ndard Por	formanco	Eval	uation Comporation				
					Copyright	h	ttp://www	spec.org	- info@sp	ec.or					
					SPEC	ower_ss	j2008 Rep	porter Vers	sion: [SSJ	1.2.1	10, May 9, 2012]				

Figure 10. Power and Temperature Detailed Report SPECpower_ssj2008 FDR: 1 Cisco UCS 5108 Chassis with 8 Cisco UCS B200 M3 Servers Including 2 Cisco UCS 6248UP Fabric Interconnects (Configuration 1)

Copyright © 2007-2014 Standard Performance Evaluation Corporation Cisco Systems, Inc. SPEC Dower_sig2008 = 3,881 overall ssi_ops Test Sponsor: Gisco Systems, Inc. SPEC License #: 9019 Test Method: Multi Not Test d By: Cisco Systems, Inc. Set Location: San Jose, CA, Iso Test Date: Feb 1, 20 Hardware Mar-2012 Software USA Usan Jose, CA, Iso Test Date: Feb 1, 20 Hardware Mar-2012 Software USA Test Location: Usan Jose, CA, Iso Test Date Test Date: Feb 1, 20 System Source: Single Supplier System Server Power Line- Set B200M3 WARNING: For point 0, elapsed nanoTime=241230174130; ns, elapsed currentTimeMilis=240025 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=2419238(193 ns, elapsed currentTimeMilis=240225 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=2419238(193 ns, elapsed currentTimeMilis=240225 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=2419238(193 ns, elapsed currentTimeMilis=	Cisco Sys Te							
Image: Set Sponsor: Cisco Systems, Inc. SPEC License #: 9019 Test Method: Multi Nor Inc. Cisco Systems, Inc. Cisco Systems, Inc. Test Location: USA Test Method: Multi Nor Hardware Availability: Mar-2012 Availability: Jun-2013 Publication: Unpublis System Source: Single Supplier System Server Provisioning: powered Set B200M3 WARNING: For point 0, elapsed nanoTime=241423012423 ns, elapsed currentTimeMilis=240023 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=2419258113 ns, elapsed currentTimeMilis=240053 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=2419258113 ns, elapsed currentTimeMilis=240053 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=2419258113 ns, elapsed currentTimeMilis=240023 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=2419258113 ns, elapsed currentTimeMilis=24025 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=2419258113305 ns, elapsed currentTimeMilis=240023 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=24192581	Te							
Tested By: Inc. Cisco Systems, Inc. Test Location: USA San Jose, CA, USA Test Date: USA Feb 1, 20 Hardware Availability: Mar-2012 Availability: Jun-2013 Jun-2013 Publication: Provisioning: Unpublis System Source: Single Supplier System Designation: Server Provisioning: Dowered Set B200M3 WARNING: For point 0, elapsed nanoTime=24142031948216 ns, elapsed currentTimeMilis=240053 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=2419538113 ns, elapsed currentTimeMilis=240053 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=2419258113 ns, elapsed currentTimeMilis=240252 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=2419538113 ns, elapsed currentTimeMilis=240252 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMilis=240252 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=2419538113 ns, elapsed currentTimeMilis=240252 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=2419538114305 ns, elapsed currentTimeMilis=240252 ms Verage Performance to Power Ratio Target Actual Sig. ops / Active Power Performance to Power Ratio 100% 38.81 overal si ops/axit 4.860 0% 4.860 00% 83.2% (20.401.345 4.190 4.860 0% 4.860 00% 83.2% (20.43.503) 4.626 4.873								
Hardware Availability: Mar-2012 Software Availability: Jun-2013 Publication: Unpublis System Source: Single Supplier System Designation: Server Provisioning: Line- provisioning: powered Set B200M3 WARNING: For point 0, elapsed nanoTime=241423012423 ns, elapsed currentTimeMillis=240022 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=24142436 ns, elapsed currentTimeMillis=240033 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=24150341485 ns, elapsed currentTimeMillis=240025 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=24135144185 ns, elapsed currentTimeMillis=240037 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=24135114305 ns, elapsed currentTimeMillis=240037 ms Performance to Power Attion Target Load Si, ops Active Power Performance to Power Ratio 100% 98.6% 22.543.503 4,626 4,873 90% 89.2% 10.401.345 4,190 4,869 60% 59.9% 13.706.824 2,983 4,596 50% 50.0% 11.443.892 2,710 4,223 40% 40.0% 14.0,571.15 2,169 2,101 10% 19.9% 4,567.115 2,169 2,101 10% 19.9% 4,567.115 2,169 2,101 10% 19.9% 4,567.115 2,169 2,101	(
System Source: Single Supplier System Designation: Server Power Provisioning: Line- powered Set B200M3 WARNING: For point 0, elapsed nanoTime=241120312423 ns, elapsed currentTimeMillis=240023 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=24121504314865 ns, elapsed currentTimeMillis=240022 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=24121504314865 ns, elapsed currentTimeMillis=240022 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=24121504314865 ns, elapsed currentTimeMillis=240022 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240022 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240022 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240022 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240022 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240037 ms Performance Power (W) Performance 0 Power Ratio (W) 100% 93.6% 12.543.503 4.626 4.873 30% 39.2% 12.434 4.626 4.873 4.680 30% 39.2% 19.179.748 3.766 4.840 4.640 4.640 4.640 100% 49.7% 115.03.1,009 3.345 4.763 4.640 4.640 4.640 4.640 4.640 4.640 4.640 4.640 4.640 4.640 4.640 <								
Set B200M3 WARNING: For point 0, elapsed nanoTime=241423012423 ns, elapsed currentTimeMillis=240022 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=24213798216 ns, elapsed currentTimeMillis=240053 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=241925361193 ns, elapsed currentTimeMillis=240225 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240023 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240037 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240037 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240037 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240037 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240037 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240037 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240037 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=242135114305 ns, elapsed currentTimeMillis=240037 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=241925361193 ns, elapsed currentTimeMillis=240037 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=241925361193 ns, elapsed currentTimeMillis=240037 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=241925361193 ns, elapsed currentTimeMillis=240037 ms Set B200M3 WARNING: For point 0, elapsed 20, 20040 3,000 4,000 6, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,	Syst							
Benchmark Results Summary Performance Power Target Actual ssj.ops Average Performance to Power Ratio Power Ratio 100% 3.000 4.000 6.200 100% 98.6% 22,543,503 4.626 4.873 90% 3.92% 20.401.345 4.190 4.869 80% 79.5% 18,179,748 3.756 4.340 70% 4.763 60% 59.9% 13,706,824 2.983 4.596 4.596 50% 50.0% 11,443,892 2.710 4.223 40% 40.0% 9,140,519 2,517 3.631 30% 30.0% 6.866,922 2,340 2.934 20% 19.9% 4.557,115 2.169 2.101 10% 5.5j_ops / ∑power = 3,881 0% 2.934 20% 1.45 0.000 3.000 4.000 4.145 0.1,000 2.000 3.000 4.000 4.994 0.1,000	Set B200M3 Set B200M3 Set B200M3 Set B200M3 Set B200M3							
Performance Power Target Actual ssj.ops Average Mactive Power Performance to Power Ratio Power Ratio 100% 93.6% 22,543,503 4,626 4,873 90% 39.2% 20,401,345 4,190 4,869 80% 79.5% 18,179,748 3,756 4,840 70% 69.7% 15,931,909 3,345 4,763 60% 59.9% 13,706,824 2,983 4,596 50% 50.0% 11,443,892 2,710 4,223 40% 40.0% 9,140,519 2,517 3,631 30% 30.0% 6,866,922 2,340 2,934 20% 19.9% 4,557,115 2,169 2,101 10% 2,302 5,381 0% 2,334 20% 19.9% 4,557,115 2,169 2,101 10% 1,00% 2,282,723 1,994 1,145 Active Idle 0								
$\frac{100\%}{100\%} \frac{98.6\%}{22,543,503} \frac{4,626}{4,626} \frac{4,873}{4,869} \\ \frac{90\%}{30\%} \frac{39.2\%}{79.5\%} \frac{20,401,345}{18,179,748} \frac{4,190}{3,756} \frac{4,340}{4,369} \\ \frac{30\%}{79.5\%} \frac{15,931,909}{13,706,324} \frac{2,983}{2,983} \frac{4,596}{4,596} \\ \frac{50\%}{50\%} \frac{50.0\%}{50.0\%} \frac{11,443,892}{1,1443,892} \frac{2,710}{2,710} \frac{4,223}{4,223} \\ \frac{40\%}{4,00\%} \frac{4,557,115}{2,169} \frac{2,101}{2,101} \\ \frac{10\%}{10.0\%} \frac{12,232,723}{2,232,723} \frac{1,994}{1,994} \frac{1,145}{1,145} \\ \frac{Active Idle}{10} \frac{1,593}{1,593} \frac{0}{1,593} \\ \frac{50\%}{50\%} \frac{52,005}{2,000} \frac{1}{2,500} \frac{1}{2,500} \frac{1}{2,500} \frac{1}{2,500} \frac{1}{2,500} \frac{1}{2,000} \frac{1}{3,000} \frac{1}{4,000} \\ \frac{4,810}{2,934} \frac{1}{2,934} \frac{1}{1,145} \frac{1}$	Target Load							
$\frac{100\%}{90\%} \frac{33.3\%}{22,0401,345} \frac{4,020}{4,190} \frac{4,073}{4,869}$ $\frac{30\%}{79.5\%} \frac{13,179,748}{13,179,748} \frac{3,756}{3,756} \frac{4,340}{4,340}$ $\frac{70\%}{69.7\%} \frac{15,931,909}{13,706,324} \frac{2,933}{4,596} \frac{4,596}{50\%} \frac{4,763}{50\%} \frac{4,763}{4,763}$ $\frac{60\%}{59.9\%} \frac{13,706,324}{2,934} \frac{2,933}{4,592} \frac{4,596}{2,110} \frac{4,223}{40\%} \frac{4,696}{3,631} \frac{4,763}{3,631} \frac{40\%}{3,631} \frac{4,696}{3,631} \frac{4,223}{40\%} \frac{4,696}{3,631} \frac{4,223}{40\%} \frac{4,696}{3,631} \frac{4,223}{40\%} \frac{4,696}{3,631} \frac{4,223}{40\%} \frac{4,223}{40\%} \frac{4,223}{40\%} \frac{4,223}{40\%} \frac{4,696}{3,631} \frac{4,223}{40\%} \frac{4,223}{4$	10.0%							
80% 79.5% 18,179,748 3,756 4,840 70% 69.7% 15,931,909 3,345 4,763 60% 59.9% 13,706,824 2,983 4,596 50% 50.0% 11,443,892 2,710 4,223 40% 40.0% 9,140,519 2,517 3,631 30% 30.0% 6,866,922 2,340 2,934 20% 19.9% 4,557,115 2,169 2,101 10% 10.0% 2,282,723 1,994 1,145 Active Idle 0 1,593 0 ∑ssj_ops / ∑power = 3,881 0% 1,45 Active Idle 0 1,593 0 Active Idle 0 1,593 0 Active Idle 0 1,593 0 Active Power (W) 3,600 4,000 Active Power (W) 1,000 2,000 3,000 4,000	90%							
70% 69.7% 15,931,909 3,345 4,763 60% 59.9% 13,706,824 2,983 4,596 50% 50.0% 11,443,892 2,710 4,223 40% 40.0% 9,140,519 2,517 3,631 30% 30.0% 6,866,922 2,340 2,934 20% 19.9% 4,557,115 2,169 2,101 10% 10.0% 2,282,723 1,994 1,145 Active Idle 0 1,593 0 ∑ssj_ops / ∑power = 3,881 0% 1,455 Active Idle 0 1,593 0 Active Idle 0 1,593 0 Active Power (W) 1,000 2,000 3,000 4,000	80%							
$\frac{60\%}{59.9\%} \frac{13,706,324}{13,706,324} \frac{2,983}{2,983} \frac{4,596}{4,223}$ $\frac{4,596}{50\%} \frac{4,596}{50.0\%} \frac{11,443,392}{11,443,392} \frac{2,710}{2,517} \frac{4,223}{3,631}$ $\frac{40\%}{30\%} \frac{4,557,115}{30\%} \frac{2,57,115}{2,169} \frac{2,101}{1,145}$ $\frac{1,145}{1,145} \frac{1,145}{1,145} 1,1$	70%							
$\frac{50\%}{50.0\%} \frac{50.0\%}{11.443,892} \frac{2,710}{2.517} \frac{4,223}{3.631}$ $\frac{40\%}{30.0\%} \frac{40.0\%}{9.140,519} \frac{2,517}{2.517} \frac{3,631}{3.631}$ $\frac{20\%}{19.9\%} \frac{4,557,115}{4,557,115} \frac{2,169}{2,101} \frac{2,101}{1.0\%} \frac{3.631}{2.334}$ $\frac{2,334}{20\%} \frac{2,334}{2.101} \frac{2,334}{1.145}$ $\frac{2,334}{1.145} \frac{2,334}{1.145} \frac{2,334}{1.1$	60%							
$\frac{40\%}{40.0\%} \frac{40.0\%}{9,140,519} \frac{2,517}{2,517} \frac{3,631}{3,631}$ $\frac{30\%}{30.0\%} \frac{30.0\%}{6,866,922} \frac{2,340}{2,340} \frac{2,934}{2,934}$ $\frac{20\%}{19.9\%} \frac{4,557,115}{4,557,115} \frac{2,169}{2,101} \frac{2,101}{1,0\%} \frac{3,631}{2,934} \frac{3,631}{2,934}$ $\frac{2,934}{2,0\%} \frac{2,101}{1,145} \frac{1,145}{1,145} \frac{1,145}{1,145} \frac{1,145}{1,145} \frac{1,145}{1,145} \frac{1,145}{1,145} \frac{1,145}{1,145} \frac{1,145}{1,145} \frac{1,145}{1,10\%} \frac{1,115}{1,10\%} \frac{1,115}{1,10\%$	50%							
30% 30.0% 6,866,922 2,340 2,934 20% 19.9% 4,557,115 2,169 2,101 10% 10.0% 2,232,723 1,994 1,145 Active Idle 0 1,593 0 ∑ssj_ops / ∑power = 3,881 Active Idle 0 1,000 2,000 Active Idle 0 1,000 2,000 3,000 Active Idle 0 1,000 2,000 3,000 4,000	40%							
20% 19.9% 4,557,115 2,169 2,101 10% 10.0% 2,232,723 1,994 1,145 Active Idle 0 1,593 0 ∑ssj_ops / ∑power = 3,881 Active Idle 0 1,000 10% 1,145 Active Idle 0 1,145 1,145 Active Idle 0,000 Active Idle 1,000 2,000 3,000 4,000 Average Active Power (W)	30%							
10% 10.0% 2,282,723 1,994 1,145 Active Idle 0 1,593 0 Σssj_ops / Σpower = 3,881 Active Idle 0 1,000 10% 1,145 1,145 1,145 1,145 1,145 0 1,000 2,000 3,000 4,000 Average Active Power (W)	20%							
Active Idle 0 1,593 0 Σssi_ops / Σpower = 3,881 10% 1,145 Idle 0 1,000 2,000 3,000 4,000 Active Idle 0 1,000 2,000 3,000 4,000 Aggregate SUT Data	10%							
<u>Σssi_ops / Σpower =</u> 3,881 Active Idle 0 1,000 2,000 3,000 4,000 Average Active Power (W) Aggregate SUT Data	Ac							
0 1,000 2,000 3,000 4,000 Average Active Power (W) Aggregate SUT Data								
Average Active Power (W) Aggregate SUT Data								
Aggregate SUT Data								
# of Nodes # of Chips # of Cores # of Threads Total RAM (GB) # of OS Images # of JVM Instance	# of Nod							
16 32 256 512 512 16								
System Under Test								
Shared Hardware								
Shared Hardware Enclosure: 2X UCS 5108 Server Chassis								
Power Supply Quantity and Rating (W): 8 × 2500								
Power Supply Details: Cisco P/N UCSB-PSU-2500ACPL								
Network Switch: 2X UCS 6248UP								
Network Switch Details: 20-Port 10Gb Fabric Interconnect								
KVM Switch: None								
KVM Switch Details: N/A	<i>.</i>							
Uther Hardware: 2X UCS 2204XP Fabric Extender per UCS 5108 Chassis								
Comment: 2X 005 62480P power not included in measurement								
Set: 'B200M3'								

Figure 11. SPECpower_ssj2008 FDR: 2 Cisco UCS 5108 Chassis with 16 Cisco UCS B200 M3 Servers (Configuration 2)

Figure 12.	SPECpower_ssj2008 FDR: 2 Cisco UCS 5108 Chassis with 16 Cisco UCS B200 M3 Servers Including 2 Cisco UCS
	6248UP Fabric Interconnects (Configuration 2)

SPECpower_ssj2008																
Cines Susta			000	opyright © 20	07-2014 Sta	ndard Pe	erfor	mance Evaluation Corporation								
Cisco Syste	ems, inc		isc	o Systems.						58	ECPOW	er_ss	2008 =	3,291 000	aran s	ssj_ops/wa
Test	t Spon	sor:	nc.) ,	SPEC	License	<u>#:</u>	90	19				Test	Method:	M	ulti Node
1	Tested	<u>By:</u>	cisco nc.	o Systems,	Tes	t Locatio	<u>on:</u>	USA <u>Test Da</u>				est Date:	Ja	in 28, 2014		
A	Hardware Availability: Mar-2012						Software Vailability: Jun-2013			3			Pu	blication:	U	npublished
Syste	System Source: Single Supplier De							Se	rver				Prov	Power isioning:	Lii	ne- wered
Set B200M3 V Set B200M3 V Set B200M3 V Set B200M3 V Set B200M3 V	iet B200M3 WARNING: For point 0, elapsed nanoTime=241610597746 ns, elapsed currentTimeMillis=240115 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=241123066089 ns, elapsed currentTimeMillis=240022 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=241742741100 ns, elapsed currentTimeMillis=240007 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=241980618264 ns, elapsed currentTimeMillis=240007 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=241980618264 ns, elapsed currentTimeMillis=240007 ms Set B200M3 WARNING: For point 0, elapsed nanoTime=241768520462 ns, elapsed currentTimeMillis=240038 ms															
					Bench	mark Res	sults	Sur	nmary							
Per	forman	ce		Power							P	erform	nance	to Power F	Ratio	
Target A Load L	ctual oad	ssj or	os.	Average Active Power (W)	Performan Power R	nce to tatio			100%	0	1.00	3,21	2,000 1 overall	3,000 ssj_ops/watt		4,000
100%	98.5%	22,516,	767	5,146		4,375			00%	4,01		_				
90%	89.2%	20,382,6	619	4,715		4,323			80%	4,52	3					
80%	79.3%	18,137,	325	4,275		4,242			80%	4,24	2					
70%	69.7%	15,936,	381	3,869		4,119		-	70%	4,11	9					
60% S	59.9%	13,698,	880	3,506		3,908		0.00	60%	3,90	8			, P		
50%	50.0%	0 1 4 0 1	441	3,232	2	3,337		et	50%	3,53	7					
30%	30.0%	6 857	971	2 863		2 3 9 5		arg	40%	3,01	0					
20%	20.0%	4 560	760	2,000		1 609	1	-	30%	2 39	5			-		
10%	10 0%	4,309,	216	2,092		907			30%	2,00				7		
Activ	aldia	2,275,	010	2,313		507			20%	1,69	8		. /			
7 (611)		Σs	sj_c	ps/∑power=		3,291			10% Active	907			/			
									Idle	1			-			1
									(ò	1,000	2.	000	3,000 4	.000	5,000
											1	Avera	ge Acti	ve Power	(VV)	
					Ag	ggregate	SUT	Dat	ta							
# of Node:	s # 0	of Chips	5	# of Cores	# of Thread	ds To	otal	RAI	M (GB)		# of C)S Im	ages	# of J	VM I	nstances
2	16	3	32	256		512			5	12			16	5		2
					S	ystem U	nder	Tes	t							
						Shared H	lardw	are								
					S	hared H	ardv	vare	<u>e</u>							
					nclosure:	2X UC	S 51	08 \$	Server	Cha	Issis					
	-	_		Fo	m Factor:	6U										
	Powe	r Supp	ly C	uantity and F	lating (W):	8 x 250	00	100		1.05						
				Power Supp	ly Details:	Cisco F		JCS	B-PSL	U-25	UUACE	۳L				
	-			Netwo	K Switch:	24 003	0 62	480)P Tabaia i	lund -						
	<u> </u>		-	Network Swite	In Details:	20-Por	100		-apric	inter	connec	51				
	<u> </u>			KNIM Curit	W SWITCH:	NOR										
				NVM SWIL	In Details:		c 22	047	DEat	rie F	viand		1100 /	100 06-	noia	
				Other	Commont	28 110	5 22	104	ID now	IC E	cludes	lin m	0035	ment	2212	
					comment.	2/ 00	0 02	-00	how		ciuuet	4 11 1 11	easure			
						Set: 'B2	200M	3'								

			I	Setup	Power Analyzer Description: Connected SU						
					Temperature Sens	or temp1					
				Ha	rdware Vendor: Digi Interna	tional					
					Driver Version: Watchport/	H Virtual Port 5 10 26 0					
	Connectivity: USB										
				PTDaemo	n Host System: same as CO						
				PIDa Set	up Description: 25 mm in fr	US ont of SUT main airflow intake					
					Notes						
None					NOTES						
Trone					Power Details for De	Nico nurt					
Target Voltage Load Avg Bar	(V) Curi iae Ava	ent (A) Range	Avg Power Factor	Avg Active Power (W)	Power Measurement Uncertainty (%)	- Average Power					
Calibration 206 30	0.0 11.5	20.0	0.983	2,316	0.4%	2.250					
Calibration por po	0.0 11.0	20.0	0.002	2.240	0.400	2.000					
2 205 30	0.0 11.6	20.0	0.983	2,340	U.4%	1,750					
Calibration 205 30	0.0 11.6	20.0	0.983	2,347	0.4%	§ 1.600					
100% 205 30	0.0 11.4	20.0	0.983	2,307	0.4%	a 1,250					
90% 205 30 80% 205 30	0.0 10.4	20.0	0.979	2,094	0.5%	a 1,000					
70% 206 30	0.0 8.38	10.0	0.969	1,669	0.4%	760					
60% 206 30	0.0 7.49	10.0	0.963	1,486	0.4%	500 -					
40% 206 30	0.0 6.37	10.0	0.957	1,340	0.5%	250					
30% 206 30	0.0 5.95	10.0	0.945	1,161	0.5%	0					
20% 206 30	0.0 5.56	10.0	0.939	1,076	0.5%	10 200 00 00 00 00 00 00 00 00 00 00 00 0					
Active Idle 206 30	0.0 4.29	5.0	0.901	797	0.4%	0 ⁵⁰ 0 ⁵⁰ 0 ⁵⁰					
						Target Load					
The literation	00.0				Power Details for De	wice pwr2					
Load Avg Rar	qe Avq	Range	Factor	Power (W)	Uncertainty (%)	Average Power					
Calibration 207 30	0.0 2.61	5.0	0.965	521	0.5%	500					
Calibration 207 20	0.0.0.04		0.007	C04	0.5%	450					
2 207 30	0.0 2.61	5.0	0.905	921	0.5%	400					
Calibration 206 30	0.0 2.62	5.0	0.965	521	0.5%	S 350					
100% 206 30	0.0 2.62	5.0	0.965	521	0.5%	250 -					
90% 206 30	0.0 2.62	5.0	0.965	521	0.5%	200 -					
70% 207 30	0.0 2.61	5.0	0.965	521	0.5%	150					
60% 207 30	0.0 2.61	5.0	0.965	521							
40% 207 30	0.0 2.61	5.0	0.007	£04	0.5%	100 -					
20% 207 20		5.0	0.965	521 521	0.5% 0.5% 0.5%	100 - 50 -					
30% 207 30	0.0 2.61	5.0 5.0	0.965 0.965 0.965	521 521 521	0.5% 0.5% 0.5%						
20% 207 30	0.0 2.61	5.0 5.0 5.0	0.965 0.965 0.965 0.965 0.965	521 521 521 522 522 521	0.5% 0.5% 0.5% 0.5% 0.5%	100 50 0 					
20% 207 30 20% 207 30 10% 206 30 Active Idle 206 30	0.0 2.61 0.0 2.62 0.0 2.62 0.0 2.62	5.0 5.0 5.0 5.0 5.0	0.965 0.965 0.965 0.965 0.965 0.965	521 521 521 522 522 521 521	0.5% 0.5% 0.5% 0.5% 0.5% 0.5%	100 50 0 charter and					
20% 207 30 20% 207 30 10% 206 30 Active Idle 206 30	0.0 2.61 0.0 2.62 0.0 2.62 0.0 2.62	5.0 5.0 5.0 5.0 5.0	0.965 0.965 0.965 0.965 0.965 0.965	521 521 522 522 522 521 521	0.5% 0.5% 0.5% 0.5% 0.5% 0.5%	100 50 0 carting the start and the start of					
20% 207 30 20% 207 30 10% 206 30 Active Idle 206 30	0.0 2.61 0.0 2.62 0.0 2.62 0.0 2.62	5.0 5.0 5.0 5.0 5.0	0.965 0.965 0.965 0.965 0.965 0.965	521 521 522 522 521 521 521	0.5% 0.5% 0.5% 0.5% 0.5% 0.5% 0.5% 0.5%	100 50 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					
20% 207 30 20% 207 30 10% 206 30 Active Idle 206 30	0.0 2.61 0.0 2.62 0.0 2.62 0.0 2.62 0.0 2.62 (V) Curr 1ge Avg	5.0 5.0 5.0 5.0 5.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8	0.965 0.965 0.965 0.965 0.965 0.965 0.965 Avg Power <u>Factor</u>	521 521 522 522 521 521 521	0.5% 0.5% 0.5% 0.5% 0.5% 0.5% 0.5% Power Details for De Power Measurement Uncertainty (%)	100 50 0 supported parts of the state of the					
20% 207 30 20% 207 30 10% 206 30 Active Idle 206 30 Target Voltage Load Avg Rar Calibration 204 30	(V) Curringe Avg 0.0 11.5	5.0 5.0 5.0 5.0 5.0 5.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7.0 7	0.965 0.965 0.965 0.965 0.965 0.965 0.965 0.965 0.965 0.965	521 521 522 521 521 521 521 521 2313	0.5% 0.5% 0.5% 0.5% 0.5% 0.5% 0.5% 0.5%	Target Load					
Jois 8 207 Jois 207	(V) Curringe Avg 0.0 11.5 0.0 2.62 0.0 2.62 0.0 2.62 0.0 2.62 0.0 11.5	5.0 5.0 5.0 5.0 5.0 ent (A) Range 20.0 20.0	0.965 0.965 0.965 0.965 0.965 0.965 0.965 Avg Power Factor 0.983 0.983	521 521 522 521 521 521 521 521 521 521	0.5% 0.5% 0.5% 0.5% 0.5% 0.5% 0.5% Power Details for De Power Measurement Uncertainty (%) 0.4%	Target Load					
Jors 30 Jorget 207 Jorget 30 10% 206 30 Active Idle 206 30 Active Idle 206 30 Active Idle 206 30 Target Voltage Avg Rar Calibration 204 30 Calibration 204 30 Calibration 204 30	(V) Curr (V) Curr (V) Curr (u) 2.62 0.0 2.62 0.0 2.62 0.0 2.62 0.0 1.62 0.0 11.5 0.0 11.7 0.0 11.7	5.0 5.0 5.0 5.0 20.0 20.0	0.965 0.965 0.965 0.965 0.965 0.965 0.965 0.965 0.965 0.983 0.983 0.983	521 521 521 522 522 521 521 521 2,313 2,345	0.5% 0.5% 0.5% 0.5% 0.5% 0.5% 0.5% Power Details for De Power Measurement Uncertainty (%) 0.4%	Target Load					
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Jor 8 Z07 S0 20% 207 30 10% 206 30 Active Idle 206 30 Calibration 204 30 Calibration 204 30 Calibration 204 30 100% 204 30 90% 204 30 90% 204 30	Image Arg 0.0 2.61 0.0 2.62 0.0 2.62 0.0 2.62 0.0 2.62 0.0 2.62 0.0 2.62 0.0 2.62 0.0 1.62 0.0 11.5 0.0 11.7 0.0 11.7 0.0 11.7 0.0 11.6 0.0 10.5 0.0 9.45	5.0 5.0 5.0 5.0 20.0 20.0 20.0 20.0 20.0	0.965 0.965 0.965 0.965 0.965 0.965 0.965 0.965 0.983 0.983 0.983 0.983 0.983 0.983	521 521 521 522 521 521 521 2,313 2,313 2,345 2,353 2,318 2,100 1,880	0.5% 0.5% 0.5% 0.5% 0.5% 0.5% 0.5% Power Details for De Power Measurement Uncertainty (%) 0.4% 0.4% 0.4% 0.4% 0.5%	Target Load					
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Jor 8 Z07 S0 20% 207 30 10% 206 30 Active Idle Z06 30 Active Idle Z06 30 Target Load Voltage Avg Rar Calibration 2 204 30 Calibration 2 204 30 Calibration 3 204 30 90% 204 30 90% 204 30 90% 204 30 90% 204 30 90% 204 30 90% 204 30 90% 204 30 90% 205 30 60% 205 30 40% 205 30 20% 30 20% 30 20% 205 30 20% 205 30 20% 30 20% 30	Image: Non-Section 1 Image: Non-Section 1 0.0 2.61 0.0 2.62 0.0 2.62 0.0 2.62 0.0 2.62 0.0 2.62 0.0 2.62 0.0 1.62 0.0 1.62 0.0 1.7 0.0 11.7 0.0 11.7 0.0 10.5 0.0 9.45 0.0 0.5 0.0 6.97 0.0 6.53 0.0 6.57 0.0 5.72 0.0 5.72 0.0 5.72 0.0 5.72	5.0. 5.0. 5.0. 5.0. 5.0. 5.0. 5.0. 20.0. 20.0. 20.0. 20.0. 20.0. 20.0. 20.0. 20.0. 20.0. 10	0.965 0.965 0.965 0.965 0.965 0.965 0.965 0.965 0.983 0.983 0.983 0.983 0.983 0.983 0.983 0.983 0.983 0.979 0.974 0.966 0.953 0.953 0.947 0.933 0.923	521 521 522 522 521 521 2,313 2,345 2,353 2,353 2,318 2,100 1,679 1,499	0.5% 0.5% 0.5% 0.5% 0.5% 0.5% 0.5% 0.5%	Target Load					

Figure 13. Power and Temperature Detailed Report SPECpower_ssj2008 FDR: 2 Cisco UCS 5108 Chassis with 16 Cisco UCS B200 M3 Servers Including 2 Cisco UCS 6248UP Fabric Interconnects (Configuration 2)

Figure 14.	SPECpower_ssj2008 FDR: 1 Dell PowerEdge M1000e Enclosure with 8 Dell PowerEdge M620 G12 Servers
	(Configuration 1)

SPECpower_ssj2008													
Dell las	Dell Deres		(Copyrigh	t © 200	7-2013 Standard P	erfor	mar	nce Eva	luation C	orporation		
Dell, Inc	. Dell Pow	er⊨ag		o Svetor	20		CARGON .		woman or	SPECPOV	ver_ssj2008 = 3 	,565 over	all ssj_ops/watt
	est Spor	isor:	Inc.	obyster	113,	SPEC Licens	e #:	90	19		Test	Method:	Multi Node
	Testec	By:	Cisc Inc.	o Syster	ns,	Test Locat	ion:	US US	in Jose SA	, CA,	<u>Te</u>	st Date:	Dec 23, 2013
Hardware Availability: Mar-2012						Softw Availabi	vare lity:	Ju	l-2013		Publ	ication:	Unpublished
Sy	stem Sou	irce:	Sing	le Suppl	ier	Sys Designat	tem ion:	Server			Provis	Power sioning:	Line- powered
Set M620 Set M620 Set M620 Set M620	Set M620 WARNING: For point 0, elapsed nanoTime=242030632682 ns, elapsed currentTimeMillis=240022 ms Set M620 WARNING: For point 0, elapsed nanoTime=241152903689 ns, elapsed currentTimeMillis=240131 ms Set M620 WARNING: For point 0, elapsed nanoTime=241043026693 ns, elapsed currentTimeMillis=240022 ms Set M620 WARNING: For point 0, elapsed nanoTime=241766040049 ns, elapsed currentTimeMillis=240022 ms												
						Benchmark Re	sults	Su	nmary				
	Performa	nce		Pov	ver					F	Performance to	Power Ra	atio
Target Load	Actual Load	ssj	ops	Aver Active	age Power /)	Performance to Power Ratio			100%	1.0	00 2,000 3,565 overall	3,000 ssj ops/watt	4,000
100%	99.0 %	11,26	9,813		2,605	4,327			00%	1.500			
90%	89.8%	10,22	2,863		2,256	4,532			90%	4,532			
80%	80.0%	9,10	7,799		1,962	4,642			80%	4,642			
70%	70.0%	7,96	4,801		1,902	4,188	2	_	70%	4,188		, a	
60%	60.0%	6,82	6,596	-	1,650	4,138		oad	60%	4,138		, P	
50%	50.1%	5,69	9,576		1,507	3,783		at L	50%	3,783			
40%	40.0%	4,55	8,883		1,413	3,225		arg	40%	3 225			
30%	30.0%	3,41	3,231		1,263	2,703		Ē	204	0.700			
20%	19.9%	2,21	0,000		1,114	2,039			30%	2,703			
10%	10.0%	1,14	0,253	3	1,010	1,120			20%	2,039			
	Active fule		U Teel (ns (Th	030	3 565			10%	1,120	1		
				<u>P072P</u>		0,000			Idle		-		
									0	500	1,000 1,	500 2,0 Dowor 0	2,500
											Average Active	FOWEI (•)
						Aggregate	e SUT	Da	ta				
# of No	des #	of Ch	ins	# of Co	res	# of Threads T	otal	RA	4 (GR)	# of	OS Images	# of .IV	Minstances
	8	01 011	16		128	256	otai		25	6	8		128
						System L	Jnder	Tes	it				
						Shared I	Hardy	vare					
						Shared H	lard	var	B				
			Encl	osure:	Dell P	owerEdge M1000e							
		F	orm F	actor:	10U]
<u>P</u>	ower Su	oply C	uanti Ratir	ty and ig (W):	4 x 27	00							
	Powe	er Sup	ply D	etails:	(Dell F	P/N K569M)							
		Netw	ork S	witch:	Nexus	2232PP							
	Netwo	rk Sw	itch D	etails:	10GE	Fabric Extender 32	2 Por	s					
		K	(VM S	witch:	Avoce	nt iKVM Switch (De	ell P/	N: 0	K036D)]
	KV	M Sw	itch D	etails:	N/A								
		Othe	r Har	dware:	2x De 10/40	ll M1000e Chasis N GbE Blade Switch	lana	gem	ent Cor	ntroller (D	ell P/N: JV950)), 2x For	ce10 MXL
			Con	ment:	Netwo	ork switch power no	t incl	ude	d in me	asuremei	nt		

Figure 15.	SPECpower_ssj2008 FDR: 1 Dell PowerEdge M1000e Enclosure with 16 Dell PowerEdge M620 G12 Servers
	(Configuration 2)

SPECpower_ssj2008													
		C	opyright	© 200	7-2013 Standar	d Perfor	rmance Evaluation Corporation						
Dell, Inc.	Dell Pow	erEdg	e M620)		I		SPECpower_ssj2008 = 3,689 overall ssj_ops/watt					
Ī	est Spor	sor:	Cisc Inc.	o System	IS,	SPEC Lice	ense #:	9019			Test	Method:	Multi Node
Tested By: Cisco System Inc.					IS,	Test Lo	cation:	San . USA	Jose,	, CA,	Ξ	est Date:	Dec 30, 2013
	Hardy Availab	ware	Mar-	2012		So Avail	oftware ability:	Jul-2013			Pub	lication:	Unpublished
Sys	tem Sou	irce:	Sing	le Suppli	er	Desig	System	Server			Prov	Power isioning:	Line- powered
Set M620 V Set M620 V Set M620 V	VARNING VARNING VARNING	: For p : For p : For p	ooint 0, ooint 0, ooint 0,	elapsed r elapsed r elapsed r	nanoTir nanoTir nanoTir	ne=24151303115 ne=24134370735 ne=24159858475	i8 ns, ela i3 ns, ela i8 ns, ela	osed cu osed cu osed cu	urrent urrent urrent	TimeMillis= TimeMillis= TimeMillis=	=240100 ms =240006 ms =240178 ms		
						Benchmark	Results	Sumn	nary				
P	erformar	nce		Pow	er					P	erformance t	o Power R:	atio
Target Load	<u>Actual</u> Load	ssj	ops	Avera Active F	age Power	Performance f	to		0	1.00	0 2,000 3,689 overall	3,000 ssj ops/watt	4,000 5,000
100%	99.0%	22,56	6,700		4,982	4,5	529	11	00%	4,529		_	
90%	89.9%	20,47	3,912		4,235	4,8	334		90%	4,834			
80%	80.0%	18,23	5,248		3,721	4,9	000		80%	4,900			
70%	70.0%	15,94	4,659		3,729	4,2	276	3	70%	4,276		A	
60%	60.0%	13,65	9,931		3,229	4,2	231	pad	60%	4,231			
50%	50.0%	11,38	9,941	-	2,949	3,8	362	a L	50%	3,862			
40%	40.0%	9,10	9,267		2,763	3,2	297	Inge	40%	3 297			
30%	30.0%	6,83	8,218		2,425	2,8	320	Ĕ		0,201			
20%	19.9%	4,54	4,314 2,204		2,204	2,062			30%	2,820			
1070	ctive Idle	2,21	0,115		1 641	1,132			20%	2,062	_		1
	cuve fute		Ssi o	ons/Σno	wer =	3.6	589		10%	1,132	1		
						-,-		Ac	dle		-		
									ó	1 00	0 2 000	3 000 4	000 5000
										1,00	Average Activ	e Power (V	N)
						Aggre	gate SUI	Data					
# of Noc	des #	of Chi	ips	# of Cor	res	# of Threads	Total	RAM	(GB)	# of (OS Images	# of JV	M Instances
	16		32		256	512			51	2	16		256
						Syste	m Under	Test					
						Shar	ed Hardy	vare					
						Share	ed Hardy	vare					
			Encl	osure:	Dell P	owerEdge M100	00e						
		F	orm F	actor:	10U								
Po	ower Sup	oply C	uanti Ratin	ty and g (W):	6 x 27	00							
	Powe	er Sup	ply D	etails:	(Dell F	P/N K569M)							
		Netw	ork S	witch:	Nexus	s 2232PP							
	Netwo	k Swi	itch D	etails:	10GE	Fabric Extende	r 32 Por	s					
		K	VM S	witch:	Avoce	ent iKVM Switch	(Dell P/	N: 0K0)36D)				
	KV	M Swi	itch D	etails:	N/A			1.000					
		Othe	r Haro	ware:	2x De 10/40	II M1000e Chas GbE Blade Swit	is Mana ch	gemen	nt Cor	ntroller (D	ell P/N: JV95	D), 2x For	ce10 MXL
			Com	ment:	Netwo	ork switch power	not incl	uded i	n me	asuremer	nt		
	Set: 'M620'												



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