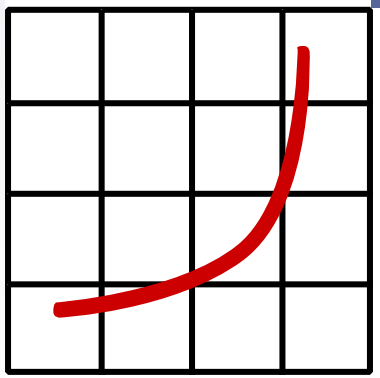
Server Efficiency Rating Tool™

Overview - SERT 1.0.2

June 2014

Klaus-Dieter Lange

Chair, SPECpower Committee, SPEC



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Agenda

ENERGY STAR Stakeholder Meeting

Offices of the Information Technology Industry Council (ITIc)

Washington, DC, USA – 23.-24. June 2014

SPEC Overview
SERT Design Goals
Workload / Worklets
SERT Output file
Metric Discussion

SPEC Overview

A world-wide non-profit consortium formed in 1988 to establish, maintain and endorse a standardized set of relevant benchmarks that can be applied to the newest generation of high-performance computers

Comprised out of over 80 computer hardware and software vendors, educational institutions and government agencies

Developed over 30 industry-standard benchmarks for system performance evaluation in a variety of application areas

Largest public repository of well documented, peer reviewed, benchmark results (~30,000)

In-depth understanding of workloads, benchmark code, fair comparisons across different platforms

SPEC welcomes organizations to join and participate in our work, and stands ready to offer guidance on workloads and benchmarks

- Membership is open to any interested company or entity

SPEC's Server Efficiency Rating Tool
Design Goals

- Performance / Watt across a wide spectrum of server configurations
  - Scale with increased resources
- Agnostic
  - Architectural, OS, Platform, Implementation Languages
- Cross-Subsystem Worklets
- Easy to configure and use
- Result Repeatability
- Extensibility & Scalability

US ENERGY STAR Computer Servers Version 2.0
March 15, 2013

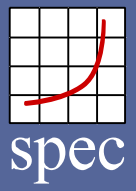
Workload

SERT's Workloads (Collections of Synthetic Worklets)

- Worklet design guidelines:
  - Worklets to assess CPU, Memory, Storage IO subsystem
  - Network IO will be handled by *configuration power/performance modifiers*
  - Worklets do not represent a particular application
  - Adjustable to different performance levels
  - Self-calibrate to maximum performance level
  - Multiple programming languages may be used
  - Scale with the available hardware resources
  - Higher worklet score indicates higher energy efficiency
    - Different worklets produce different metrics and can not be compared against each other
    - The worklet score definitions are currently in development

SPEC's Server Efficiency Rating Tool

Worklets



Workload	Worklet Name	Load Level
CPU	Compress	100%, 75%, 50%, 25%
	CryptoAES	
	LU	
	SHA256	
	SOR	
	SORT	
	XMLValidate	
Memory	Flood	Flood: Full, Half
	Capacity	Capacity: 4GB, 8GB, 16GB, 128GB, 256GB, 512GB, 1024GB
Storage	Random	100%, 50%
	Sequential	
Hybrid	SSJ	100%, 87.5%, 75%, 62.5%, 50%, 37.5%,25%, 12.5%
Idle	Idle	idle

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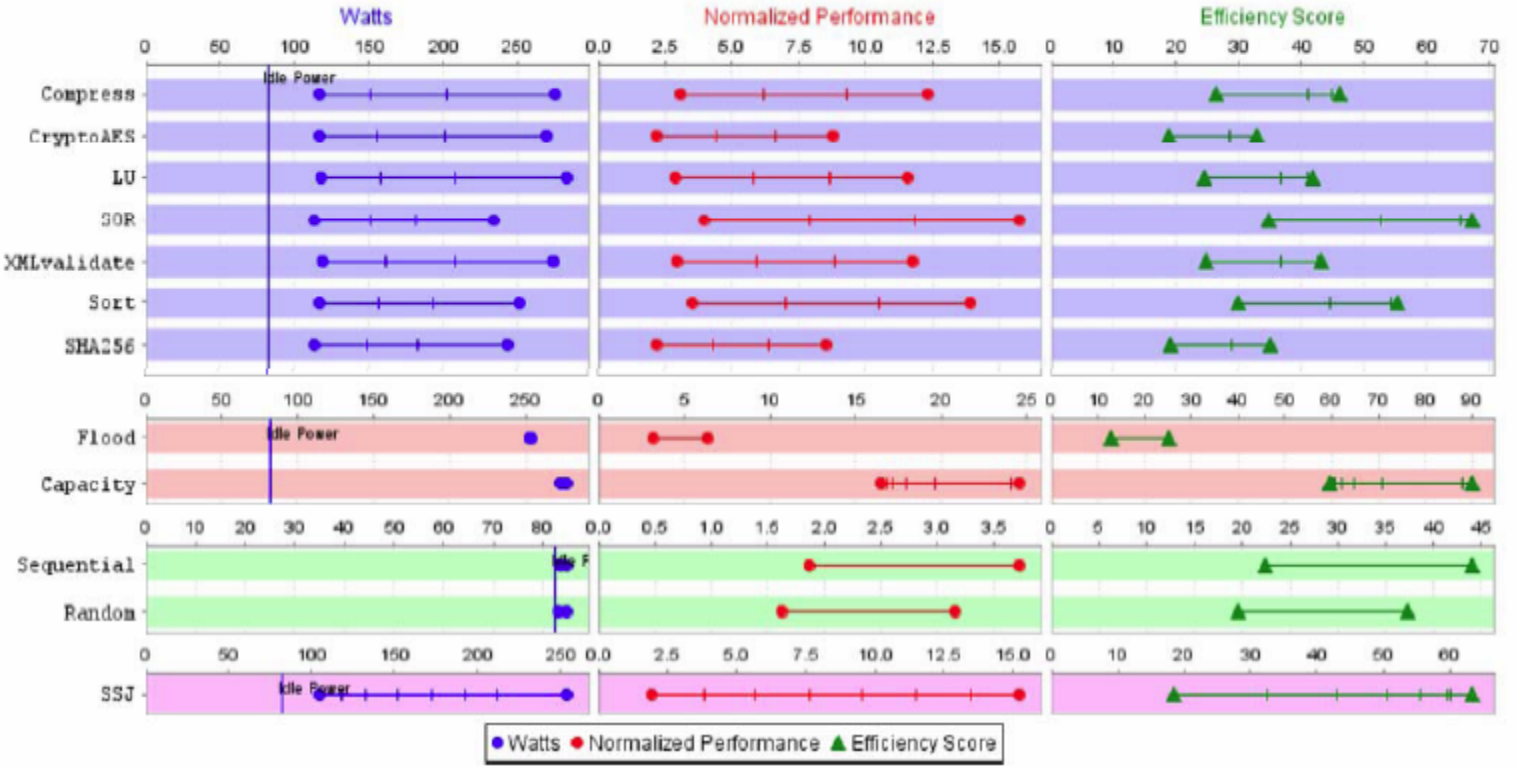
SERT™ Report

Company X Model Y			
Test Sponsor	Company X	**Software Availability**	Sep-2013
Tested By	Company X	**Hardware/Firmware Availability**	Sep-2013
SPEC License #	3	**System Source**	Single Supplier
Test Location	XYZ, XY, Earth	**Test Date**	Aug 26, 2009

Summary



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Output file 2/4 - html

Workload	Worklet	Normalized Peak Performance	Watts at Lowest Load Level	Watts at Highest Load Level	∑ Normalized Performance	∑ Power (Watts)	Efficiency Score
CPU	Compress	12.323	116.7	275.4	30.882	745.2	41.438
	CryptoAES	8.802	116.7	269.5	22.005	742.4	29.642
	LU	11.578	118.4	283.2	28.961	767.5	37.733
	SOR	15.771	113.3	234.7	39.463	680.0	58.034
	XMLvalidate	11.795	119.6	273.5	29.536	762.1	38.756
	Sort	13.936	117.2	251.8	34.907	719.4	48.522
	SHA256	8.514	112.9	243.7	21.355	688.4	31.023
Memory	Flood	6.395	253.0	253.8	9.638	506.8	19.018
	Capacity	24.581	272.7	277.2	169.841	2,480.7	68.465
Storage	Sequential	3.732	83.3	84.7	5.598	168.0	33.330
	Random	3.167	83.2	84.8	4.796	168.0	28.549
Hybrid	SSJ	15.236	104.4	253.7	68.745	1,336.0	51.457
Idle	Idle	n/a	82.4	82.4	n/a	82.4	n/a

Aggregate SUT Data

# of Nodes	1	# of Processors	2
Total Physical Memory	24.0 GB	# of Cores	16
# of Storage Devices	1	# of Threads	32

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System Under Test			
Hardware per Node (1 Node)			
Hardware Vendor	Company Y	Power Supply Quantity (active / populated / bays)	1 / 1 / 2
Model	Model Y	Power Supply Details	1 x 700W, 121222-021
Form Factor	1U	Power Supply Operating Mode	Standard
CPU Name	Intel(R) Xeon(R) CPU E5-2660 @ 2.20GHz	Available Power Supply Modes	Standard, Redundant
CPU Frequency	2200 MHz (up to 3000 MHz), Intel Turbo Boost Technology is enabled	Disk Drive Bays (populated / available)	1 / 8
Number of CPU Sockets (populated / available)	2 / 2	Disk Drive	1 x (Standard disk drives) 146.0 GB SAS Fixed hard disk media XZY ArrayController Z100 Drive Write Cache is disabled
CPU(s) Enabled	16 cores, 2 processors, 8 cores/processor	Network Interface Cards	4 x XYZ Ethernet 1Gb 4-port 99DYZ Adapter 1 connected, 0 enabled in OS, 2 enabled in firmware 0 Mbit/s
Number of NUMA Nodes	2	Network Interface Cards	4 x XYZ Ethernet 1Gb 4-port 99DYZ Adapter 0 connected, 1 enabled in OS, 2 enabled in firmware 1000 Mbit/s
Hardware Threads	32 (2/core), Hyperthreading enabled	Network Interface Cards	3 x XYZ Ethernet 1Gb 4-port 99DYZ Adapter 1 connected, 0 enabled in OS, 2 enabled in firmware 0 Mbit/s
Primary Cache	32KB I+D on chip per chip	Management Controller or Service Processor	Yes
Secondary Cache	256MB I+D on chip per chip	Expansion Slots (populated / available)	0 / 2 PCI
Tertiary Cache	20MB I+D on chip per chip	Optical Drives	No
Additional Cache	None	Keyboard	KVM
Additional CPU Characteristics	None	Mouse	KVM
Total Memory Available to OS	16.0 GB	Monitor	No
Total Memory Amount (populated / maximum)	24.0 GB / 192.0 GB	Additional Hardware	0 x N/A
Total Memory Slots (populated / available)	4 / 24		
Memory DIMMs	4 x 4GB 2Rx4 PC3L-12800R ECC CL11; slots 1, 2, 3, and 4 populated		
Memory Operating Mode	Advanced ECC		

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Software per Node (1 Node)			
Power Management	Enabled (see SUT Notes)	Boot Firmware Version	P71 09/08/2013
Operating System (OS)	Microsoft Corporation Microsoft Windows Server 2008 R2 Enterprise |C:\Windows|\Device\Harddisk0\Partition2	Management Firmware Version	1.20
OS Version	6.1.7601	JVM Vendor	IBM Corporation
Filesystem	NTFS	JVM Version	pwa6470sr1-20120405_01 (SR1)
Additional Software	None	SERT Client Configuration	Intel_Win_J917_1

SUT Notes

- Using the local security settings console, lock pages in memory was enabled for the user running the benchmark.

Aggregate Electrical and Environmental Data

Line Standard	208V / 60 Hz / 1 phase / 2 wires
Elevation (m)	132
Minimum Temperature (°C)	24.9

http://www.spec.org

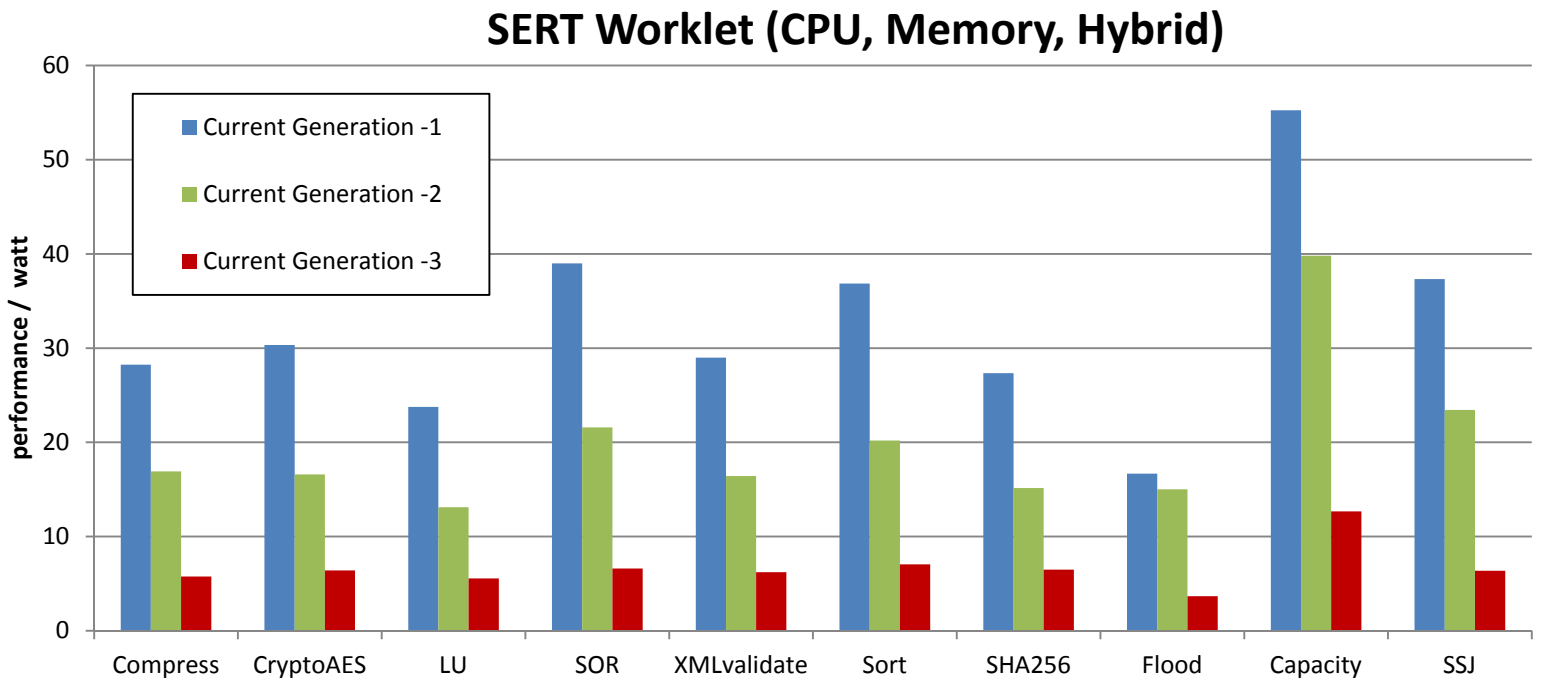
Result obtained with SERT 1.0.1

Report generated with Reporter 1.0.2 (20130718)

SPEC's Server Efficiency Rating Tool
Metric Discussion 1/2

Example:

Worklet efficiency scores across 3 generations of one server model



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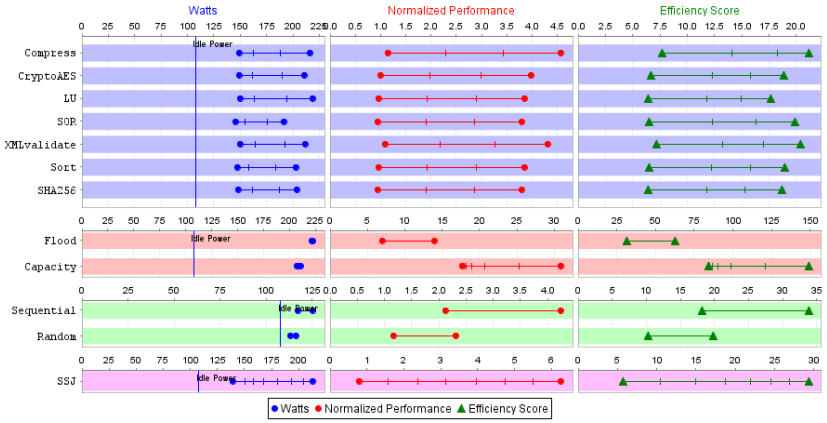
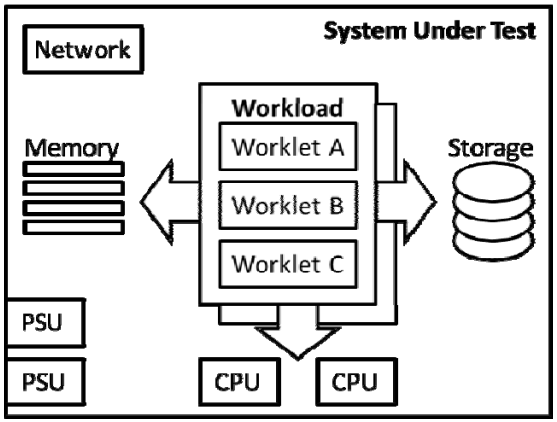
Metric Discussion 2/2

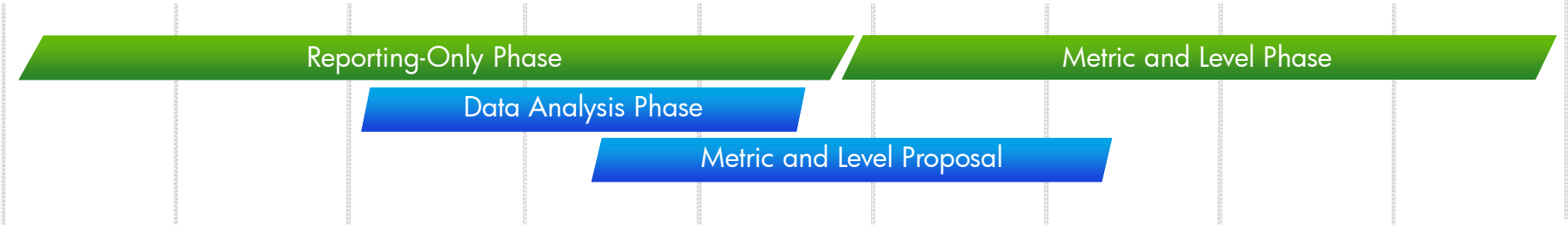
Each worklet measures the performance and average power consumption at multiple target load levels.

Configuration power/performance modifier "Substitution" for real measurements for items SERT cannot measure or the performance cannot be determined (e.g., redundant power supplies)

Complexity of performance and power measures across components at multiple target load levels makes creation of a metric difficult. An overall score(s) is not provided and not recommended.







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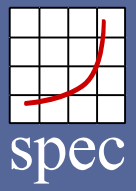
Q&A



Resources

Server Efficiency Rating Tool home page

- http://www.spec.org/sert/

Server Efficiency Rating Tool (SERT) Design Document 1.0.2

- http://www.spec.org/sert/docs/designdocument.pdf

SPEC PTDaemon

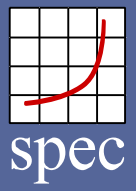
- http://www.spec.org/power/docs/SPECpower-Device_List.html

SPEC Benchmark Methodology

- http://www.spec.org/power/docs/SPEC-Power_and_Performance_Methodology.pdf

ENERGY STAR Enterprise Servers V2 home page

- https://www.energystar.gov/products/specs/node/142



Thank you!

Acknowledgements

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Corporate Support

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Backup Slide(s)

SPEC's Server Efficiency Rating Tool
Hardware and Software Configuration

Controller and SUT