Server Efficiency Rating Tool (SERT) 1.0.2: An Overview

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ABSTRACT
The Server Efficiency Rating Tool (SERT) has released the Standard Performance Evaluation Corporation (SPEC) and the EPA released Version 2.0 of the ENERGY STAR for Computer Servers program in early 2013 to include the mandatory use of the SERT. Other governments world-wide that are concerned with the growing power consumption of servers and datacenters are also considering adoption of the SERT. This poster-paper provides an overview of the current release of 1.0.2 version of SERT.

Categories and Subject Descriptors
H.3.4 [**Systems and Software**]: Performance evaluation (efficiency and effectiveness)

General Terms
Design, Experimentation, Measurement, Performance, Reliability, Standardization.

Keywords
SPEC, Benchmark, Energy Efficiency, Server, System Performance, Performance Engineering, Memory, System Discovery, Affinitization, Framework, Reporting, Energy Star, Environmental Protection Agency (EPA).

1. SERT OVERVIEW
The SERT [2] is designed to be an architecture-neutral rating tool for measuring the overall energy efficiency of servers. It is highly scalable and has been tested on servers with up to eight sockets (or processors) and on up to 64 homogeneous multi-node servers (or blade servers). It is supported on servers based on the Intel and AMD x64 family of processor, IBM POWER, Oracle SPARC (all 64-bit) and ARM Cortex-A9 & A15 (32-bit).

The use of multiple power analyzers and temperature sensors is supported by the SERT in order to measure a large scope of system configurations. The most basic SERT measurement configuration requires one **power analyzer**, one **temperature sensor**, a system under test **(SUT),** and a **Controller** system.

The SERT's test harness, named **Chauffeur** [7], controls the software installed on the SUT and **Controller**. Chauffeur also handles the logistical side of measuring and recording the power consumption and inlet temperature of the SUT.

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The SUT gets instructions from the **Director** (Chauffeur instance) to execute the suite, which is comprised of a set of **workloads**. The workload consists of a set of **Worklets**, which exercise the SUT while Chauffeur collects the power and temperature data. The Worklets are the actual code designed to stress a specific system resource or resources, such as the CPU, memory, or storage IO [3].

Each power analyzer and temperature sensor interacts with its dedicated instance of the **SPEC PTDaemon**, which gathers their readings while the Worklets are executed.

The **Reporter**, executed after all measurement phases are completed, compiles all of the environmental, power, and performance data for a complete test run into an easy-to-read HTML report as well as an extensible markup language (XML) report; the HTML report includes a graphical visualization of the results.

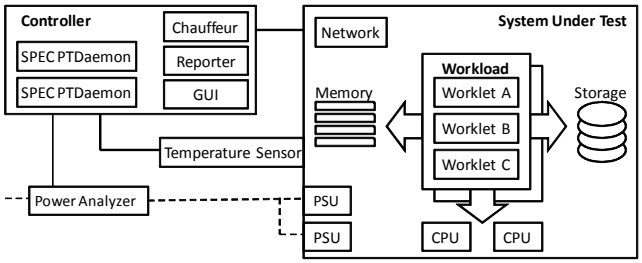


Figure 1 - Discovery Workflow

2. GRAPHICAL USER INTERFACE
The SERT includes a graphical user interface (GUI) in order to simplify the configuration and setup of test runs, allow real-time monitoring and to review the final results. The GUI is provided to enable test engineers with minimal power consumption and efficiency experience to more easily configure the SUT, including hardware and software detection and configuration, selecting the correct tests and initiating the test sequence.

The GUI offers ease of navigation with tabbed screens via a navigation menu and Back/Next buttons, per screen Help, and the ability to review/edit/save fields which are automatically populated via the automated discovery support. This also allows a specific configuration to be saved for subsequent re-use when re-testing the same or a similar SUT.

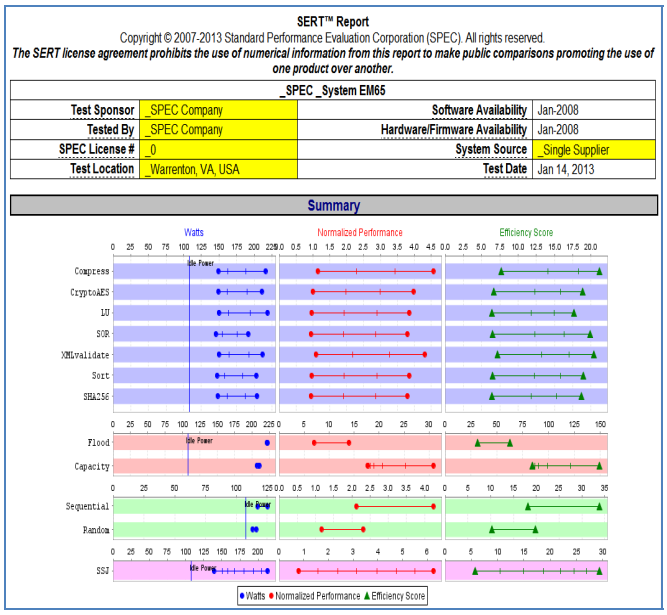
The GUI can automatically select the appropriate command-line options and number of clients, based on the processor, operating system and Java Virtual Machine (JVM) being used.

The GUI also supports selecting the correct power analyzer and temperature sensor for the list of supported devices, performing

the necessary configuration and creating and testing the connections between PTDaemon and the selected devices.

3. SERT OUTPUT

The SERT produces a final HTML report [4] that looks like this:



The main SERT report is generated in XML format. This contains all the information regarding the SERT run including all hardware and software configurations of the Controller, the SUT, and the SERT workloads. It includes all relevant information about the Worklets, such as JVM affinity & options, and other launch settings, along with the resulting performance, power and efficiency results.

As well as the XML, there are also four more human readable reports, two in HTML and two more in formatted text, covering higher level results (as shown in the included image) and the full detailed drill-down of all possible parameters and results

4. WORKLOADS and WORKLETS

The SERT includes five workloads (CPU, Memory, Storage, Hybrid and Idle) which in turn comprise a total of thirteen Worklets that focus on specific areas of processor, memory or storage IO behavior.

Due to the complexity and potential cost of creating a highly performant networking environment the Network IO is handled by a configuration modifier that simulates steady state efficiency of an ideal network adapter.

A detailed examination of all the SERT Worklets is included in the SERT Design Document [6]. This includes a section describing what they do, how they work and why they were selected for the final release.

5. NEXT STEPS

Development of the SERT is on-going, with regular enhancements being provided to further simplify configuration and use, as well as adding support for more hardware platforms and power analyzers.

SPEC is planning to create a Worklet construction kit, enabling 3rd parties to develop new Worklets and workloads, and initially targeting academic partners. There is also significant on-going work to define metrics, making use of the initial data that has been acquired during the development and initial public use of the SERT [5].

6. CONCLUSIONS

The SERT was released in February 2013, for use in Version 2.0 of the EPA ENERGY STAR for Computer Servers program [1]. Updates are already underway to support simplified test configuration, and to add additional processor support. Use of the SERT became mandatory as part of acquiring ENERGY STAR for Computer Servers Version 2 in December 2013.

7. ACKNOWLEDGEMENTS

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[5] Server Efficiency Rating Tool - Home Page: http://www.spec.org/sert/

[6] Server Efficiency Rating Tool - Design Document (Section 7 describes the current set of Worklets): http://www.spec.org/sert/docs/SERT-Design_Document.pdf

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