Server Efficiency Rating Tool™
May 2010 – Development Update

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ENERGY STAR® Computer Server Version 2.0 – Draft 1
Stakeholder Webinar – May 27, 2010

- SPEC – Overview and Philosophy
- SPEC’s Server Efficiency Rating Tool™
  - Goals and Requirements
  - Worklet
  - Workload
  - Scores and Metric
  - Scope (First Release)
  - Schedule
- Next Steps
- Q & A
SPEC’s Server Efficiency Rating Tool™
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 (20,000+)
- In-depth understanding of workloads, benchmark code, fair comparisons across different platforms
SPEC’s Server Efficiency Rating Tool™

SPEC’s Philosophy

- To ensure that the marketplace has a fair and useful set of metrics to differentiate systems
  - A good benchmark, that is reasonable to utilize, will lead to a greater availability of results in the marketplace

- To provide a standardized suite of code that has already been ported to a wide variety of platforms
  - The licensee can immediately start with the measurement on all supported platforms without code-porting

- 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
Server Efficiency Rating Tool (SERT)

- Evaluate the energy efficiency of computer servers
- Built for and in conjunction with the US EPA Energy Star Program
  - Collaborate on workload, metric and logistics
- First order approximation of server efficiency
  - Executes a variety of common types of work (worklets)
  - Not representative of any particular application area
  - Not a capacity planning tool
- Economical, easy to use, minimal equipment and skills requirements
  - Through automated processes
- Hardware Architecture and OS Agnostic
  - Supports various hardware platforms and OS’s
- Leverage and extend SPEC methods, code-base and expertise
- AMD, Dell, Fujitsu, HP, Intel, IBM, Microsoft, Oracle have committed resources for the development of SERT in the SPECpower Committee
SERT 1.0.0 workload will be a collection of synthetic worklets

- Worklets design guidelines:
  - Worklets to assess CPU, Memory, Network IO, Storage IO subsystem
  - 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 worklet scores will have different metrics and cannot be compared against each other
    - The definition of the worklet scores is currently in development
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SERT Workload

- **Worklet Execution**
  - In the current design the worklets will run consecutively, each in its own phase. This allows the generation of independent scores at different load levels which can be combined to an overall metric.
  - Selected worklets or additional worklets specifically designed for concurrent execution may be run simultaneously in an extra phase. Concurrent execution of worklets will introduce more realistic task-switching, especially using IO load modules.

- **Load Levels**
  - Multiple load levels are a design goal of SERT. The active idle load level as well as a 100% workload level (not max power) are already good candidates. Prototype testing will show which levels will be included and if any weighting will be necessary.
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SERT Metric/Score

- Configuration power/performance adders
  - “Substitution” for real measurements for items SERT can not measure or the performance can not be determined (e.g., redundant power supplies)
  - TBD by EPA based on data collection

- Each worklet will produce a measure representing the performance achieved by the SUT, which then must be combined with the measures produced by the other worklets to yield a metric indicative of the overall performance of the SUT on all worklets used in the tool

- SPEC currently plans that the multiple performance measures produced in this manner be combined into a single metric as the geometric mean of the individual measures
Processor sockets/compute nodes

- SERT 1.0.0 will be designed for and tested with
  - Max. 8 sockets per node
  - Max. 64 nodes
  - Limited to homogeneous and blade servers

Platform/OS

- SERT 1.0.0 will be implemented for and is planned to be tested on the following platform OS (64 bit only) combinations, pending resources:

<table>
<thead>
<tr>
<th>Platform</th>
<th>X86 (AMD)</th>
<th>X86 (AMD)</th>
<th>X86 (Intel)</th>
<th>X86 (Intel)</th>
<th>Itanium</th>
<th>Itanium</th>
<th>Power</th>
<th>Power</th>
<th>Power</th>
<th>SPARC</th>
</tr>
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<tbody>
<tr>
<td>OS</td>
<td>Windows 2008 R2</td>
<td>LINUX</td>
<td>Windows 2008 R2</td>
<td>LINUX</td>
<td>Solaris</td>
<td>Solaris</td>
<td>HP-UX</td>
<td>LINUX</td>
<td>AIX</td>
<td>IBM i</td>
</tr>
</tbody>
</table>
- Alpha test phase is planned to start in September 2010
- The start of each phase required successful completion of its predecessor

**Test Phases**

- Alpha (4+1 weeks) - SPEC members
  - Feedback review and problem solving
- Beta 1 (3+1 weeks) - Qualified Volunteers
  - Feedback review and problem solving
- Beta 2 (6+2 weeks) - EPA Stakeholders
  - Feedback review and problem solving
- Beta 3 (6+2 weeks) - EPA Stakeholders
  - Feedback review and problem solving
- SERT 1.0.0 Finalization (2 weeks)
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Next Steps

- Worklet selection/development and evaluation
- EPA schedule requirements challenge
  - Function/scope may be tradeoff for time
- Restricted tuning
  - Configuration as shipped– TBD by the EPA
  - Minimize software variability
- DC power measurement
  - No resource committed for development and testing
- SERT design document updates
  - Each ~5 weeks
- Analysis of EPA stakeholder feedback
SPEC Power and Performance Methodology

- An introduction on power and performance metrics for computer systems
- Guidance for Power and Performance benchmark development (existing and new designs)
- Methodology – captures the experience/conclusions of the SPECpower committee since January 2006
- [http://www.spec.org/power_ssj2008/docs/SPECpower-Methodology.pdf](http://www.spec.org/power_ssj2008/docs/SPECpower-Methodology.pdf)

SPEC Power Temperature Daemon (PTDaemon)

- Infrastructure software to connect, control and collect data from power and temperature measurement devices
- [http://www.spec.org/power_ssj2008/docs/device-list.html](http://www.spec.org/power_ssj2008/docs/device-list.html)
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Milestones 2/2

SPECpower_ssj2008

- First industry standard benchmark that measures the power and performance characteristics of server-class compute-equipment. A leap forward in power and performance analysis of Enterprise Computer Servers
- Released end of 2007
- 160+ published results at SPEC
- Submission from 20 companies world-wide
- Over 4.4x energy efficiency gain since SPECpower_ssj2008 released
  - 698 - 3106 overall ssj_ops/watt
    (best result from first submission cycle to the best current result)
- http://www.spec.org/power_ssj2008/

SPECweb2009

- First industry standard benchmark that measures the power and performance characteristics of web serving compute-equipment
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Taxonomy of Platform Evaluation Tools

Orders of Approximation¹

FIRST
- Generalized Evaluation Tools
  - Architecture Agnostic
  - Usually Synthetic
  - Represents Multiple Environments
  - Software Selection & Tuning Limited
  - Consistent, Repeatable Results
  - Low Cost to Use

SECOND
- Standard Benchmarks
  - Usage Categories
  - Architecture Agnostic
  - Represents Generic App Environment
  - Software Selection & Tuning Open
  - Consistent, Repeatable Results
  - Moderate to High Cost to Use

THIRD
- Application Benchmarks
  - Usage Specific
  - Architecture Dependent
  - Represents Specific Environment
  - Software Selection & Tuning Limited
  - Results dependent on builder skills
  - High Cost to Create and/or Use

Examples

- Server Efficiency Rating Tool™
- SPECweb2009
- SPECpower_ssj2008
- SPEC CPU2006
- SPECmail2009
- TPC-E
- …

SAP R/3 SD
- User Created
- …


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