

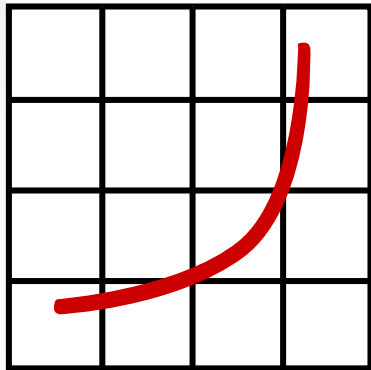


SPECpower™

**Benchmarking the Energy
Efficiency of Servers**

Klaus-Dieter Lange

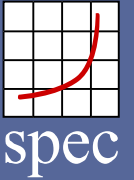
Chair, SPEC Power and Performance Committee



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SPECpower™ Development Status

Agenda



CEE Program Meeting

September 25., 2007 – St. Louis, MO – Fourth Annual Industry Partners Meeting

- SPEC in a Nutshell
- SPEC's Philosophy
- Background
- Energy Star for Server
- Committee Status
- Benchmark Goals
- Benchmark Deliverables
- Design Decisions:
 - Power Analyzer Requirements
 - AC Measurement - Automation
 - Environment Conditions
 - Benchmark Harness - Framework
 - Benchmark Workload
 - Variable System Utilization
- Q & A

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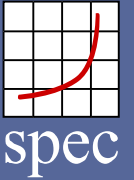
SPEC in a Nutshell



- 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.
- Development of benchmark suites, review and publication of submitted results (no certification).
- Over 80 computer hardware and software vendors, educational institutions, and government agencies.
- Large repository of well documented, peer reviewed, benchmark results.
- Understanding of workloads, benchmark code, fair comparisons across different platform.

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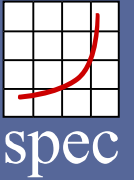
SPEC's Philosophy



- 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.

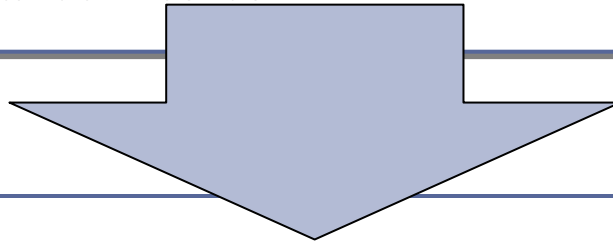
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Background



Industry Needs

The drive to create the SPECpower™ benchmark comes from the recognition that the IT industry, computer manufacturers, and governments are increasingly concerned with the energy use of IT equipment. Development of the SPECpower™ benchmark provides a means to measure energy use in conjunction with a performance metrics.



Development

On January 26, 2006, the SPEC Power and Performance Committee began development of the first generation SPEC benchmark for evaluating the energy efficiency for server class computers. The SPECpower™ benchmark's goal is to provide a means to fairly and consistently report system energy use under various usage levels. The goal of the committee is to utilize proven SPEC server benchmarks in order to provide workloads under which energy use can be measured.

SPECpower™ Development Status

Energy Star for Server



“A server power-performance benchmark from SPEC will have a positive impact on computer systems manufacturers and customers worldwide. It's a good first step in enabling manufacturers to better compete based on power consumption and helping IT managers design datacenters with energy efficiency in mind.”

Andrew Fanara

Product Development Team Leader, USEPA, ENERGY STAR Program

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Committee Status



- Current active SPEC member companies committed to developing a power and performance measurement standard are AMD, Dell, Fujitsu Siemens Computers, HP, Intel, IBM, and Sun Microsystems. Also participating are SPEC Associates University of California Berkeley and Virginia Polytechnic Institute and State University, as well as Lawrence Berkeley National Laboratory.
- The collaborated development effort is conducted via e-mail, Wiki, virtual meetings (6-8 hours / week), and quarterly Face-to-Face meetings.
- The SPEC Power and Performance Committee is currently evaluating its developed beta-version of the benchmark kit and plans the completion of the final version in 2007.

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Benchmark Goals



- The committee develops a means to fairly and consistently report system energy use under various usage levels.
- The first release of the benchmark needs to run on a wide variety of OS and hardware architectures and should not require extensive client or storage infrastructure.
- Fulfills the need to provide standard methods for measuring the intersection of power and performance.
- The performance measurement setup should be relatively easy and the run-time needs to be reasonable.
- The power, performance, and environmental measurements are automatic in order to prevent human errors.

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Benchmark Deliverables



A Complete Benchmark Package

- OS Independent Workload
- Server Energy Measurement Methodology
- Extensible Software Framework
 - Power Daemon
 - Control and Collection System
- Run and Reporting Rules
- Documentation

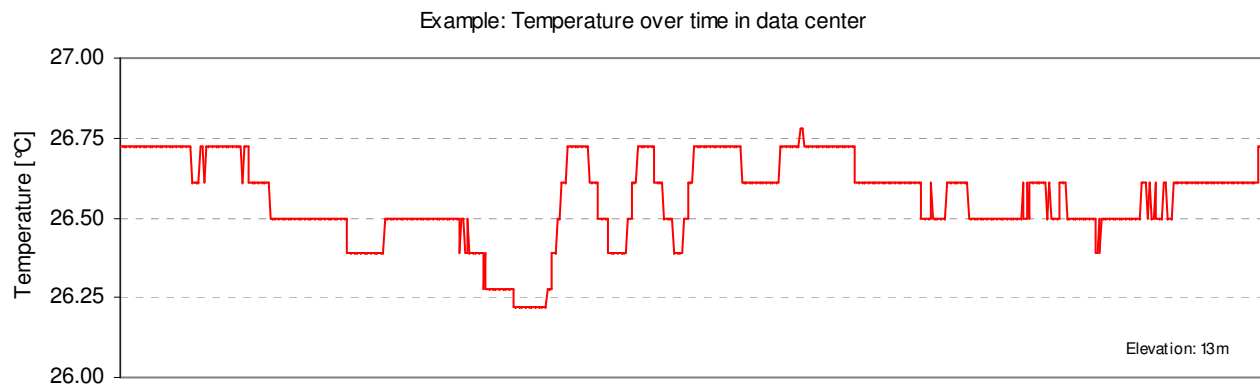
SPECpower™ Development Status

Design Decisions



Environment Conditions

- SPECpower™ will not require a climate chamber, nevertheless it requires a minimal environmental temperature of 20°C.
- The Committee found that the cost of procurement, maintenance and space allocation for a climate chamber and the decrease of ease-of-use outweigh the usefulness of a climate chamber.



SPECpower™ Development Status

Design Decisions



Power Analyzer Requirements

- The Committee has set requirements for:
 - Calibration, Crest Factor, Measurements, Logging, Power Accuracy, Power Resolution

- Also SPECpower™ will require that the power analyzer must have an interface that allows its measurements to be read by the benchmark harness.
 - Tremendously increases ease of use, since exact synchronization from power and performance data is automated.
 - Power analyzers which meet the other requirements generally come with an interface option.
 - Several power analyzers are currently supported and meet these requirements.

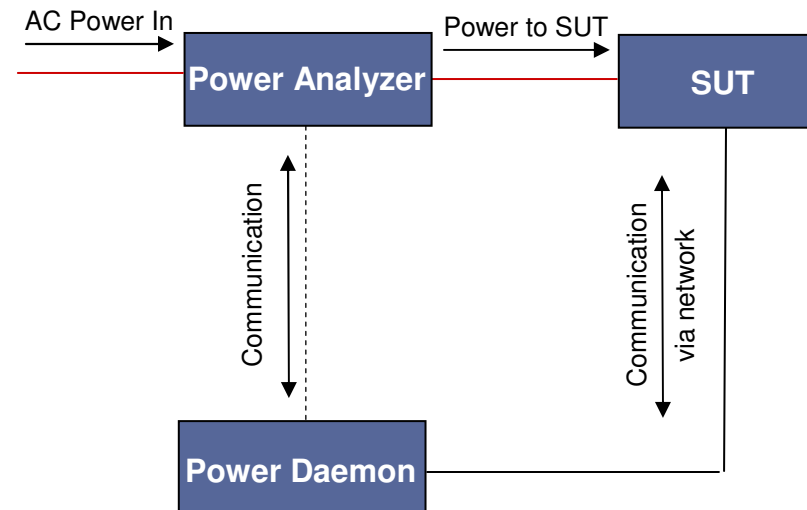
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Design Decisions



AC Measurement - Automation

- Energy measurements are made at the AC input to the system under test.



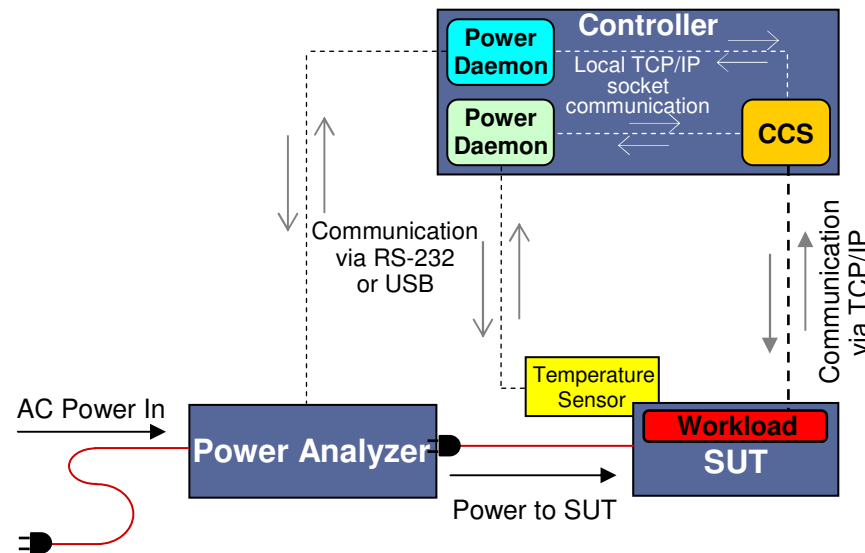
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Design Decisions



Benchmark Harness - Framework

- Ensures the synchronization of the measured performance, power, and environmental data.



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Design Decisions



Benchmark Workload

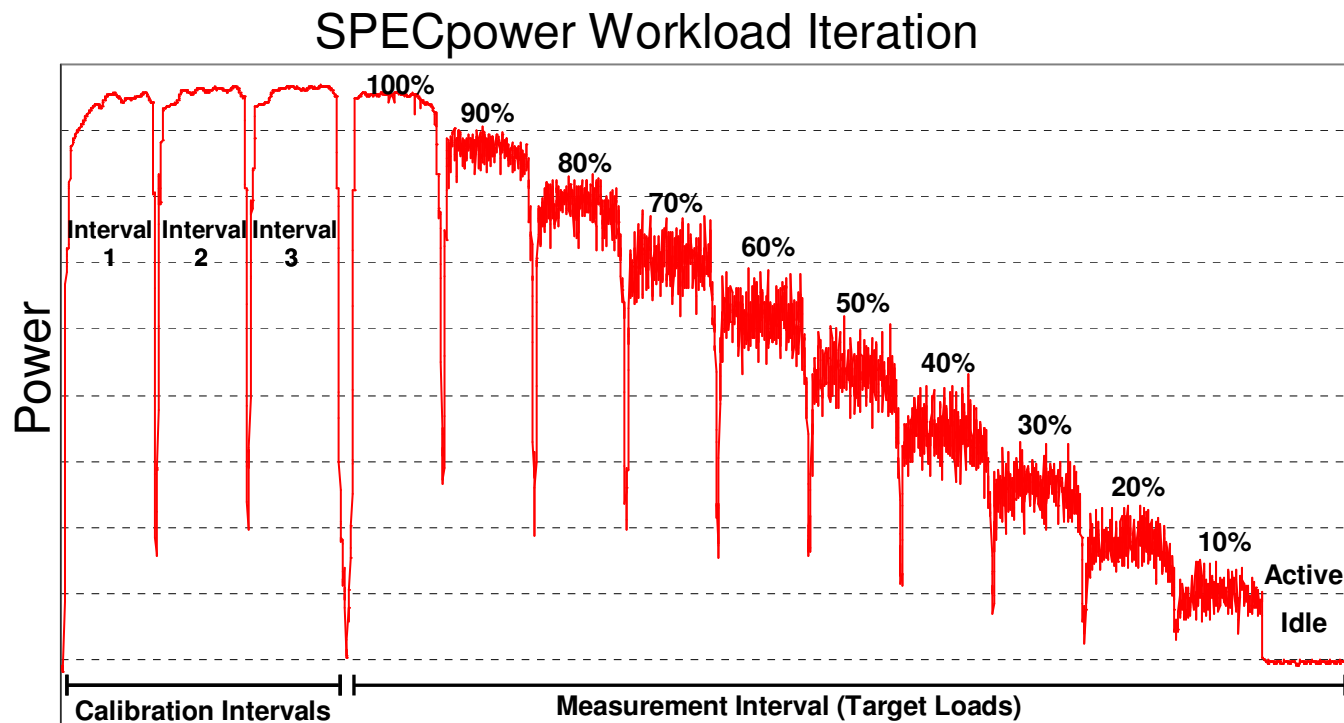
- The initial benchmark addresses one subset of server workloads, the performance of a server side java.
- It exercises the CPUs, caches, memory hierarchy and the scalability of shared memory processors (SMPs) as well as the implementations of the JVM (Java Virtual Machine), JIT (Just-In-Time) compiler, garbage collection, threads and some aspects of the operating system.

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Design Decisions

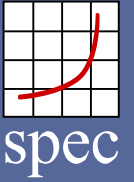


Variable System Utilization



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Energy Star for Server



The first SPECpower benchmark will be a leap forward in the state of the art in power and performance analysis of Enterprise Computer Servers. We would like to work closely with the EPA in defining additional requirements to enhance our benchmark suite to satisfy EPA needs, where feasible.

The first SPECpower benchmark is only focusing on one application space. In order to represent a wide spectrum of the application space, a means for introducing additional workloads must be a part of the Tier II plan. We welcome EPA input in prioritizing future work.

Source: SPEC's Response to EPA's Energy Star Server Draft (30. August 2007)

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Q & A



For further information

- Public information on development of SPEC Power and Performance Benchmark are available at www.spec.org/specpower.
- Contact the SPEC Power and Performance Committee via email: info@spec.org