SPC-1/E and SPC-1C/E

Storage Performance Benchmark

with Energy Use Extensions

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EPA Stakeholders Meeting
15 October 2009

EPA Stakeholders Meeting

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SPC Overview

The Storage Performance Council (SPC) is a vendor-neutral standards body focused on the storage industry. The SPC has created a suite of benchmarks and benchmark energy extensions targeted at the needs and concerns of the storage industry.

SPC benchmark results provide a source of comparative storage performance and energy use information that is objective, relevant, and verifiable.

That information provides value through the storage product lifecycle, which includes development of product requirements, product implementation, performance characterization, capacity planning, market positioning and purchase evaluations.

SPC Overview

SPC benchmarks are designed to be vendor and platform independent and are applicable across a broad range of storage configurations and topologies.

Any SPC member can sponsor and publish an SPC benchmark result, provided the tested configuration satisfies the requirements of the appropriate SPC benchmark specification or energy extension.

SPC Value Proposition

- SPC benchmark results provide in-depth quantitative performance and energy use information across a broad spectrum of storage configurations.
- SPC benchmark results are used by end-users, industry analysts and vendors.
  - Product development
  - Product positioning and competitive comparisons
  - Purchase decisions

SPC Benchmarks and Extensions

- To date, the SPC has released four benchmark specifications and two benchmark energy extensions with 140+ results.
  - SPC-1, SPC-2 *(OLTP and sequential)*
  - SPC-1C, SPC-2C *(component-level versions)*
  - SPC-1C/E, SPC-1/E *(energy extensions to SPC-1 and SPC-1C)*
  - SPC-3 *(in development)*
  - See http://www.storageperformance.org/results for more information on each benchmark specification/extension

SPC Member Companies

SPC Member Companies

SPC Benchmark Development

- SPC Specification
  - Define the benchmark context based on real world workloads and valid end-user assumptions.
  - Define configuration constraints to ensure realistic configurations and prohibit “benchmark specials”
  - Define the workload(s) for the benchmark
  - Specify benchmark execution, measurement, data collection, and reporting requirements
  - Develop an SPC Toolkit to implement the above
  - Final testing and validation of workload and toolkit
  - Specify audit, disclosure, and peer-review requirements

SPC Result Production

- SPC Required Audit
  - Test Sponsor *(SPC member company)* preparation:
    - Pre-Audit and Audit checklists
    - Pre-Audit measurements and review
  - Audit ensures compliance with the benchmark specification for consistency and comparability
    - Valid configuration
    - Correct execution, measurement, data collection, and reporting
    - Full disclosure of all components in the benchmark configuration and the entire set of benchmark activities
      - » The Full Disclosure Report (FDR) contains sufficient detail to duplicate the complete tested configuration and reproduce the SPC Result.

SPC Result Production

- SPC Full Disclosure Report (FDR) and Public Use Requirements
  - Transparency
  - Consistency
  - Completeness
  - Comparability

SPC Energy Extensions

- SPC-1/E and SPC-1C/E Goals
  - Address the need for energy use measurement and reporting in addition to storage performance measurement and reporting.
  - Develop each extension using existing benchmark specifications: SPC-1 and SPC-1C.
  - Use identical measurement, data collection and reporting requirements for each extension.
  - Quantify storage performance and energy use without constraining technologies/implementations.

SPC-1/E and SPC-1C/E Details

- Common elements:
  - SPC approved power meter/analyzer
  - SPC developed tools for data collection, synchronization, post-processing, and reporting
  - Execution profile
    - Single/multiple application idle states
    - Active/performance state *(SPC-1, SPC-1C measurements)*
  - Reporting and disclosure

SPC-1/E and SPC-1C/E Details

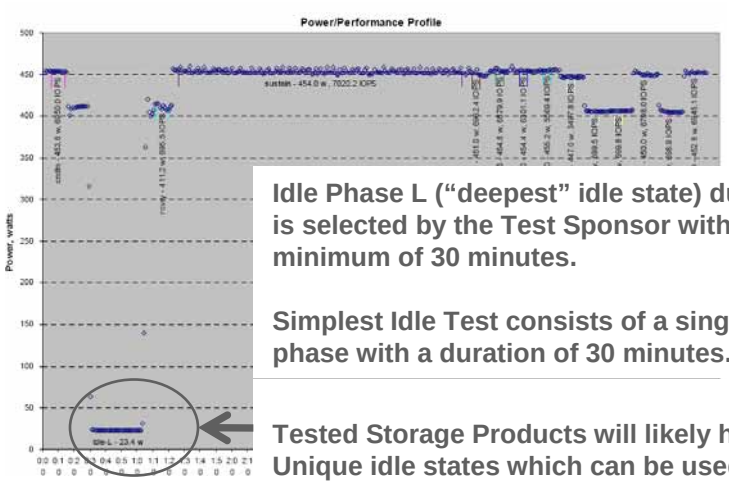
- SPC-1/E, SPC-1C/E execution profile:
  - A 10 minute “precondition” phase at 100% of the specified performance offered load.
  - An application idle phase lasting at least 30 minutes with one or more distinct phases.
  - Each application idle phase may be preceded by an optional transition period not to exceed 3 minutes.
  - A second 10 minute “precondition” phase at 10% of the specified performance offered load.
  - Execution of the current SPC-1, SPC-1C Tests: Metrics *(Sustainability, IOPS, Response Time Ramp),* Repeatability, and Persistence *(energy use measurements are not taken during the Persistence Test*

SPC-1/E and SPC-1C/E Details

- SPC-1/E, SPC-1C/E application idle phases:
  - More than one idle phase is allowed as long as transitions between idle phases do not require manual intervention. *Idle Phase 0, Idle Phase 1…Idle Phase L-1, Idle Phase L*
  - Idle Phase 0 thru Idle Phase L-1 must have the same duration, selected by the Test Sponsor, up to a maximum of 10 minutes.
  - Idle Phase L ("deepest" idle state) duration is selected by the Test Sponsor with a minimum of 30 minutes.
  - The simplest Idle Test consists of a single idle phase with a duration of 30 minutes.

SPC-1/E and SPC-1C/E Details

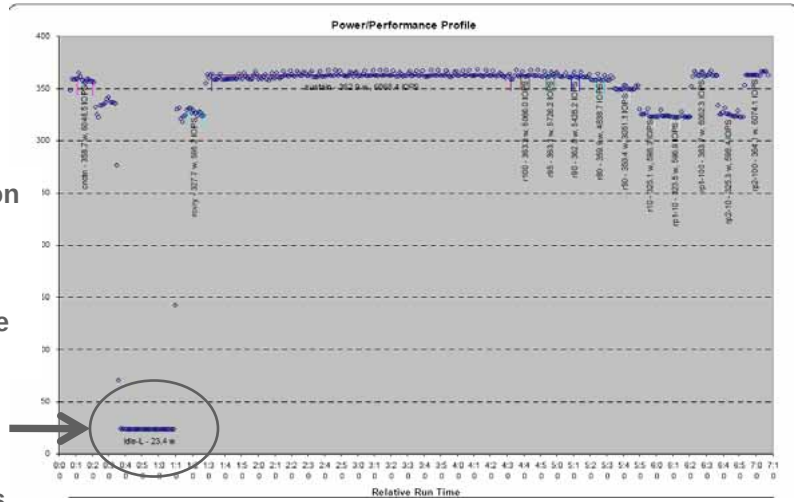
SPC-1/E, SPC-1C/E application idle examples:

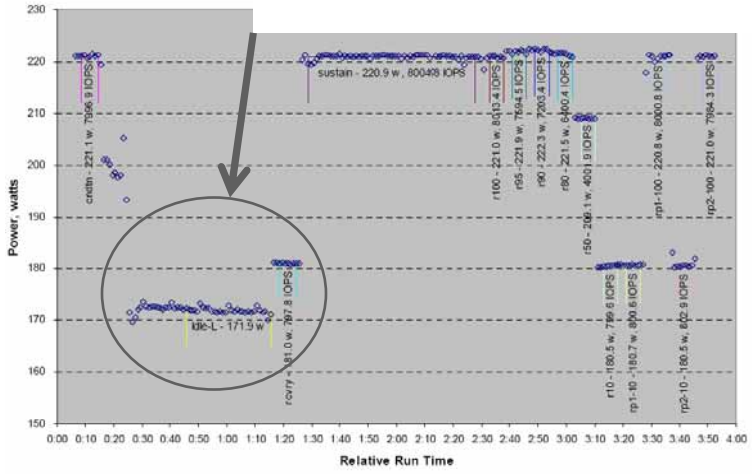


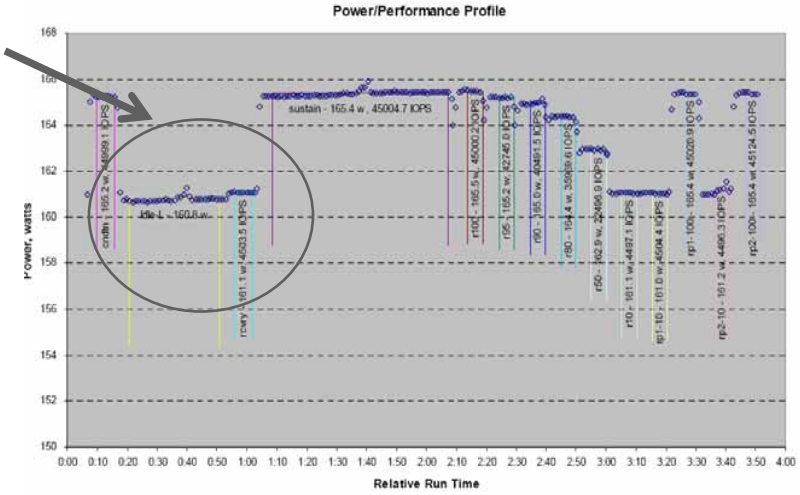
Idle Phase L ("deepest" idle state) duration is selected by the Test Sponsor with a minimum of 30 minutes.

Simplest Idle Test consists of a single idle phase with a duration of 30 minutes.

Tested Storage Products will likely have Unique idle states which can be used to highlight new energy saving technologies & techniques







SPC Energy Data and Reporting

- Power and SPC-1 or SPC-1C IOPS are measured for each test segment
  - Application Idle Phase
    - Pre-condition 1, application idle, and pre-condition 2
  - Active/Performance Phase:
    - Each SPC-1 / SPC-1C Test Run
  - The measured data is presented in a graph that illustrates the entire measurement sequence.

SPC Energy Data and Reporting

- Example of SPC-1/E, SPC-1C/E required graph