Solid State Storage
Performance Test Specification

Measuring the Performance of Solid State Storage Devices

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Solid State Storage Industry At-A-Glance

Until now, there has been no widely-accepted industry standard test methodology for measuring solid state storage (SSS) device performance. As a result, each SSS manufacturer has utilized different measurement methodologies to derive performance specifications for their solid state storage products. This made it difficult for purchasers of SSS to fairly compare the performance specifications of SSS products from different manufacturers.

SNIA - Establishing Industry Standards

The SNIA Solid State Storage Technical Work Group, working closely with the SNIA Solid State Storage Initiative (SSSI), has developed Enterprise and Client Solid State Storage Performance Test Specifications (SSS PTS) to address these issues. The SSS PTS defines a suite of tests and test methodologies that effectively measure the performance characteristics of SSS products. When executed in a specific hardware/software environment, SSS PTS provides measurements of performance that may be fairly compared to those of other SSS products measured in the same way in the same environment.

Solid State Storage Performance Test Specification (SSS PTS):

- **Standard Terms & Methodologies.** The SSS PTS defines common nomenclature and procedures.
- **Device Preparation**. The SSS PTS prescribes standard device preparation to ensure that the device under test both reaches and maintains a Steady State condition during the test.
- **Test Conditions & Variables.** SSS PTS defines test conditions for repeatable synthetic device level testing. Test variables include setting the Access Pattern (*R/W mix & Block Sizes*), outstanding IOs (*QD & Thread Count*), precondition LBA range, and Test Active Range (*LBA range*).
- **Test Flow.** The SSS PTS defines the test sequence below to ensure consistent measurements:
  1. **Purge the Device:** *Put the device in a state such that subsequent writes execute, as closely as possible, consistent with a device which has never been written to.*
  2. **Precondition the Device:** *Write a prescribed pattern of test data in order to facilitate the device reaching a Steady State.*
  3. **Test the Device:** *Run the test sequence until Steady State is reached and maintained for at least 5 rounds, creating a "measurement window" from which the official test data is later extracted and reported.*
- **Tests & Metrics.** The SSS PTS sets forth tests for both client and enterprise SSDs. PTS Enterprise tests are WSAT *(RND 4K Writes from FOB),* IOPS, Throughput (TP) and Latency (LAT). PTS Client tests utilize a limited Precondition and Test Active Range and test for IOPS, TP and LAT.
- **Standardized Reporting.** The SSS PTS provides informational annexes defining Sample Test Reports and a recommended Reference Test Platform for repeatable, comparable testing.

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Solid State Storage Initiative

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Device Steady State

An SSS device's performance is highly dependent on its workloads and the write history of the device. A previously unused SSS device may exhibit a period of elevated performance which levels off to a relatively stable performance state (Steady State). It is very important to report test results from the Steady State.

Test Environment

The SSS PTS specification is test platform agnostic. The tests and methodologies assume nothing about the underlying test environment except some generic requirements. However, while individual testers can run SSS PTS on their particular platform to compare the relative performance of SSS devices they are evaluating, in order for SSS PTS results to be compared on a true "apples-to-apples" basis, across multiple testers, a consistent test platform must be used.

The SNIA SSS PTS includes a Reference Test Platform (RTP) that describes the test hardware, software, and tools used by the Technical Work Group to do the bulk of the research and validation of the SSS PTS. The RTP is not required to run the SSS PTS tests; it is merely an example of a platform that has been confirmed to meet the SSS PTS platform requirements. Readers are encouraged to use the RTP and/or any of the tools specified therein to generate data as prescribed in the SSS PTS and to submit data to the SSS TWG.

How to Get Involved

Contribute to the important work of creating standards for measuring SSS performance - join the SSSI and the SSS TWG. Send an email to **asksssi@snia.org** for more information.

The SSS Performance Test Specification can be downloaded at **http://www.snia.org/pts**.

Presentations, articles and related white papers can also be found at **http://www.snia.org/forums/sssi**.

About SNIA

The Storage Networking Industry Association (SNIA) is a not-for-profit global organization made up of some 400 member companies and 7,000 individuals spanning virtually the entire storage industry. SNIA's mission is to lead the storage industry worldwide in developing and promoting standards, technologies, and educational services to empower organizations in the management of information. To this end, the SNIA is uniquely committed to delivering standards, education, and services that will propel open storage networking solutions into the broader market. For additional information, visit the SNIA web site at **http://www.snia.org**.

About SSSI

The SNIA Solid State Storage Initiative (SSSI) was formed to foster the growth and success of the market for solid state storage in both enterprise and client environments. It consists of various subcommittees that are focused on developing technical standards and tools, in order to educate users about the advantages of SSS devices.

About SSS TWG

The SNIA Solid State Storage Technical Work Group (SSS TWG) was formed by the SNIA Technical Council and is ultimately responsible for the technical development, ratification, and publication of solid state storage standards. It consists of member companies across the storage industry. For more information, see **http://www.snia.org/forums/sssi/programs/twg/**.

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