SINA Emerald Power Efficiency Measurement Specification 2.0.2 Overview

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SNIA Emerald™ Training

SNIA Emerald Power Efficiency Measurement Specification, for use in EPA ENERGY STAR®

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SNIA™ Green Storage Initiative

SNIA Emerald™

Who developed it

- Specification was developed by the Storage Networking Industry Association
  - Developed by the Green Technical Working Group
  - Supported by GSI
  - To support the Emerald Program

What is it for

- Standard measurement of power efficiency of storage systems
  - Measurement of multiple storage categories / classifications
    - Disk, Tape, Solid State / size of system (More to come in taxonomy section)
    - Compare trade offs between the categories / classifications
- Measuring performance of storage and compare to the power required to do the work
  - Measuring ratio of useful work to the power required

What does it measure

- Work of Storage
  - Store data (Ready Idle)
    - Data is not moving on or off the storage system
  - Move data on and off the system
    - Random access to the data on the storage system (IOPS)
    - Sequential access to the data on the storage system (MiBS)

What is inside the specification

- Well it's a written spec designed to help people go to sleep
- By the numbers
  - 8 Sections
  - Sections 1 through 6 are informative sections
  - Sections 7 through 8 define test, execution rules and metrics
  - Three appendixes
- The following slides will give an overview of each section and highlight areas that may or may not be covered in this training
- Read the Specification

Informative sections review

- Clause 1 – Overview
- Clause 2 – Normative References
- Clause 3 – Scope
- Clause 4 – Definitions, Symbols, Abbreviations, and Conventions
- Clause 5 – Taxonomy
  - Covered in another talk
- Clause 6 – Capacity Optimization
  - Covered in another talk

Closer look at informative sections

- Clause 1 Overview
  - Sections 1.4 Terminology
  - Specification uses efficiency in two ways
    - Ratio of output / input
    - Ratio of useful work / energy required to do it
  - Section 1.5 Disclaimer
    - Provide an high level power estimate actual power usage will depend on environment
- Clause 2 Normative References
  - ASHRAE Thermal Guidelines for Data Processing Environments
  - SNIA Understanding Data Deduplications ratios

Closer look at informative sections

- Clause 3 Scope
  - Define the two states of storage power usage
    - Active and Idle
  - What is possible for future revisions

Closer look at informative sections continued 2/3

- Clause 4 Definitions, Symbols, Abbreviations, and Conventions
  - Link to the SNIA dictionary
  - Abbreviations defined
- Clause 5 Taxonomy
  - Breaks up the Storage Universe based on
    - Operational profile
    - Supported features that affect power
    - Power requirements
  - States specification may not define efficiency measurements for all categories or classifications

Closer look at informative sections continued 3/3

- Clause 6 Capacity Optimization
  - Introduction
  - Space consuming practices (Why have it)
  - COMs defined as
    - Delta Snapshots
    - Thin Provisioning
    - Data Deduplication
    - Parity RAID
    - Compression

Clause 7 Test Definition and Execution Rules section overview

- Defines how to test
- 7.2 Execution overview (steps to run the test/measurement)
  - Pre-fill data
  - Condition the system under test
  - Active test measurement
    - Hot band
    - Random write
    - Random read
    - Sequential write
    - Sequential read
  - Ready idle measurement
  - Capacity optimization test (if defined)

Clause 7 Test Definition and Execution Rules section overview Continued 2/4

7.3 General requirements and definitions

- General requirements for all taxonomy categories
  - Unless overwritten in the categories section
- Defined what is to be used to test/measure
  - Input power requirements
  - Environment of the test
  - Test instrumentations requirements
  - RAS
  - Input Output profiles
  - Vdbench script
  - Test sequence
  - SUT consistency
  - No non-test activity
  - Metric stability
  - Average response time
  - Average power
  - Operations rate
  - Periodic power efficiency
  - Measurement interval

Section 7.3 closer look

- 7.3.6 RAS (Reliability, Accessibility, Serviceability)
  - List of power consuming features
  - Also requirements for taxonomy classification
- 7.3.9 to 7.311 (Test Sequence, SUT consistency, Non-test activity)
  - Uninterrupted sequence
  - Cant change SUT during test
- 7.3.13 Metric Stability
  - Defines a process to verify if conditioning, active test was stable
  - Uses an exponential moving average and compares the beginning of the test to the end for % change

Clause 7 Test Definition and Execution Rules section overview Continued 3/4

- Section 7.4 (Online testing)
  - Defines testing procedure for Online storage taxonomy
  - For each of the tests defines
    - Overview
    - Test Phases
    - Procedure
    - Data to be collected
    - Validity
    - Capacity optimization test

Clause 7 Test Definition and Execution Rules section overview Continued 4/4

- Section 7.5 (Near Online testing)
- Section 7.6 (Removable Media Library Testing)
- Section 7.7 (VML)
- Section 7.8(Adjunct Product)
  - No test defined
- Section 7.9 (Interconnect Element)
  - No test defined

Clause 8 Metrics

- Clause 8.1 and 8.2
  - Defines the primary metrics for each taxonomy category
- Clause 8.3 to 8.5
  - Defines how to calculate the primary metrics for each taxonomy category
- Clause 8.6 Secondary Metrics
  - Capacity Optimization Metrics

Appendixes

- Appendix A
  - List of recommended power meters and link to SPEC for updated list of power meters
  - List of recommended environmental meters
- Appendix B
  - Benchmark driver requirements
  - Link where to get example scripts for Vdbench
- Appendix C Informative requirements table
  - Table of what is to be collected
  - Required sample rate
  - Test duration