ENERGY STAR
Data Center Storage
Version 1.1 Overview

ES Storage Stakeholder Meeting

January 25, 2018

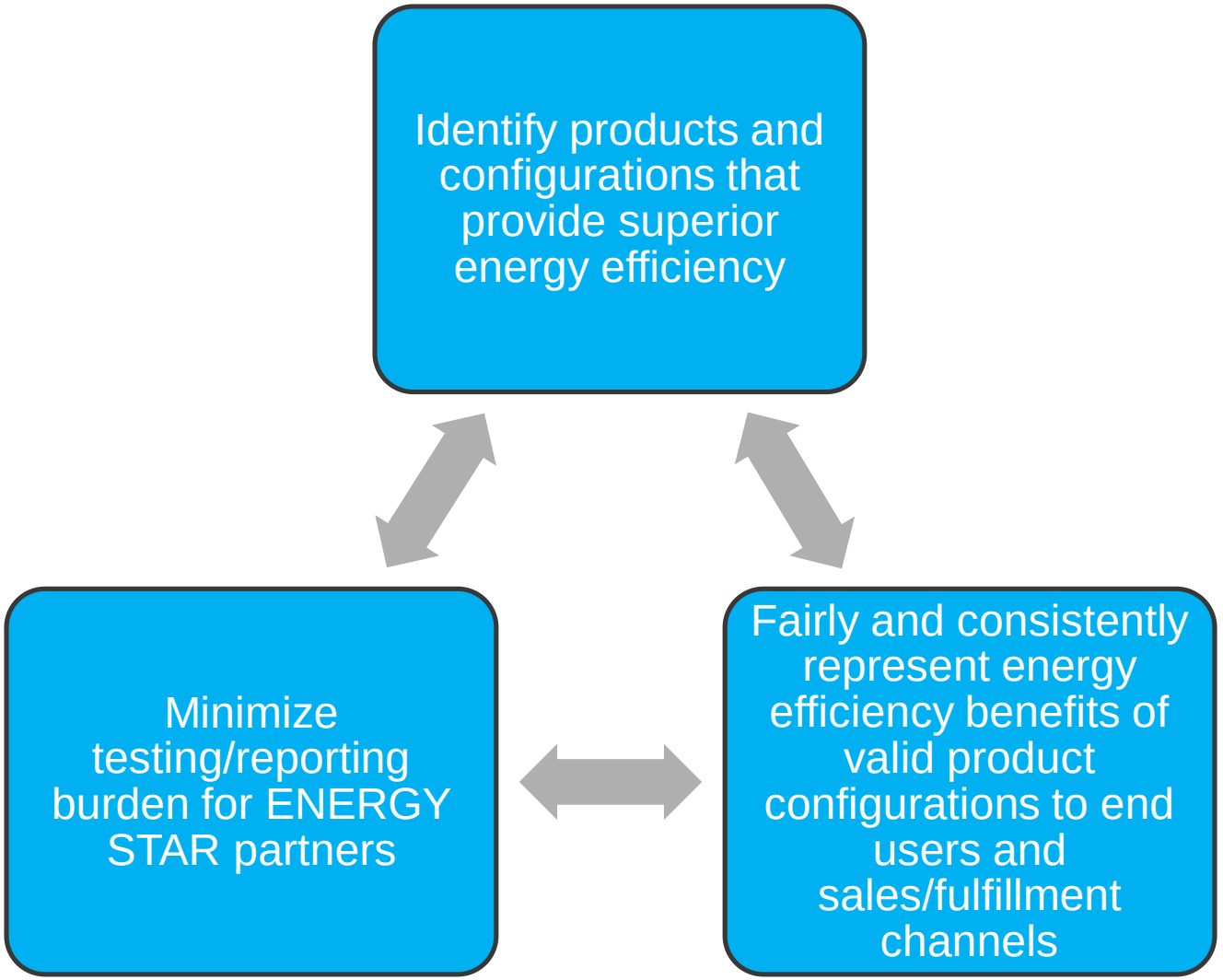
EPA and SNIA

- Collaboration over last 7+ years
- SNIA developed Emerald™ Specification
  - Test procedure adopted by EPA for ENERGY STAR Storage V1.0 and soon to be finalized V1.1
    - V1.1 incorporates File I/O testing and certification
  - Anticipate using this specification for future ENERGY STAR Storage revisions
    - Version 2.0

EPA and SNIA

- Current ENERGY STAR Storage spec result of years of discussions between EPA, SNIA
  - How to use Emerald Specification in ENERGY STAR
- SNIA and its members have provided major contributions to the development of this specification.
  - Feedback on drafts, hosting face-to-face talks, system test data, conference calls, training, and more.
- EPA looks forward to continuing to work with SNIA.

Review of ENERGY STAR Goals



Adoption of Version 3.0.1 SNIA Emerald™ Specification

- In the ENERGY STAR Draft V1.1 Storage specification, EPA has proposed adopting the V3.0.1 Emerald specification

Definitions

- Align with the SNIA dictionary whenever possible
- Product family is defined in Section I, and provides guidance on:
  - Defining the range of system sizes that fall within a product family
  - How to create configurations for certification using multiple storage device types and/or workload types

Definitions

- Other important concepts covered in the definition section include:
  - Product Types
  - Storage Taxonomy
  - Capacity Optimizing Methods (COMs)
  - Scale-up and Scale-out Storage
  - Automated Storage Tiering
  - Advanced Data Recovery Capability

In Scope

- Characterized within the Online 2, 3, or 4 Storage Taxonomy with the following additional criteria:
  1. Contain a controller with advanced data recovery capability (no JBODs allowed)
  2. Support Block I/O and/or File I/O storage functionality
  3. Implement either scale-up or scale-out storage

Out of Scope

- Storage devices in the following categories of the Storage Taxonomy:
  - Near-online
  - Removable Media Library
  - Virtual Media Library
  - Adjunct Storage Products
  - Interconnect Elements

Out of Scope

- Personal / Portable Data Storage Products
- Computer Servers
- Blade Storage Products
- Direct Attached Storage Products
- Storage Products that are only capable of object based storage

Power Supply Requirements

- 80 Plus Silver
  - PSUs for primary components
  - i.e. PSUs for controllers, drawers
- All other power supplies excluded from this requirement

Power Modeling Requirements

- Use of a power/performance modeler is allowed for certification
  - Subject to criteria outlined later
- If modeled data is used for certification:
  - Partner is expected to make power modeling tools, that can characterize the system, available to purchasers of the storage product
  - Should provide performance/watt data for user-selected configuration characteristics

Energy Efficiency Feature Requirements

- Adaptive Active Cooling:
  - Must utilize adaptive cooling tech that scales cooling to the current needs of the product.
- COMs:
  - Make available in quantities greater or equal to those listed in Table 4.

Energy Efficiency Feature Requirements - COMs

Table 3: Recognized COM Features

Feature	Verification Requirement
COM: Thin Provisioning	SNIA verification test
COM: Data Deduplication	SNIA verification test
COM: Compression	SNIA verification test
COM: Delta Snapshots	SNIA verification test[3]

Table 4: COM Requirements for Online 2, 3, and 4 Systems

Storage Product Category	Minimum number of COMs required to be made available
Online 2	0
Online 3	1
Online 4	1

Information Reporting Requirements

- For every required testing point in system size, submit either:

Block I/O

Workload Test
Hot Band
Random Read
Random Write
Sequential Read
Sequential Write
Ready Idle

File I/O

Workload Test
DATABASE
SW Build
VDA
VDI
Ready Idle[3]

Workload Weighting Requirements

- Manufacturers will optimize storage products for specific types of optimization based on the individual workloads specified in Table 7 or Table 8:

Table 7: Workload Weighting Requirements for all Block I/O Systems

Workload Test	Transaction Optimization	Streaming Optimization	Capacity Optimization
Hot Band	100%	0%	0%
Sequential Read	0%	50%	0%
Sequential Write	0%	50%	0%
Ready Idle	0%	0%	100%

Table 8: Workload Weighting Requirements for all File I/O Systems

Workload Test	Transaction Optimization	Streaming Optimization	Composite Optimization
DATABASE	50%	0%	0%
SW Build	0%	0%	100%
VDA	0%	100%	0%
VDI	50%	0%	0%

Testing Data Requirements

- Strongly encourage review of Sections:
  - 3.5.3
  - 3.5.4
  - 3.5.5
- Contain detailed recipe for designing, testing product families plus data points recorded

Data Displayed on ENERGY STAR Website

- Product model name, model number, and SKU or other configuration identification number;
- A list of important product characteristics, including;
  - System configuration and test I/O type;
  - Storage controller details (e.g. model name and number);
  - Software configuration;
  - Storage controller power supply information;
  - Storage device drawer power supply information;
  - Storage devices used per optimization points
  - Input power and environmental characteristics during testing;
  - System power optimization capabilities;
  - Inlet air temperature and power consumption reporting capabilities.

Data Displayed on ENERGY STAR Website

- A list of qualified configurations within a family, including performance per watt data for the applicable workloads in Table 9 or Table 10:

Table 9: Active and Idle State Efficiency Block I/O Test Results Displayed

Workload Test	Transaction Optimization	Streaming Optimization	Capacity Optimization
Hot Band	Yes	No	No
Random Read	Yes	No	No
Random Write	Yes	No	No
Sequential Read	No	Yes	No
Sequential Write	No	Yes	No
Ready Idle	Yes	Yes	Yes

Table 10: Active and Idle State Efficiency File I/O Test Results Displayed

Workload Test	Transaction Optimization	Streaming Optimization	Composite Optimization
DATABASE	Yes	No	No
SW Build	No	No	Yes
VDA	No	Yes	No
VDI	Yes	No	No
Ready Idle	Yes	Yes	Yes

Storage Product Variation Allowances

- Once a product is qualified, system performance/watt may not change by more than 20% as defined in Table 6 (with the exception of Ready Idle)
- If >20%, must test new optimal configuration
  - Added to the existing product family
  - Expands scope of product family
- Device level requirements as well

Standard Performance Data Measurement and Output Requirements

- Report input power at system level
  - Online 3 and Online 4 only
  - Optionally report inlet air temperature too
- Implementation shall follow the reporting and sampling requirements in Sections 3.7.2 and 3.7.3 of the specification.
- iPDUs may be used to fulfill these requirements if the storage product cannot
  - iPDUs must be made available for purchase with the storage product

Test Method

- Provides guidance on input power and frequency requirements for the following product types:
  - Products with Ac-dc single output PSUs
  - Products with Ac-dc multi-output PSUs
  - Products with Ac-dc for Japanese markets
  - Three-phase products for North American market
  - Three-phase products for European market

Test Method

- Guidance on environmental test variables including:
  - Ambient temperature
  - Relative humidity
- Guidance on power meter and temperature sensor accuracy requirements

Test Method – Deviations from SNIA Emerald™ Specification

- Online 2 storage products must contain a controller with advanced data recovery capability
- Storage products shipped with COMs must disable all COMs that are capable of being disabled during the following tests:
  - SUT Pre-fill Test
  - SUT Conditioning Test
  - Block Access Active State Test (if applicable)
  - File Access Active State Test (if applicable)
  - Ready State Idle Test

Version 2.0 Roadmap

- Q4 2018/Q1 2019 – Begin research into V2.0 specification.
- Q1/Q2 2019 – Release Draft 1, V2.0

Stakeholder Feedback

- Please send written feedback on the Draft V1.1 specification to storage@energystar.gov.

Comment Deadline
February 2, 2018

Thank You!

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