SNIA Emerald™
SNIA Emerald Power Efficiency Measurement Specification
SNIA Emerald Program

Wayne M. Adams, SNIA Board of Directors, Chairman

Leah Schoeb, SNIA Green Storage Initiative, Chair

SNW October 2011 Orlando, FL USA

Agenda

- SNIA GSI Overview
- SNIA Emerald™ Power Efficiency Measurement Specification
- SNIA Emerald™ Program
- SNIA Green Storage Tutorials

SNIA Green Storage Initiative (GSI)
An Initiative within SNIA

The GSI's Mission

- To conduct research on power and cooling issues confronting storage administrators

- Educate the vendor and user community about the importance of power conservation in shared storage environments

- Leverage SNW and other SNIA and partner conferences to focus attention on energy efficiency for networked storage infrastructures

- Provide input to the SNIA Green Storage TWG on requirements for green storage metrics and standards

- Provide external advocacy and support of the technical work of the SNIA Green Storage Technical Working Group
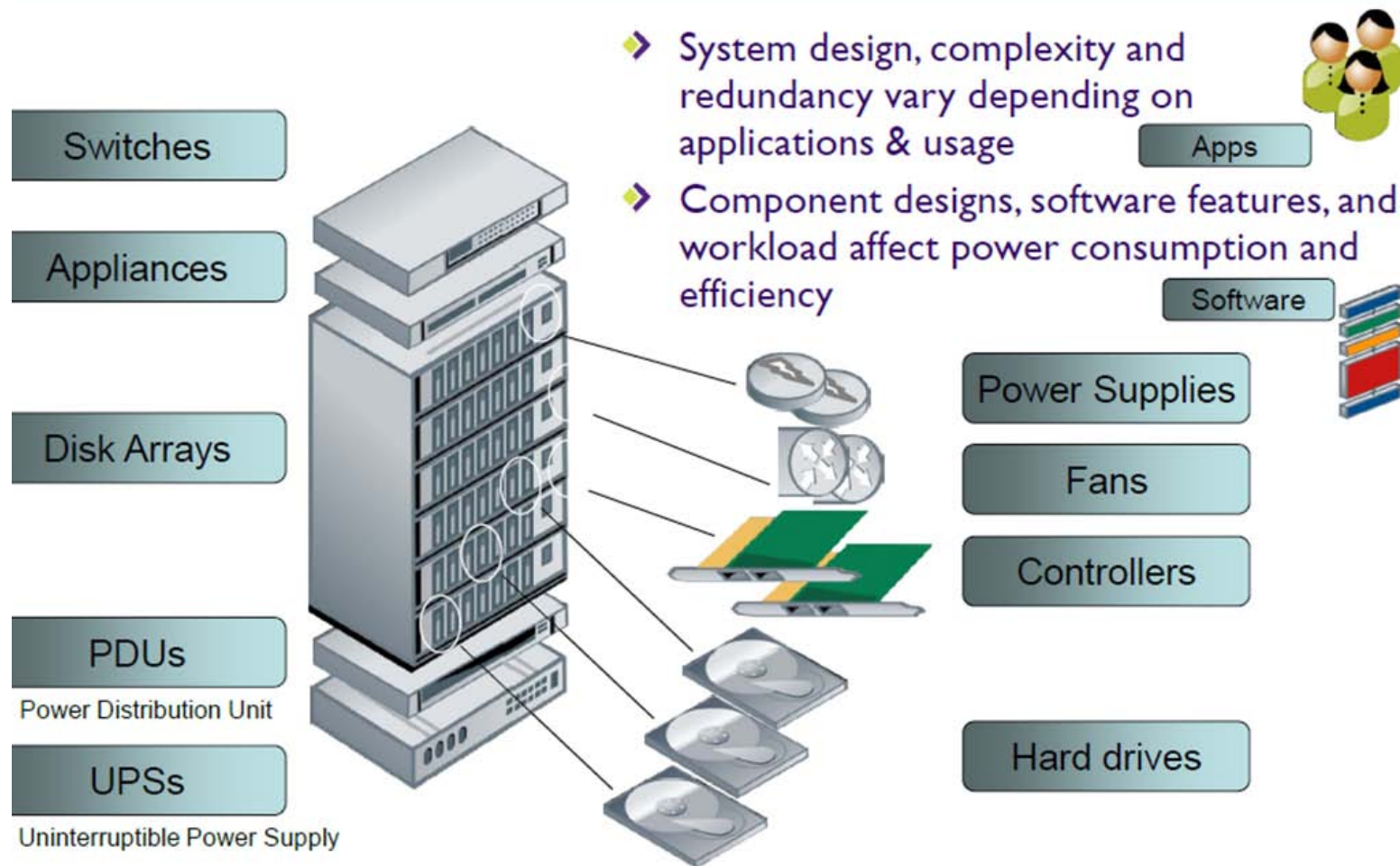
Current GSI Members

Members as of 10.1.11

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- ◆ SNIA GSI Overview
- ◆ SNIA Emerald™ Power Efficiency Measurement Specification
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- ◆ SNIA Green Storage Tutorials

Switches

Appliances

Disk Arrays

PDUs
Power Distribution Unit

UPSs
Uninterruptible Power Supply

◆ System design, complexity and redundancy vary depending on applications & usage

Apps

◆ Component designs, software features, and workload affect power consumption and efficiency

Software

Power Supplies

Fans

Controllers

Hard drives

SNIA Combined Work Effort
An industry effort, still ongoing

- 25 companies in SNIA Green Storage TWG
- 11 companies in SNIA GSI
- Decomposing the storage system challenge
- Observed industry efforts for servers: SPEC, EPA, etc.
- Three years significant technical work
  - Many iterations of system testing, data analysis and methodology review
- Power supply efficiency work
  - ClimateSavers, EPRI, ECOS
- Power measurement tools
  - Reference SPEC

SNIA Emerald™ Power Efficiency Measurement Specification

SNIA

Advancing storage & information technology

SNIA Emerald™ Power Efficiency Measurement Specification

Version 1.0

SNIA Emerald™

This document has been released and approved by the SNIA. The SNIA believes that the ideas, methodologies and technologies described in this document accurately represent the SNIA goals and are appropriate for widespread distribution. Suggestions for revision should be directed to http://www.snia.org/feedback/.

SNIA Technical Position

23 August 2011

- ◆ **Taxonomy**: An industry-wide means of segmenting storage systems for products that span the range from consumer solutions to enterprise configurations which will be used to categorize the test results.
- ◆ **Test Methodology:** A detailed and consistent means of testing various types of storage systems with load generators and power measurement instruments.
- ◆ **Test Metrics - Idle Measurement Test:** The idle test applies to storage systems and components which are configured, powered up, connected to one or more hosts and capable of satisfying externally initiated, application-level initiated IO requests within normal response time constraints, but no such IO requests are being submitted.
- ◆ **Test Metrics - Active Measurement Test:** Testing of storage products and components are said to be in an "active" state when they are processing externally initiated, application-level requests for data transfer between host(s) and the storage product(s).
- ◆ **Capacity Optimization:** The specification and program test report do address disclosing configuration information for the system under test about energy-saving storage capacity optimizations that the system may have including features such as deduplication and thin provisioning.

http://snia.org/tech_activities/standards/curr_standards/emerald
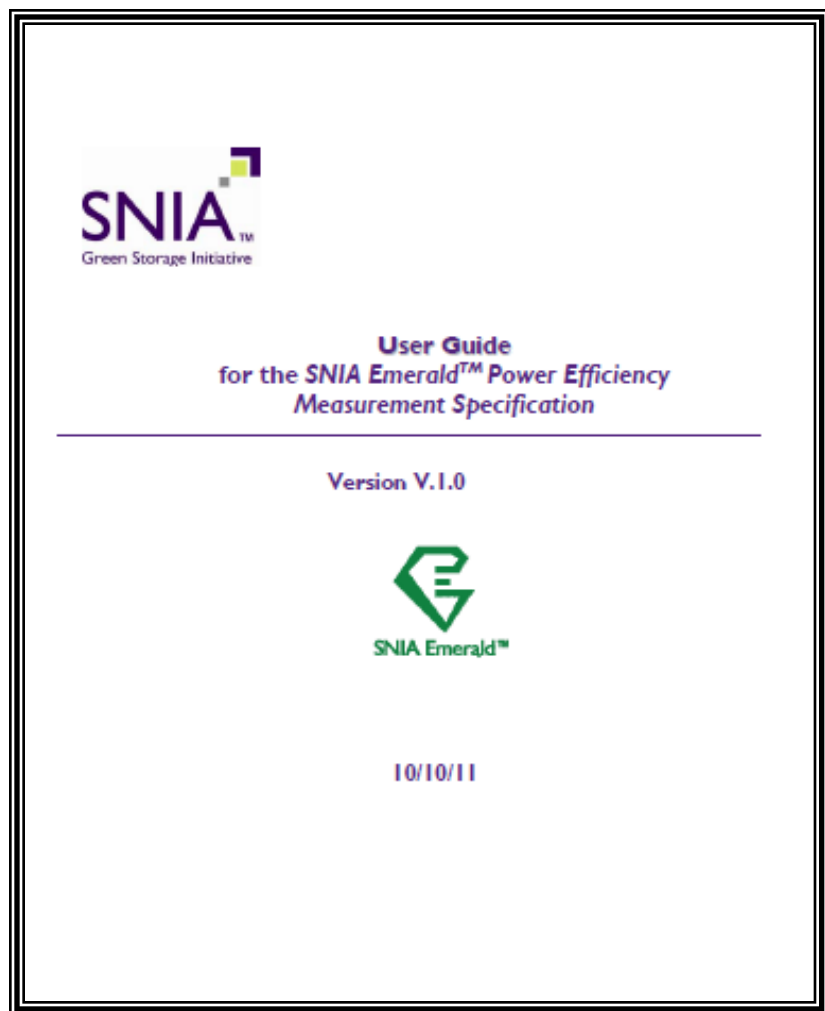
Storage Taxonomy

Attribute	Category					
	Online	**Near Online**	**Removable Media Library**	**Virtual Media Library**	**Adjunct Product**	**Interconnect Element**
Access Pattern	Random/ Sequential	Random/ Sequential	Sequential	Sequential		
MaxTTFD (t)	t < 80 ms	t > 80 ms	t > 80 ms t < 5 min	t < 80 ms	t < 80 ms	t < 80 ms
User Accessible Data	Required	Required	Required	Required	Prohibited	Prohibited

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Category / Level	Online	Near Online	Removable Media Library	Virtual Media Library
Consumer/ Component	Online 1	Near Online 1	Removable 1	Virtual 1
Low-end	Online 2	Near Online 2	Removable 2	Virtual 2
Mid-range	Online 3	Near Online 3	Removable 3	Virtual 3
	Online 4			
High-end	Online 5	Near Online 5	Removable 5	Virtual 5
Mainframe	Online 6	Near Online 6	Removable 6	Virtual 6

Adjunct Product	Interconnect Element

SNIA Emerald™ User Guide for Measurement Specification

SNIA
Green Storage Initiative

User Guide
for the *SNIA Emerald™ Power Efficiency Measurement Specification*

Version V.1.0

SNIA Emerald™

10/10/11

- ◆ How to, step-by-step guidance and recommendations
- ◆ How to submit test results to the SNIA Emerald™ Program
- ◆ Develop a product family definition beyond the SNIA Emerald Measurement Specification taxonomy
- ◆ Arriving at appropriate system configurations to test
- ◆ Set-up system under test and complete the measurement sequence
- ◆ Sample workload scripts for tools to generate IO workload
- ◆ How to avoid test and measurement mistakes and problems

Storage System Testing for Power Efficiency

System Under Test (SUT)

Benchmark Driver System

e.g. IOMETER or Vdbench

Environmental Meter for Temp. and Hum.

Power Meter

e.g. Yokogawa or others….
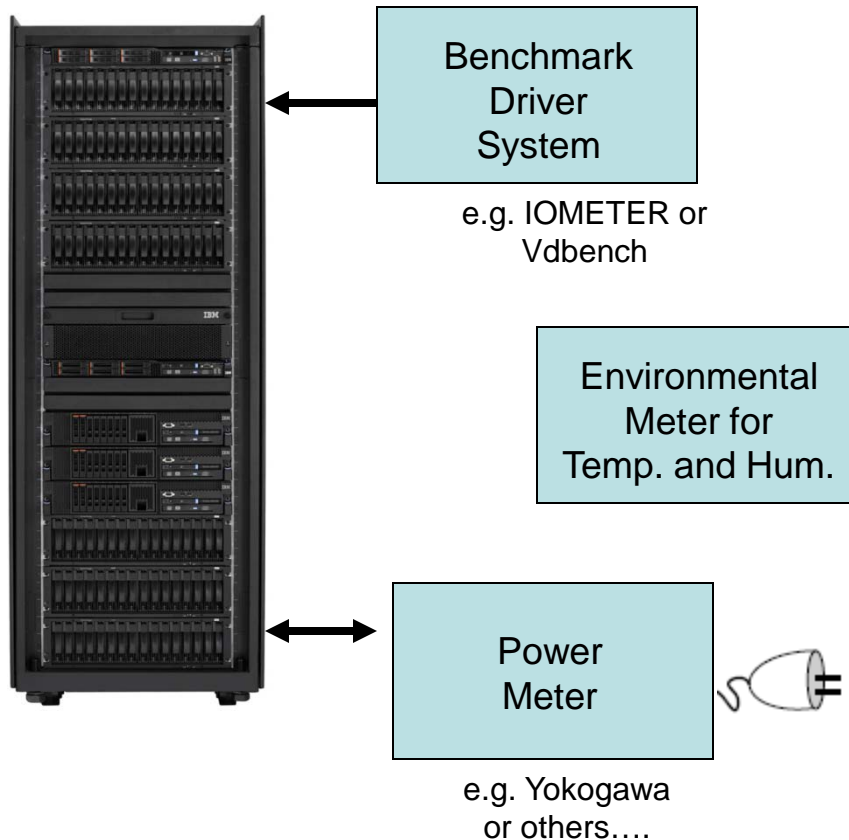
- ❖ System Under Test (SUT) pre-test measurement conditioning
- ❖ Active workload generation and measurements
- ❖ Idle workload and measurements
- ❖ Capacity optimization method (COM) verification.

C.1 Data Collection Requirements

A summary of the data collection requirements for the benchmark driver is provided in Table C-1.

Table C-1 Data Collection Summary

Test	Collection Interval (seconds)		Minimum Benchmark Driver Data Collection		Minimum Test Duration (minutes)	
	Power Meter	Temp Meter	Online/ Near Online	Removable/ Virtual	Online/ Near Online	Removable/ Virtual
Conditioning	5	60	Response Time (per 1m Interval)	Throughput (MB/s)	720	7
Active	5	60	Response Time (per 1m Interval)	Throughput (MB/s)	30	30
Idle	5	60	N/A	N/A	120	120

8.2   Primary Metrics

This revision of the specification defines the following primary metrics:

- POWER EFFICIENCY for each test phase for Online and Near Online systems (see 8.3):
    - EP_{MW1} for Mixed Workload 1
    - EP_{MW2} for Mixed Workload 2
    - EP_{RR} for Random Read
    - EP_{RW} for Random Write
    - EP_{SR} for Sequential Read
    - EP_{SW} for Sequential Write
    - EP_{RI} for Ready Idle

- POWER EFFICIENCY for each test phase for Removable Media Library systems (see 8.4):
    - EP_{SW} for Sequential Write
    - EP_{SR} for Sequential Read
    - EP_{RI} for Ready Idle

- POWER EFFICIENCY for each test phase for Virtual Media Library systems (see 8.5):
    - EP_{SW} for Sequential Write
    - EP_{SR} for Sequential Read
    - EP_{RI} for Ready Idle

- **Online Storage**
    - **Active Metrics ("work")**
        - IOs/Watt (R/W)
        - MBs/Watt (Sequential)
    - **Idle Metric ("capacity")**
        - GB/Watt

Capacity Optimization

The COMs tests are existence tests.

- They include:
    - Delta Snapshots (read and write)
    - Thin Provisioning
    - Data De-duplication
    - RAID groups
    - Compression

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SNIA Emerald™ Program
www.sniaemerald.com

SNIA Emerald™ Program

- Open, public web-based repository location for SNIA Emerald™ Program Test Data Reports based on SNIA Measurements Specification
    - The report includes information related to system power including system configuration details such as storage device types, RAS features and their configuration, and power supply types.

- Easily identifiable program logo

- Voluntary, low cost program for manufacturers
    - Options to self-measure or third party measurement
    - No SNIA membership required

- Free to download the specifications, user guides, and test data report access

- The report data can help IT professionals make storage platform selections as part of an overall Green IT and Sustainability objective.

- Sign up for the mailing list: www.SNIAEmerald.com

◆ Program Participants and Test Sponsors

 ◆ Manufacturers of Storage Systems

 ◆ Resellers/OEMs of Storage Systems

 ◆ Professional Services

  › Independent Testing Labs
  › Test Auditors

◆ Consumers of SNIA Emerald Test Data Reports

 ◆ IT Decision Makers

 ◆ Manufacturers of Storage Systems

 ◆ National bodies focused on Green IT initiatives

SNIA Emerald™ Program Fees

- ◆ Test Data Report Submission
  - ◆ SNIA GSI Member
    - › Voting member, first 8 are free, >8 $375
    - › Non-voting member, first 4 are free, >4 $500
    - › Test bundles, 10 for the price of 7, to supplement GSI membership entitlements
      - – Non-voting member, $3,500
      - – Voting member, $2,625
  - ◆ SNIA Member, but not a SNIA GSI Member
    - › $750
  - ◆ Industry at Large, not a member of SNIA
    - › $1,500
- ◆ SNIA Members Fee
  - ◆ Depending on membership type and level, $2,500-$40,000
  - ◆ Special membership programs offered throughout the year are discounted
- ◆ SNIA GSI Membership Fee
  - ◆ Voting - $9,000
  - ◆ Non-voting - $4,500
  - ◆ Special membership programs offered throughout the year are discounted
- ◆ Fee structure is cost recovery only to cover expenses of test data administration and program administration
- ◆ Free/No cost for end users to download results

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SNIA Green Storage Tutorials

◆ For access to SNIA Green Storage Tutorials, please visit:

- http://www.snia.org/forums/green/knowledge/tutorials
- OR
- http://www.snia.org/education/tutorials/2011/fall

Thank You

www.snia.org

www.snia.org/green

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