SNIA Emerald Storage Taxonomy

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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

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Emerald storage taxonomy

- Taxonomy
  - The technique of classification
  - A classification into ordered categories
- Storage Taxonomy
  - Many ways to classify storage into categories
    - Type of media used to store data
    - IDC price bands
    - Required power
    - Performance
    - Ext.

Why have a storage taxonomy for Emerald™

- Need a fair comparison among similar products
  - Able to compare power performance trade offs
  - Compare a car and truck

- Similar green metrics may apply to all product categories/classifications but different values establish best-in-class
  - Best commuter car and best sports car MPG

- Unique considerations apply to special categories
  - Truck towing capacity vs MPG
- A clear taxonomy will simplify comparisons / trade offs
- Help customers predict power usage in their IT environment

Criteria for Emerald™ storage taxonomy categories

- Based on power performance trade offs
  - Access time to data vs power
    - Tape (Removable Media Library) has great power utilization but long access times
  - Access pattern of the data
    - Can the storage system randomly place/retrieve a block of data
    - Can the storage system only handle sequential blocks of data
  - User accessible data
    - In the storage network there are many systems
      - Store data
      - Transfer data between host and storage
      - Support the storage system or manipulate data
    - Is user data stored on the system

Emerald™ data center storage taxonomy categories

- Data Center Storage Taxonomy Categories
  - Online
  - Near Online
  - Removable Media Library
  - Virtual Media Library
  - Adjunct Product
  - Interconnect Element

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

- The EmeraldTM power measurement specification only defines test for four of the categories

Break down categories into classification

- Added features of storage system that would consume more power are used to break down the categories
  - Component or consumer product
  - How is it connected to the host
  - Where is the storage controller
  - Reliability Availability Serviceability
    - Storage protection
    - No Single point of failure
    - Non disruptive serviceability
  - Size of system
  - Other features of the storage system
- Classification of systems on size and added power requirements

Storage classifications

- For consistency broke up each category into six classifications
  - Started with the small systems (classification 1) and worked up to the larger systems (classification 6)
  - The EmeraldTM power measurement specification may not define some of the classifications or have tests for them
    - I.e. did not define an class 4 classification for near-online, removable media libraries, or virtual media library
  - Tried to keep the size of the system (classification) consistence across the categories

Online Classification Breakdown

- Start small with online 1 and work up to large storage system with online 6
  - Online 1 system small consumer products
    - Did not define a power efficiency test for this classification in the specification
  - Online 2 system small storage system
    - Generally JBOD
    - For Energy Star needs to have a controller
  - Online 3 system
    - Integrated control and needs to have some storage protection
  - Online 4 system
    - Larger storage systems that require no SPOF
  - Online 5 system
    - Very large high end systems that require non-disruptive serviceability
  - Online 6 system
    - Very large mainframe systems

Classification of Online Systems

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Online Classification

- Online 1
- Online 2
- Online 3
- Online 4
- Online 5
- Online 6

Attribute	Classification					
	Online 1	Online 2	Online 3	Online 4	Online 5	Online 6
Access Pattern	Random/ Sequential	Random/ Sequential	Random/ Sequential	Random/ Sequential	Random/ Sequential	Random/ Sequential
MaxTTFD (t)	t < 80 ms	t < 80 ms	t < 80 ms	t < 80 ms	t < 80 ms	t < 80 ms
User-Accessible Data	Required	Required	Required	Required	Required	Required
Connectivity	Not specified	Connected to single or multiple hosts	Network-connected	Network-connected	Network-connected	Network-connected
Consumer/ Component	Yes	No	No	No	No	No
Integrated Storage Controller	Optional	Optional	Required	Required	Required	Required
Storage Protection	Optional	Optional	Required	Required	Required	Required
No SPOF	Optional	Optional	Optional	Required	Required	Required
Non-Disruptive Serviceability	Optional	Optional	Optional	Optional	Required	Required
FBA/CKD Support	Optional	Optional	Optional	Optional	Optional	Required
Maximum Supported Configuration	≥1	≥ 4	≥ 12	> 100	>400	>400

Near Online Classifications

Attribute	Classification					
	Near Online 1	Near Online 2	Near Online 3	Near Online 4	Near Online 5	Near Online 6
Access Pattern	Random/ Sequential	Random/ Sequential	Random/ Sequential		Random/ Sequential	Random/ Sequential
MaxTTFD (t)	t > 80 ms	t > 80 ms	t > 80 ms		t > 80 ms	t > 80 ms
User-accessible Data	Required	Required	Required		Required	Required
Connectivity	Not specified	Network connected	Network connected		Network connected	Network connected
Consumer/ Component	Yes	No	No		No	No
Integrated Storage Controller	Optional	Optional	Required		Required	Required
Storage Protection	Optional	Optional	Required		Required	Required
No SPOF	Optional	Optional	Optional		Optional	Required
Non-Disruptive Serviceability	Optional	Optional	Optional		Optional	Required
FBA/CKD Support	Optional	Optional	Optional		Optional	Optional
Maximum Supported Configuration	≥ 1	≥ 4	≥ 12		> 100	> 1000

Removable Media Library Classifications

Attribute	Classification					
	Removable 1	**Removable 2**	**Removable 3**	**Removable 4**	**Removable 5**	**Removable 6**
Access Pattern	Sequential	Sequential	Sequential		Sequential	Sequential
MaxTTFD (t)	80ms < t < 5m	80ms < t < 5m	80ms < t < 5m		80ms < t < 5m	80ms < t < 5m
User-Accessible Data	Required	Required	Required		Required	Required
Robotics	Prohibited	Required	Required		Required	Required
No SPOF	Optional	Optional	Optional		Optional	Required
Non-disruptive Serviceability	Optional	Optional	Optional		Optional	Required
Maximum Supported Drive Count	Not specified	4	≥ 5		≥ 25	≥ 25

Virtual Media Library Classifications

Attribute	Classification					
	Virtual 1	Virtual 2	Virtual 3	Virtual 4	Virtual 5	Virtual 6
Access Pattern	Sequential	Sequential	Sequential		Sequential	Sequential
MaxTTFD (t)	t < 80 ms	t < 80 ms	t < 80 ms		t < 80 ms	t < 80 ms
User-accessible Data	Required	Required	Required		Required	Required
Storage Protection	Optional	Optional	Required		Required	Required
No SPOF	Optional	Optional	Optional		Optional	Required
Non-Disruptive Serviceability	Optional	Optional	Optional		Optional	Required
Maximum Supported Configuration	12	>12	> 48		> 96	> 96