



# Storage Taxonomy Emerald™ 3.0.1

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SNIA Emerald™ Training

*SNIA Emerald™ Power Efficiency  
Measurement Specification*

*Version 3.0*

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## ➤ 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
  - › Etc.

# 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
  - ◆ Online vs Tape Library
- ◆ 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
  - ◆ Online 3 / Online 4
- ◆ Unique considerations apply to special categories
  - ◆ Truck towing capacity vs MPG
  - ◆ Sequential for VML only
- ◆ A clear taxonomy will simplify comparisons / trade offs
- ◆ Help customers predict power usage in their IT environment



# Storage Taxonomy Categories, v3.0.1

## ➤ Based on power-performance trade-offs

- ◆ Online
- ◆ Near Online
- ◆ Removable Media Library
- ◆ Virtual Media Library

Common Category Attributes

Attribute	Category			
	Online	Near-Online	Removable Media Library	Virtual Media Library
Access Pattern	Random/ Sequential	Random/ Sequential	Sequential	Sequential
MaxTTFD (t) <sup>a</sup>	t < 80 ms	t > 80 ms	t > 80 ms t < 5 min	t < 80 ms

- Block and File fall under the Online and Near-Online Categories
- Removed Adjunct Product and Interconnect Element (*change from v2.1.1*)
- Removed User Accessible Data attribute (*change from v2.1.1*)



# Categories are broken into Classifications

- 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 by 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 Emerald™ power measurement specification may not define some of the classifications
    - 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

# Taxonomy Rules (new for v3.0.1)

- A product shall satisfy all the attributes (required and prohibited) for its designated category and designated classification
- If a product satisfies one or more category or classification it may be considered a member of the category or classification if the requirements can be met by all of its storage devices
- If a product satisfies the attributes of multiple classifications, the product may be considered to be in any or all of these classifications



# 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 (dual controllers, power supplies, ext.)
  - ◆ Online 5 system
    - › Very large high end systems that require non-disruptive serviceability (Able to get to data even with system upgrade)
  - ◆ Online 6 system
    - › Very large mainframe systems



## ➤ 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
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
Stable storage support	Optional, unless Required by protocol	Optional, unless Required by protocol	Required	Required	Required	Required
Non-Disruptive Serviceability	Optional	Optional	Optional	Optional	Required	Required
FBA/CKD Support	Optional	Optional	Optional	Optional	Optional	Required
Maximum Supported Configuration <sup>1</sup>	≥1	≥ 4	≥ 12	> 100	>400	>400



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## Questions?

# Near Online Classifications, v3.0.1

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
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, v3.0.1

Attribute	Classification					
	Removable 1	Removable 2	Removable 3	Removable 4	Removable 5	Removable 6
Access Pattern	Sequential	Sequential	Sequential		Sequential	Sequential
MaxTTFD (t)	t > 80 ms t < 5 min	t > 80 ms t < 5 min	t > 80 ms t < 5 min		t > 80 ms t < 5 min	t > 80 ms t < 5 min
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, v3.0.1

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
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