



# **ENERGY STAR**

## **Data Center Storage Meeting**

### **Draft 3 Version 1.0 Specification**

#### **Supplemental Material – Combinations of Optimal Configurations Examples**

July 11, 2012

# Storage Family Examples

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- Expanded examples of Combinations of Optimal Configurations for ENERGY STAR for
  - Increased complexity of tested and sold combinations
  - Inclusion of NAS storage device
- Additional detail can be located in the notes section of the following slides

# Example Systems



## System 1

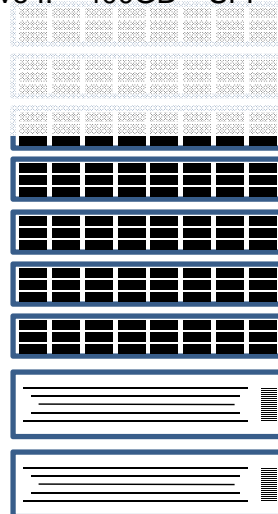
- Single controller
  - Supports to 28 LFF HDDs (2 drawers of 14x)
  - Optional redundant controller
- Storage media options
  - Drive A: 300GB - LFF – 15K
  - Drive B: 450GB – LFF – 15K
  - Drive C: 600GB – LFF – 15K
  - Drive D: 1TB – LFF – 7.2K
  - Drive E: 2TB – LFF – 7.2K
  - Drive F: 3TB – LFF – 7.2K
  - Drive G: 300GB – LFF – 10K
  - Drive H: 600GB – LFF – 10K
  - Drive I: 900GB – LFF – 10K
  - Drive J: 200GB – LFF – SSD
  - Drive K: 400GB – LFF – SSD



Optional

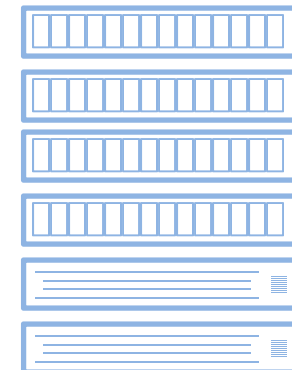
## System 2

- Dual controller
  - Supports to 168 SFF HDDs (7 drawers of 24x)
- Storage media options
  - Drive A: 146GB – SFF – 15K
  - Drive B: 300GB – SFF – 15K
  - Drive C: 600GB – SFF – 7.2K
  - Drive D: 1TB – SFF – 7.2K
  - Drive E: 300GB – SFF – 10K
  - Drive F: 600GB – SFF – 10K
  - Drive G: 900GB – SFF – 10K
  - Drive H: 200GB – SFF – SSD
  - Drive I: 400GB – SFF – SSD



## System 3

- Dual controller - NAS
  - Supports to 56 LFF HDDs (4 drawers of 14x)
- Storage media options
  - Drive A: 300GB – LFF – 15K
  - Drive B: 450GB – LFF – 15K
  - Drive C: 600GB – LFF – 15K
  - Drive D: 1TB – LFF – 7.2K
  - Drive E: 2TB – LFF – 7.2K
  - Drive F: 3TB – LFF – 7.2K



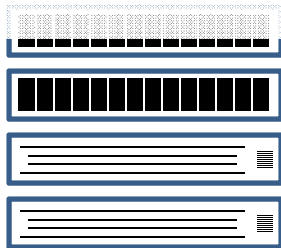
# Submitted Optimal Test Points



- Vender selected Optimal Test Points selected for Transaction *and/or* Sequential workloads.
  - Additional Capacity Optimal Test Point submitted at Venders choice
- Vender selected storage media and controller options / configuration.
  - Homogeneous examples assume SNIA tool modified to support homogeneous environments for Transaction workloads.
- Note vender chose not to include all available media types in selecting submitted test points:
  - Influenced by their expected market – which drive types are needed in ENERGY STAR qualified systems.
  - Influenced by final process around Component Testing and equivalency.

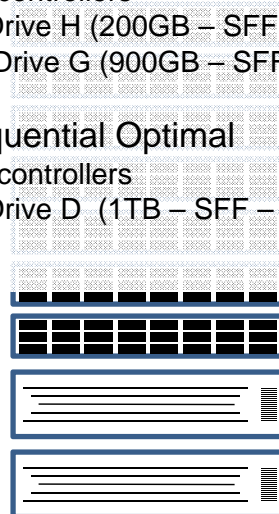
## System 1

- #1 Transaction Optimal
  - Dual controllers
  - 8x Drive B (450GB – LFF – 15K) (RAID-5)
- #2 Sequential Optimal
  - Dual controllers
  - 10x Drive E (2TB – LFF – 7.2K) (RAID-6)
- #3 Capacity Optimal
  - Dual controllers
  - 14x Drive f (3TB – LFF – 7.2K) (RAID-4)



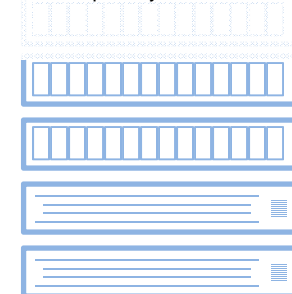
## System 2

- #1 Transaction Optimal
  - Dual controllers
  - 16x Drive A (146GB – SFF – 15K) (RAID-5)
- #2 Transaction Optimal
  - Dual controllers
  - 4x Drive H (200GB – SFF – SSD) (RAID-1)
  - 12x Drive G (900GB – SFF – 10K) (RAID-5)
- #3 Sequential Optimal
  - Dual controllers
  - 45x Drive D (1TB – SFF – 7.2K) (RAID-6)



## System 3

- #1 Transaction Optimal
  - Dual controllers
  - 22x Drive A (300GB – LFF – 15K) (RAID-5)
  - 4x Drive D (1TB – LFF – 7.5K) Minimum quantity needed for NAS functionality
- #2 Sequential Optimal
  - Dual controllers
  - 37x Drive E (2TB – LFF – 7.2K) (RAID-6)
  - 4x Drive D (1TB – LFF – 7.5K) Minimum quantity needed for NAS functionality

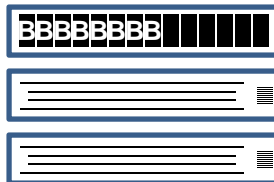


# Determining Approved Family Configurations

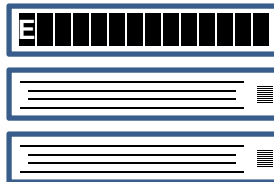


## Example System 1

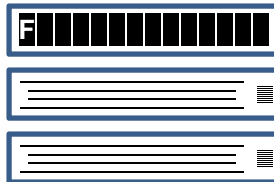
- #1 Transaction Optimized
  - Dual controllers
  - 8x Drive B (450GB – LFF – 15K)



- #2 Sequential Optimized
  - Dual controllers
  - 10x Drive E (2TB – LFF – 7.2K)



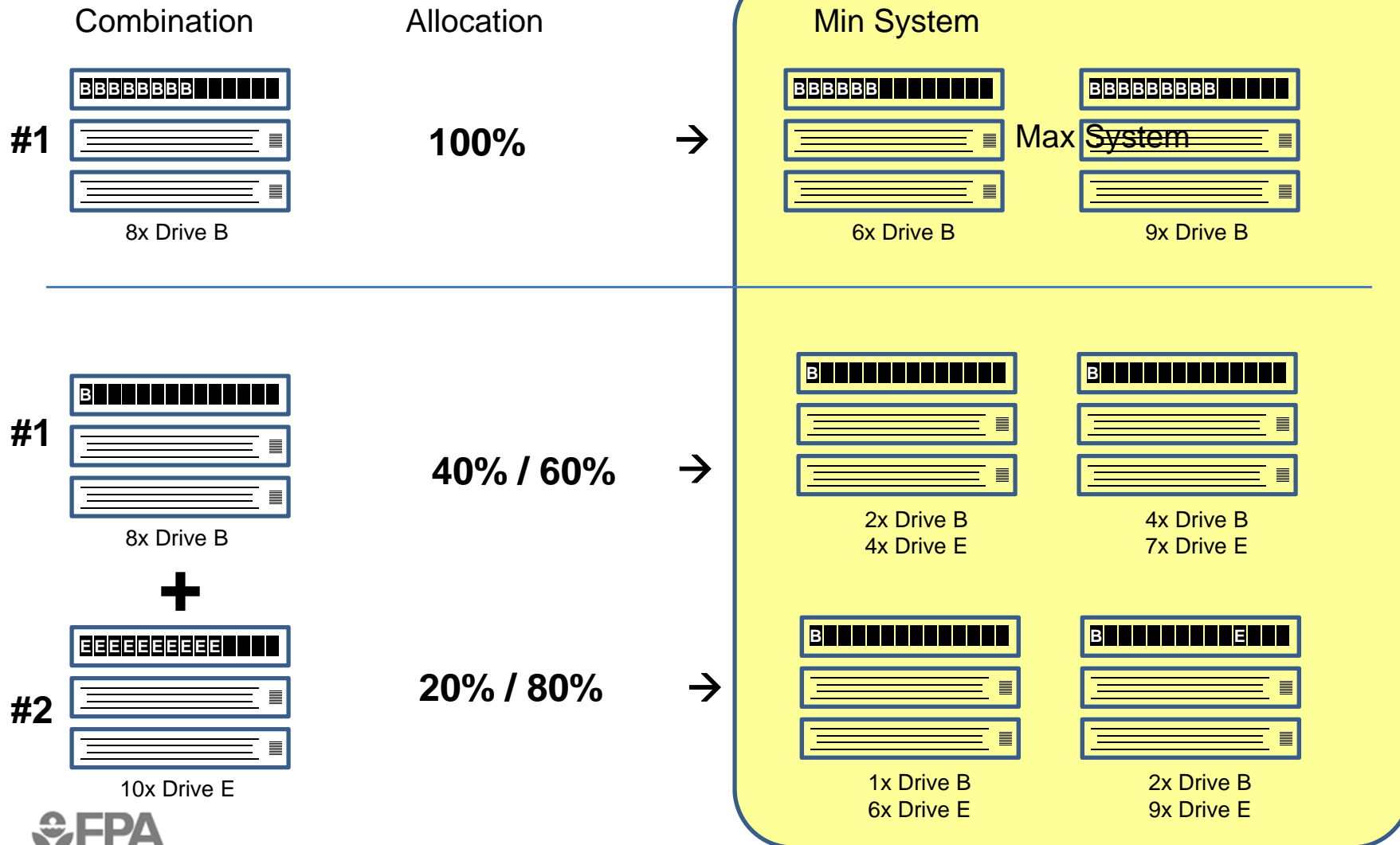
- #3 Capacity Optimized
  - Dual controllers
  - 14x Drive E (2TB – LFF – 7.2K)



## Steps to calculate Approved Configurations

1. Allocate storage media
  - Allocated by % of Optimal test configurations
  - % of allocations must sum to 100%
2. Media Rounding
  - Round UP +5% to nearest whole
  - Round DOWN -20% to nearest whole
    - May use Expanded Minimum Configuration %
3. Drawer Rounding (if applicable)
  - Eliminate –or- fill in partial drawers
  - Keeping overall ratio of drive types the same

# Example System 1



# Example System 2



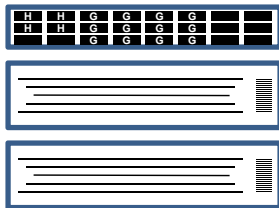
Combination

Allocation

Over/Under

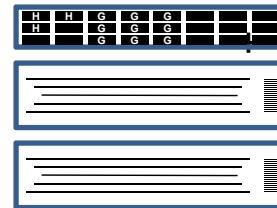
Rounding

#2

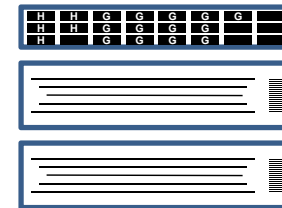


4x Drive H  
12x Drive G

100%

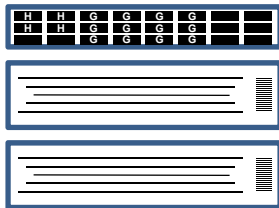


3x Drive H  
9x Drive G



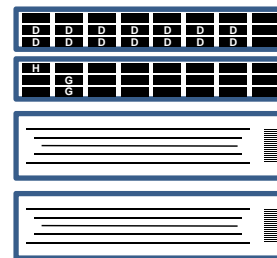
5x Drive H  
13x Drive G

#2

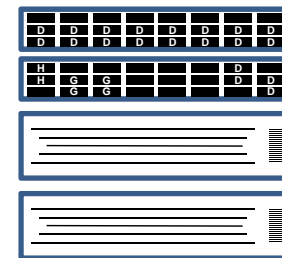


4x Drive H  
12x Drive G

40% / 60%



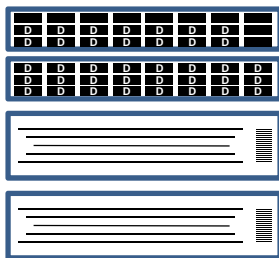
1x Drive H  
3x Drive G  
21x Drive D



2x Drive H  
6x Drive G  
29x Drive D

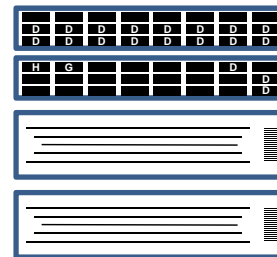


#3

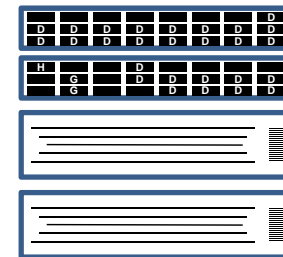


45x Drive D

20% / 80%



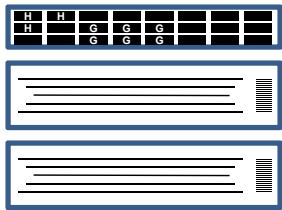
1x Drive H  
1x Drive G  
28x Drive D



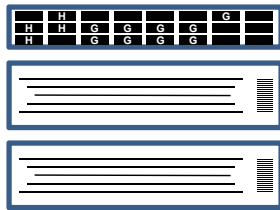
1x Drive H  
3x Drive G  
38x Drive D



# System 2 Drawer Rounding



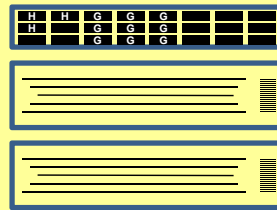
3x Drive H  
9x Drive G



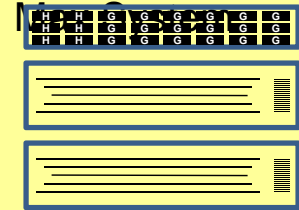
5x Drive H  
13x Drive G



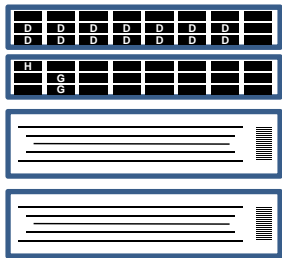
## Min System



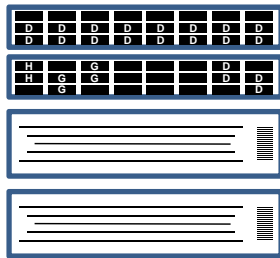
3x Drive H  
9x Drive G



6x Drive H (20%)  
18x Drive G (38%)



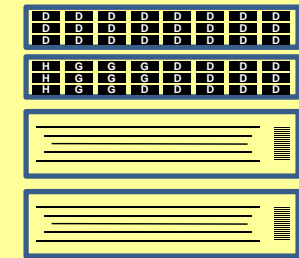
1x Drive H  
3x Drive G  
21x Drive D



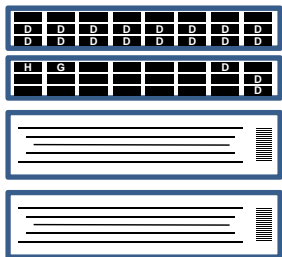
2x Drive H  
6x Drive G  
29x Drive D



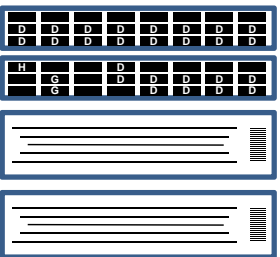
1x Drive H  
2x Drive G (-33%)  
21x Drive D



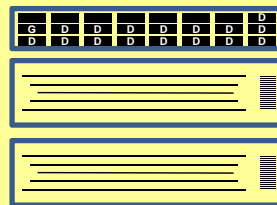
3x Drive H (50%)  
8x Drive G (33%)  
37x Drive D (28%)



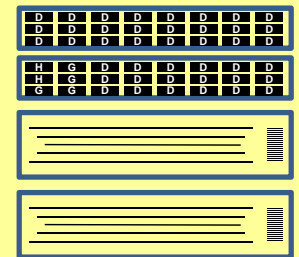
1x Drive H  
1x Drive G  
28x Drive D



1x Drive H  
3x Drive G  
38x Drive D



1x Drive H  
1x Drive G  
22x Drive D (-18%)

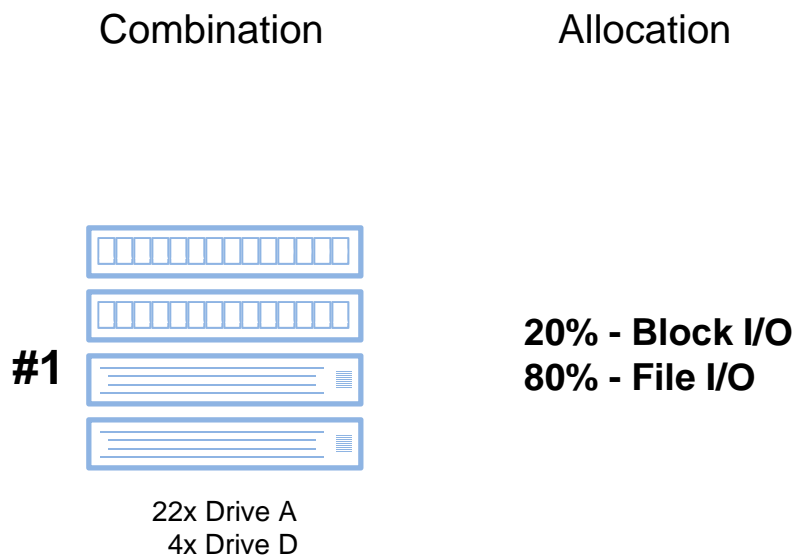


2x Drive H (100%)  
4x Drive G (33%)  
42x Drive D (11%)

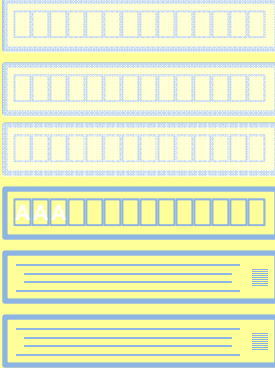




# Example System 3 (NAS)

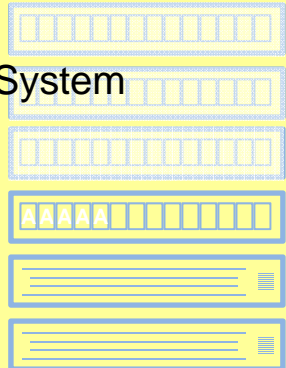


**Min System**



3x Drive A

**Max System**



5x Drive A

Storage media utilized for File I/O access is not regulated under Version 1 of ENERGY STAR for Storage.

Any drive combination may be delivered for File I/O deployment.

# References and resources

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- ENERGY STAR Data Center Storage specification revision:
  - [www.energystar.gov/NewSpecs](http://www.energystar.gov/NewSpecs)
  - Select “Data Center Storage”