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DB2 for z/OS With EMC Storage Tiering: FAST VP

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SHARE in Boston

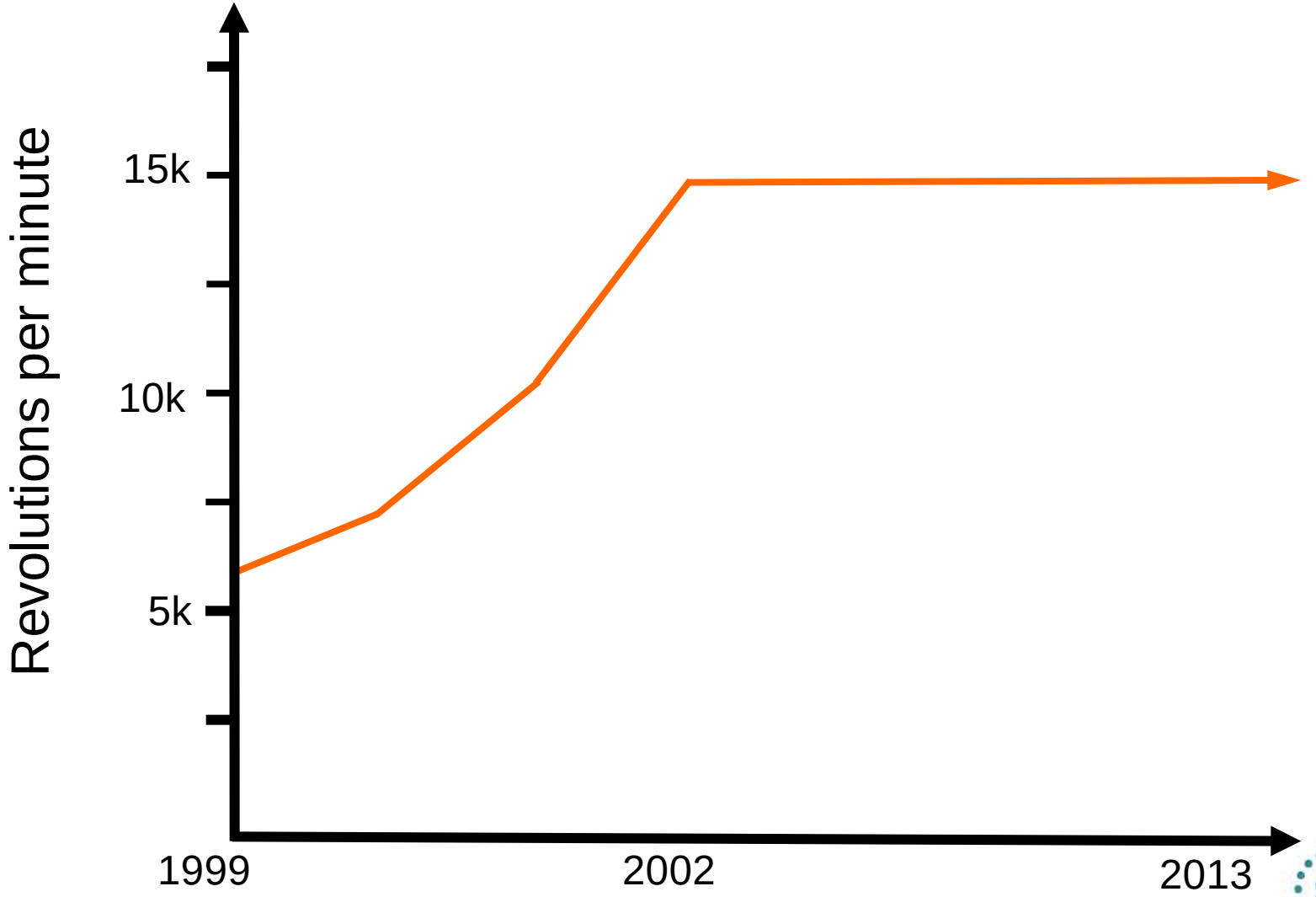
Agenda

- The drivers for tiered storage
  - Technology changes
  - Workload skew
- FAST VP
  - Storage elements
  - Operating parameters
  - Lab testing and results
- Operational/host considerations
- Summary

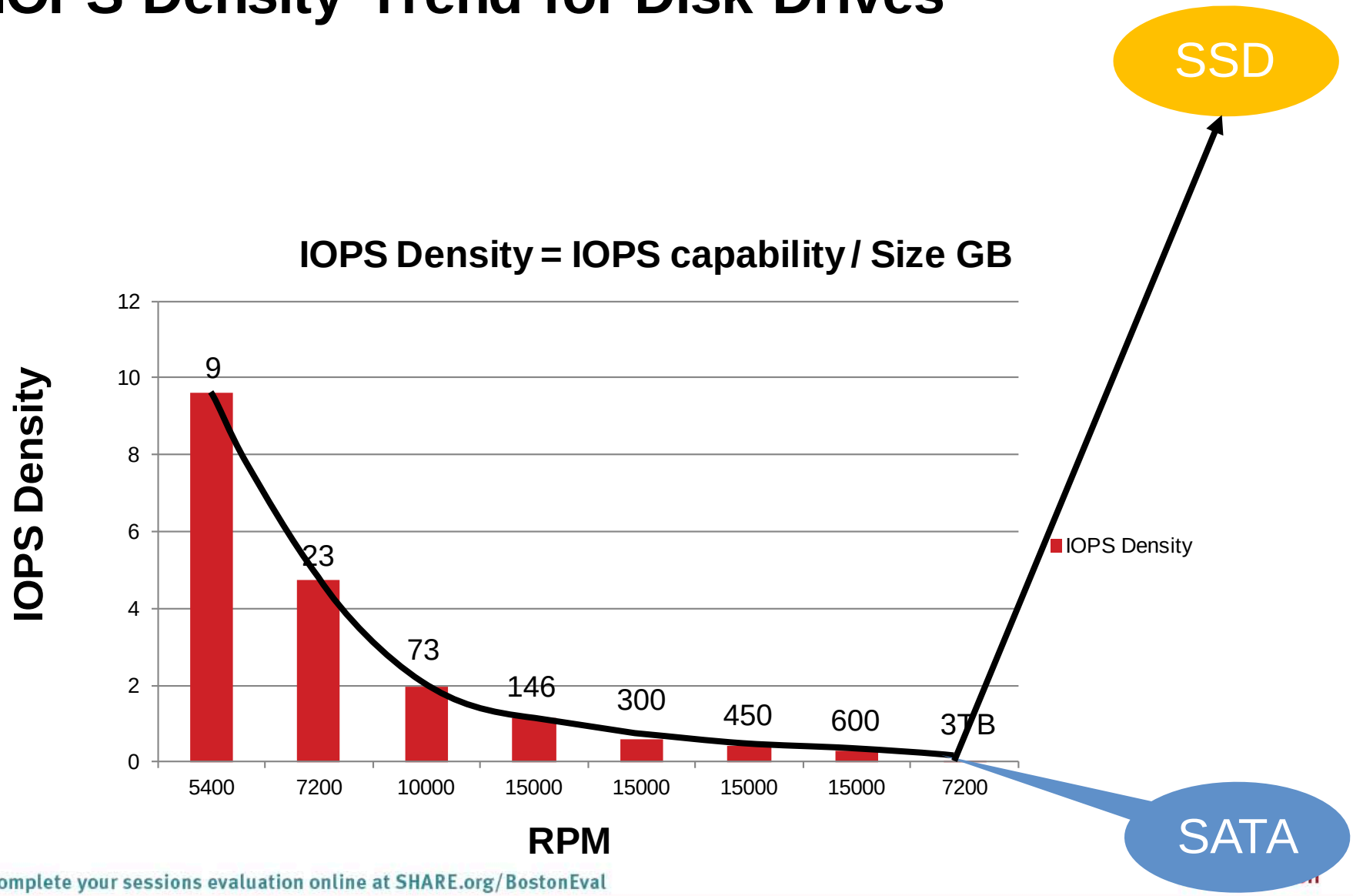
Drivers Towards Storage Tiering

- Massive data growth
- Faster and faster processors
- Faster and faster channels
- Budgets are flat or decreasing
- Decline of the hard drive
- Arrival of SSD
  - Extremely high price and performance!
- Arrival of SATA
  - Extremely low price and performance!

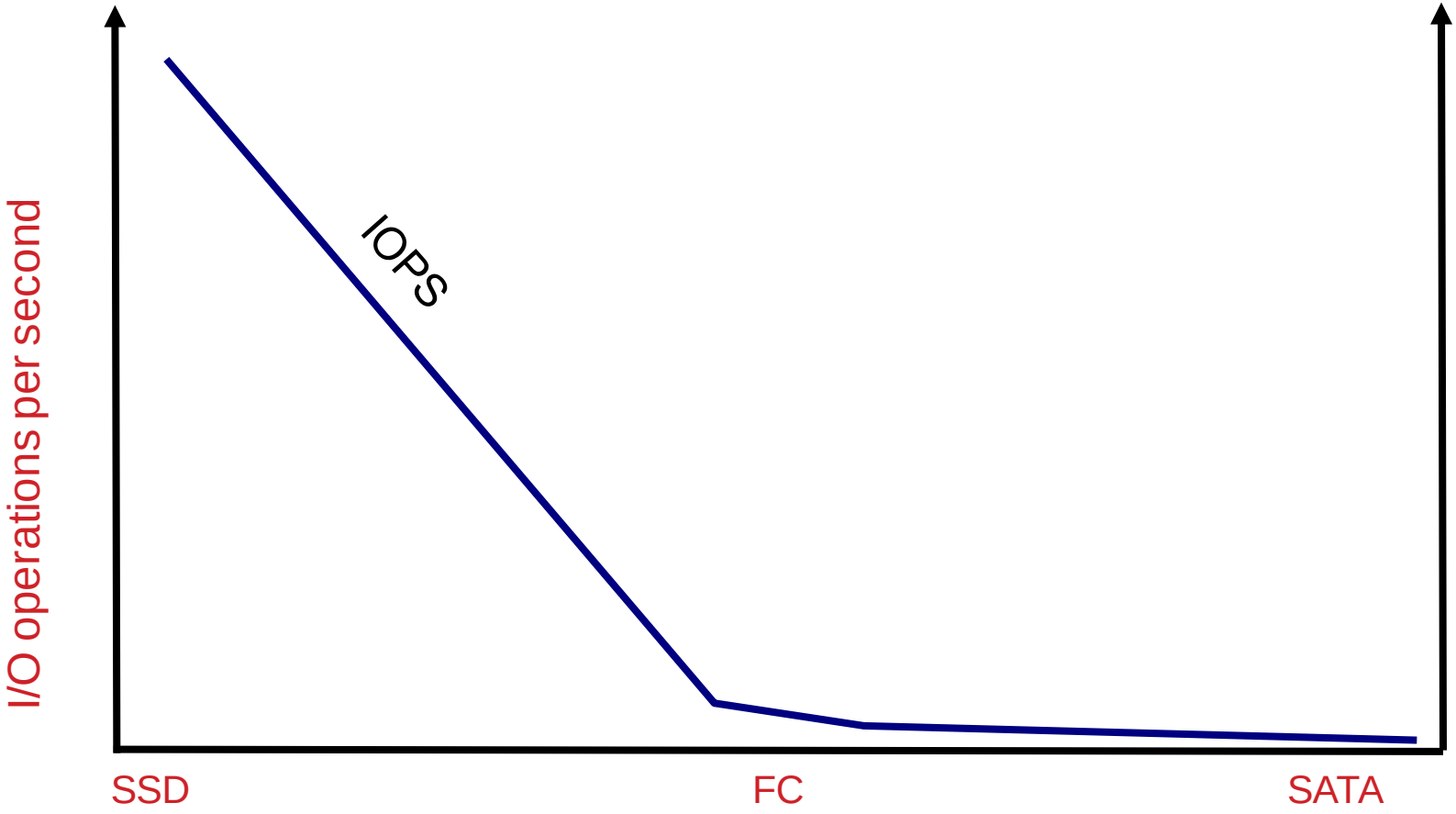
The Hard Drive RPM Story



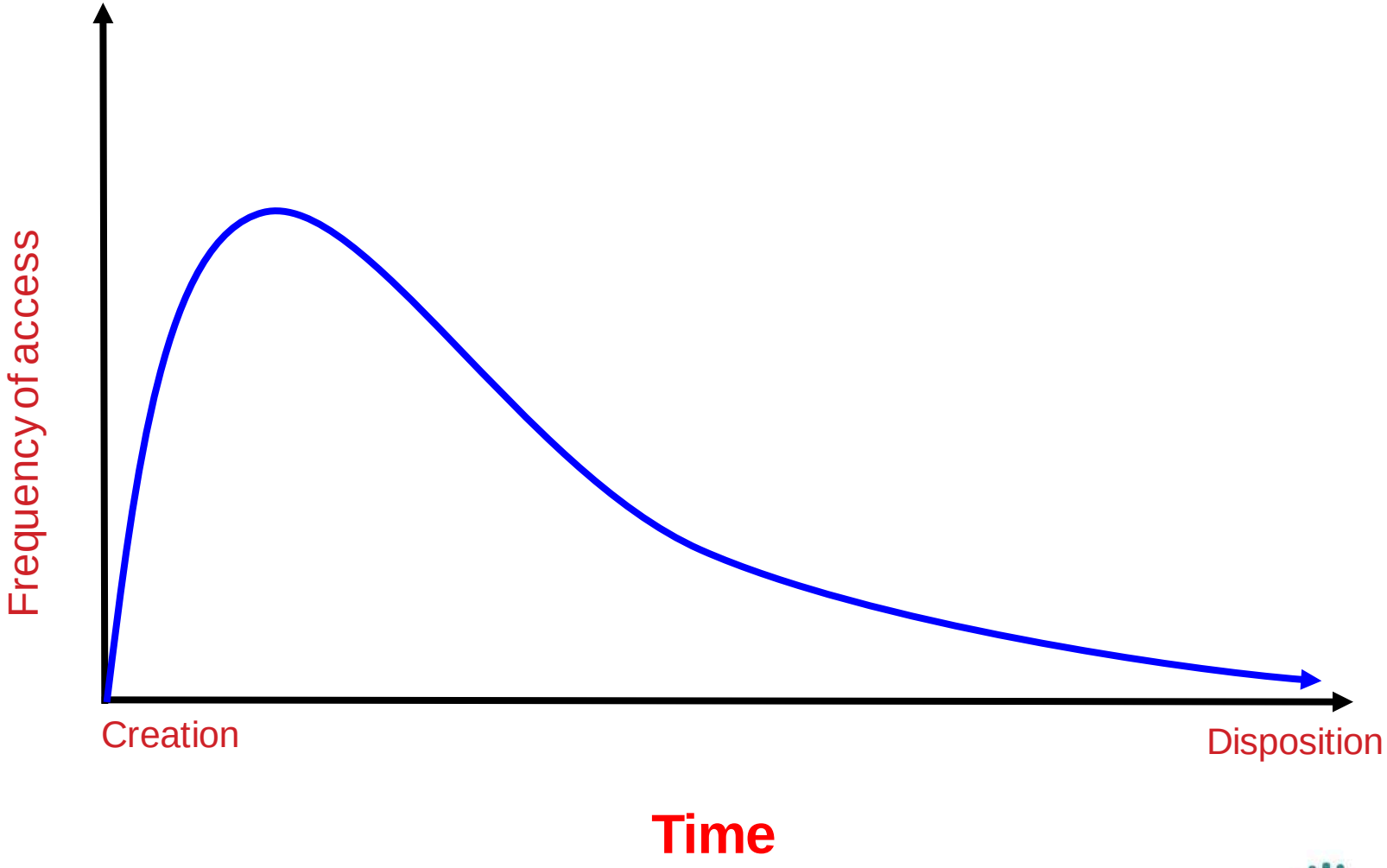
IOPS Density Trend for Disk Drives



IOPS Comparisons of Drive Technology



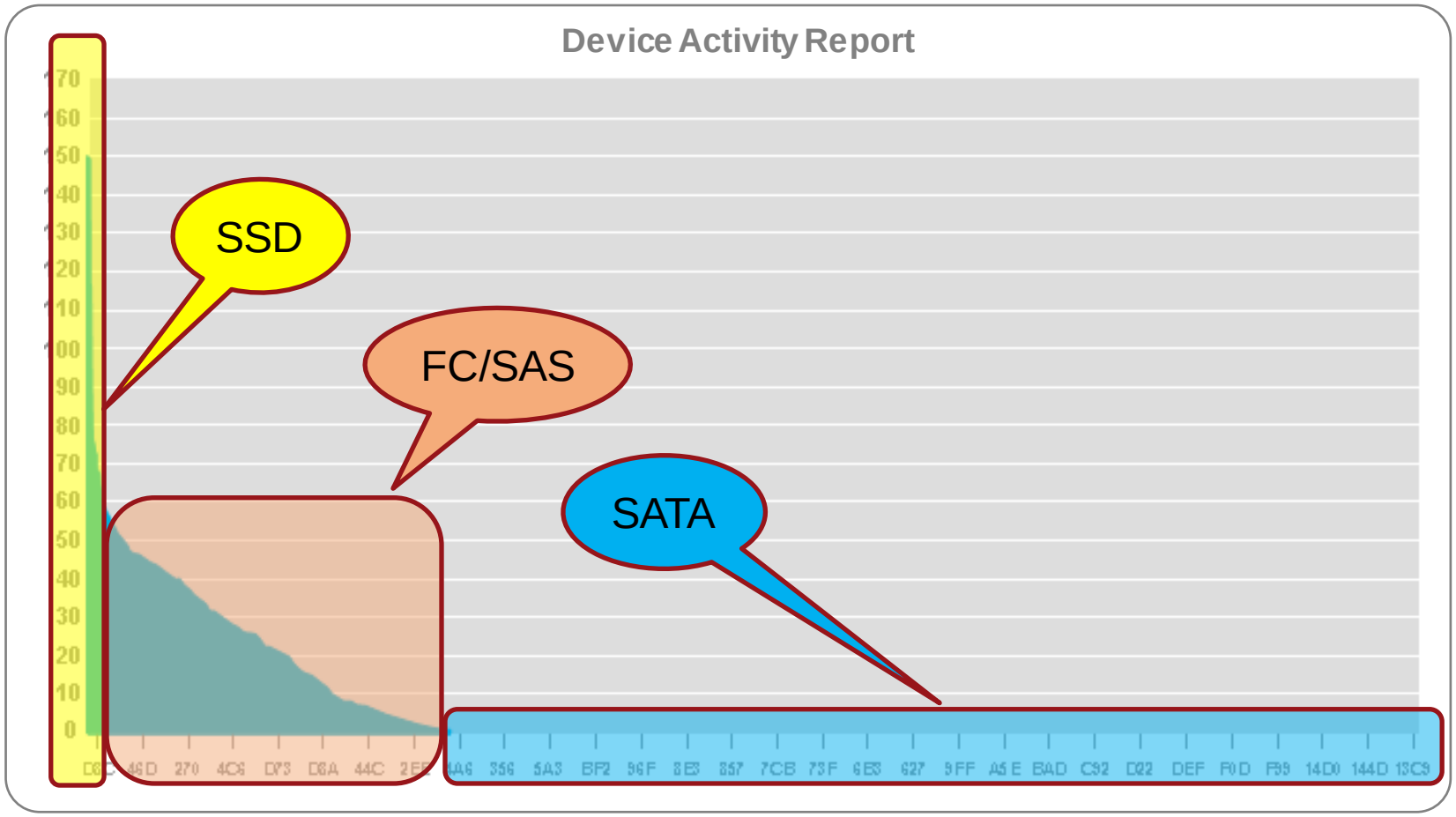
Data Life Cycle



Types of Workload Skew

- Persistent
  - To a large extent, historical activity is a good predictor of future activity
  - Good candidates for static tiering
- Non-persistent
  - Activity is mostly randomly skewed
  - Hot data today may not be hot tomorrow
  - Good candidates for automated tiering
- No skew (at full-volume level)
  - TPF, DB2 LUW DPF, Teradata

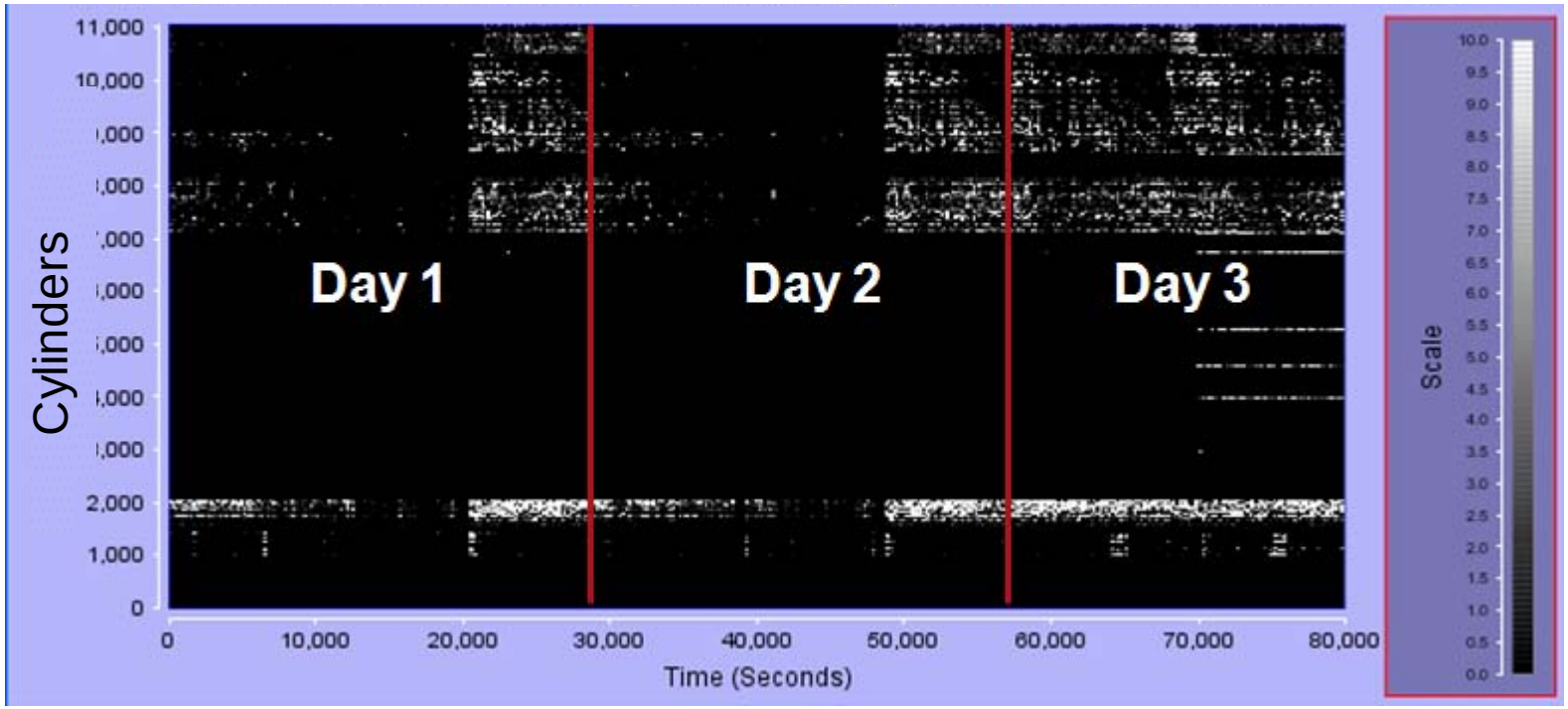
Workload Skew by Volume



The Static Tiering Challenge

- How do you know what database objects to place on each tier?
  - Largely, access patterns to an object change over time
  - The most frequently accessed objects are in the DB2 buffer pool or in the storage controller cache
  - The biggest objects are not good choices
- What about DB2 logs?
- High write table spaces?
- Sequentially accessed table spaces?
- The whole table space? Partition? Part of a table space?

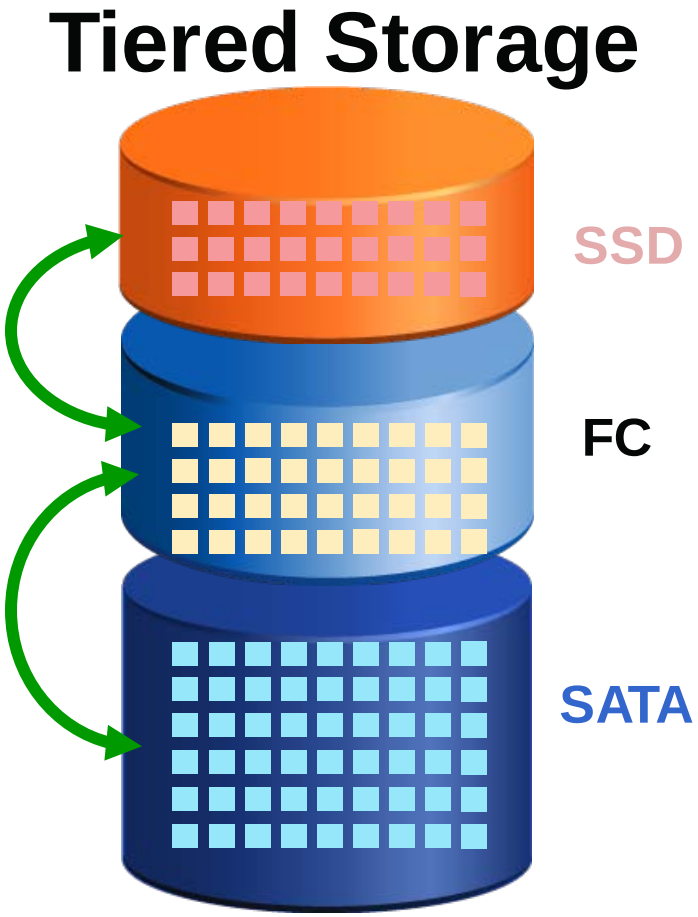
Sub-Volume Skewing



Typically, only parts of a volume are consistently “hot”

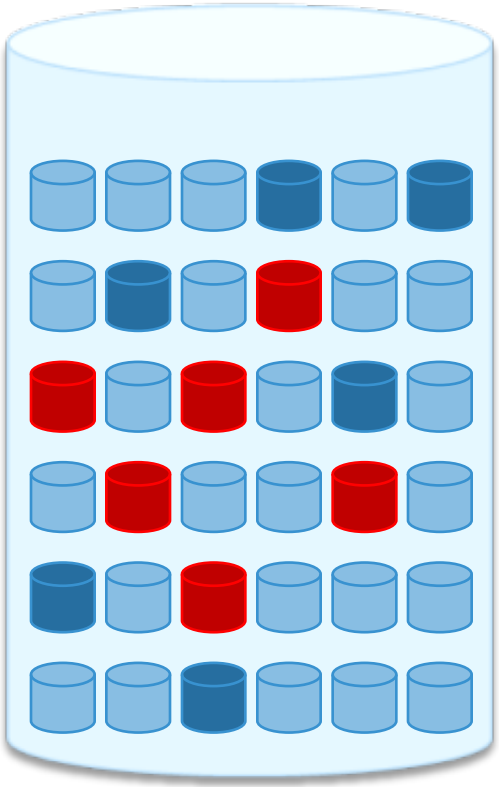
FAST VP: Automated Storage Tiering

- FAST VP – Fully Automated Storage Tiering Virtual Pools
- FAST VP is a policy-based system that automatically promotes and demotes data across storage tiers to achieve performance objectives and cost targets
- Gets the right data, to the right place, at the right time

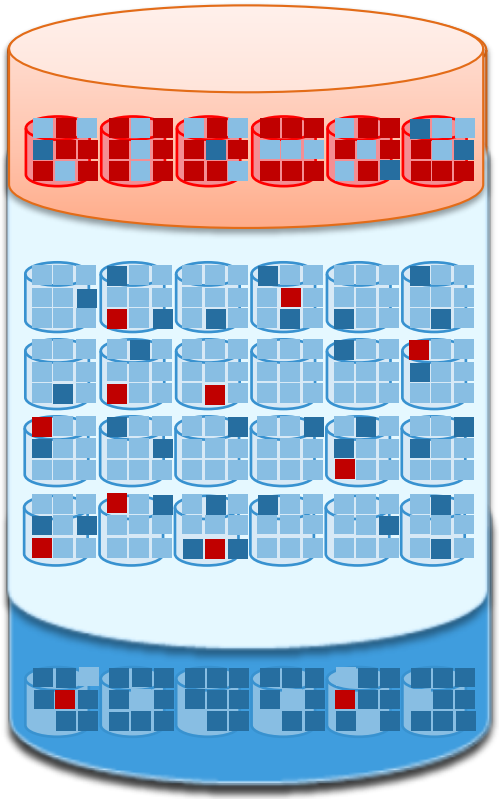


Evolution of FAST

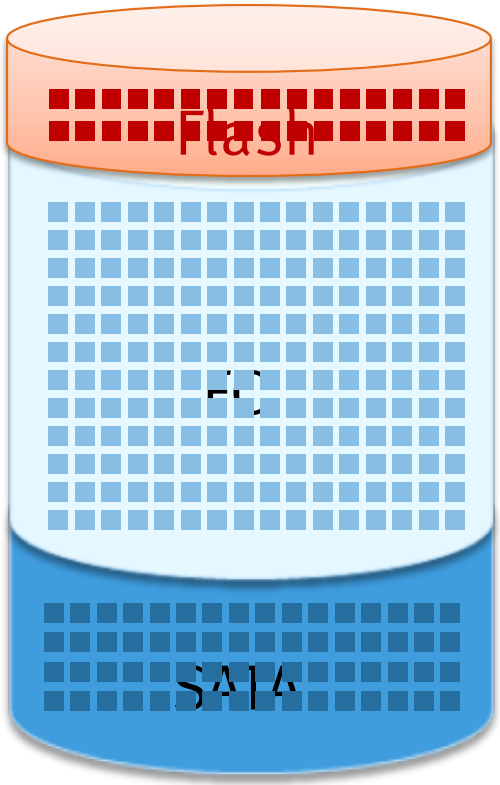
Traditional



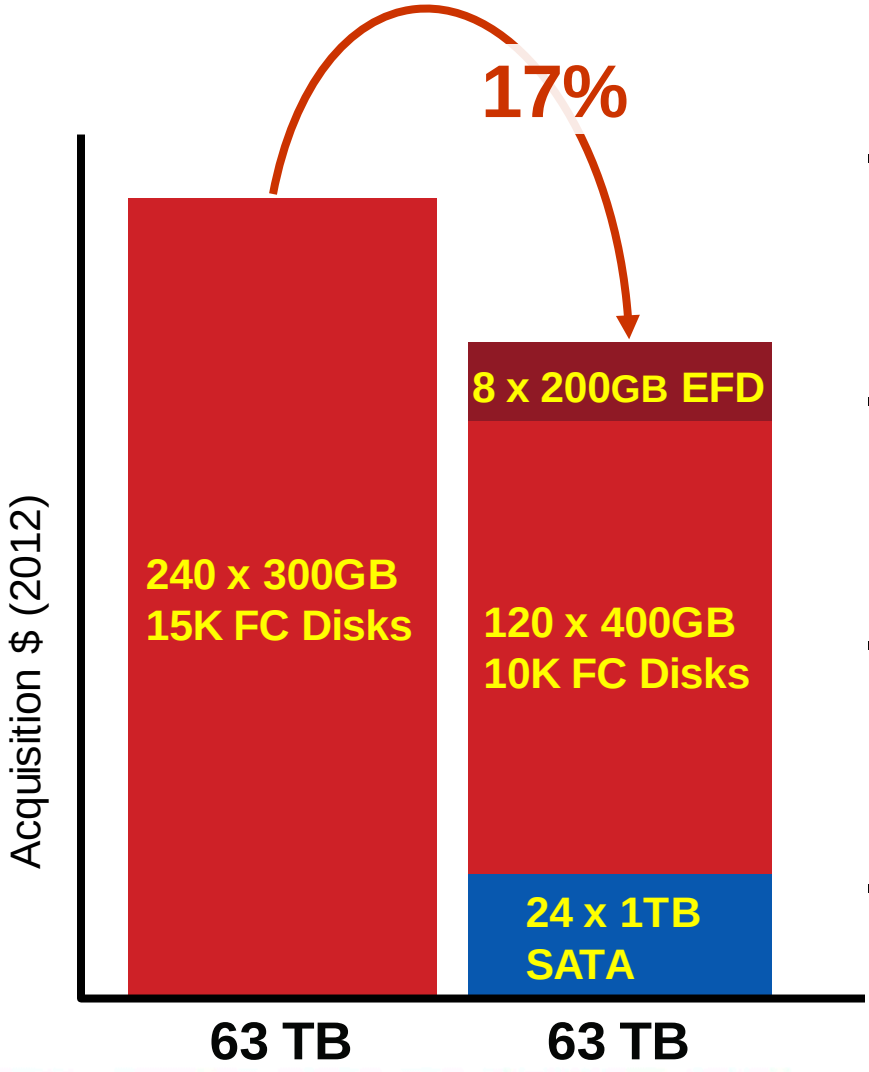
FAST



FAST VP



Tiered storage use case



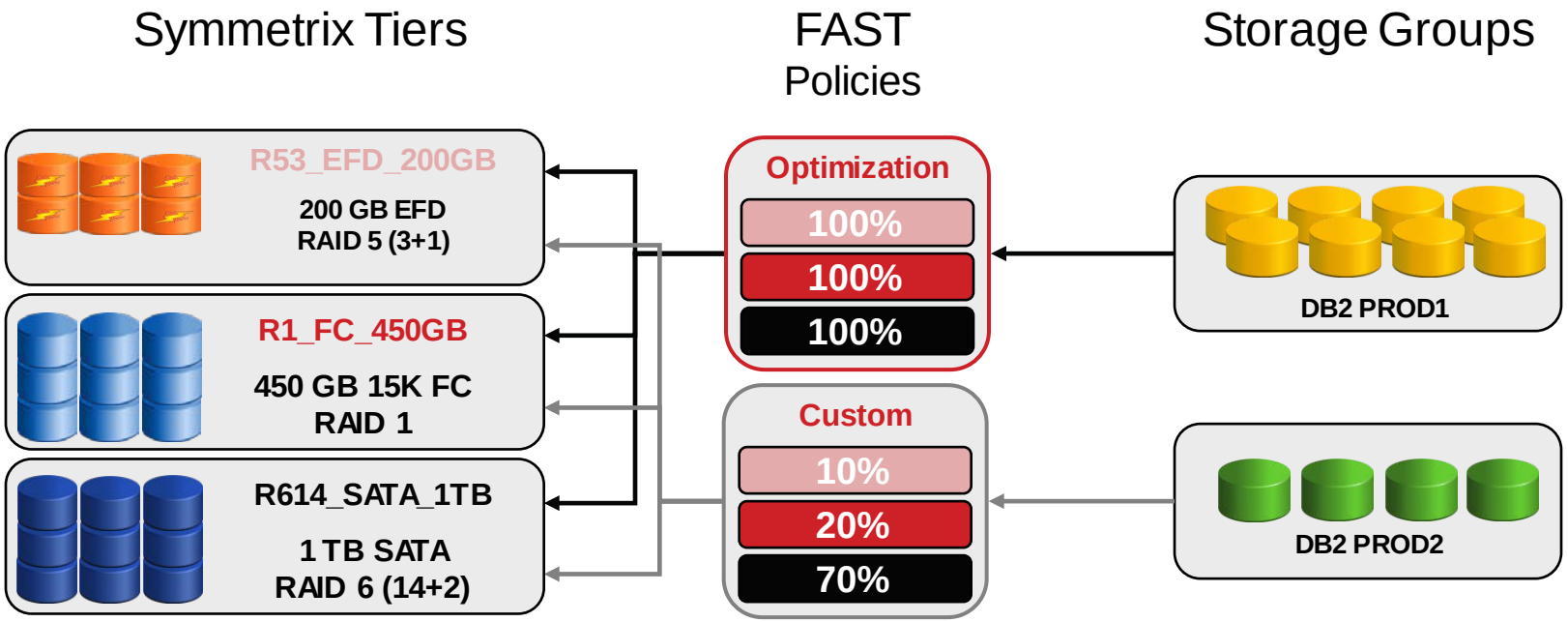
17% Lower Storage Costs
+ reduce maintenance & SW costs

45% More Disk IOPS
+ more aligned with workloads

32% Less Power & Cooling
+ more efficient use of space

37% Fewer Disk Drives
152 EFD+FC+SATA vs. 240 FC

FAST VP Elements



Symmetrix Tiers

- Tiers combine a drive technology and a RAID protection type, e.g.
  - Solid state
  - SAS/FC 15K RPM
  - SATA/SAS 7200 RPM

FAST Policies

- FAST Policies manage data placement and movement across Symmetrix Tiers for one or more Storage Groups
- Each Policy can contain up to three Symmetrix Tiers
  - Policies define the upper usage limit of each tier
- Each tier usage rule defines the maximum capacity of a storage group that can be moved to that tier
  - Each tier usage rule may be between 1% and 100%
  - Combined tier usage rules must total at least 100%, but may be greater than 100%
- Symmetrix Tiers may be shared among multiple FAST Policies

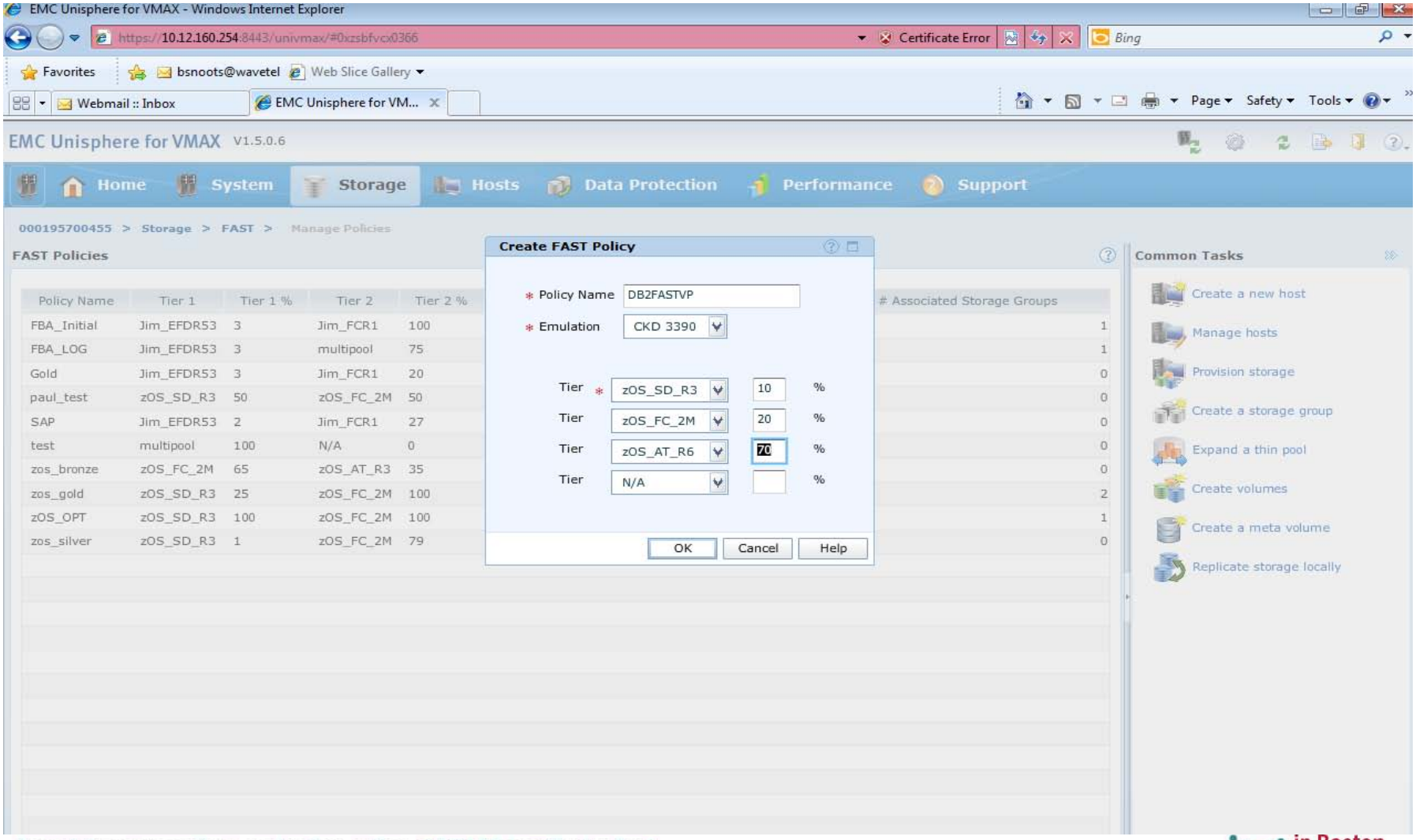
FAST Storage Groups

- Storage Groups logically group together devices for common management
- A Storage Group can have at most one policy associated with it
- Storage Groups may contain multiple device types
- Devices may be “pinned” to prevent FAST movement
  - Performance statistics will continue to be collected for pinned devices
  - Statistics included when generating a new performance movement policy

Time Windows

- Performance Window
  - Defines the times of the day, and the days of the week during which performance data is collected
  - Allows for “quiet” periods, or irregular workloads to be excluded from analysis
- Data Movement Window
  - Defines the times of the day, and the days of the week during which data movements will automatically be performed

Create FAST Policy



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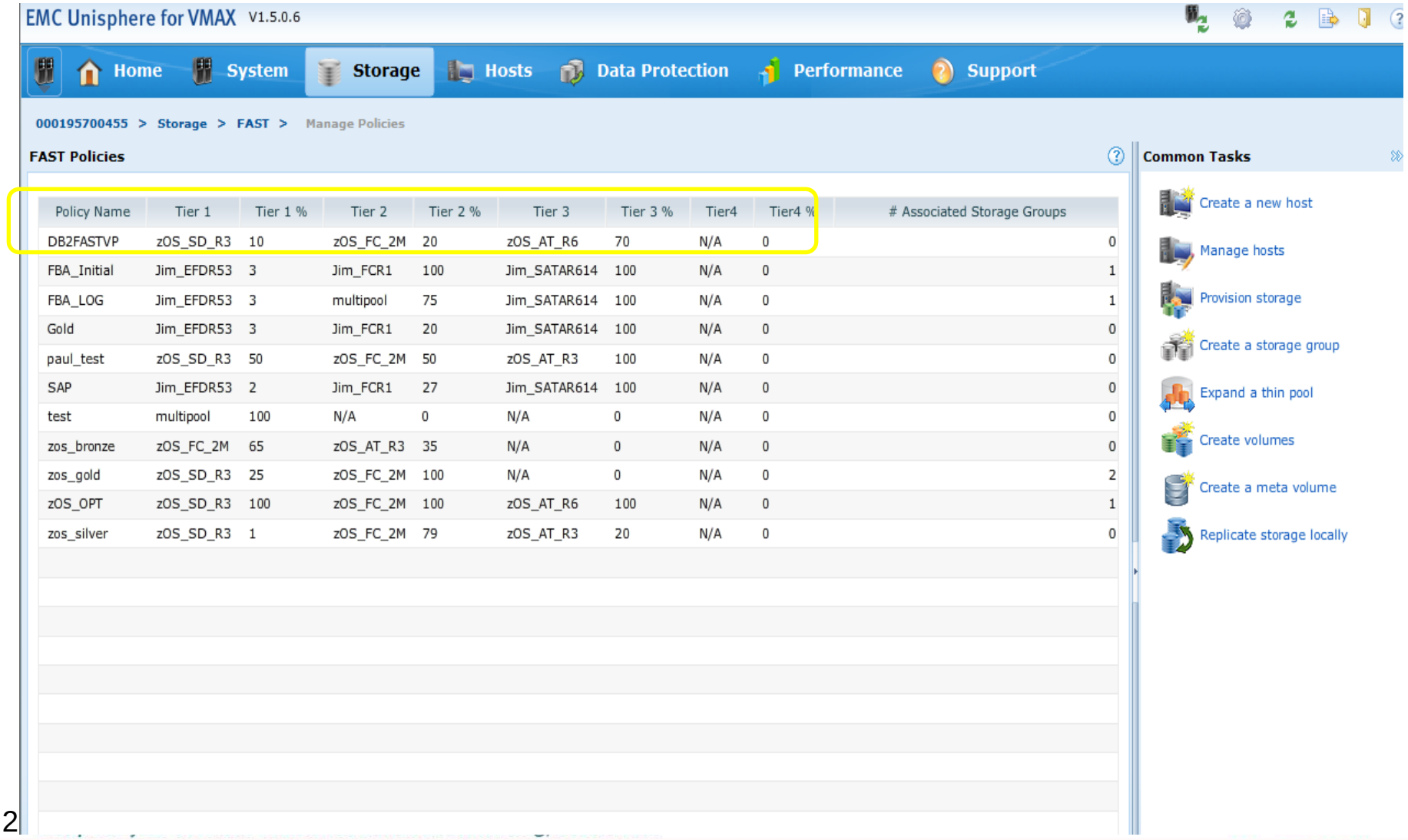
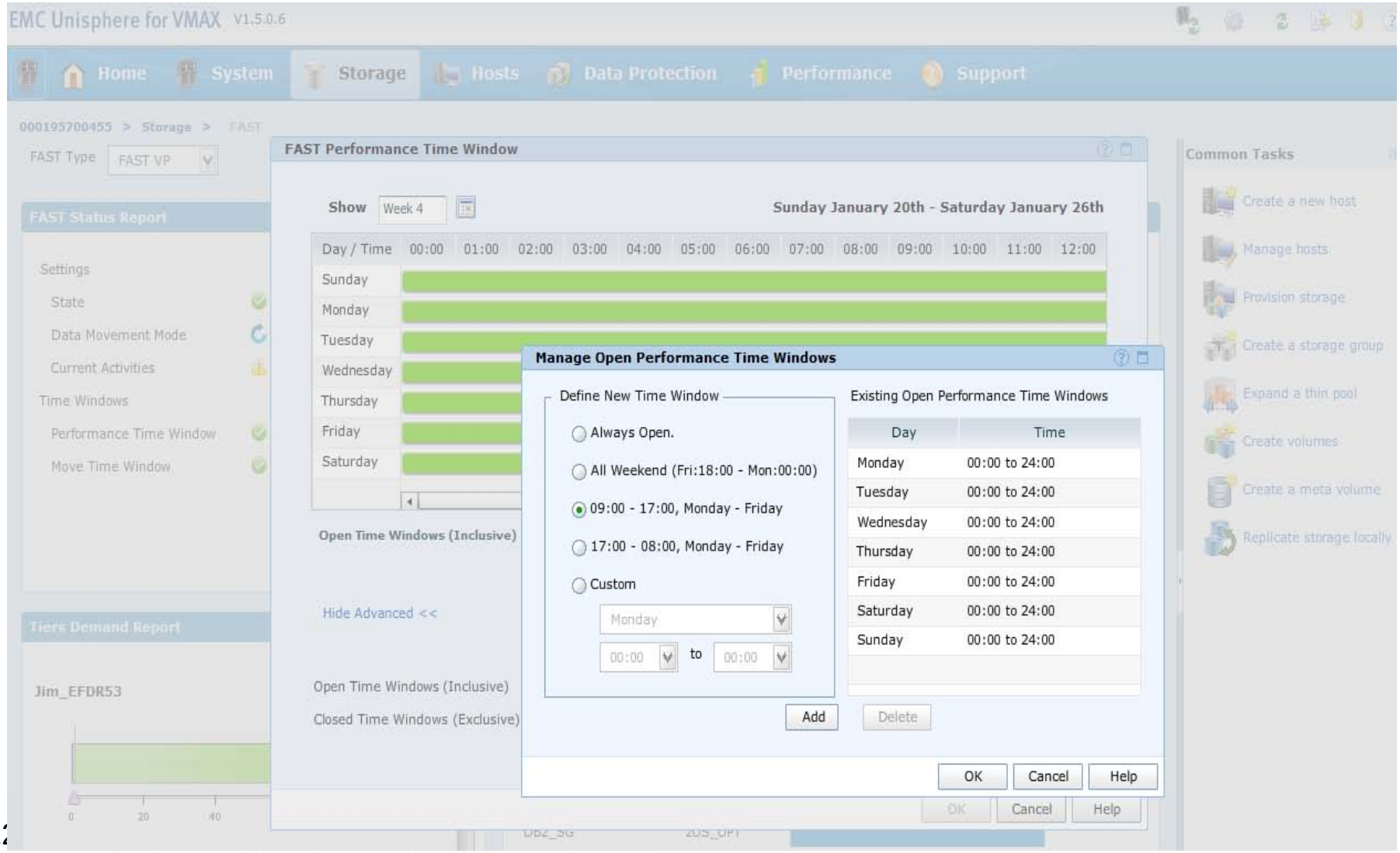
FAST Policies with New Policy Listed

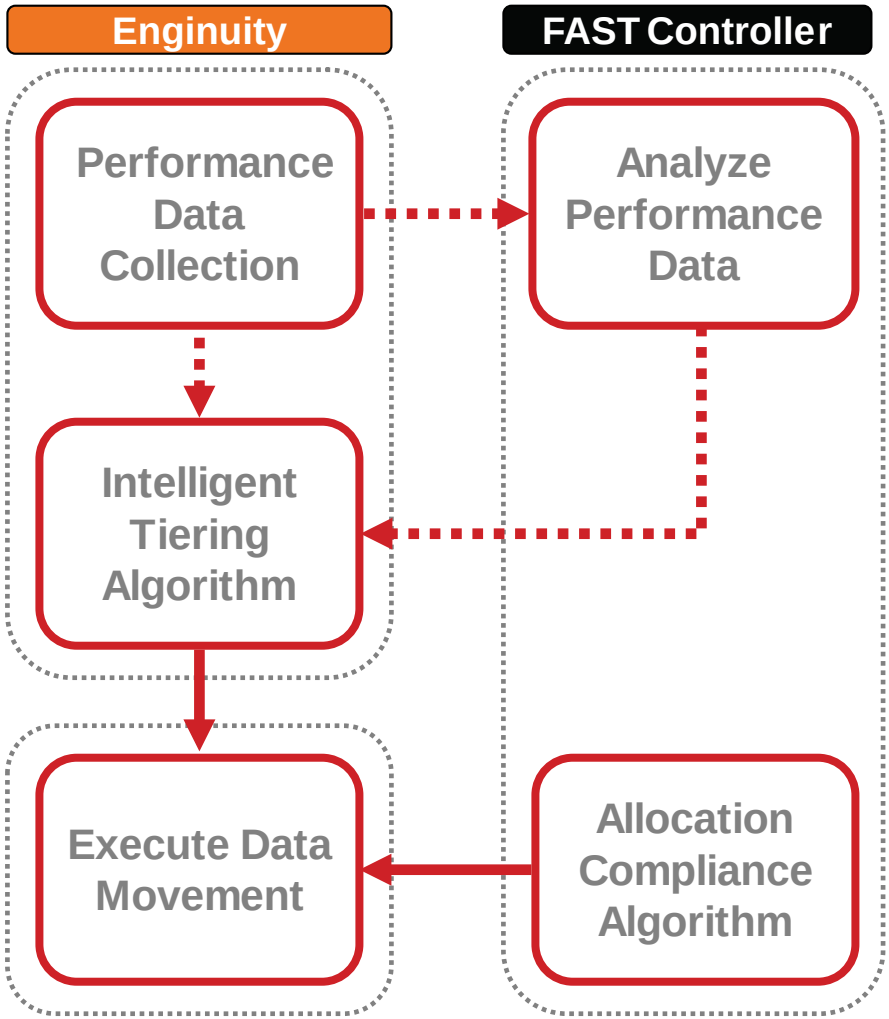


Policy Name	Tier 1	Tier 1 %	Tier 2	Tier 2 %	Tier 3	Tier 3 %	Tier4	Tier4 %	# Associated Storage Groups
DB2FASTVP	zOS_SD_R3	10	zOS_FC_2M	20	zOS_AT_R6	70	N/A	0	0
FBA_Initial	Jim_EFDR53	3	Jim_FCR1	100	Jim_SATAR614	100	N/A	0	1
FBA_LOG	Jim_EFDR53	3	multipool	75	Jim_SATAR614	100	N/A	0	1
Gold	Jim_EFDR53	3	Jim_FCR1	20	Jim_SATAR614	100	N/A	0	0
paul_test	zOS_SD_R3	50	zOS_FC_2M	50	zOS_AT_R3	100	N/A	0	0
SAP	Jim_EFDR53	2	Jim_FCR1	27	Jim_SATAR614	100	N/A	0	0
test	multipool	100	N/A	0	N/A	0	N/A	0	0
zos_bronze	zOS_FC_2M	65	zOS_AT_R3	35	N/A	0	N/A	0	0
zos_gold	zOS_SD_R3	25	zOS_FC_2M	100	N/A	0	N/A	0	2
zOS_OPT	zOS_SD_R3	100	zOS_FC_2M	100	zOS_AT_R6	100	N/A	0	1
zos_silver	zOS_SD_R3	1	zOS_FC_2M	79	zOS_AT_R3	20	N/A	0	0

Create New Time Window



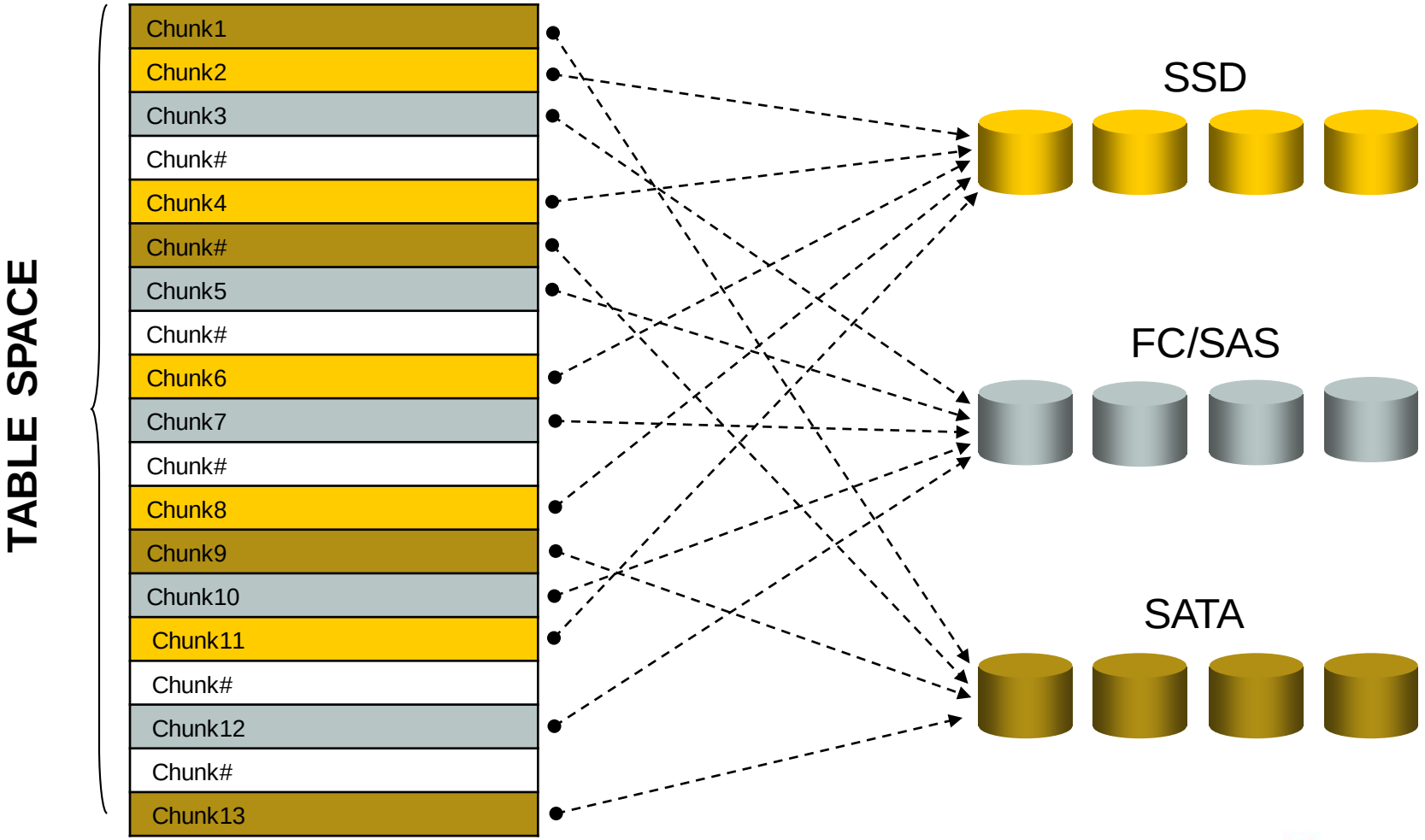
FAST VP Implementation



Data Movement

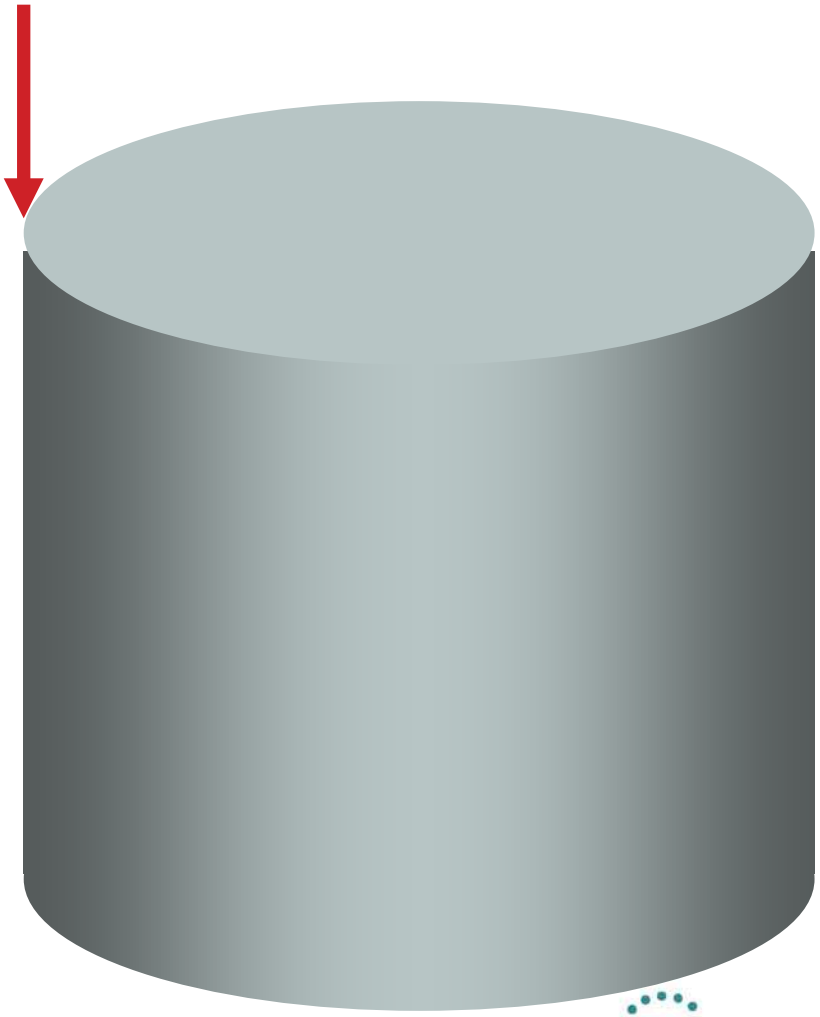
- Data chunks are moved using 6.8MB chunks
- Performance-based
  - Promotions due to high I/O rates
  - Demotions to free up space for promotions
- Compliance-based

Sub-volume Tiering



Sequential Tablespace Scan

- Long Seek (costly)
- Rotational delay (costly)
- Read
- Read
- Read …

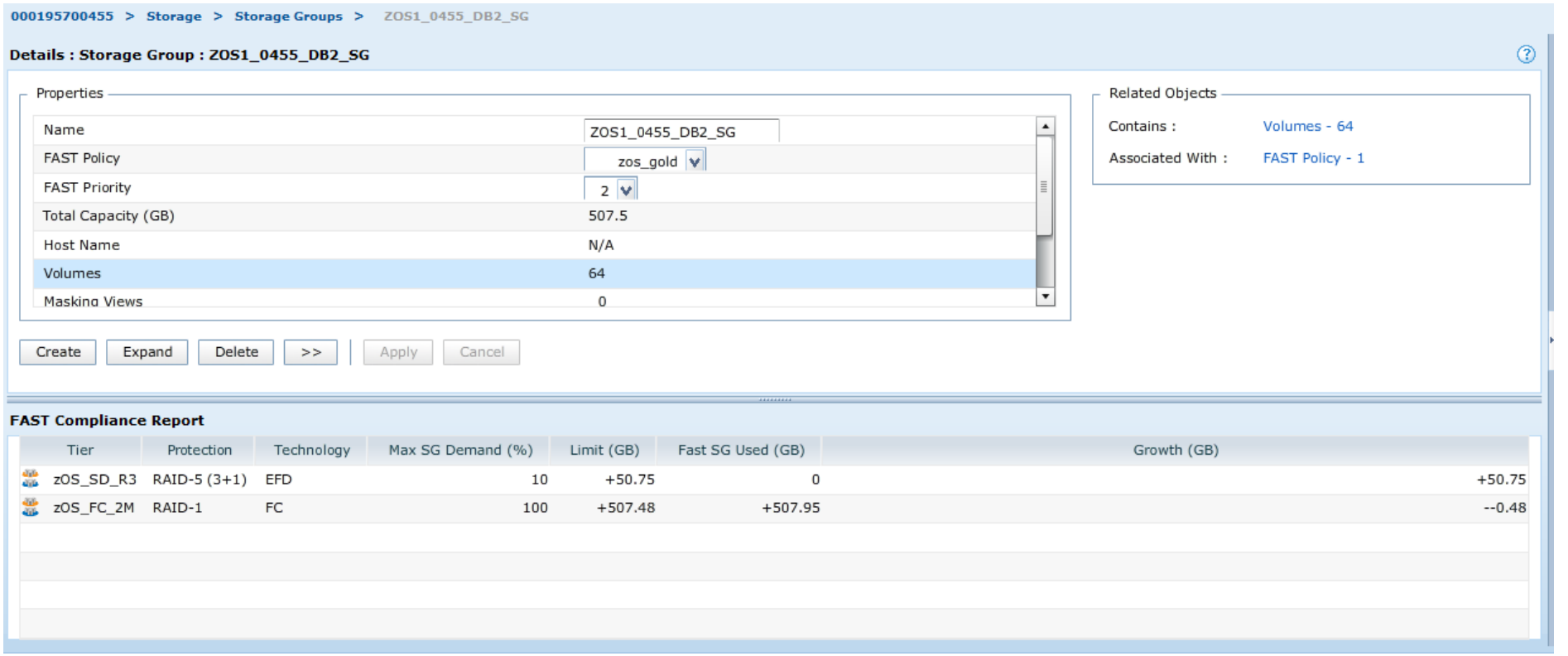


FAST VP TESTING WITH DB2

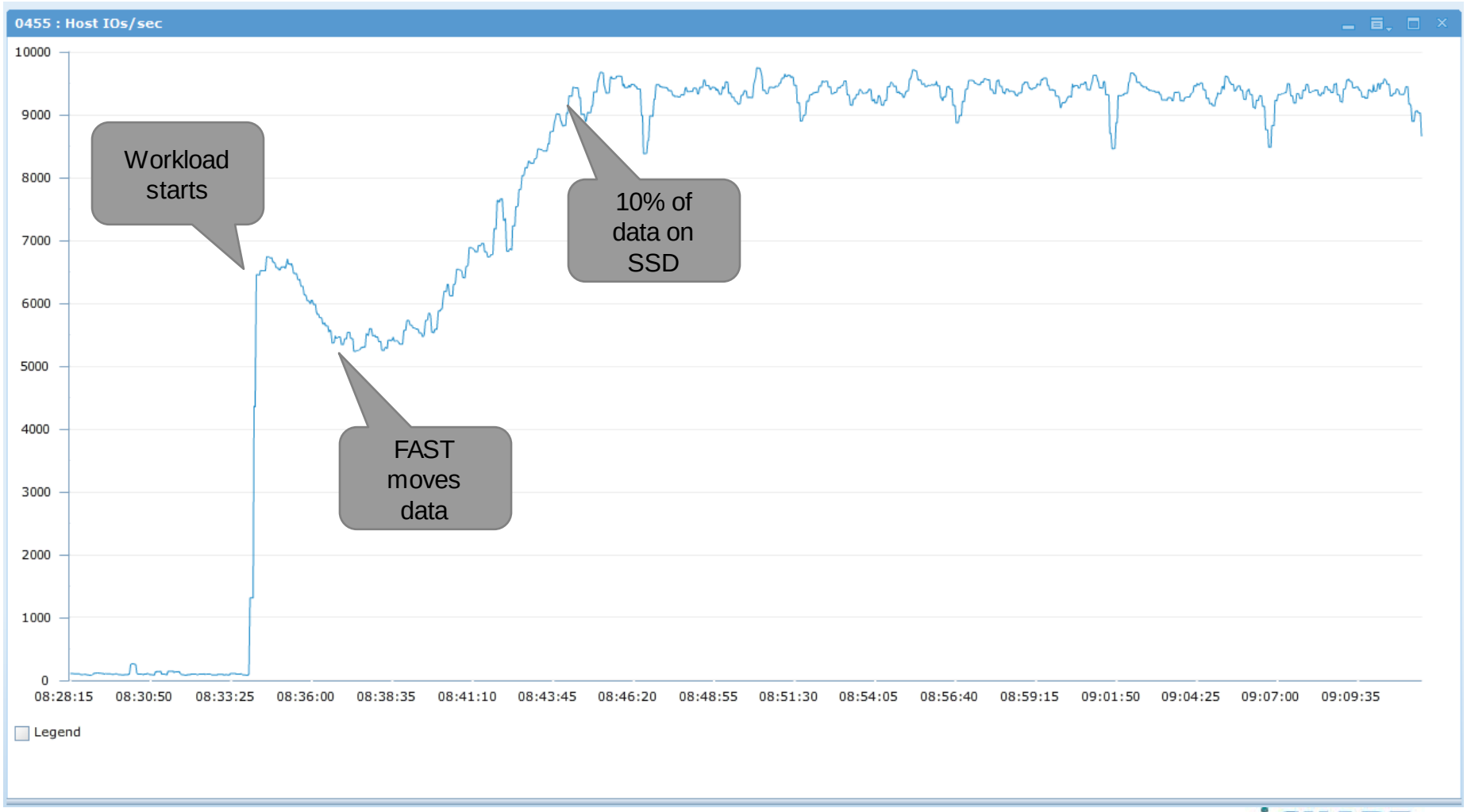
What was tested

- DB2 V10
- Symmetrix VMAX SE (single Engine)
- 2x4Gb Channels
- Highly random OLTP workload driven by 32 batch jobs
- 4x200GB Solid State drives
- 32x300GB 15K FC drives
- 507GB DB2 subsystem
- FAST VP policy set to 10% SSD use

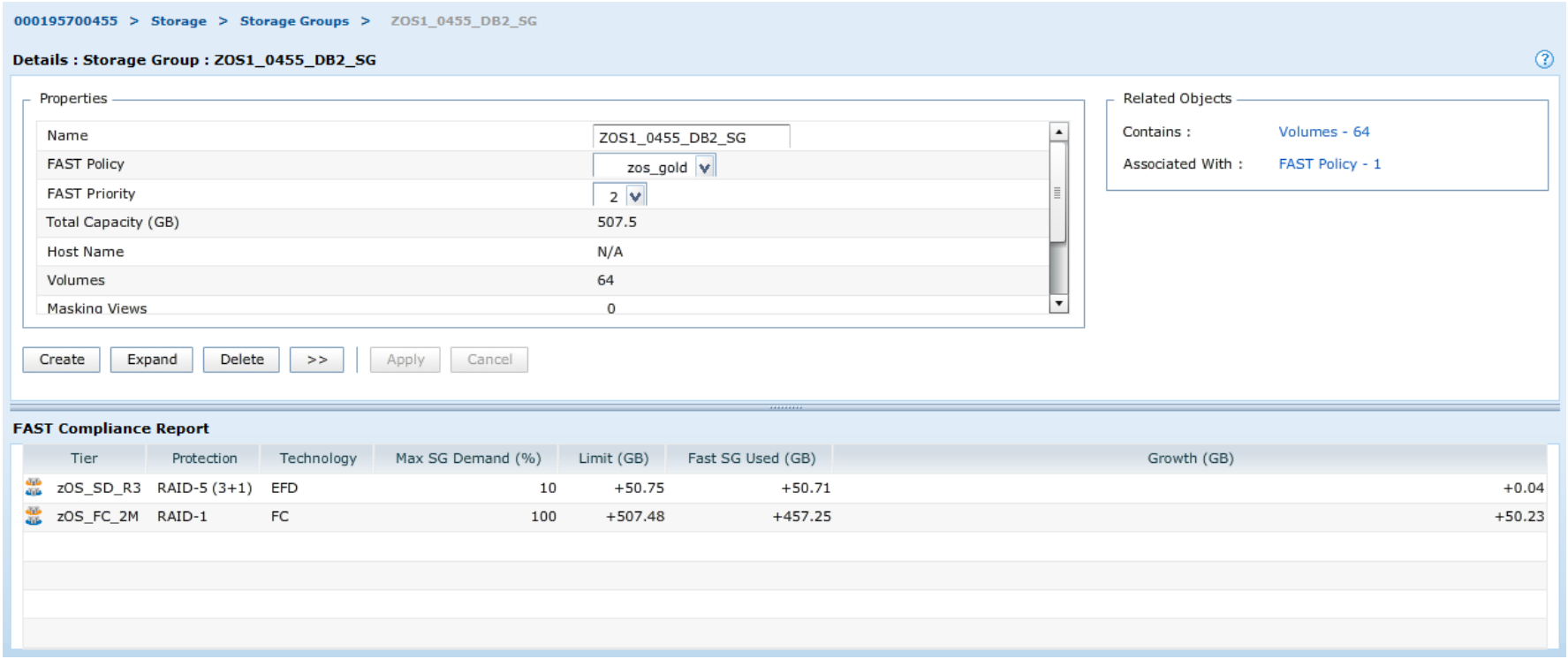
Policy display before workload



IOPS Measured: Unisphere for VMAX Performance View



Policy display after workload



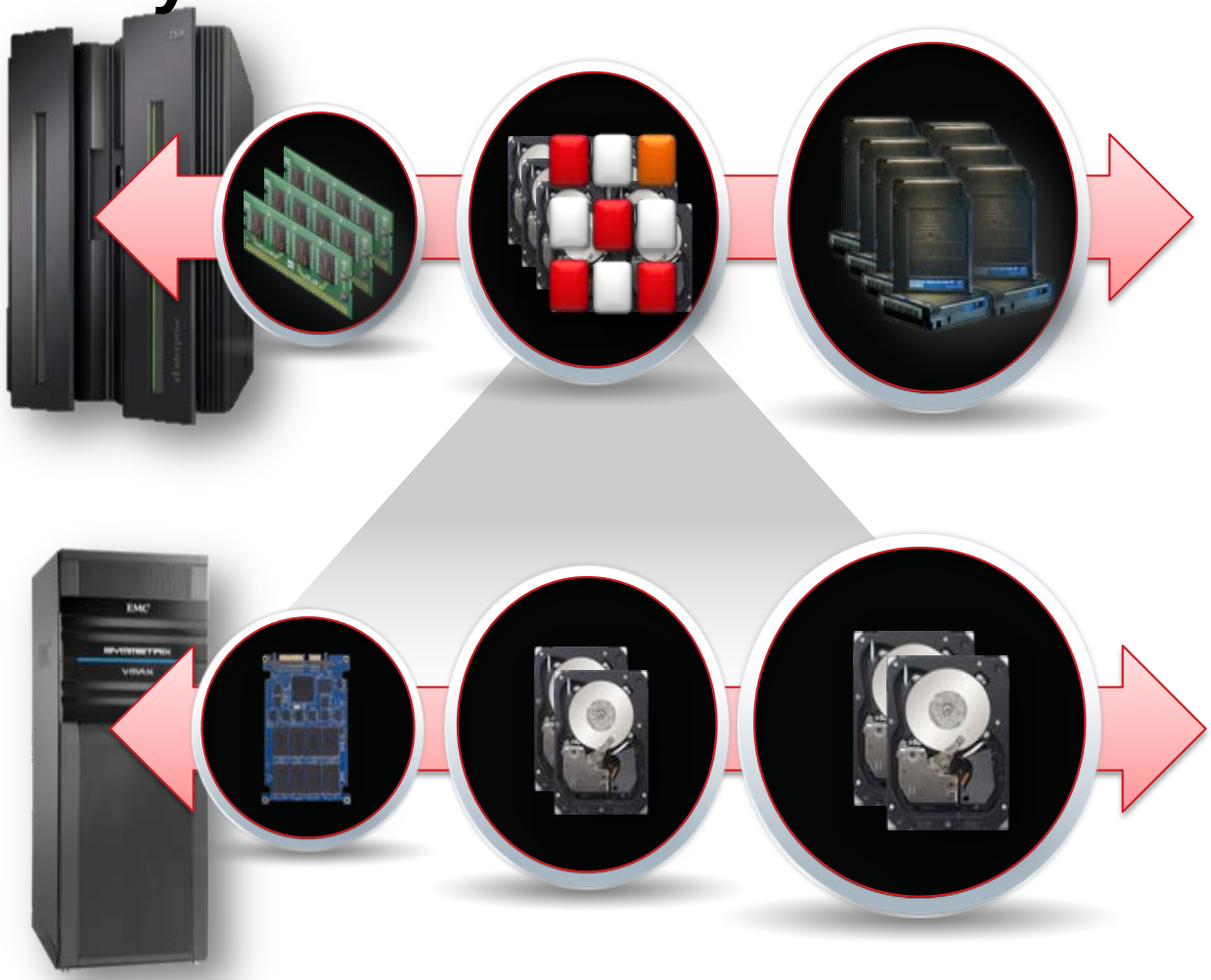
HOST CONSIDERATIONS

Automation at all Layers

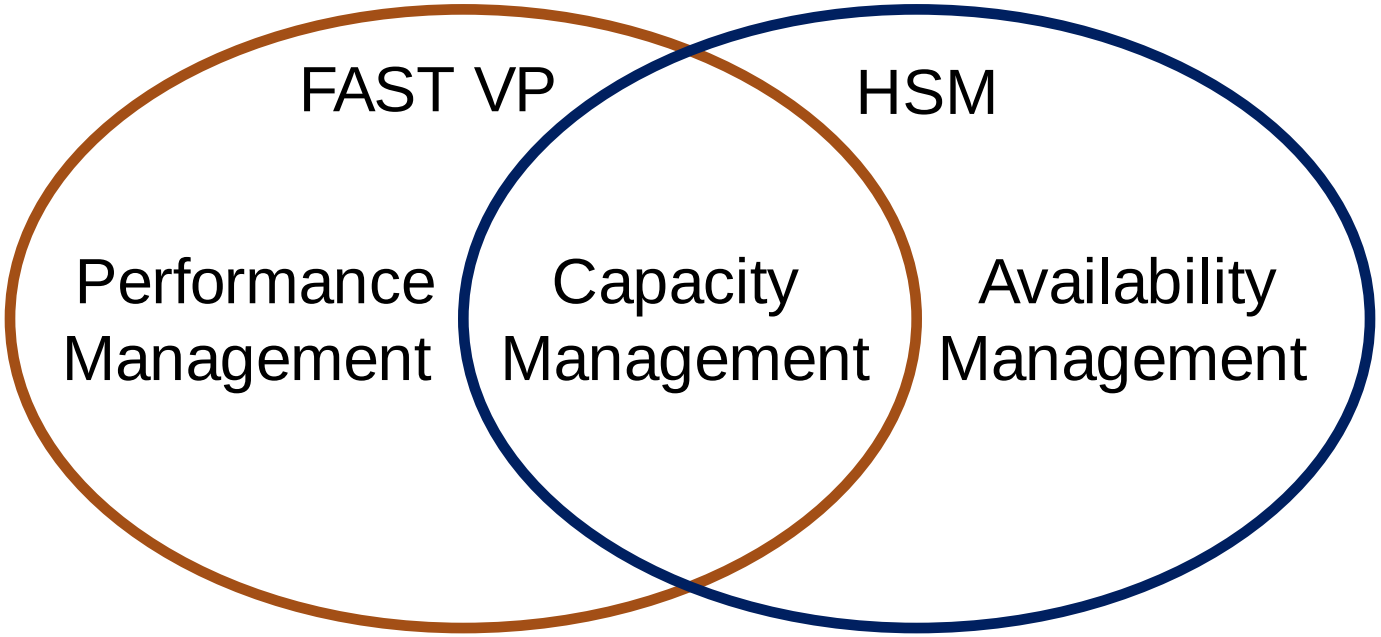
SMS &
HSM

+

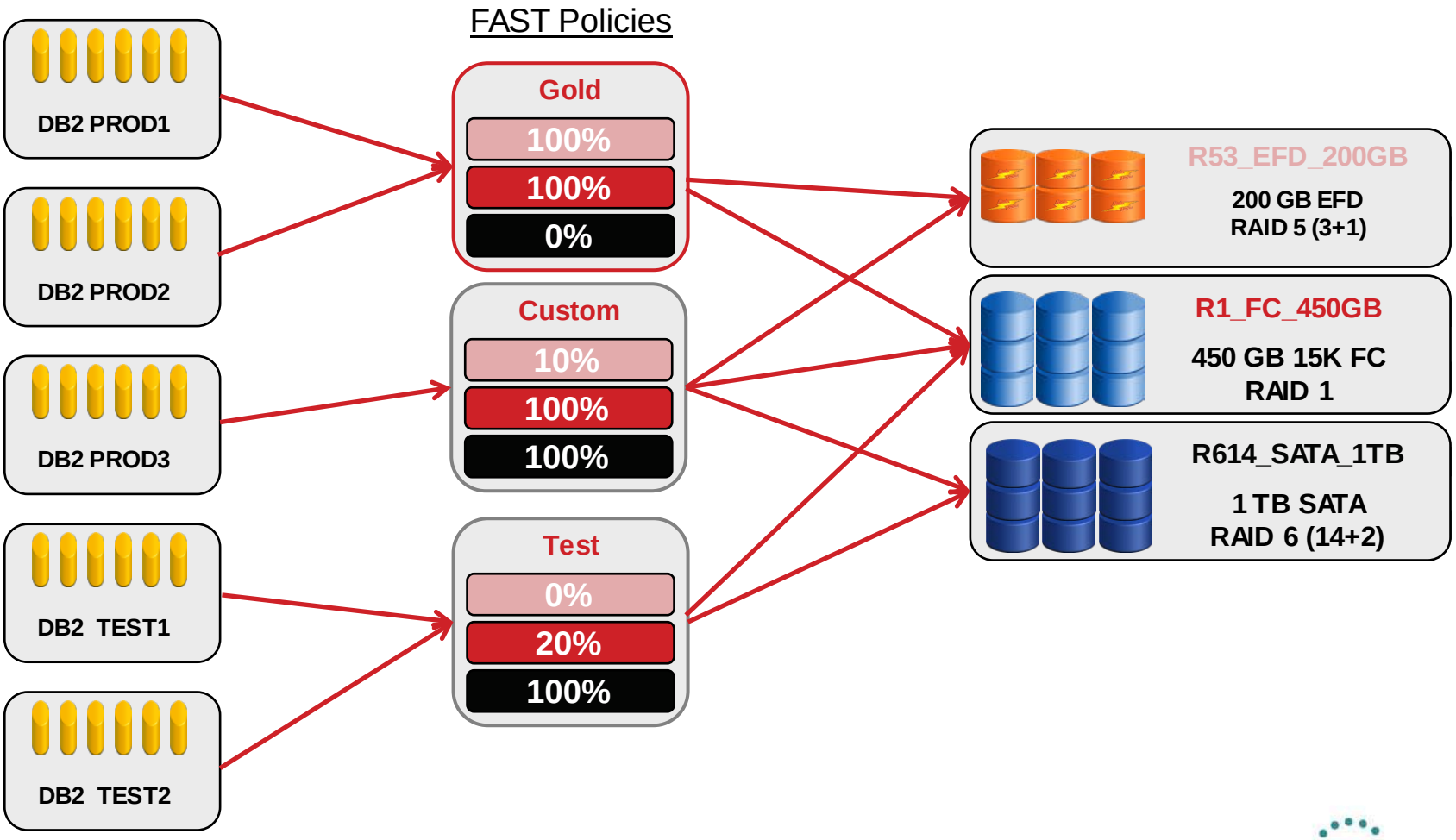
FAST VP



HSM and FAST VP Intersect



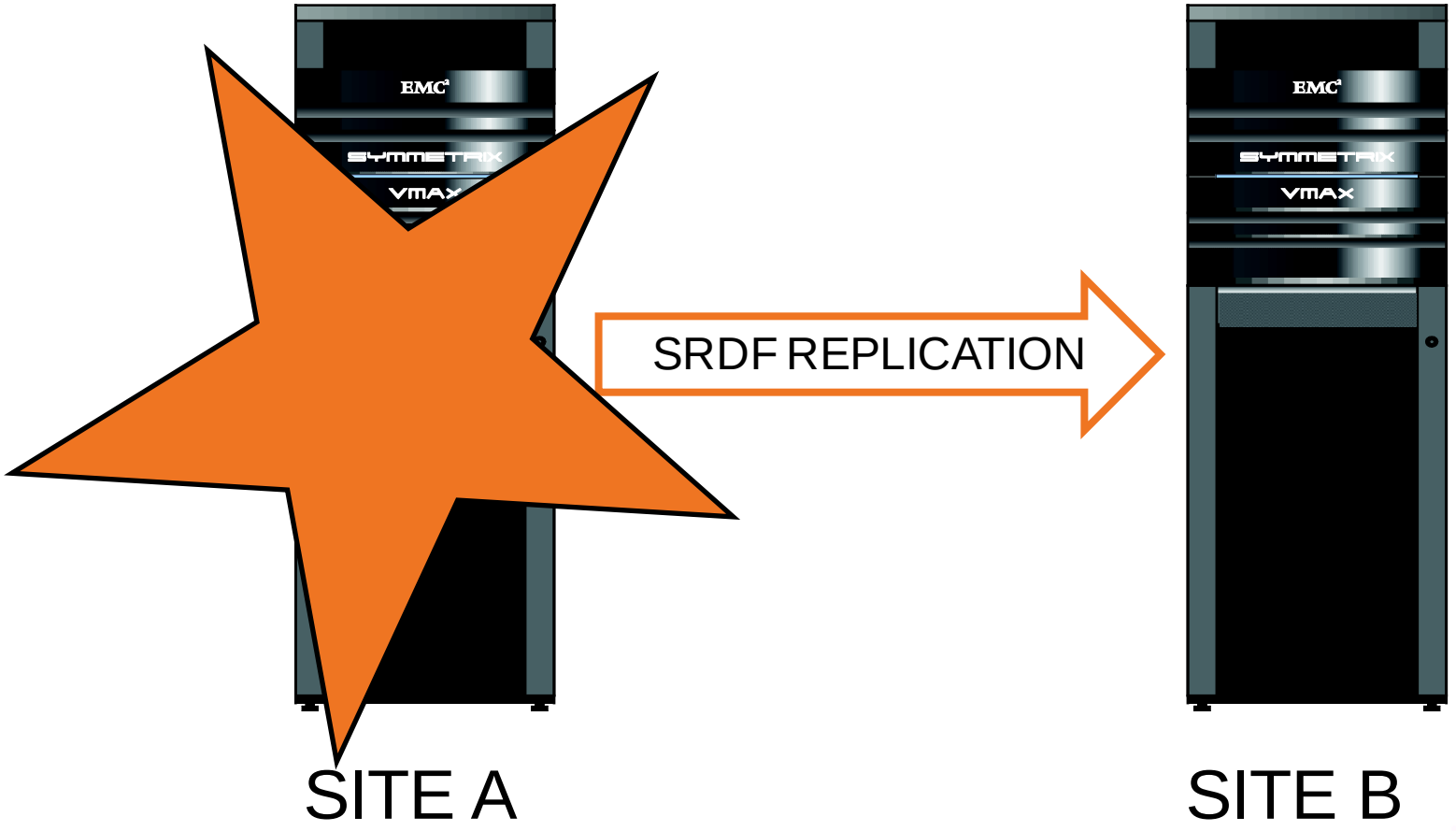
SMS Storage Groups



Operational Considerations

- Storage tiering interactions with z/OS
- SMS
  - Performance-based allocations
  - DIRECT MSR Values (what do they mean now?)
- Thrashing
  - DB2 REORGs
  - HRECALLs
  - Dataset moves
  - Volume restore

FAST VP with Remote Replication Integration



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Operational Considerations (contd)

- How to manage charge back
- How to influence decisions in the performance engine
- How to determine where everything is/was

Benefits of Storage Tiering

- Autonomic/automatic operation
- Optimized performance
- Reduced cost (power and cooling)
- Reduced footprint
- Better capacity utilization
- Ease of management

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