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

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February 6, 2013
Session Number: 12945

SHARE in San Francisco 2013

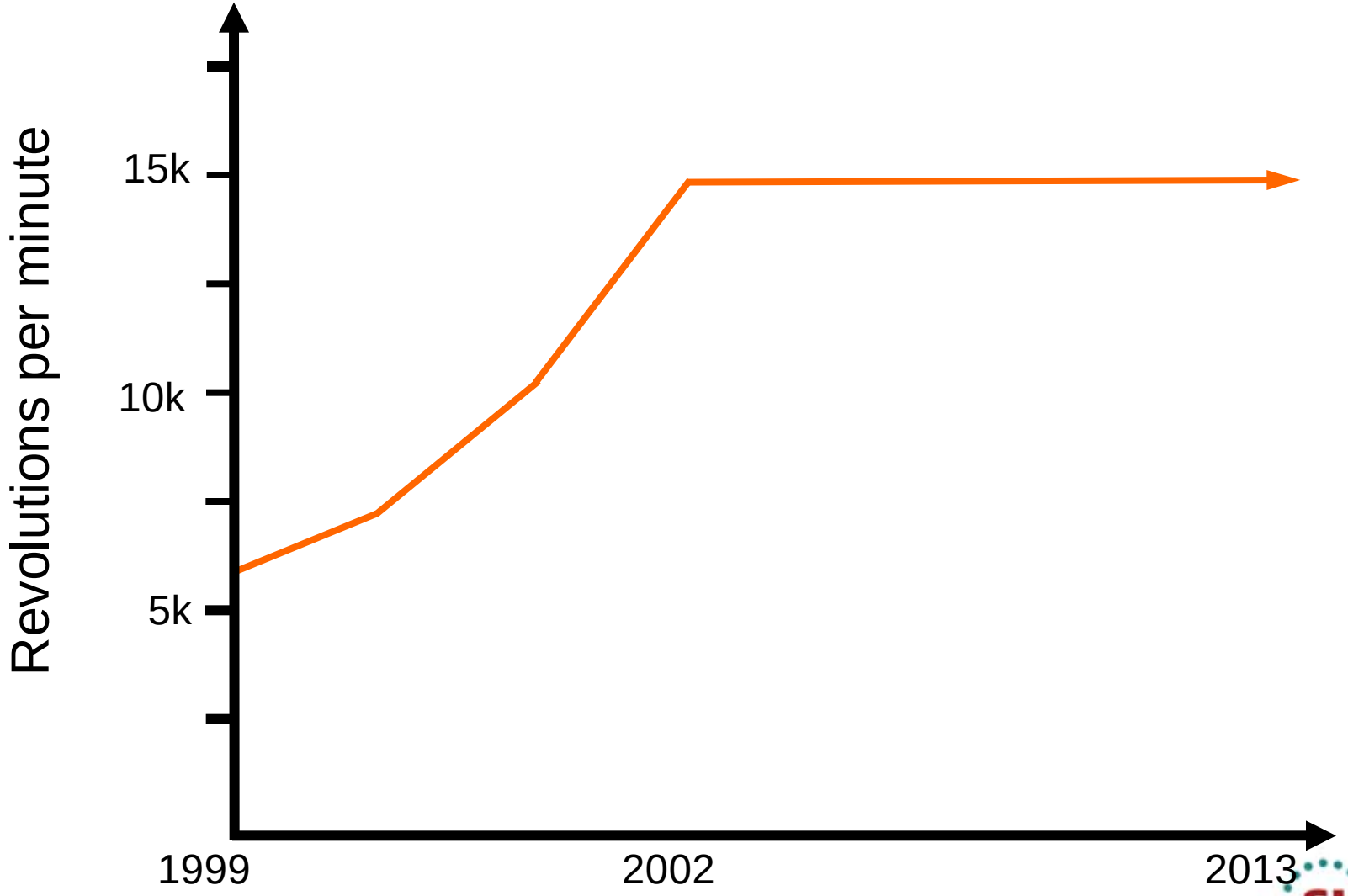
Agenda

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

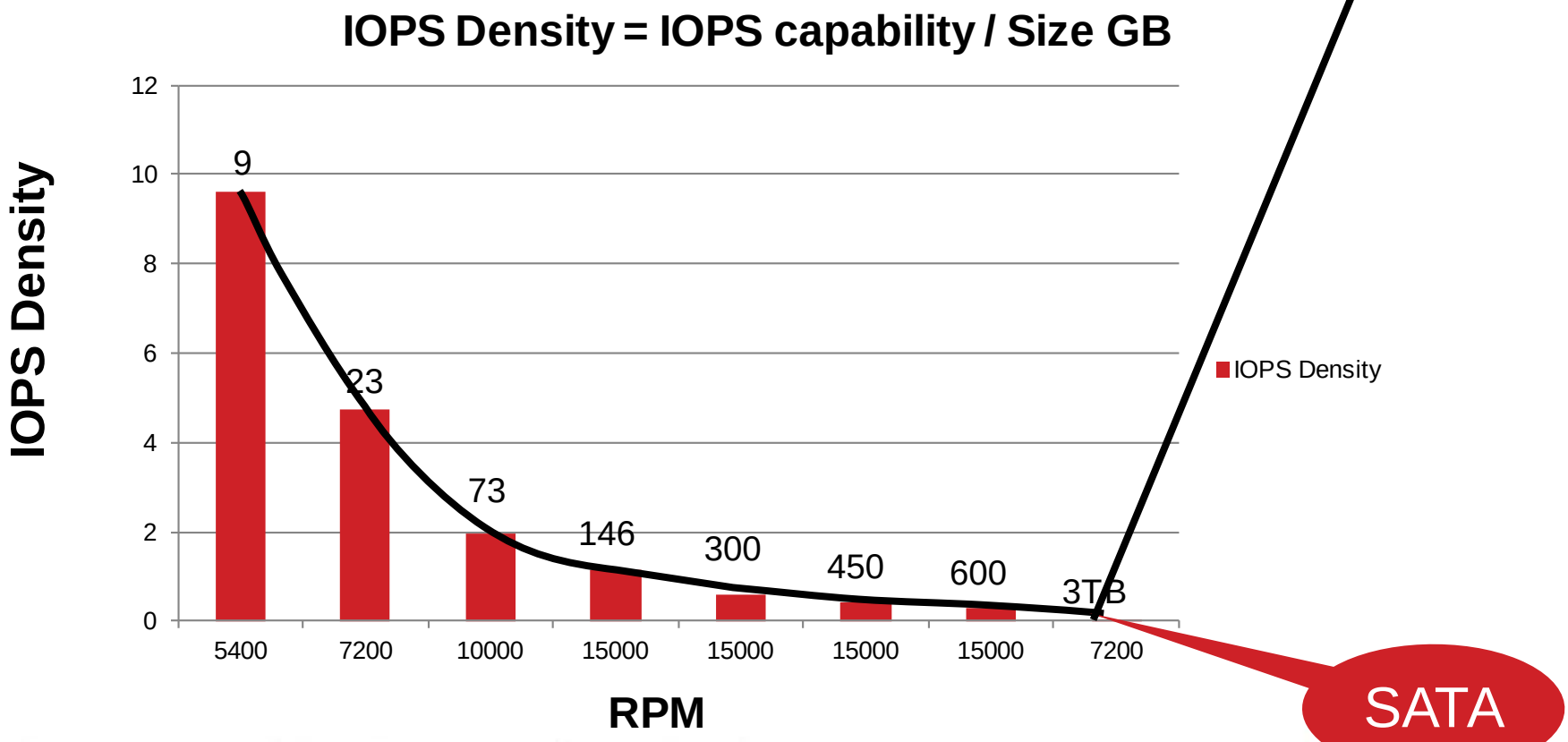
Drivers Towards Storage Tiering

- 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!

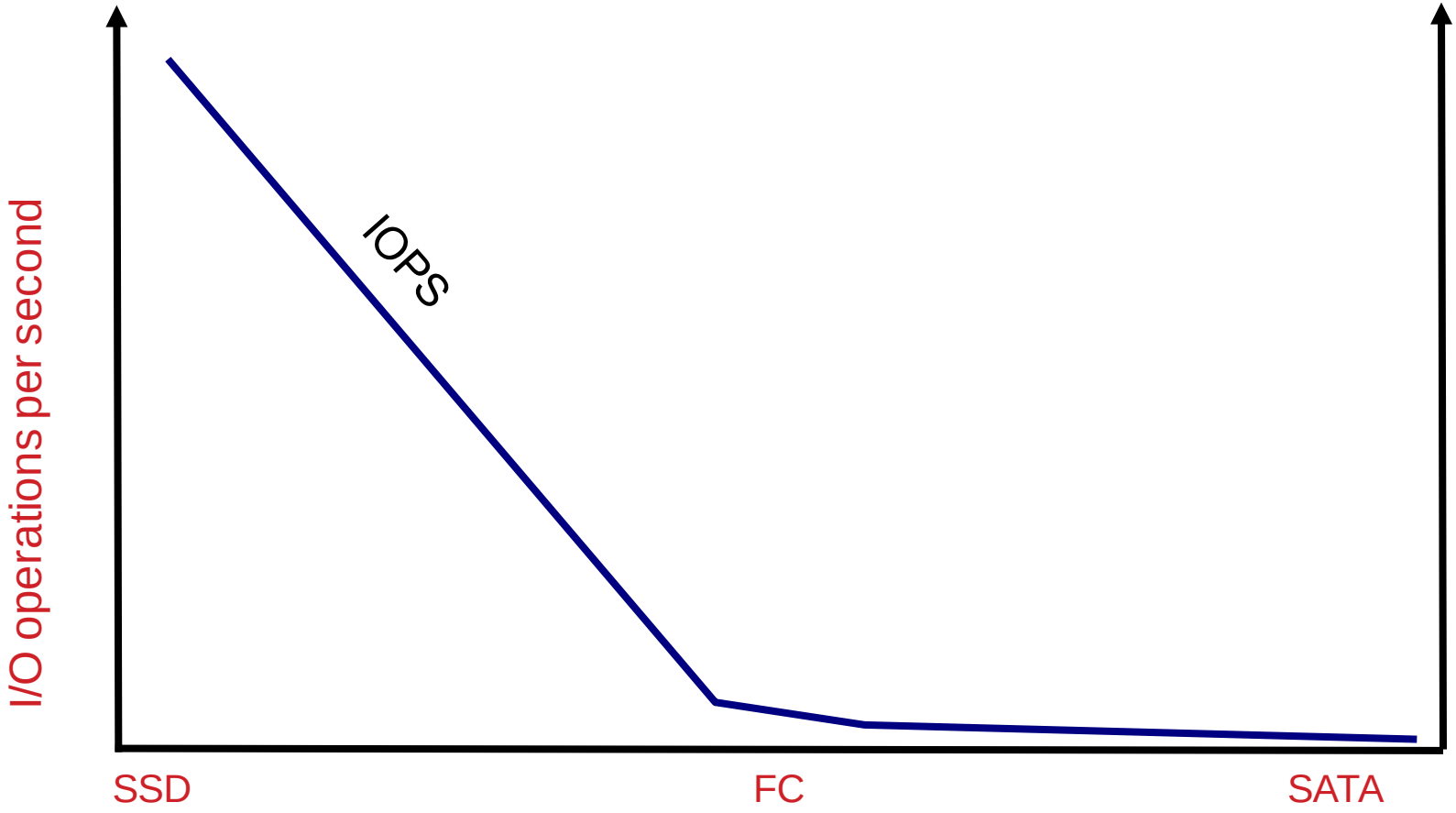
The RPM Story



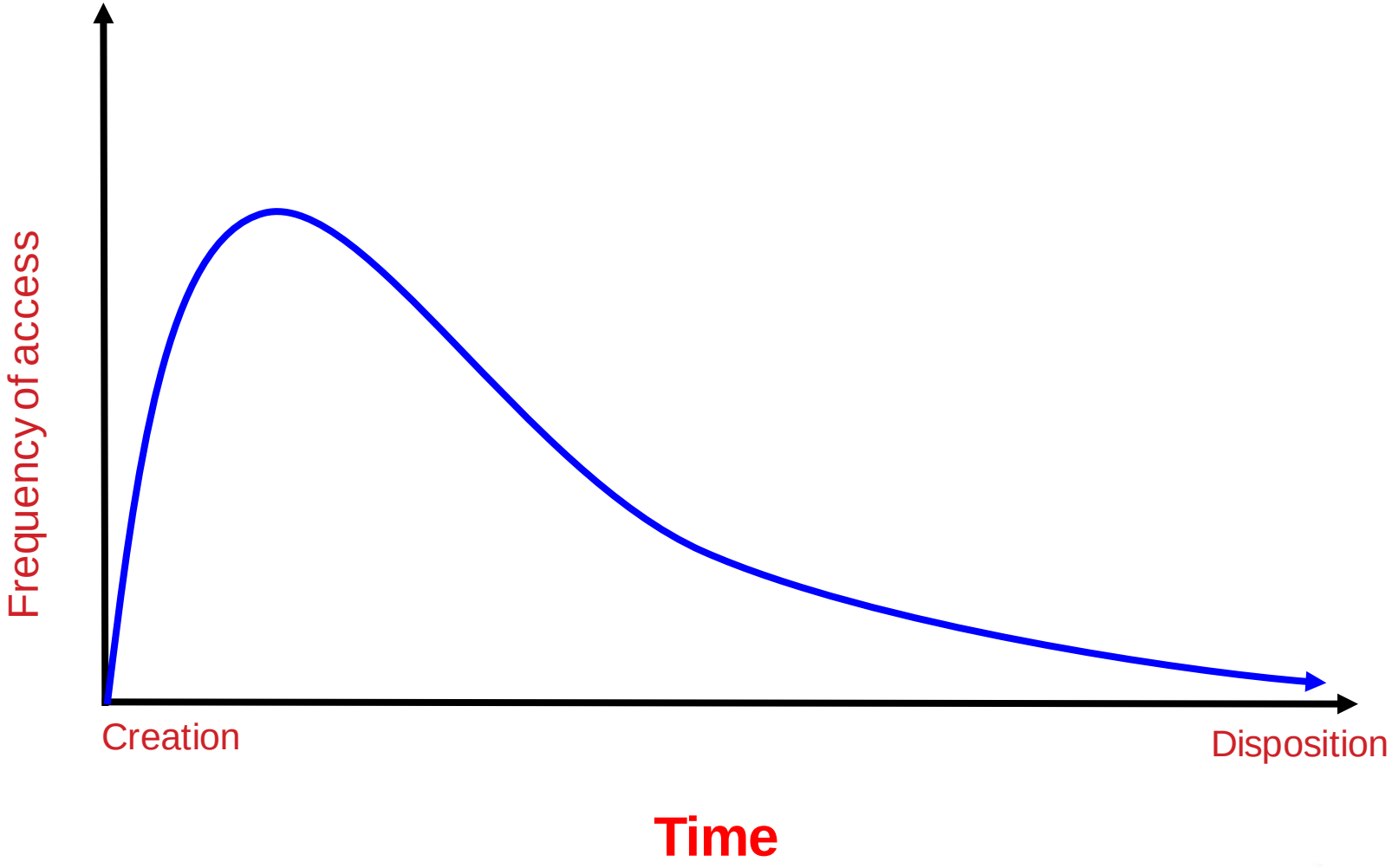
IOPS Density Trend for Disk Drives



IOPS Comparisons of Drive Technology



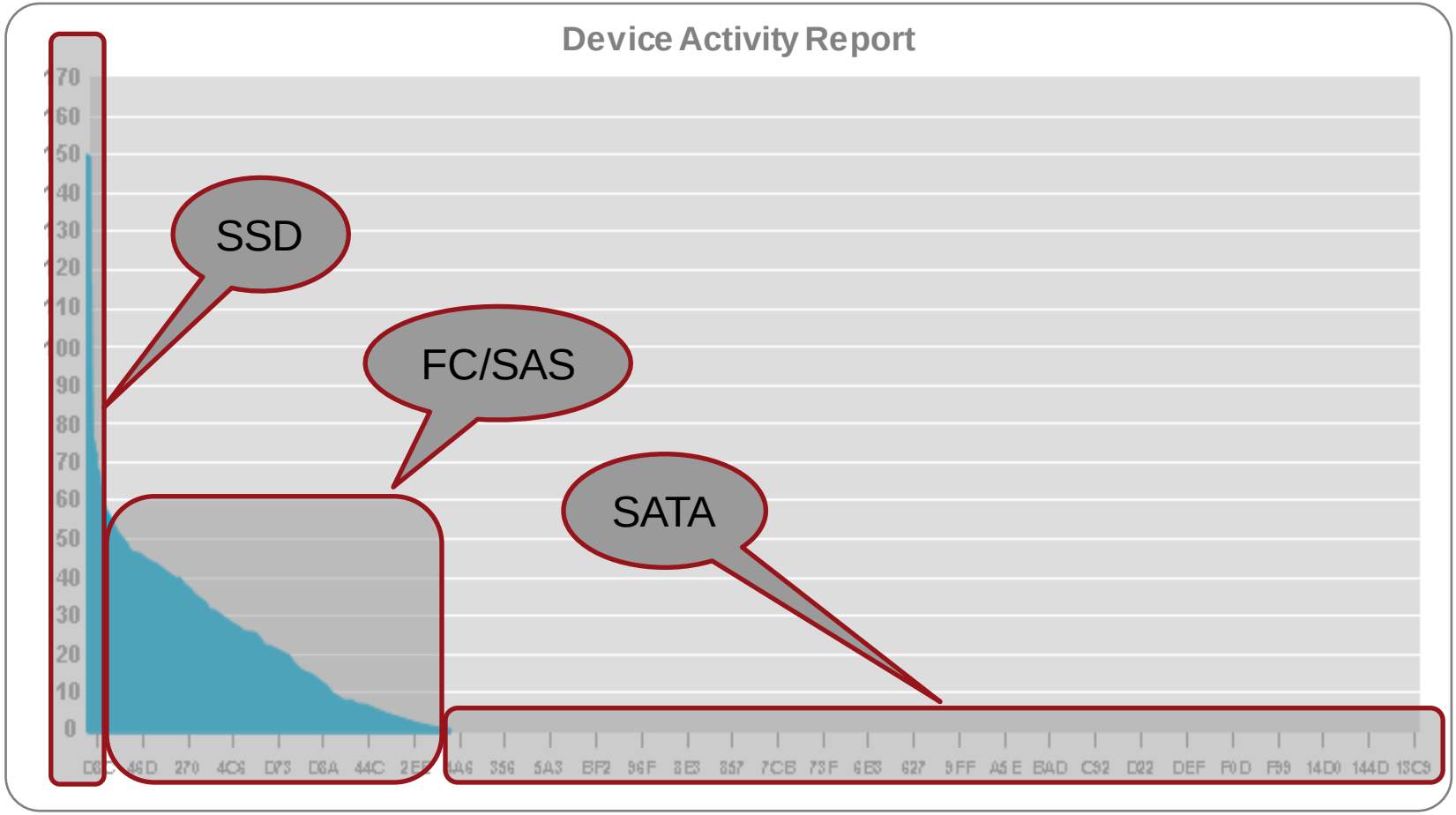
Data Life Cycle



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
- No skew (at full-volume level)
  - TPF, DB2 LUW DPF, Teradata

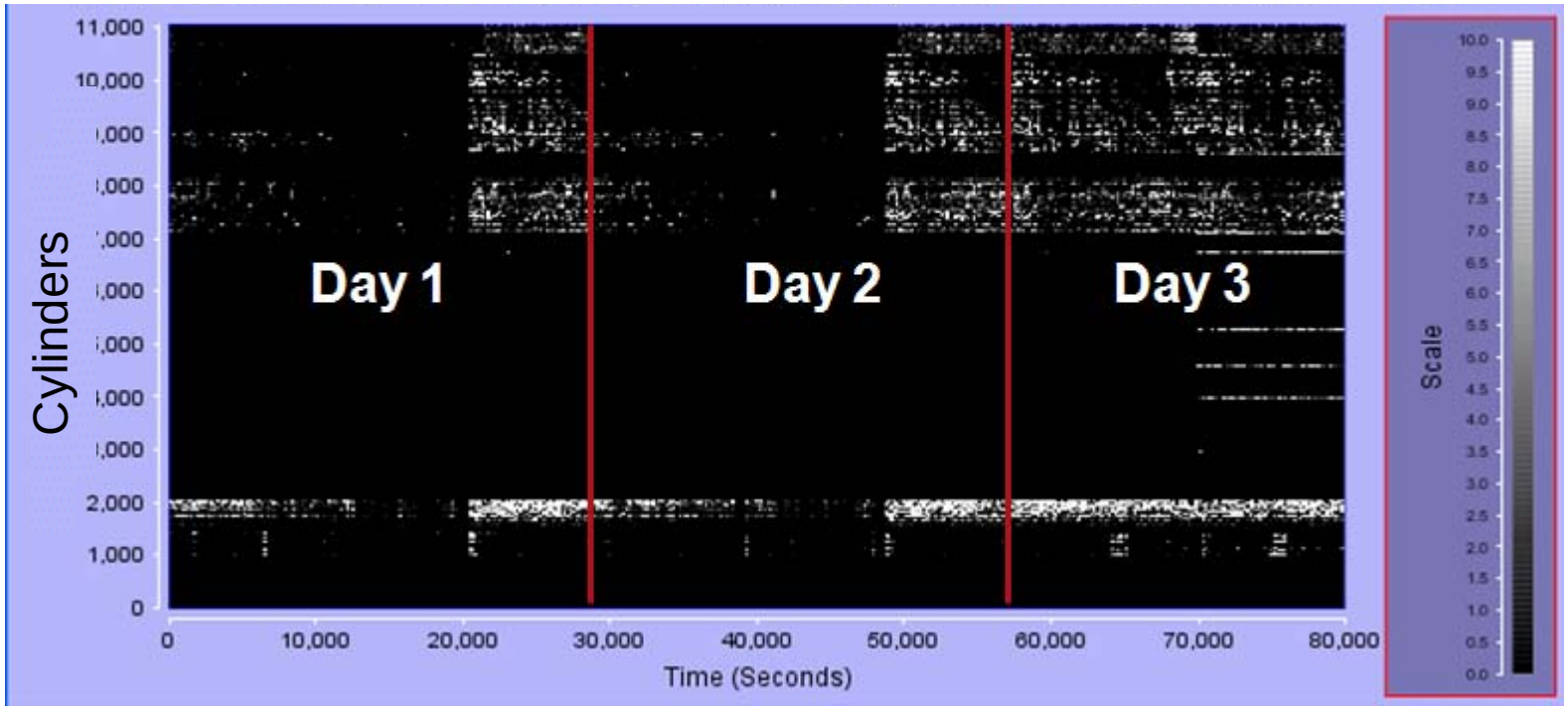
Workload Skew by Volume



The Static Tiering Conundrum

- 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?

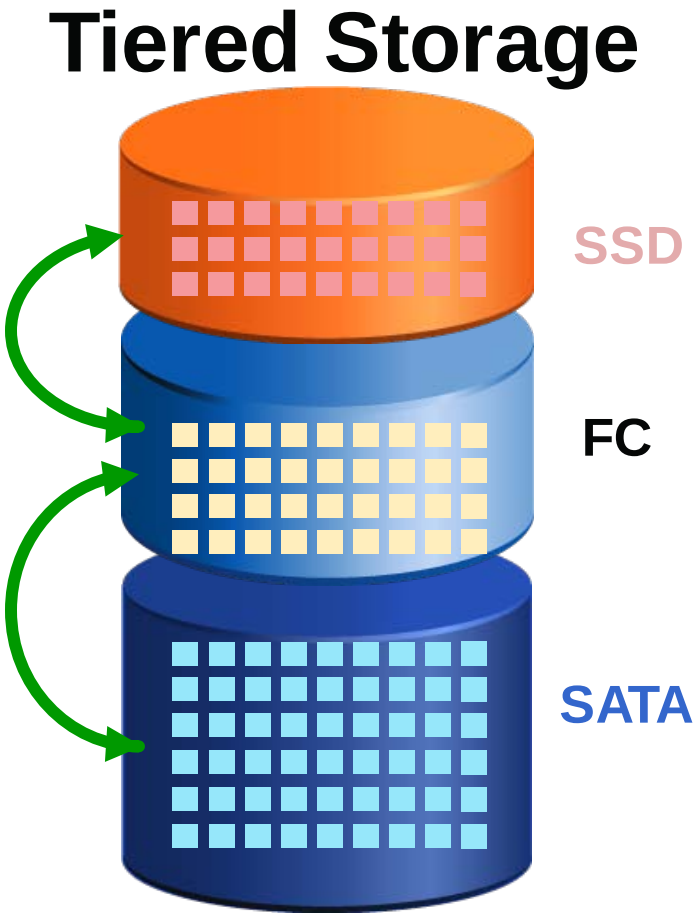
Sub-Volume Skewing



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

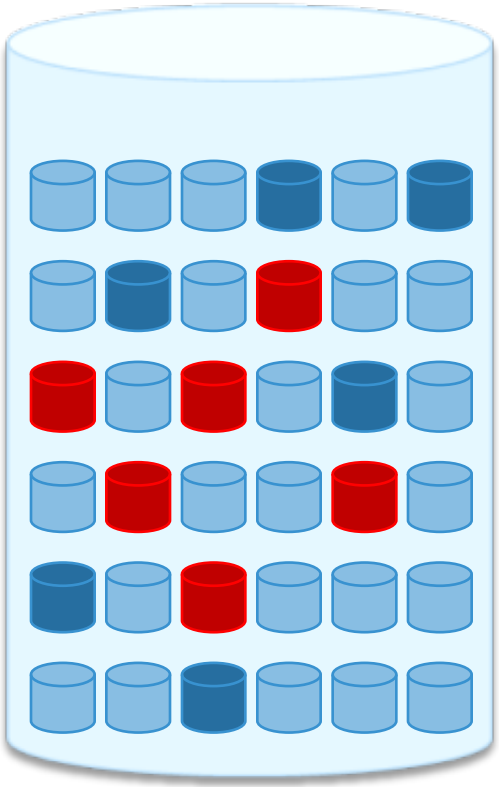
FAST VP: Automated Storage Tiering

- 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

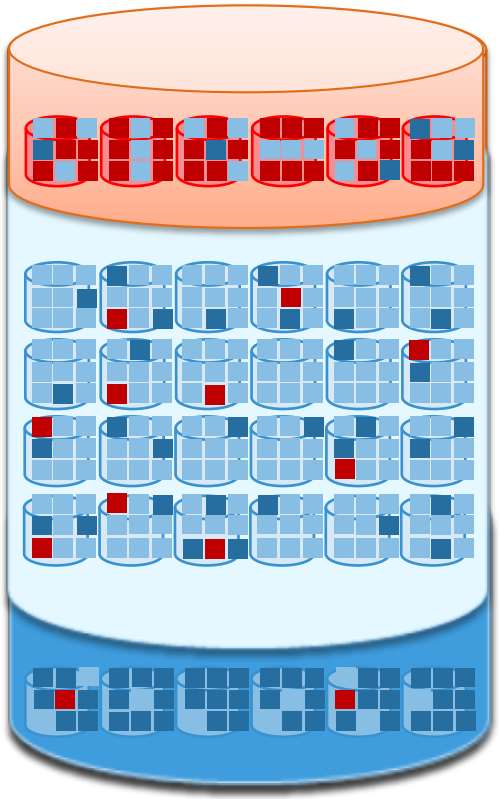


Evolution of FAST

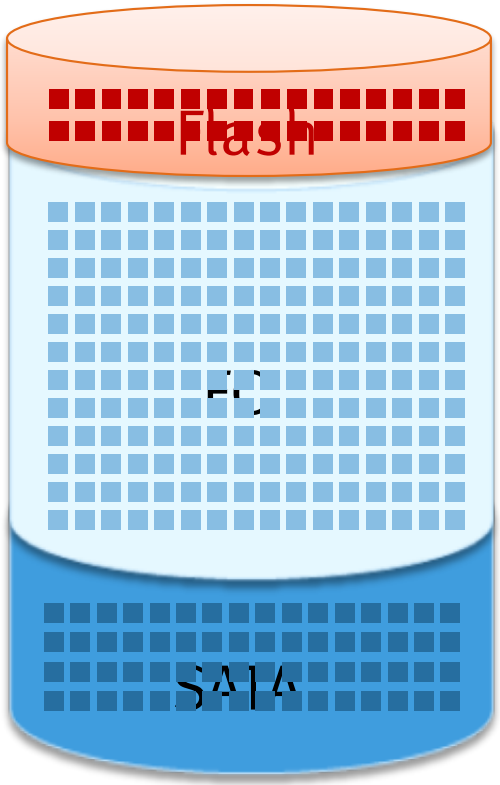
Traditional



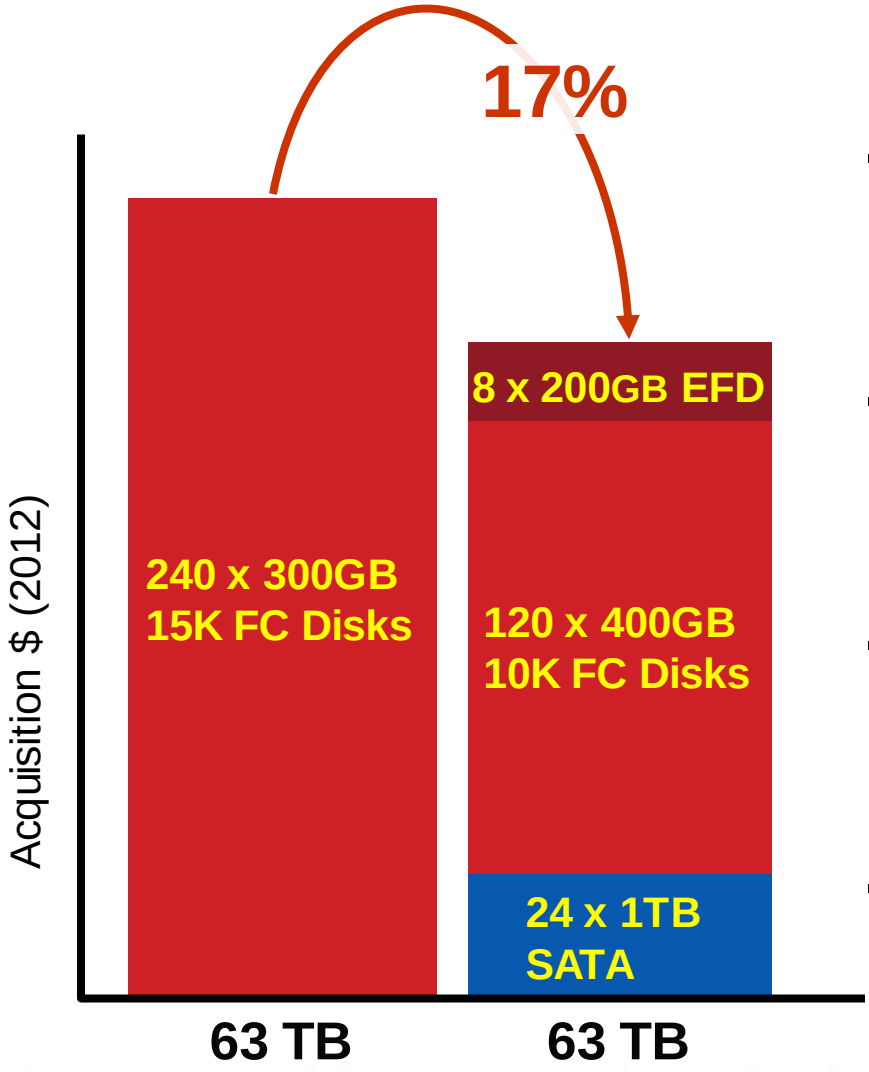
FAST



FAST VP



Tiered storage use case



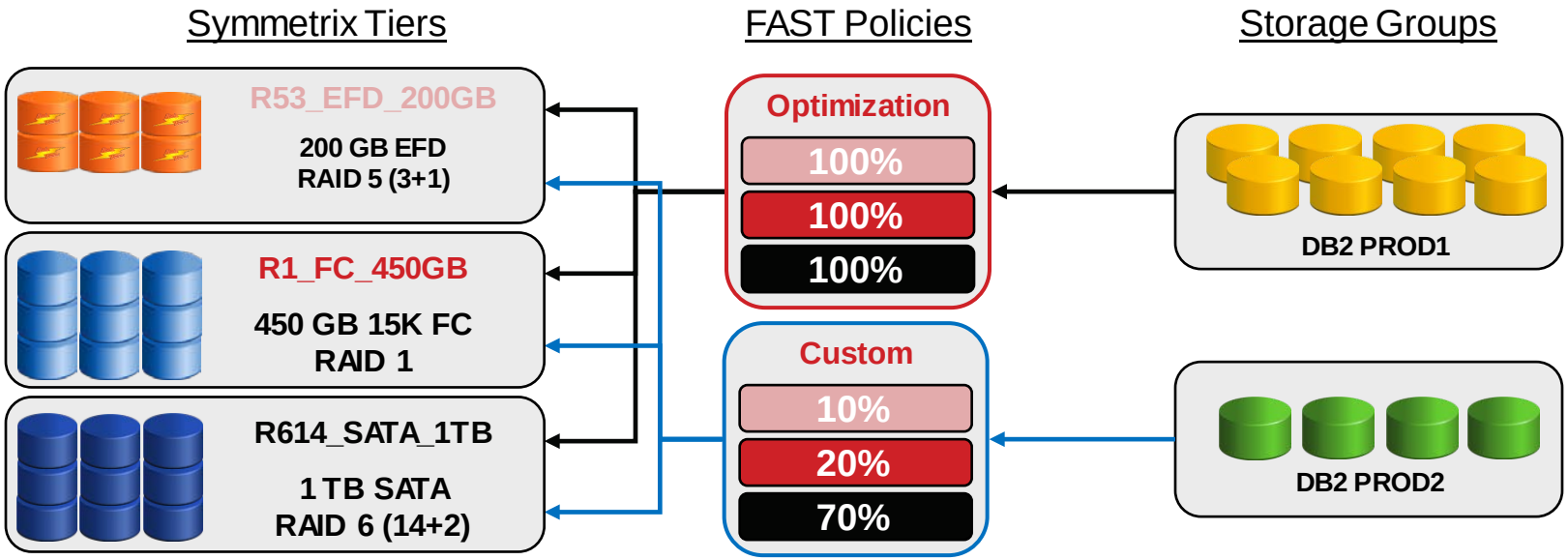
17% Lower Storage Costs
+ reduce maintenance & SW costs

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
- Virtual Pool tiers
  - Contain between 1 and 4 thin pools
    - Thin pools must consist of same drive technology and RAID protection type
    - Pools cannot be shared across multiple tiers

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 amongst multiple FAST Policies

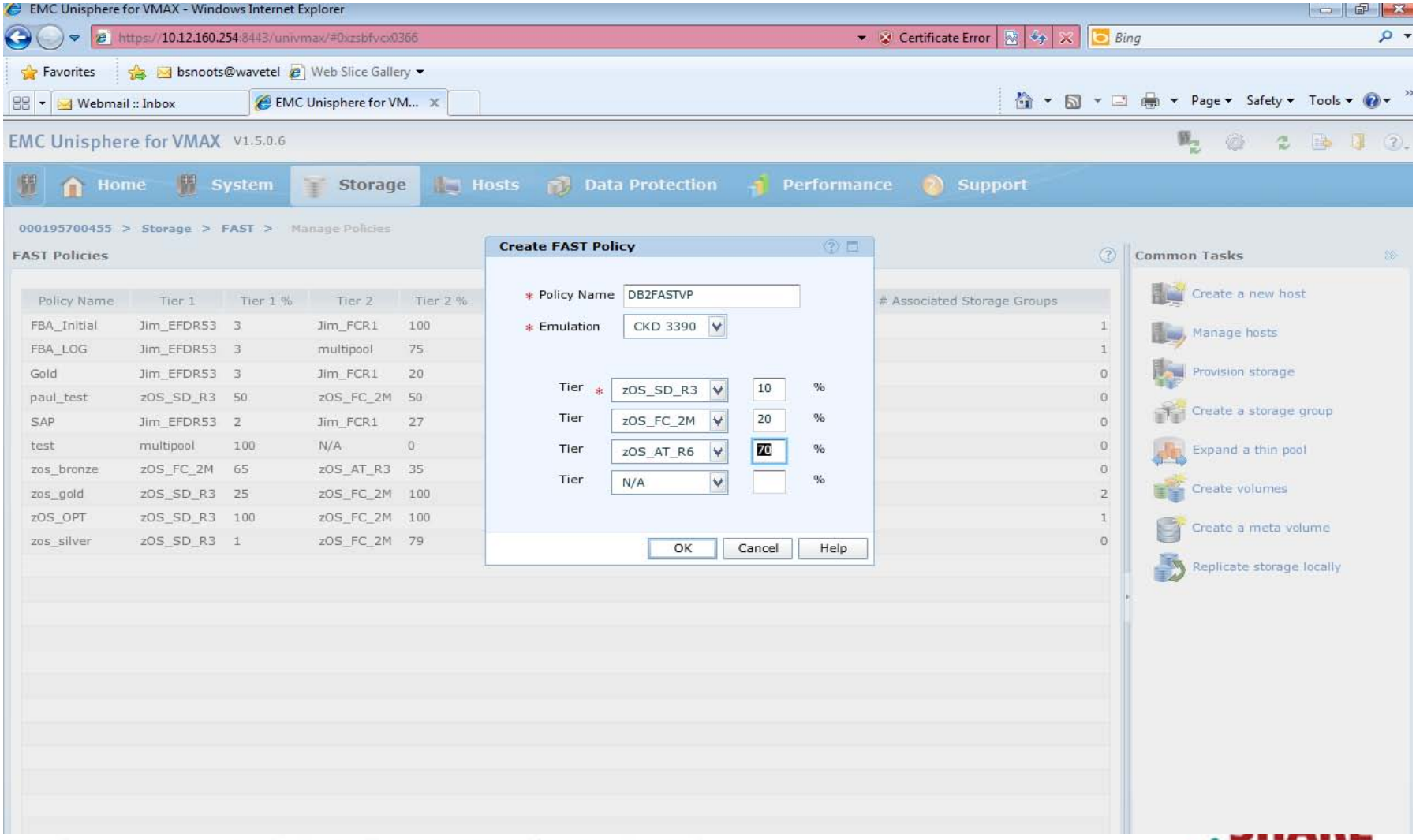
FAST Storage Groups

- 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
  - Associated FAST Policy will only operate on the devices that match the FAST policy type
- 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

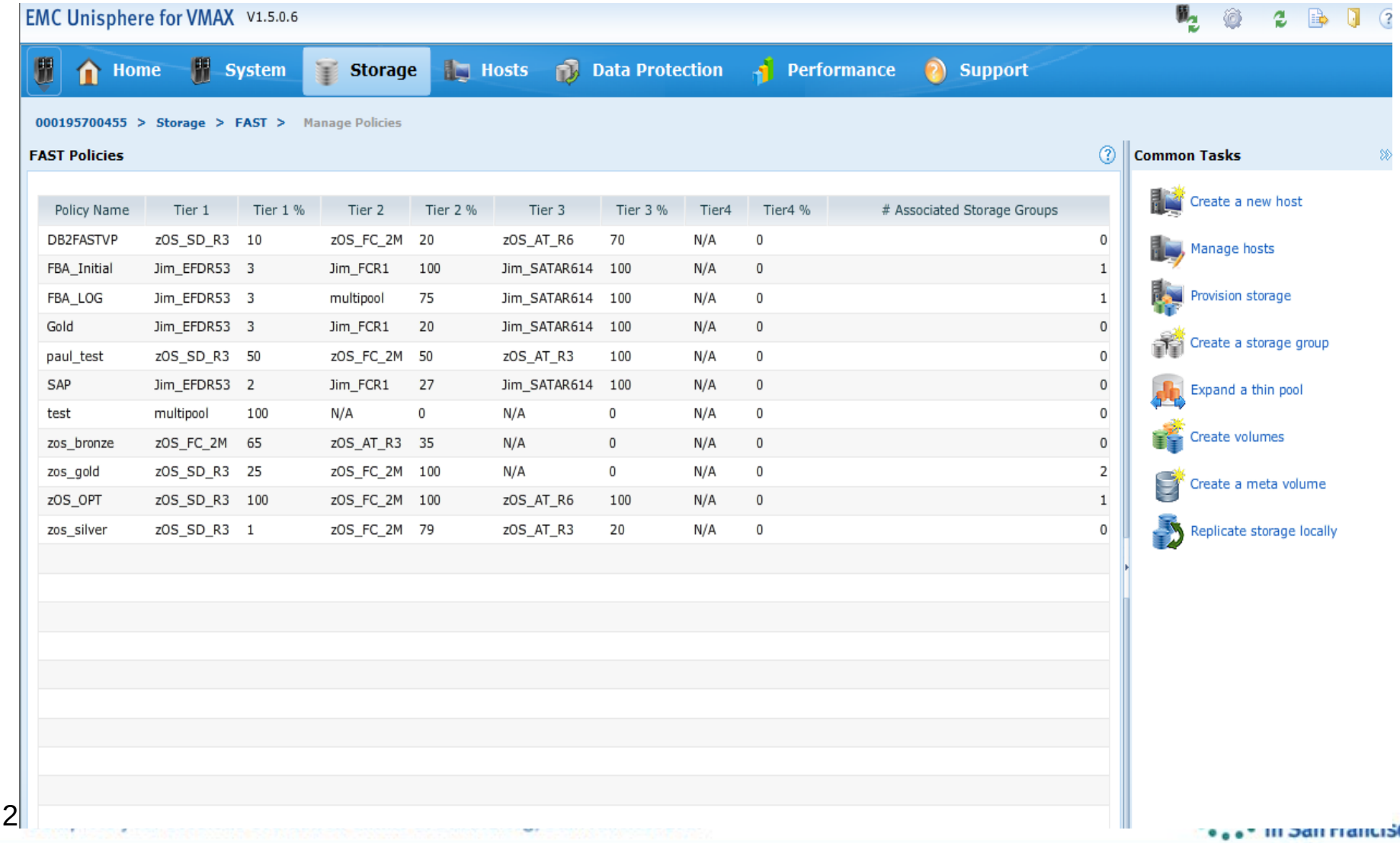
Time Windows

- 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

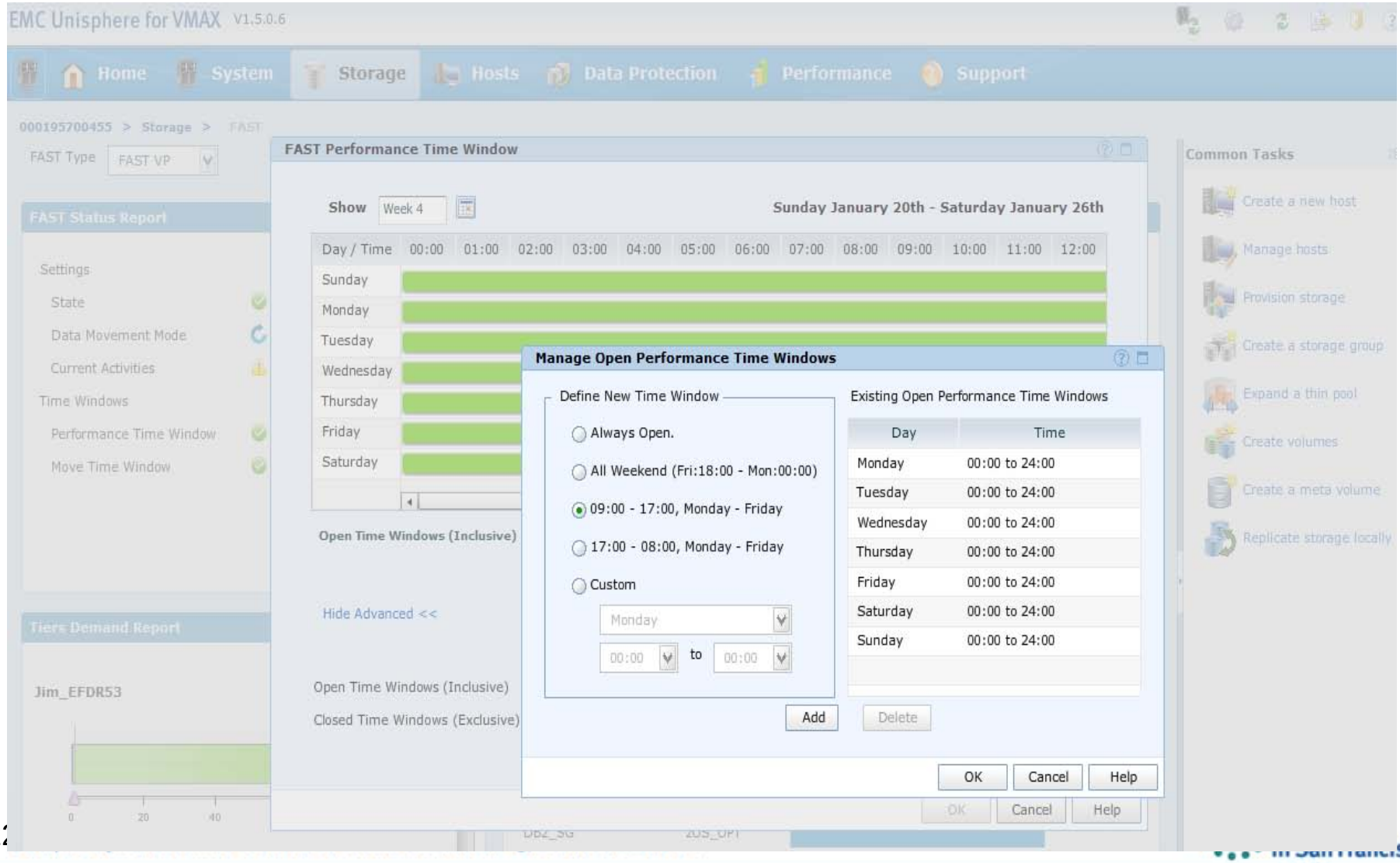


FAST Policies with New Policy Listed

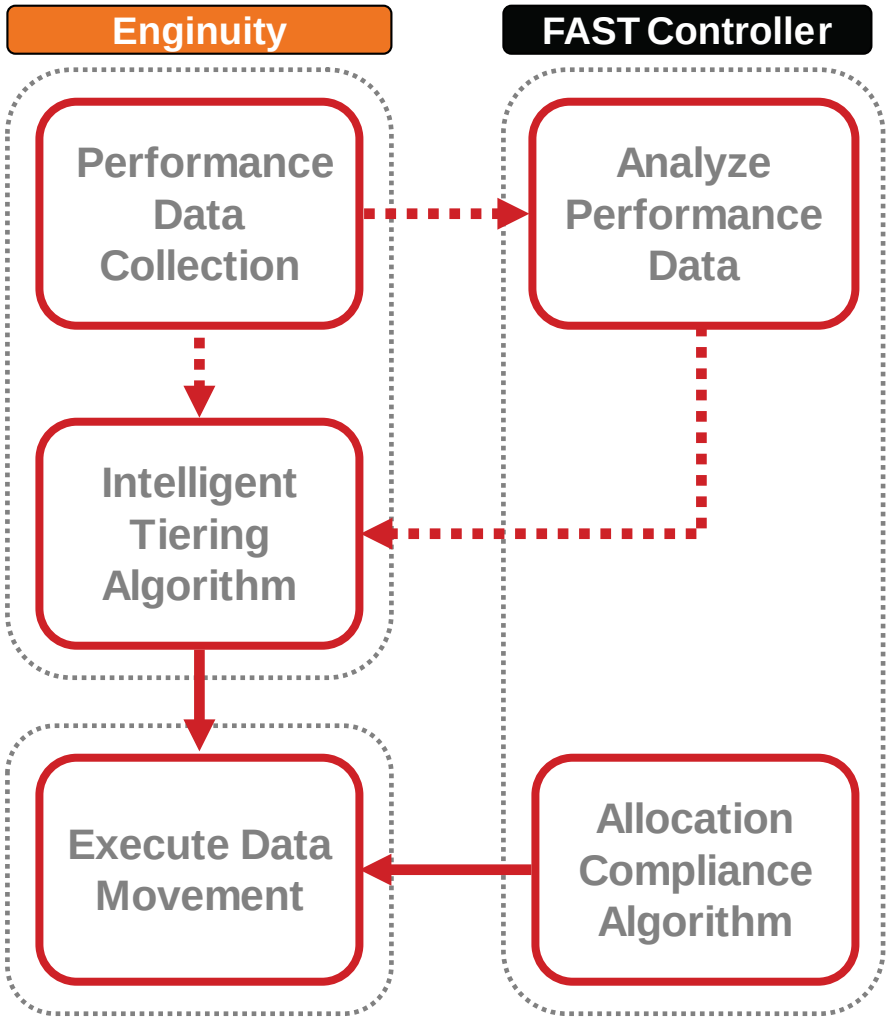


Policy Name	Tier 1	Tier 1 %	Tier 2	Tier 2 %	Tier 3	Tier 3 %	Tier4	Tier4 %	# Associated Storage Groups
DB2FASTVP	zOS_SD_R3	10	zOS_FC_2M	20	zOS_AT_R6	70	N/A	0	0
FBA_Initial	Jim_EFDR53	3	Jim_FCR1	100	Jim_SATAR614	100	N/A	0	1
FBA_LOG	Jim_EFDR53	3	multipool	75	Jim_SATAR614	100	N/A	0	1
Gold	Jim_EFDR53	3	Jim_FCR1	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



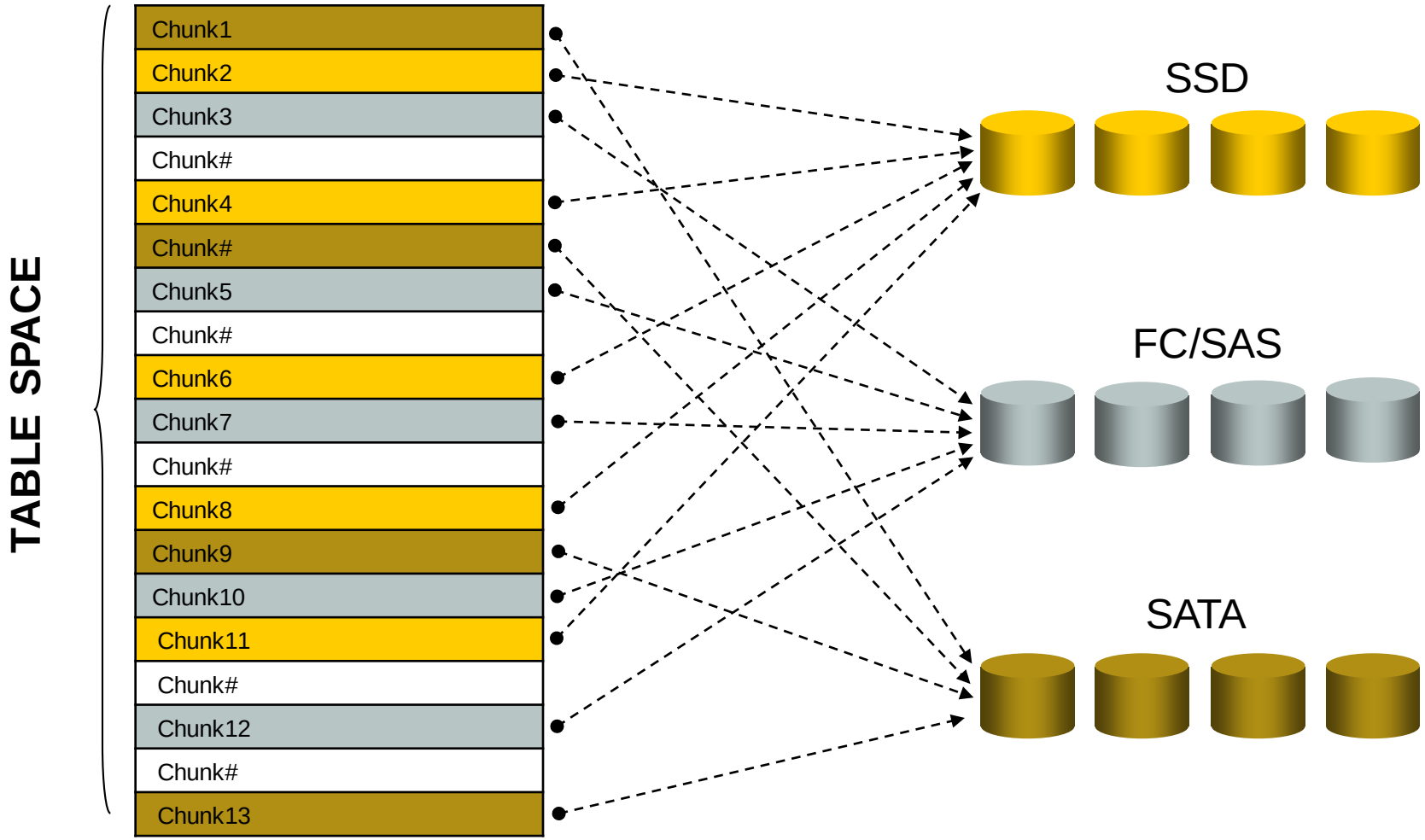
FAST VP Implementation



Data Movement

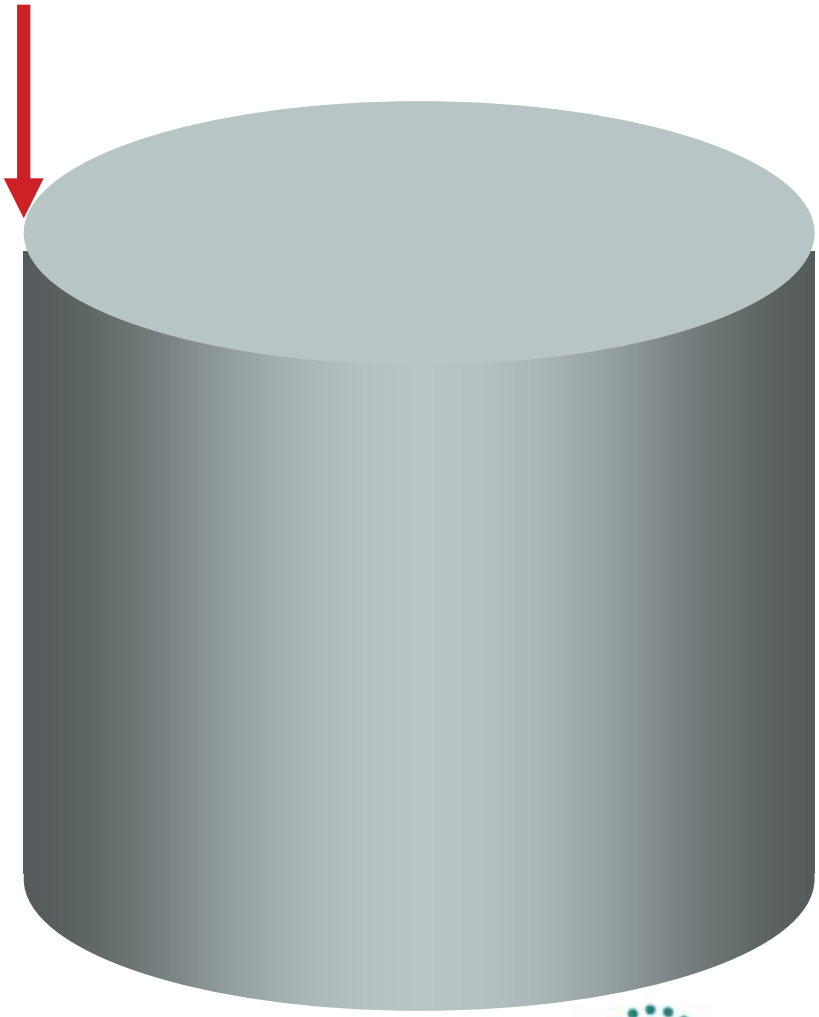
- Data chunks are moved using 6.8MB chunks
- Performance-based
  - Promotions due to high I/O rates
  - Demotions to free up space for promotions
- Compliance-based

Sub-volume Tiering



Sequential Tablespace Scan

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



FAST VP TESTING WITH DB2

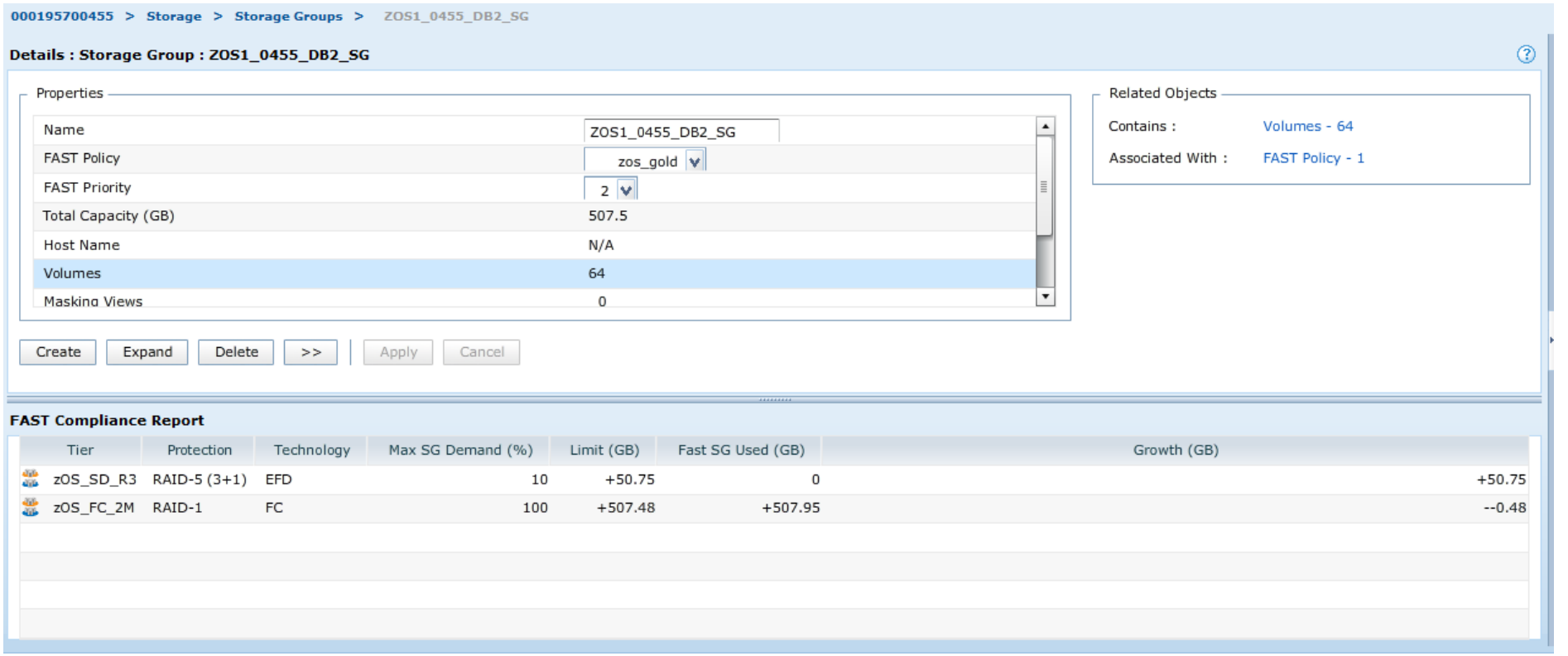
What was tested

- DB2 V10
- Symmetrix VMAX SE (single Engine)
- 2x4Gb Channels
- 4x200GB Enterprise Flash drives
- 32x300GB 15K FC drives
- 10% SSD in FAST VP policy

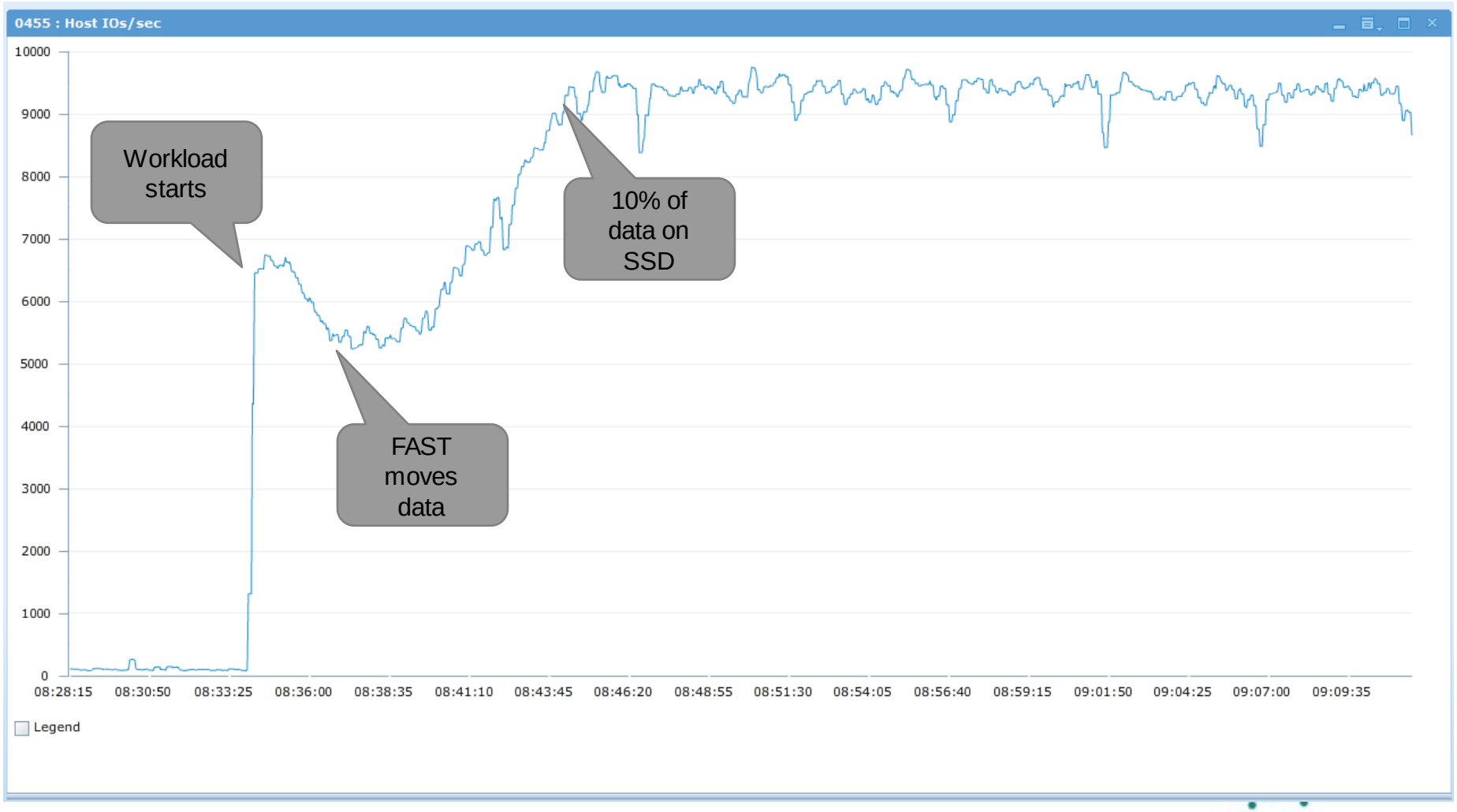
DB2 Workload

- 26 4GB partitions on 26 MOD 9s
- Highly random OLTP workload driven by 32 batch jobs
- 4x200GB Enterprise Flash drives
- 32x300GB 15K FC drives
- 507GB DB2 subsystem
- FAST VP policy set to 10% EFD use

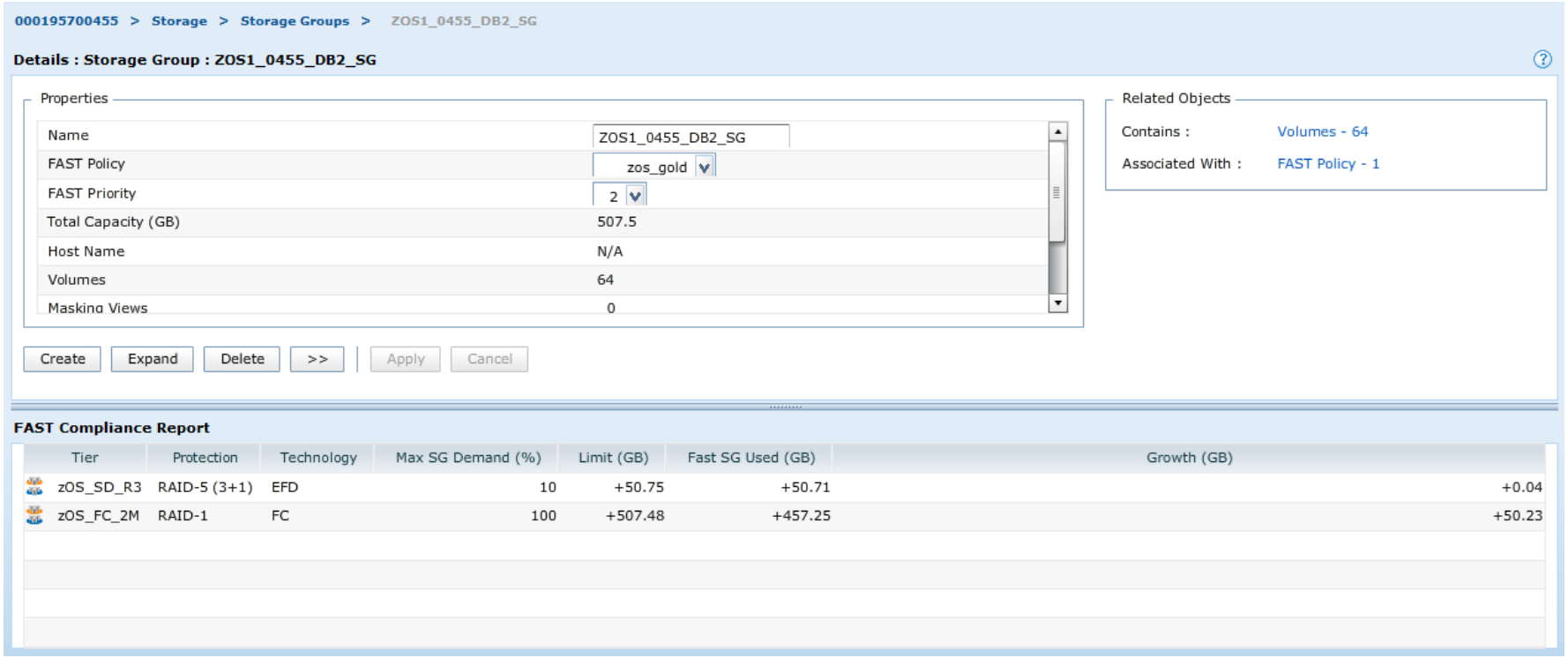
Policy display before workload



IOPS Measured: Unisphere for VMAX Performance View



Policy display after workload



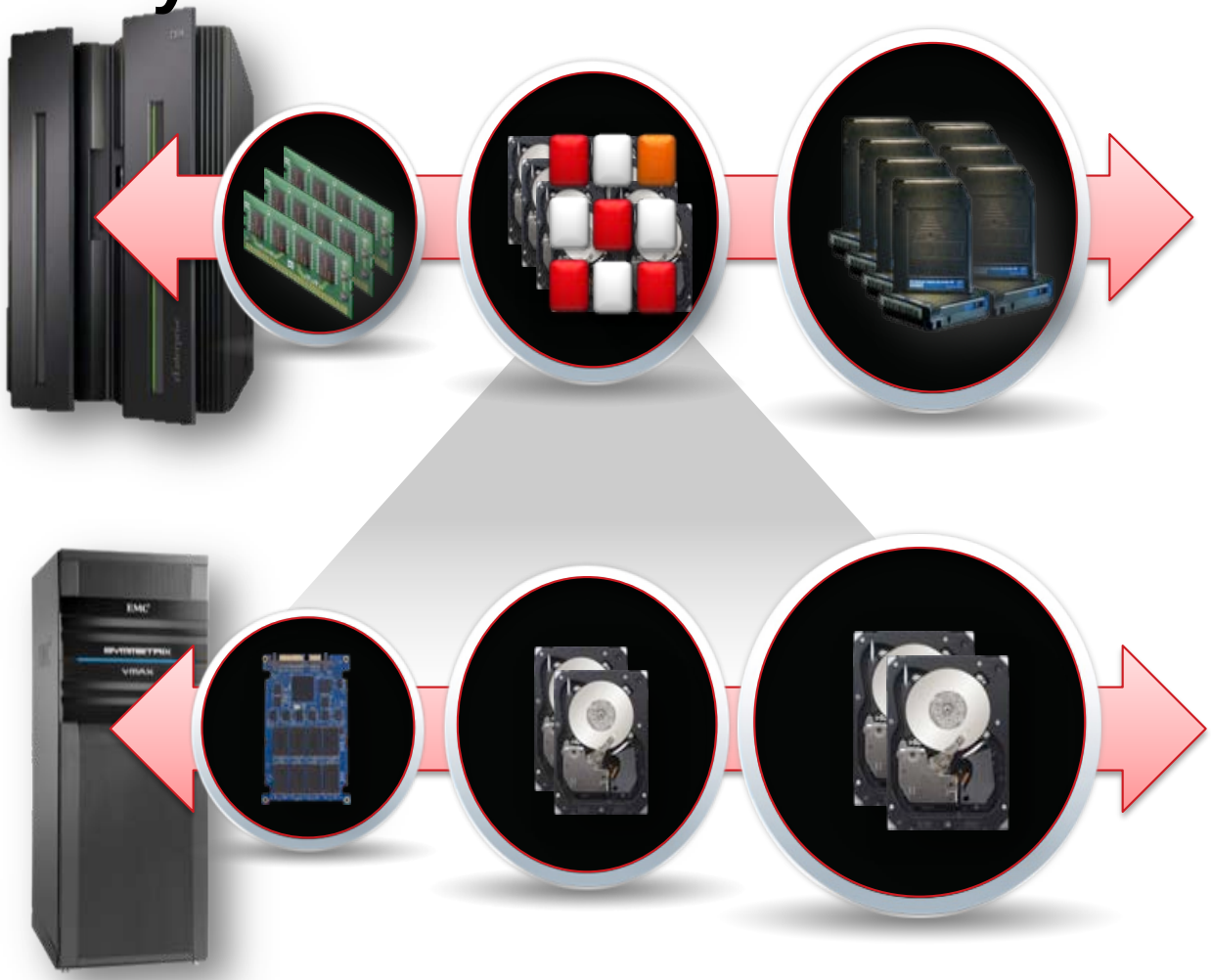
HOST CONSIDERATIONS

Automation at all Layers

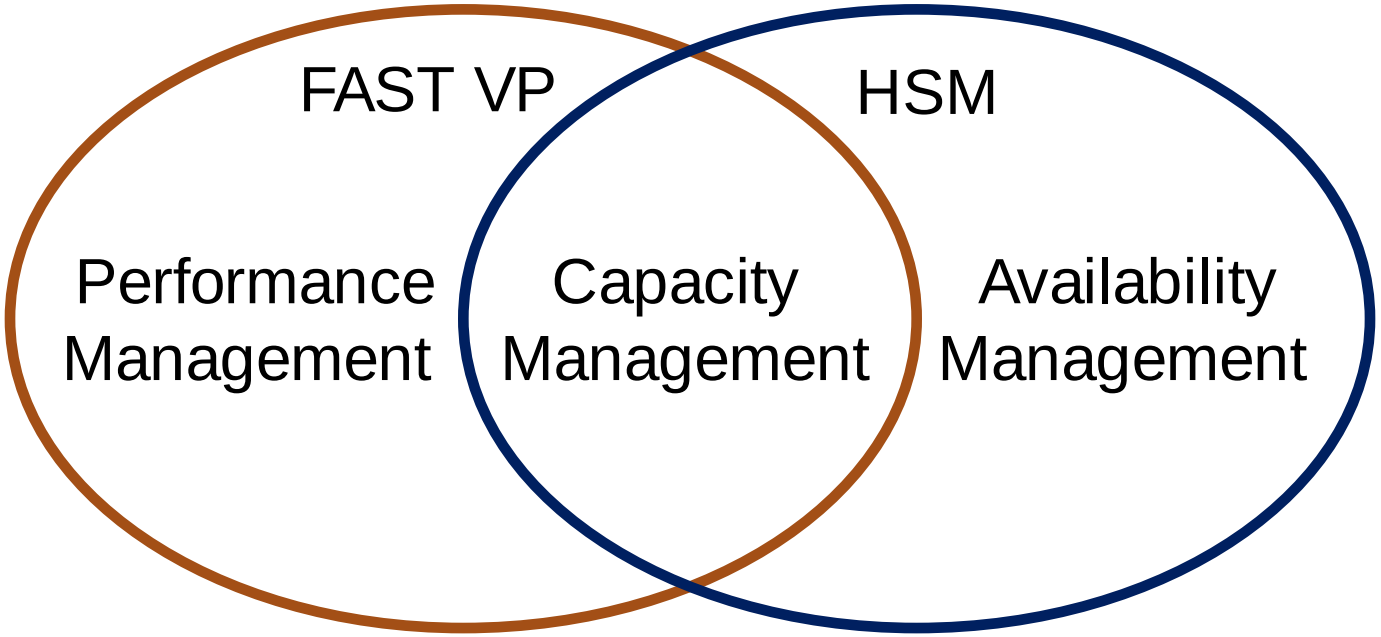
SMS &
HSM

+

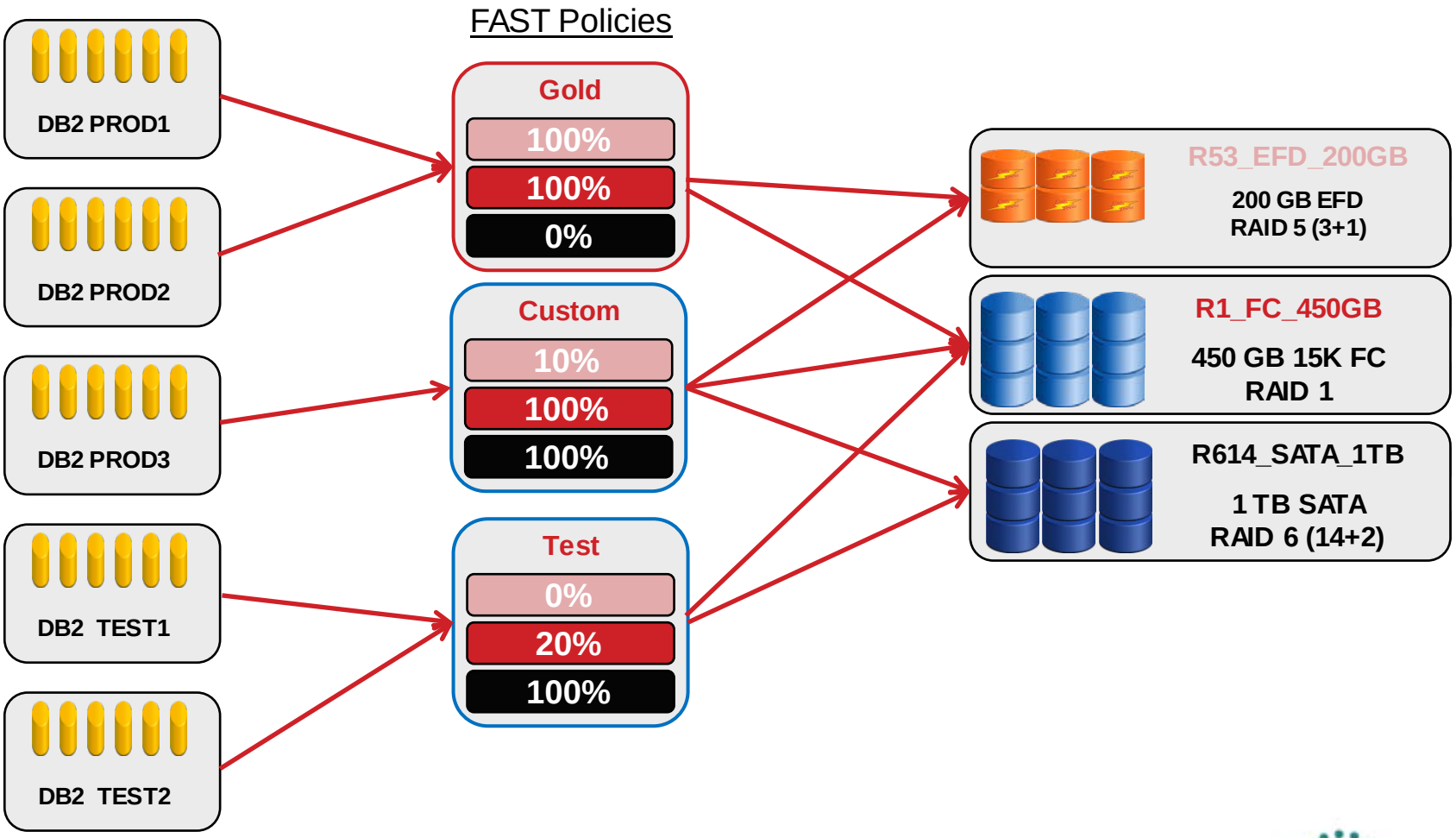
FAST VP



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

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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