All Flash Array Market Segmentation

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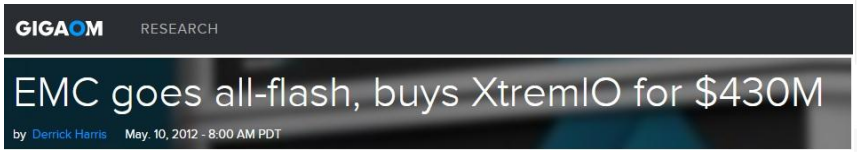
AFA Market Can Appear Chaotic…

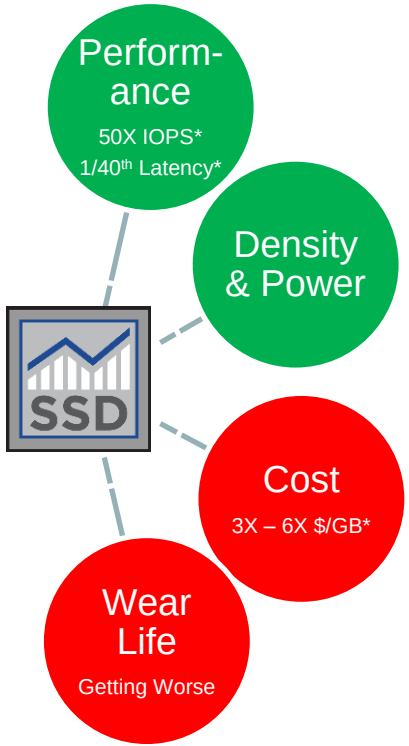


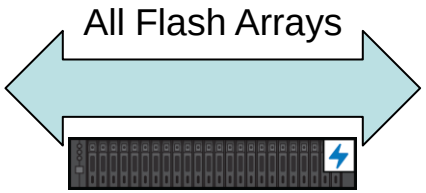
Other Notable Events:

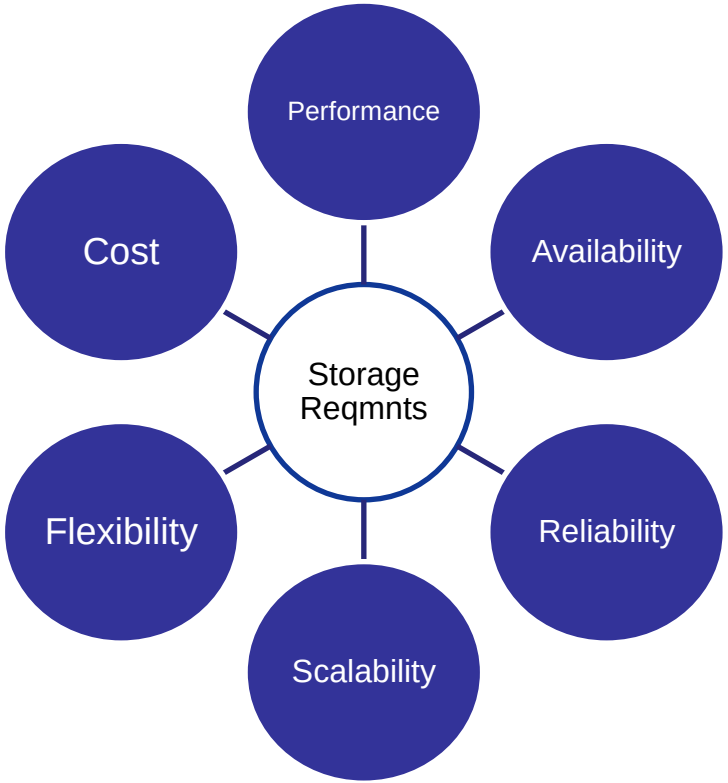
- Violin Memory went from ~40% share to <5%
- HGST buys Skyera
- Nimbus Data went from ~15% share to <5%

This is typical of new technologies

Opportunity and Challenge of Flash







* Comparing SSDs with SATA, NL-SAS and SAS HDDs

Storage Requirements

Requirement	Details
Performance	Latency, IOPS, and throughput (GB/s)
Availability	• Maintain data access through HW and SW failures (HA features) • Non-disruptive HW and SW upgrades • Non-disruptive operations (e.g. capacity & performance balancing)
Resiliency	Ability to protect data against: • System failures – SSDs (e.g. RAID, RAIN), controller (multiple local copies) • Site failures: Async or sync replication for disaster recovery • User errors, corruptions: Snapshots, backup/recovery (to HDDs/cloud)
Scalability	• Start small, then pay as your needs grow • Seamless scaling of performance and capability
Flexibility	• Ability to choose storage services – SAN, NFS, SMB/CIFS • Ability to share storage for multiple applications and tenants – secure access, quality of service to manage service level objectives • Test and development copies – clones

Lowest Cost Possible

Framework for Evaluating Storage Architectures

Storage Attributes

High Performance
Low latency and high IOPS

Availability
HA, non-disruption upgrade & operations

Resiliency
Snapshots, replication, backup/recovery

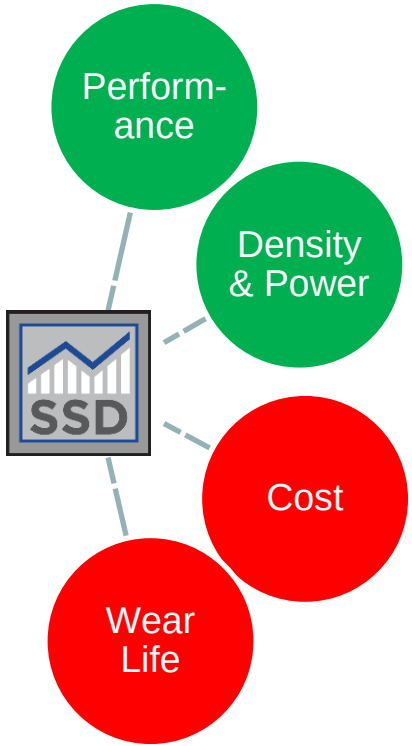
Scalability
Performance and capacity

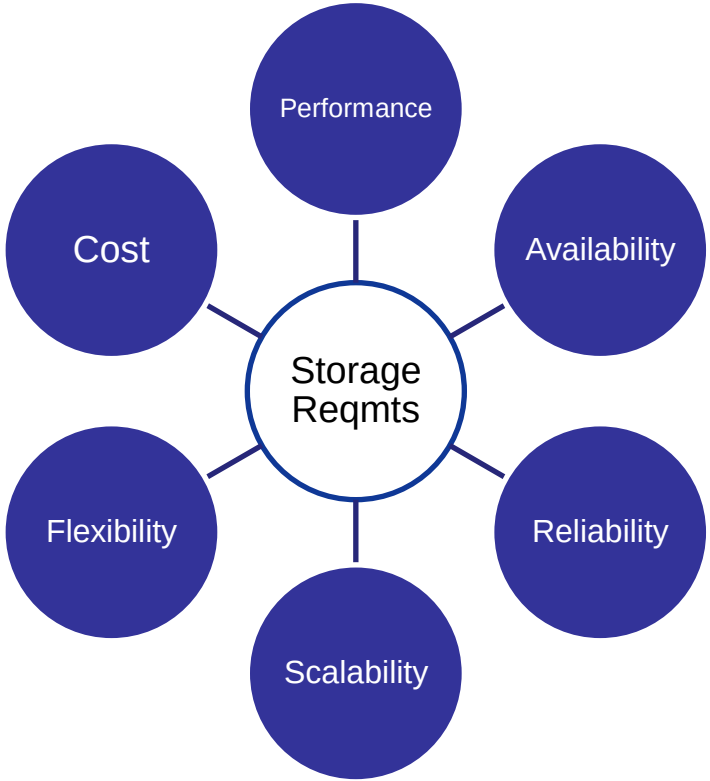
Flexibility
SAN & NAS, Multi-workload, multi-tenancy

Cost
Total solution cost, cost/TB, cost/IOPS

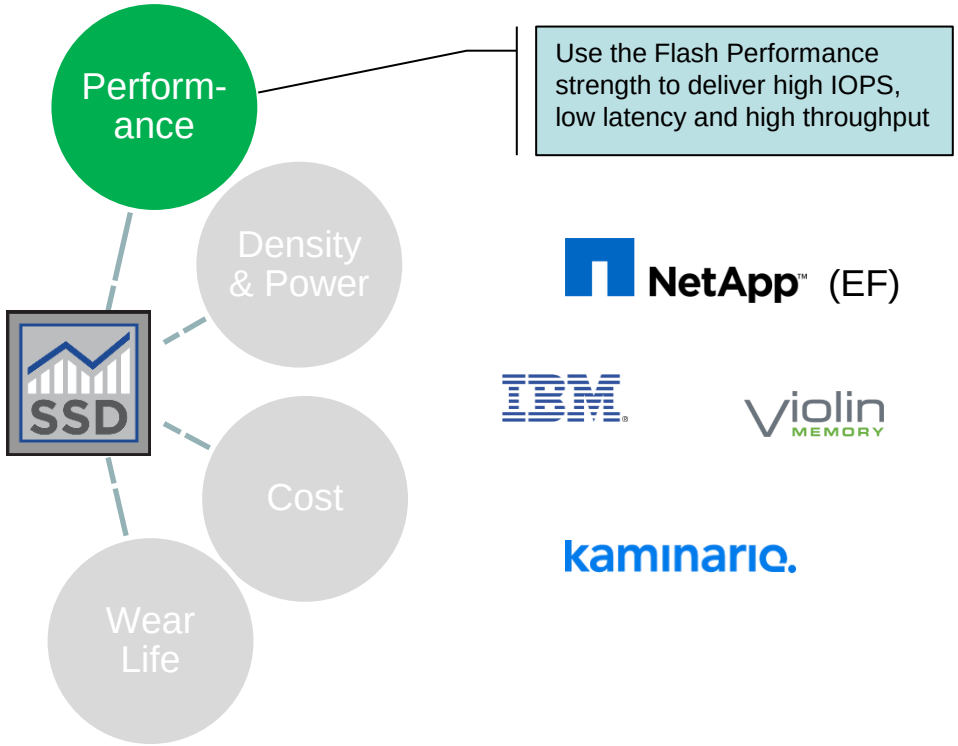
- Common for all storage solutions
- Elevates the discussion to customer value

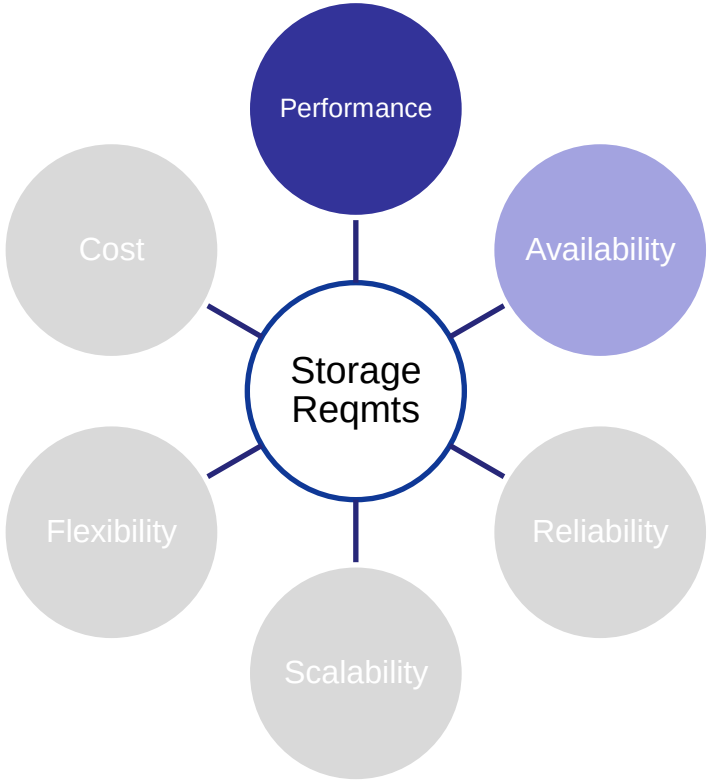
Comparison of Architectures



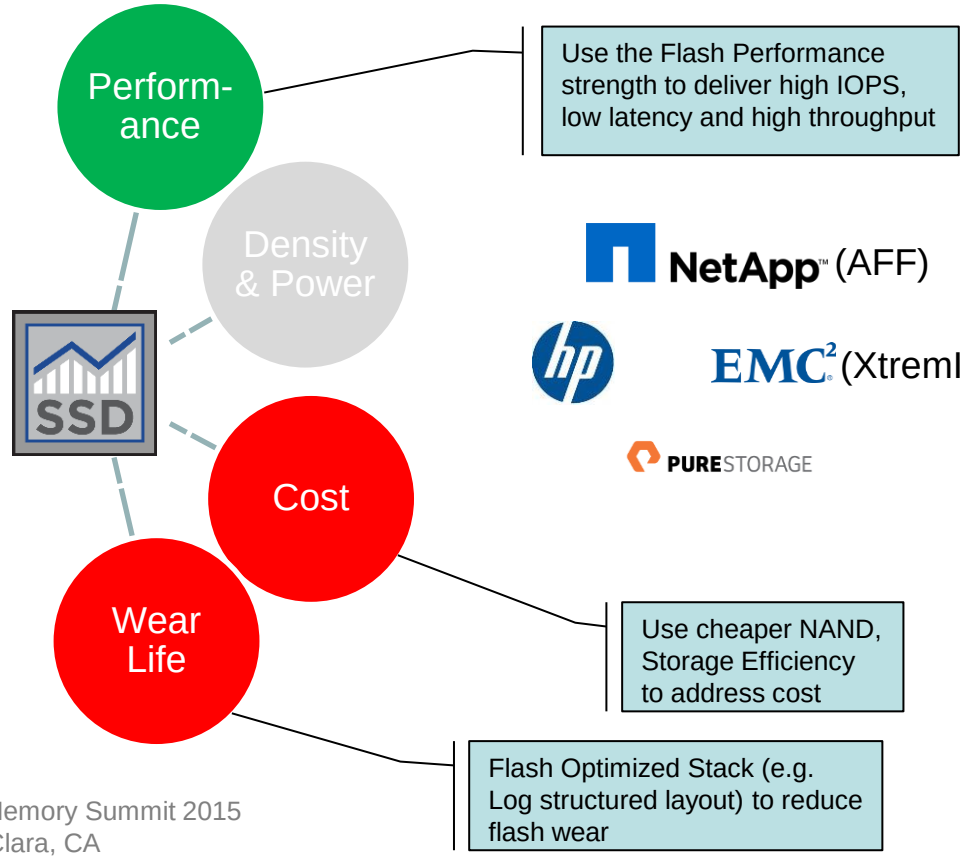


Performance Optimized Architectures





Shared Storage Architectures

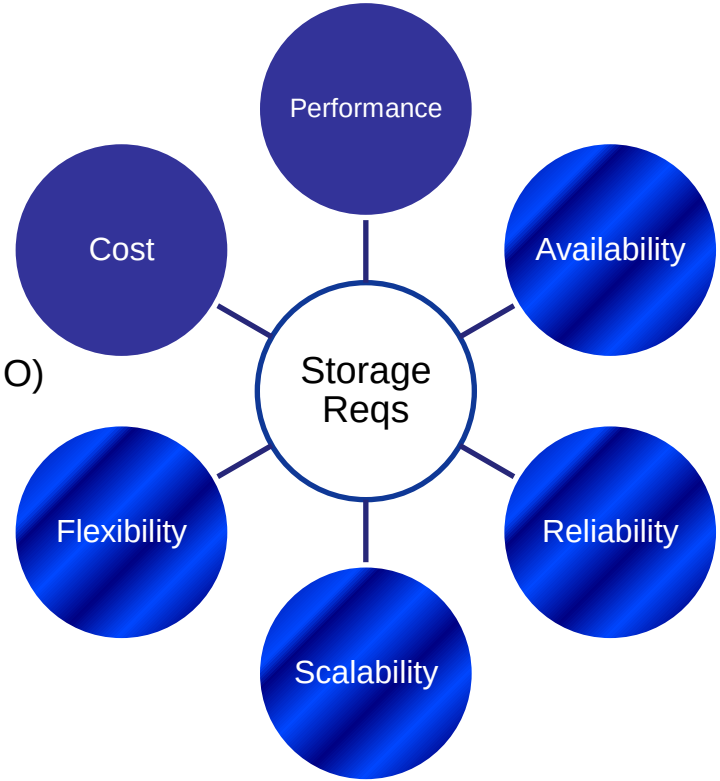


NetApp™ (AFF)

hp

EMC² (XtremIO)

PURESTORAGE



Framework for Evaluating Storage Architectures

Storage Attributes	Performance Optimized	Shared Storage Architectures
High Performance Low latency and high IOPS	+	●
Availability HA, non-disruption upgrade & operations	◒	●
Resiliency Snapshots, replication, backup/recovery	No native capability or high perf impact	Focus area but capabilities vary today
Scalability Performance and capacity	Capacity Scaling Only	Scale Out / Scale Up
Flexibility SAN & NAS, Multi-workload, multi-tenancy	Limited	Focus area but capabilities vary today
Cost Total solution cost, cost/TB, cost/IOPS	$/IOPS, $/GB raw	$/GB effective

AFA Segments

	Performance Optimized	Feature Rich Shared Storage
Deployment	Small number of performance sensitive applications	Large number of applications sharing the storage services
Data Management	Done at the application layer	Consolidated at storage layer
Scaling	Scale Up	Scale Up or Scale Out
Performance	500K – 1M IOPS @ 0.5ms or lower	200 – 500K IOPS @ < 1ms
$/GB Range	$2 - $4/GB (raw)	$6 - $8/GB (raw)
Density	1 - 2RU for 20TB	5-6RU for 20TB
Storage Eff	Generally no native storage efficiency	Dedupe, compression, thin provisioning
Features	low data mgmt features or have perf impact	Storage level snapshot, clones, replication, backup, etc

Need for Scale Out

- AFAs deliver high performance density (IOPS/GB)
  - Given dual socket server can power limited capacity
  - Scaling up CPUs is not attractive from a cost & thermal envelope point of view
  - Avoid array sprawl
- Without scale out the solution is either:
  - Overpowered (i.e. higher cost) for lower capacity points, OR
  - Underperforming for higher capacity points
- Capacity and performance scaling
  - Expect linear scaling for virtualized environments, structured workloads
  - Often times non-linear scaling (capacity grows faster than performance needs) is a result of lack of data migration or tiering on primary

Road Ahead

- Growing AFA adoption (at the expense of SAS HDDs) for primary data
- Feature-rich shared storage arrays
  - Adopt PCIe connected 3D/TLC NAND to reduce costs and improve perf
  - Scale out will become the differentiating capability
- Performance-only AFAs:
  - Continued pressure
    - Feature rich arrays on cost / value
    - Host forms of flash for performance
  - Integration with Protocol “Gateways” and storage efficiency appliances
- Flash solutions exploiting high density, low power advantage of flash

Thank You!