

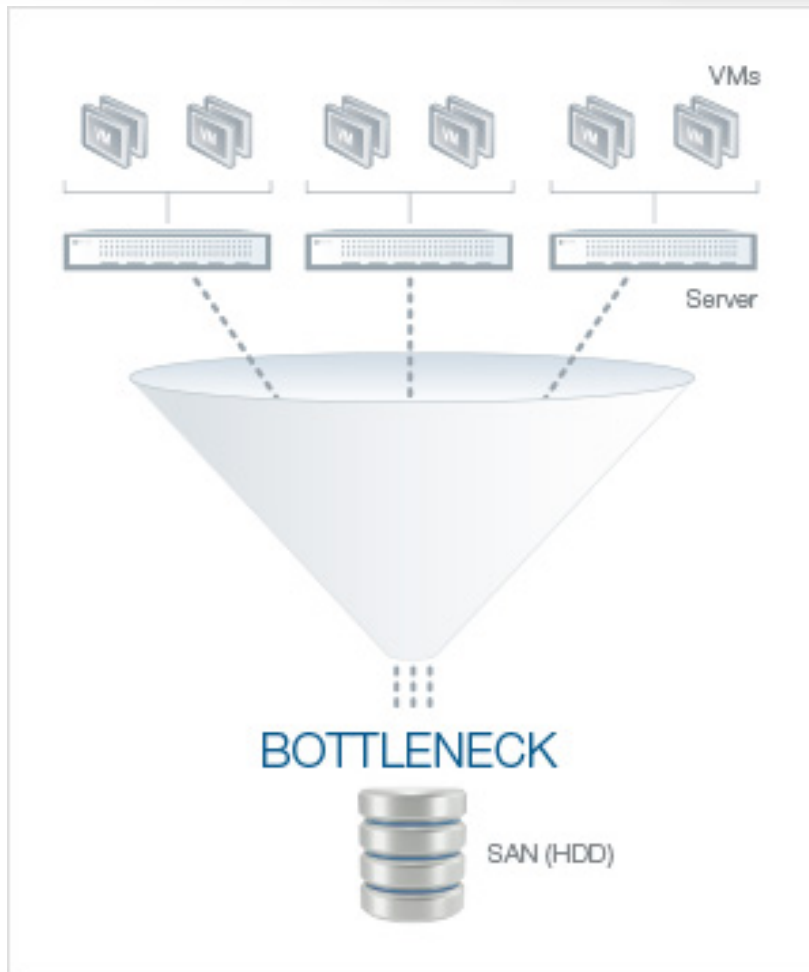
# How To Get The Most Out Of Flash Deployments

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**Research Director, Storage Practice**  
**IDC**

# Flash: A Must Have

- Storage performance req'ts very different in virtual infrastructure
  - ◆ VM I/O blender effect
- Managing data growth is driving new economic considerations
  - ◆ Infrastructure cost, floor space, power, cooling
- Effective flash cost continuing to drop
  - ◆ The rise of new storage metrics: IOPS/watt, IOPS/TB not \$/TB

# VM I/O Blender Effect



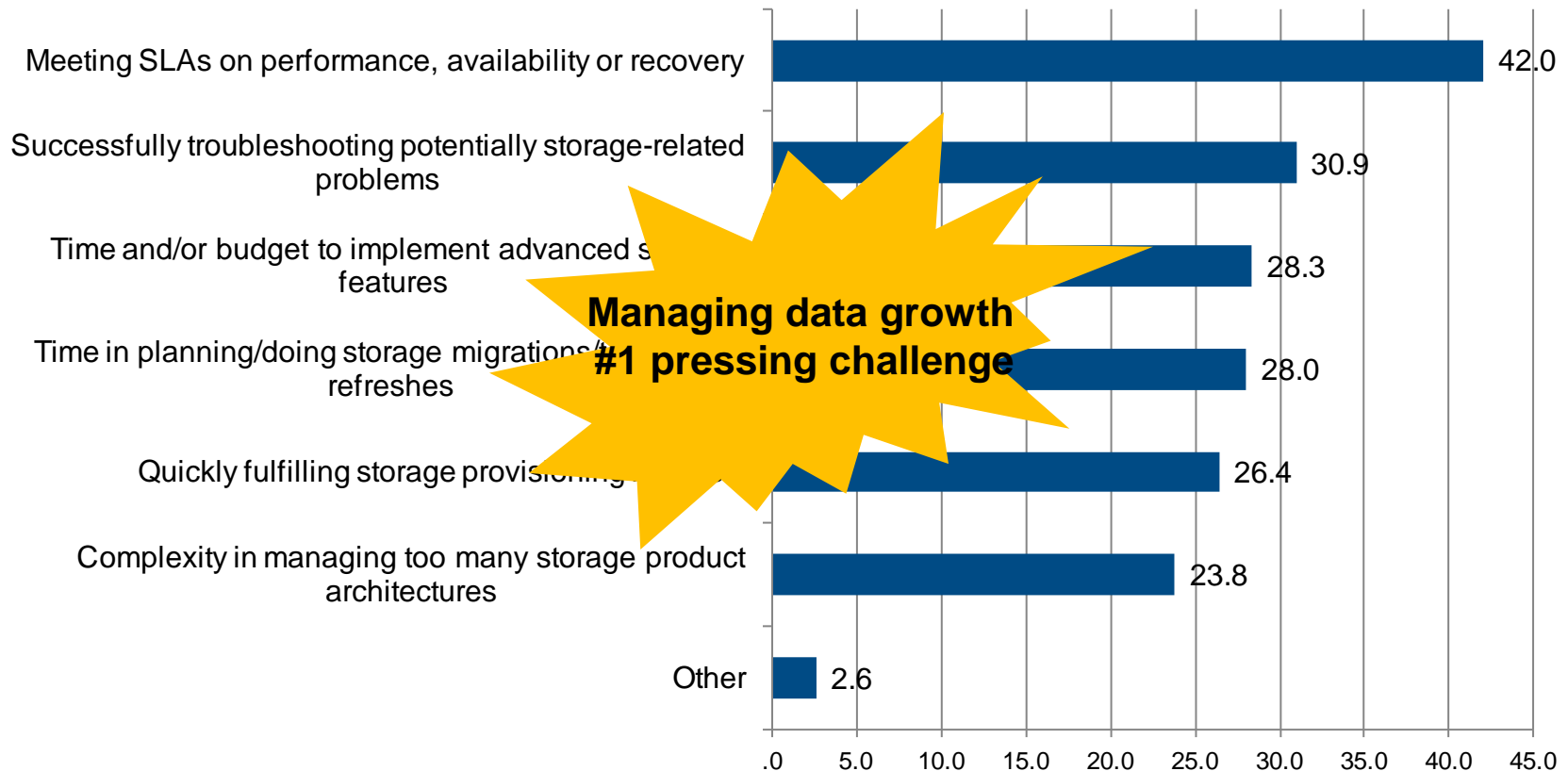
- ◆ OS sequentializes each individual VM's I/O stream
- ◆ Hypervisor multiplexes all VM's I/O streams together
- ◆ Creates extremely random I/O pattern
- ◆ Spinning disks do not handle random I/O well
- ◆ Increased rotational latencies and seek times
- ◆ End result: each HDD produces up to 10x lower IOPS than before
- ◆ Apps run more slowly

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# Storage Administrator Insomnia

## Most Pressing Storage Challenges



# Legacy Flash Concerns

**COST**

**ENDURANCE**

**PREDICTABLE  
PERFORMANCE**



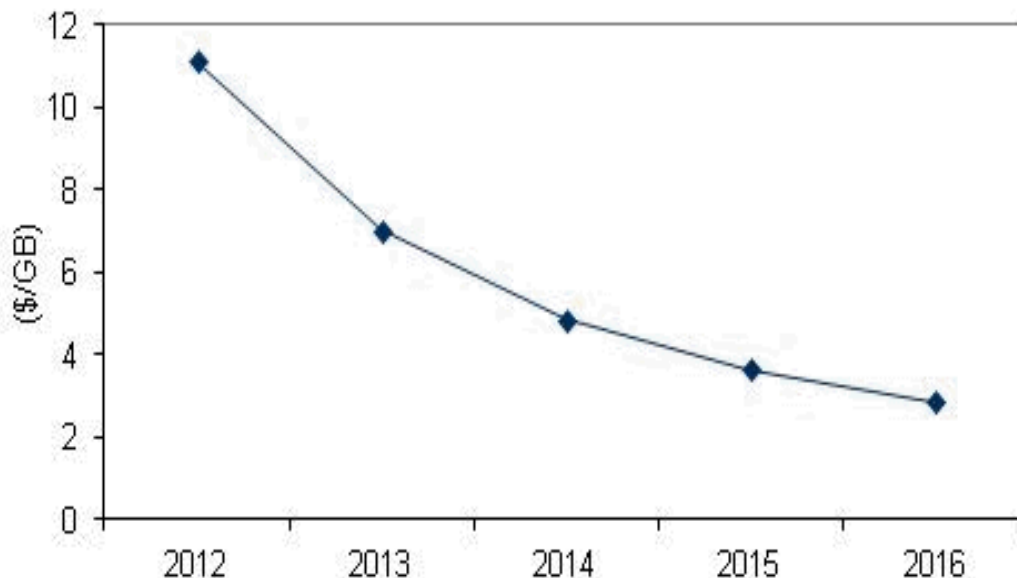
**FLASH OPTIMIZED  
ARCHITECTURES**



Required for optimal  
flash utilization/benefits

# Flash Cost Projections

## Worldwide Enterprise All Flash Array Average \$/GB, 2012 - 2016

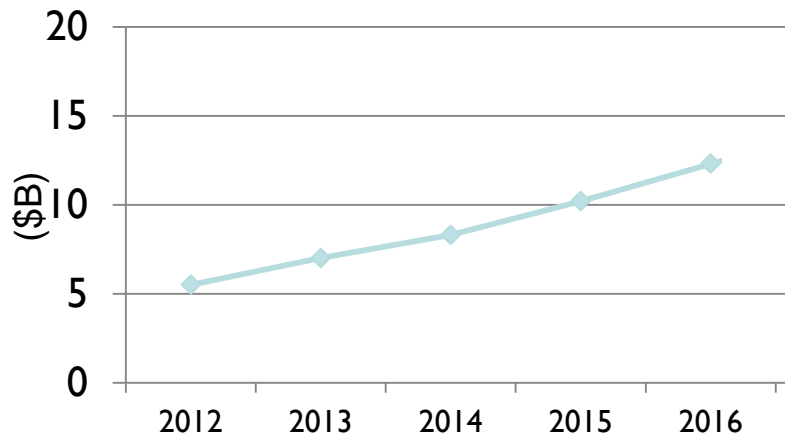


## Add'l Factors Driving Down Effective Flash \$/GB

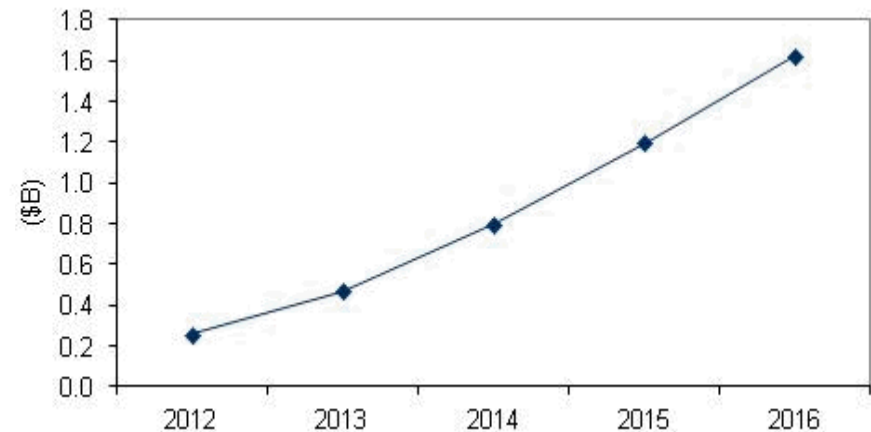
- ◆ Write minimization
- ◆ Increasing endurance
- ◆ Compression
- ◆ Deduplication
- ◆ Shift from SLC to MLC

# High Expected Growth in Flash

## WW Hybrid Array Revenue



## WW All Flash Array Revenue



- Flash-optimized array shipments will grow at a rapid rate
  - ◆ Hybrid array market grows at 21.1% CAGR through 2016 to \$12.3B
  - ◆ All flash array market grows at 58.5% through 2016 to \$1.6B
- Hybrid arrays will become the new enterprise storage workhorse
  - ◆ By 2017 45% of shipping storage capacity will be flash-based



# Does Flash Optimization Matter?

Flash is flash.



How you deploy it  
DOES matter.



# Flash Optimized Architectures

Look for a storage architecture that has been designed with flash in mind.



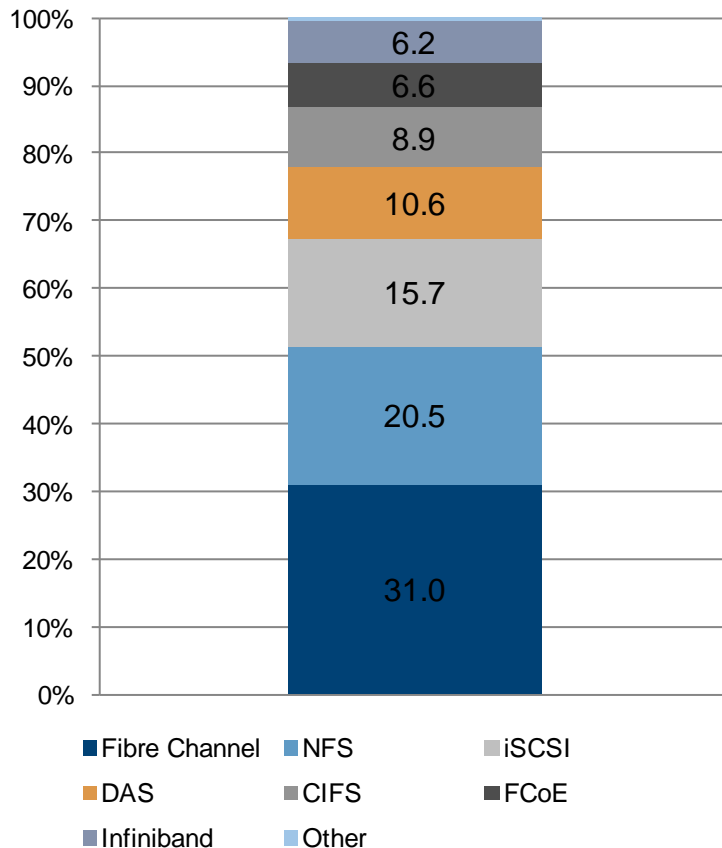
# FOA

- ◆ Write minimization and wear leveling
- ◆ Garbage collection does not impact write performance
- ◆ Tiered storage environments with caching and volume pinning
- ◆ In-line data reduction that does not impact performance
- ◆ Thin provisioning, space-efficient snapshots and clones
- ◆ QoS controls for consistently predictable performance in high density storage environments

- Scale out or scale up
- VM-centric storage management
  - ◆ Dedicated storage administrators disappearing
  - ◆ Line of business rising to prominence
  - ◆ Dialing in to meet application performance req'ts
  - ◆ Manage virtual disks not LUNs
  - ◆ Industry examples (Tintri, VVOLs, etc.)
- Maturity of enterprise-class data services
  - ◆ Thin provisioning, snapshot, replication, etc.

# Support For Mixed Workloads (1)

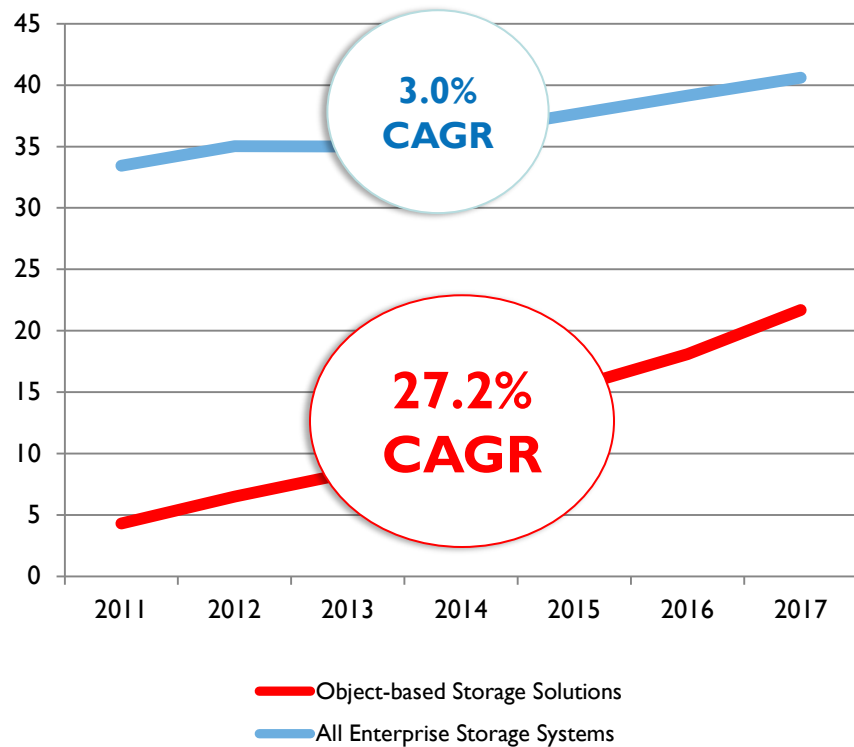
## Mean % of Raw TB by Protocol (External)



- High storage density drives low TCO
- Storage consolidation must support mixed workloads
  - ◆ Flash with QoS
- Balanced scalability with predictable performance
  - ◆ Scale-out architectures
- Multi-protocol support

# Support For Mixed Workloads (2)

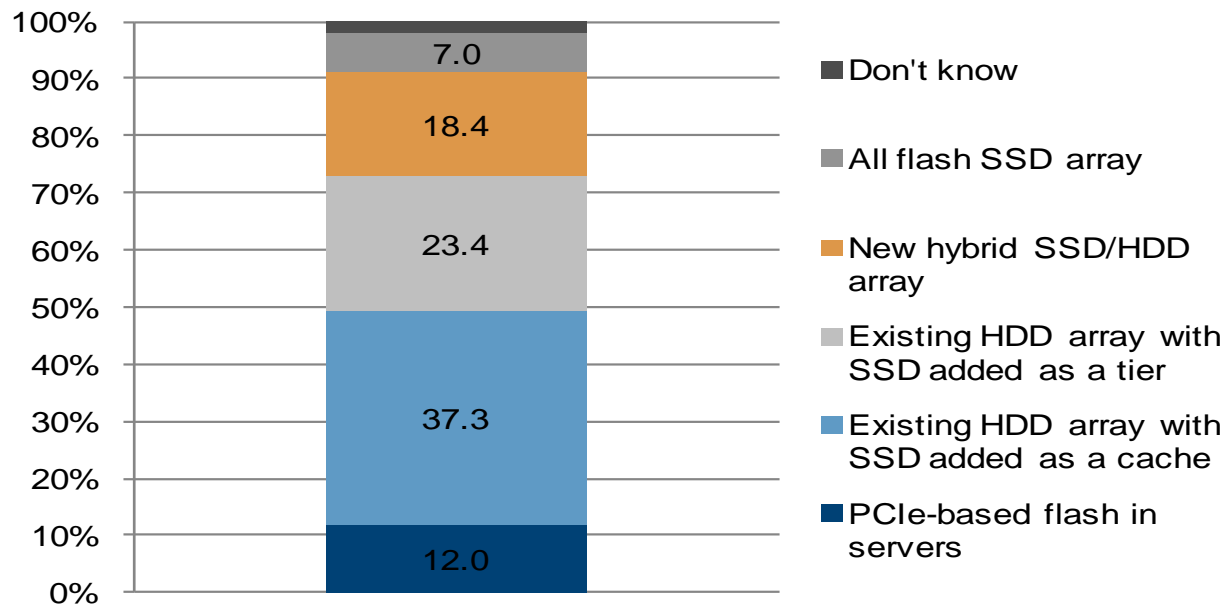
## Storage Systems & OBS Spending (\$B)



- Aggressive CAGR for object based storage (OBS)
- Scale out and OBS often go together
- 80% of new data creation by 2017 will be unstructured
  - ◆ Big Data/Analytics play
- Importance of block, file and object on the same platform
  - ◆ Maximizes density potential
- Increasing importance of NoSQL databases

# Where To Put Flash

Q: Where do you deploy flash today?



- ◆ Easy deployments were first (existing HDD array)
- ◆ PCIe-based deployments have increased significantly
- ◆ Industry moving in the direction of flash optimization
- ◆ Emerging memory bus attached flash options

## ➤ Latency

- ◆ Having compute near the data
- ◆ Host vs network latencies

## ➤ High availability/recovery

- ◆ Data loss issues
- ◆ Performance vs recovery trade-offs

## ➤ Cost

- ◆ Shared storage has higher entry cost

## ➤ Application considerations

# Choosing A Solution

**PERFORMANCE**



The “best” architecture for any given environment will be selected by trading off these three considerations

**COST**



**All Flash  
or Hybrid?**

**CAPACITY**





## ➤ Performance

- ◆ Higher IOPS, lower latencies to meet SLAs
- ◆ Flash can deliver 1000x the performance of HDD

## ➤ Increased storage density

- ◆ Ability to host more workloads increases value

## ➤ Lowers infrastructure costs

- ◆ Lowers floor space, capacity, and energy requirements
- ◆ “3<sup>rd</sup> platform” CAPEX and OPEX profile

# Deployment Recommendations

- Consider flash for all new apps but especially...
  - ◆ Virtual infrastructure, databases, VDI
- Consciously select deployment model
  - ◆ Host, array or appliance
  - ◆ Legacy or flash-optimized
- Plan for increasing storage density over time
  - ◆ QoS, multi protocol support, balanced scalability
- Consider scale-out architectures
  - ◆ As a long term approach to managing high data growth
- Balance performance, cost, capacity in your choice
  - ◆ There is no “best” solution for all needs

# Example Flash Players

## HOST FLASH

- ▶ Fusion-io
- ▶ Samsung/SanDisk
- ▶ Toshiba

## SCALE OUT FLASH

- ▶ Coho Data
- ▶ DDN
- ▶ Gridstore
- ▶ VMware VSAN
- ▶ Many others...

## ALL FLASH ARRAYS

- ▶ Dell Compellent
- ▶ EMC XtremIO
- ▶ HDS HUS VM/VSP
- ▶ HP 3PAR
- ▶ IBM FlashSystem
- ▶ Kaminario
- ▶ NetApp E-Series
- ▶ Nimbus Data
- ▶ Pure Storage
- ▶ Skyera, SolidFire
- ▶ Violin, WhipTail (Cisco)

## HYBRID ARRAYS

- ▶ Coraid
- ▶ Fusion-io (NexGen)
- ▶ Nimble Storage
- ▶ Tegile
- ▶ Tintri
- ▶ Many legacy arrays...

NOTE: Not a comprehensive list.

# Thank You!

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