New Economics of Flash

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Dir, Product Marketing Dell

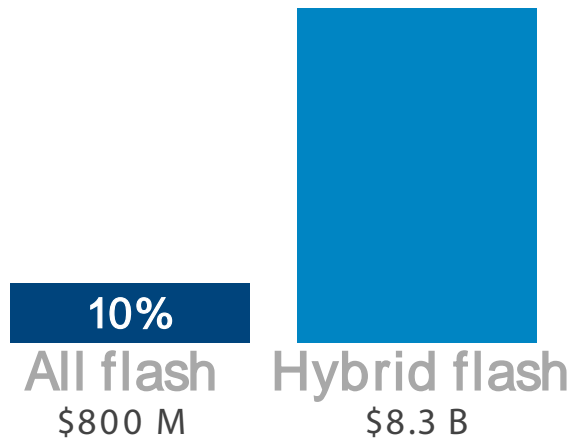## Forum D-12: Enterprise Storage Design

Agenda

- Market Overview

- Finding the perfect drive

- Using this perfect drive

- Other places for flash

- Questions

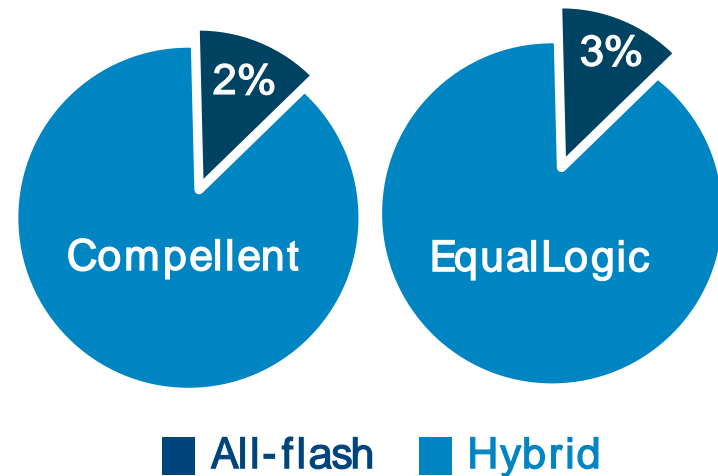# Market vs Dell Perspective – Favors Hybrid

Market Size

Dell Flash Deployments

10%

All flash
$800 M

Hybrid flash
$8.3 B

Compellent
2%

EqualLogic
3%

■ All-flash   ■ Hybrid

10X more
hybrid solutions

50X more
hybrid solutions

Source: IDC market data

Source: Dell Phone home and
internal sales data

Where is the best place for flash in the enterprise?

DAS

- Small datasets
- Highest performance
- Lowest latency
- Difficult to manage/share

SAN array

- Huge datasets
- Full enterprise feature set (replication, etc.)
- Historical: started with cache
- Now: Larger quantities

Server cache

- Small datasets
- Highest performance
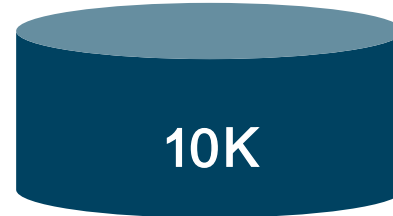- Lowest latency

Not all SSD are the same

Category	Write Intensive SLC	Read Intensive MLC
Workload	Mainstream Applications Any usage	Mostly Read 90/10 R/W Mix
Capacity	400 GB	1.6 TB
Endurance (Full writes / Day)	30	3
Endurance (written PBs)	21.9PB	8.76PB
Performance IOPS (8K 70/30 R/W)	38K	14K
Write Bandwidth	400 MB/s	70 MB/s

Finding the ideal drive – today's choices

HDD

15K	10K	7.2K
Performance ▲ Cost ▼	Cost ▲ Capacity ▼	Performance ▼ Capacity ▲

SSD

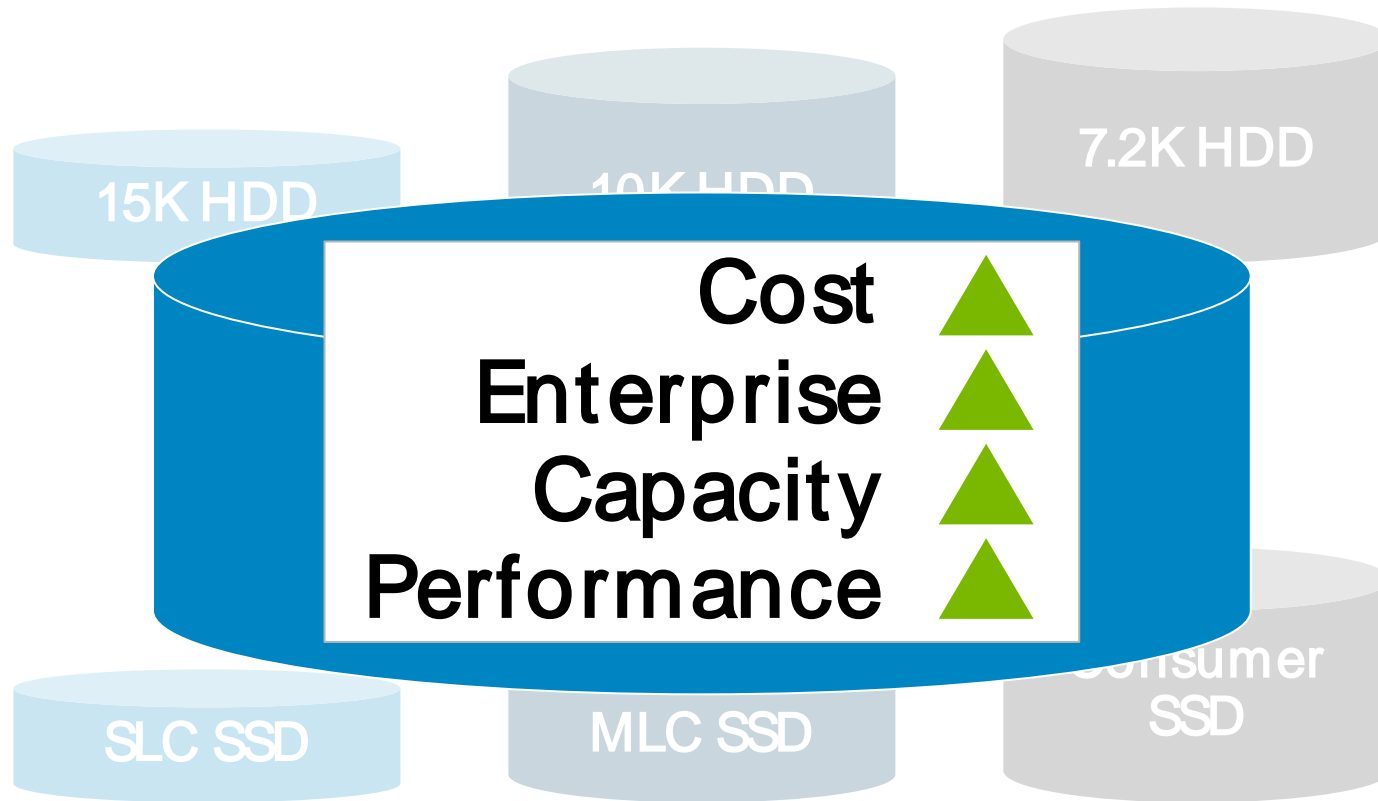| SLC	MLC	Consumer
Performance ▲ Cost ▼	Cost ▲ Enterprise ▼	Cost ▲ Enterprise ▼

Data has different storage needs over time

Finding the ideal drive – Which vendor
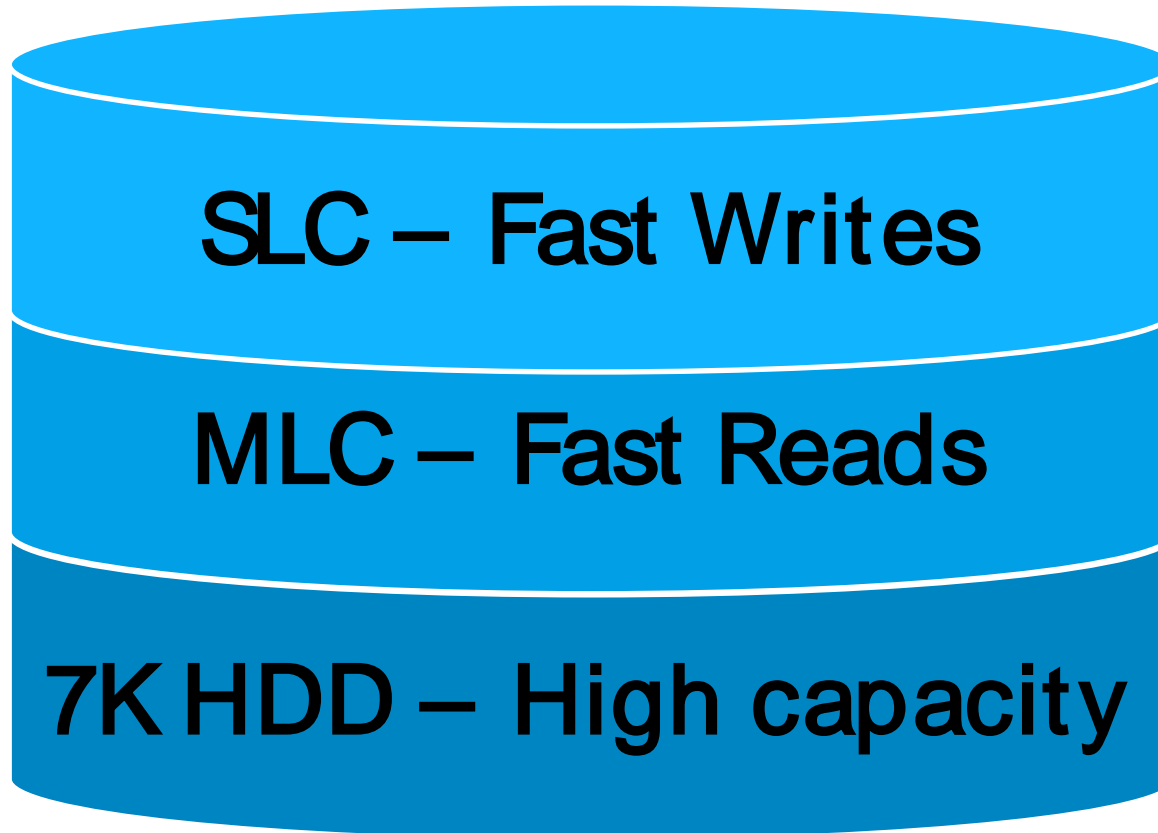
Finding the ideal drive – Best Attributes

Cost ▲
Enterprise ▲
Capacity ▲
Performance ▲

15K HDD
10K HDD
7.2K HDD
SLC SSD
MLC SSD
Consumer SSD

8

Finding the ideal drive – New virtual drive

Intelligent Data Placement

Tier 1

Tier 2

Tier 3
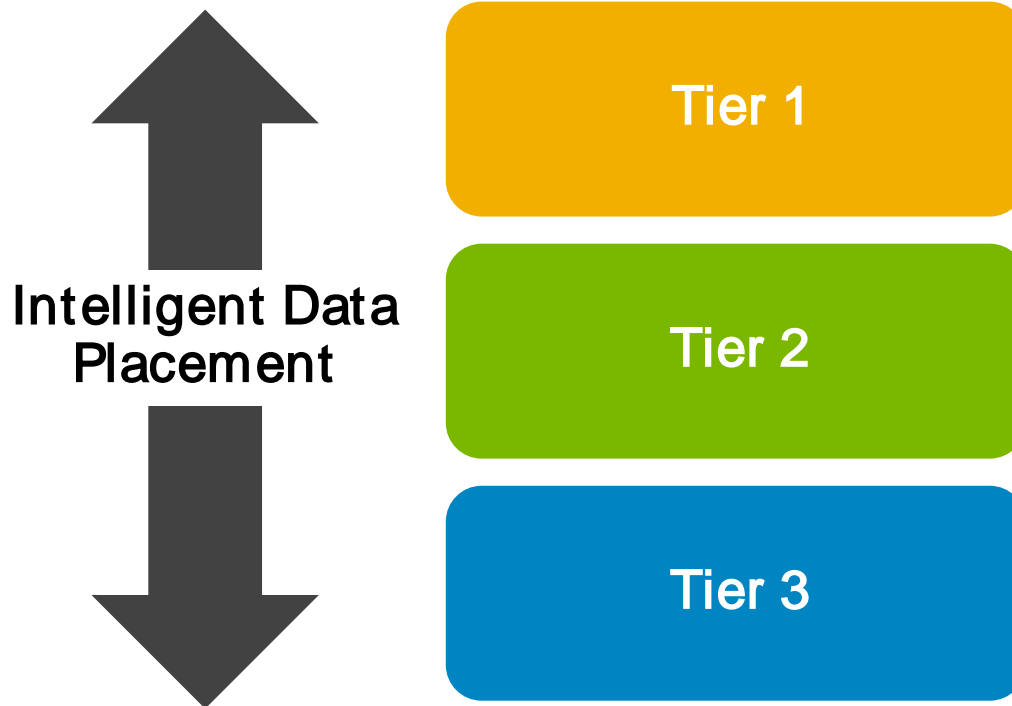
Finding the ideal drive – Today's products

SLC – Fast Writes

MLC – Fast Reads

7K HDD – High capacity

Customer concerns:
Investment and Future Proofing

Insert new technology here

Fast Writes
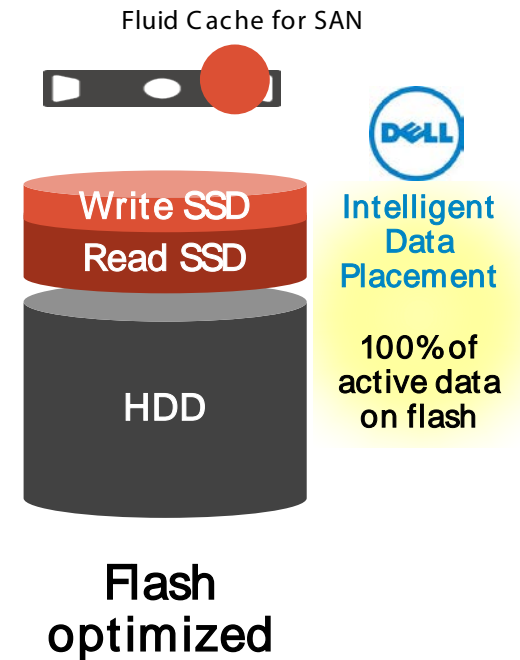
Fast Reads

High capacity
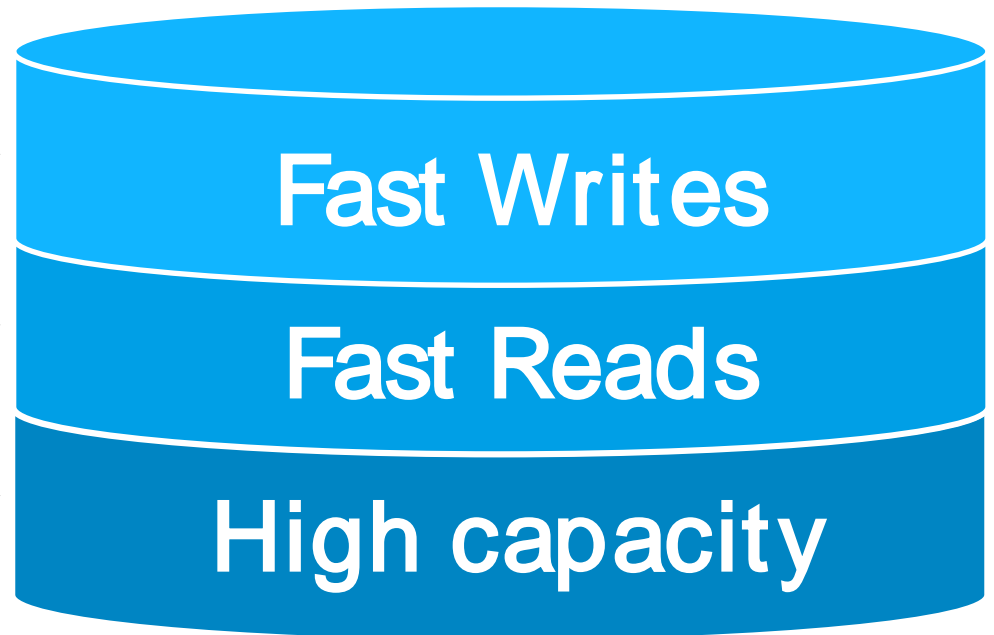
Optimizing Flash in the Datacenter

"How much of my data can I afford to put on flash?"
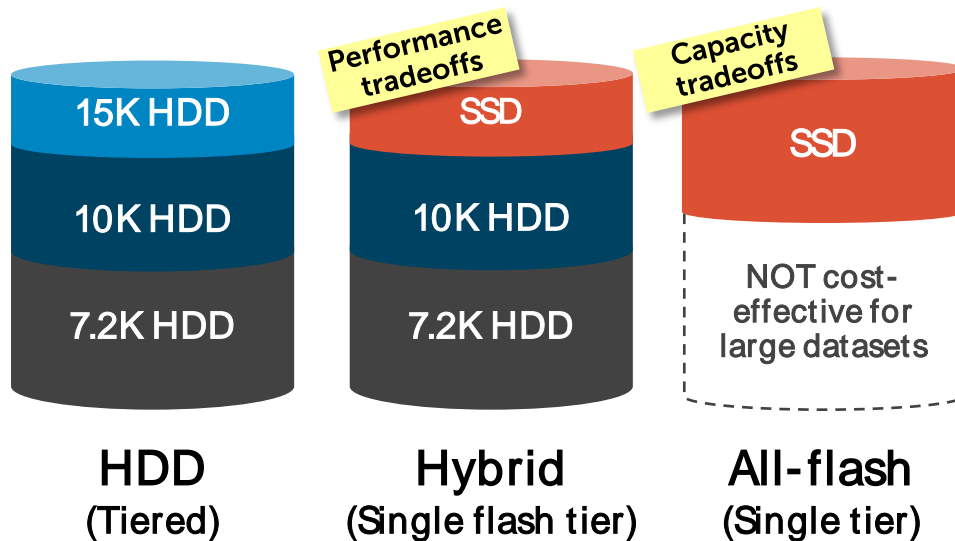
"How do I put ALL my hot data on flash?"

Fluid Cache for SAN

Performance tradeoffs

Capacity tradeoffs

15K HDD	SSD	SSD
10K HDD	10K HDD	NOT cost-effective for large datasets
7.2K HDD	7.2K HDD	

HDD
(Tiered)

Hybrid
(Single flash tier)

All-flash
(Single tier)

Write SSD
Read SSD

HDD

Intelligent Data Placement

100% of active data on flash

Flash optimized

Flash investment required

Actual Results

Market Size

10%	
All flash	Hybrid flash
$800 M	$8.3 B
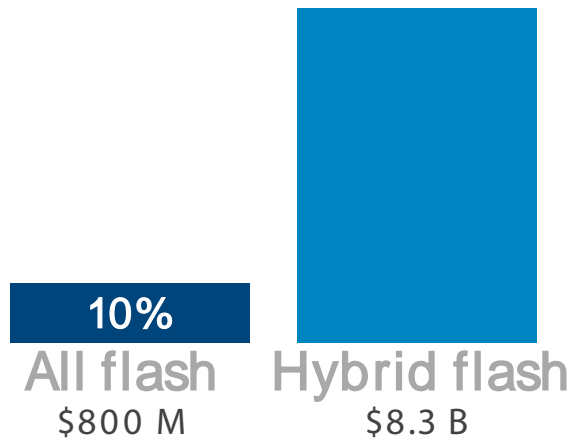
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hybrid solutions

Source: IDC market data

Dell Flash Deployments

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■ All-flash ■ Hybrid
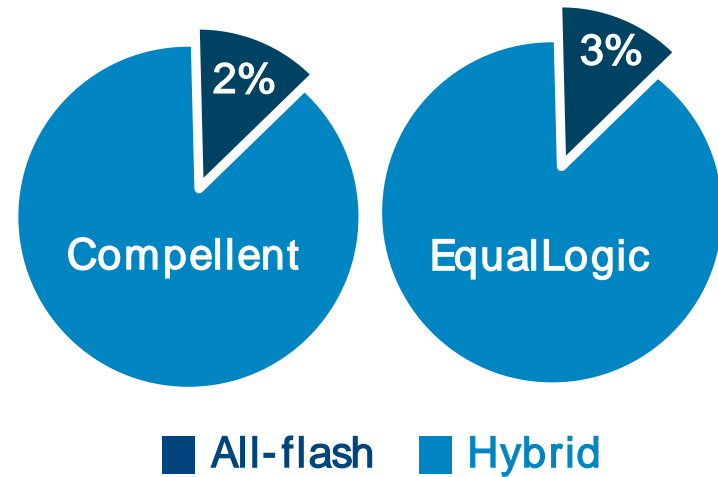
50X more
hybrid solutions

Source: Dell Phone home and internal sales data

Flash Memory
SUMMIT

DELL

Dell builds on Intelligent Data Placement to optimize enterprise storage at all levels

Intelligent Data Placement

Server — Fluid Cache

High-Performance Storage Tiers — Industry-leading flash optimization

Cold Storage — Intelligent compression Business continuity Secure storage
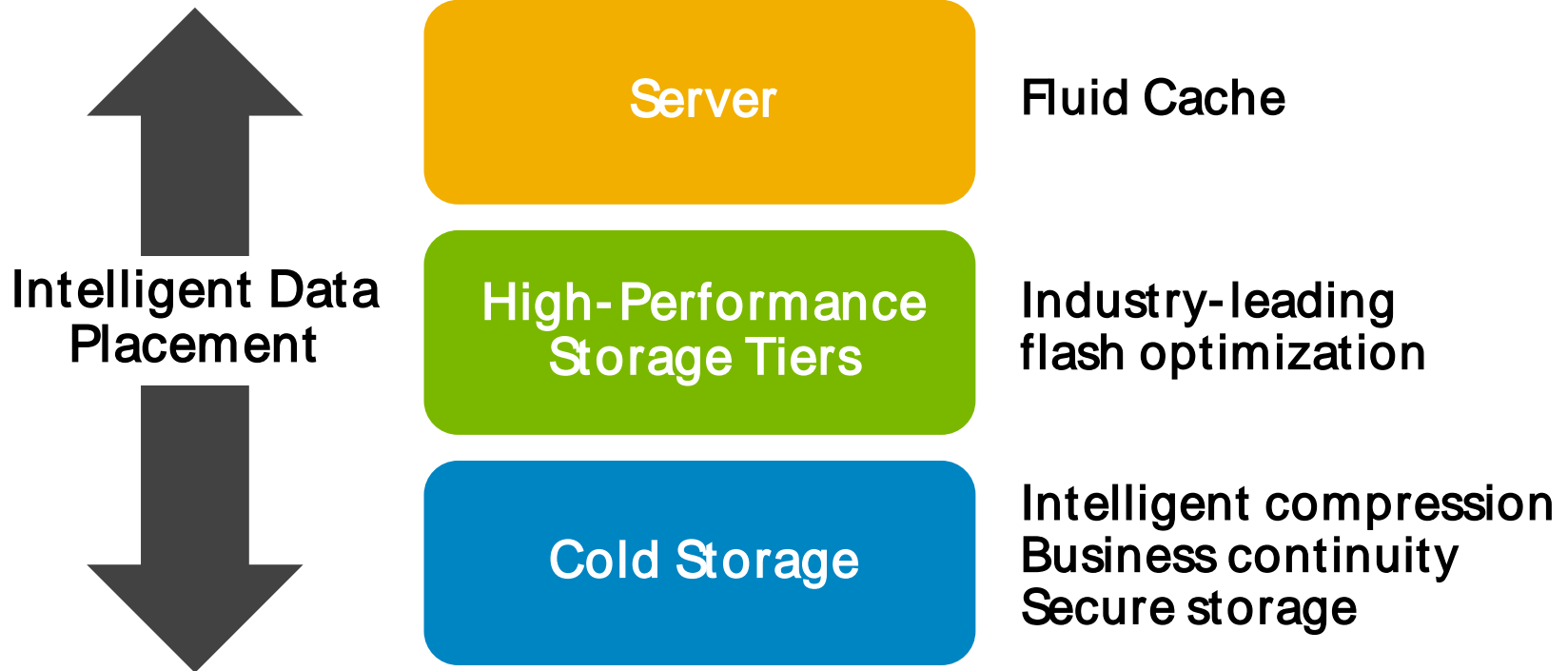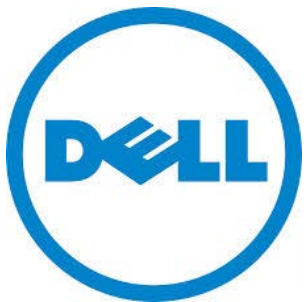
Where we are Today

Server Side Flash

Fluid Cache for SAN

Flash Optimized Storage

All Flash Array &
Ultra-dense enclosure

Questions