

# Future of Flash in the Enterprise

**Forrest Norrod**

Vice President and General Manager  
Dell Server Solutions

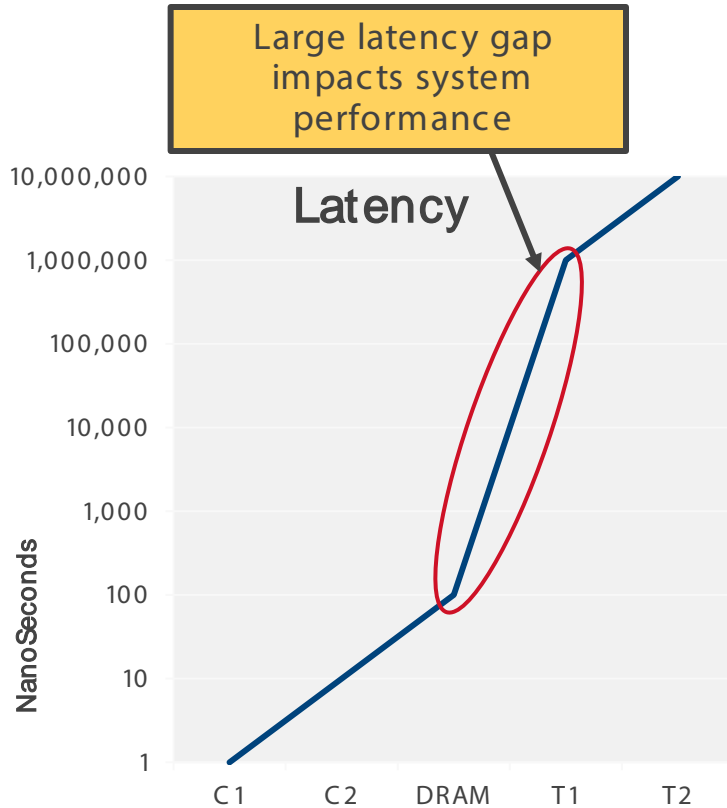


# Internet Of Things

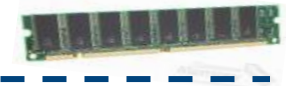
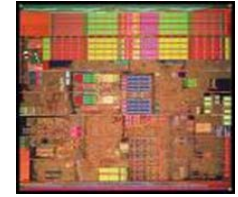
**Slide Included in Compliance with CA 27B/6**

Cloud

# Life before Flash & The Promise



L1 Cache	1ns
L2 Cache	10ns
DRAM	100ns



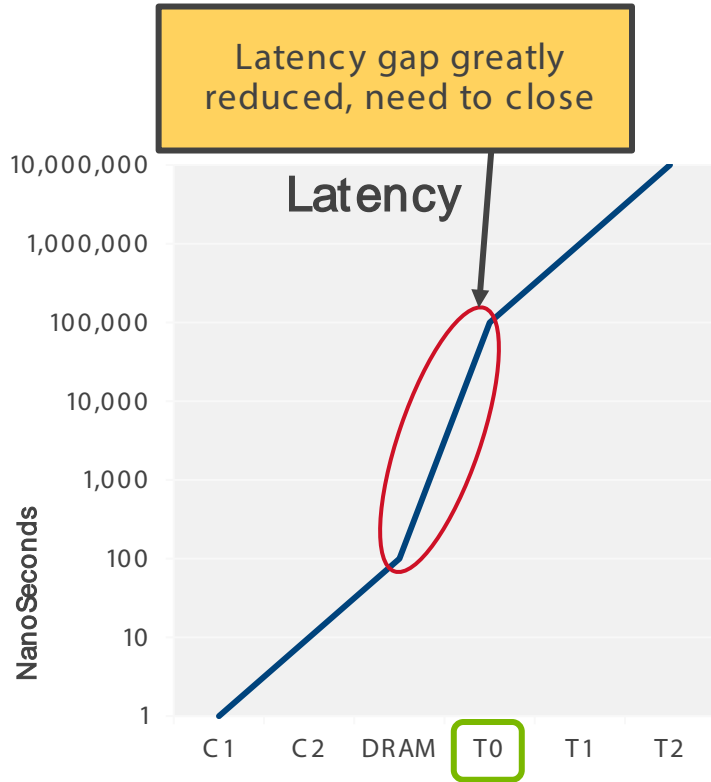
Latency gap  
of ~10,000 X

T1 Storage	1ms
T2 Storage	10ms



The Promise: Flash will close the "Performance Gap"

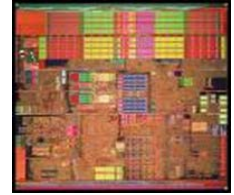
# Today's Actuality



L1 Cache	1ns
L2 Cache	10ns
DRAM	100ns

1000 X

T0 (SSD)	100us
T1 Storage	1ms
T2 Storage	10ms



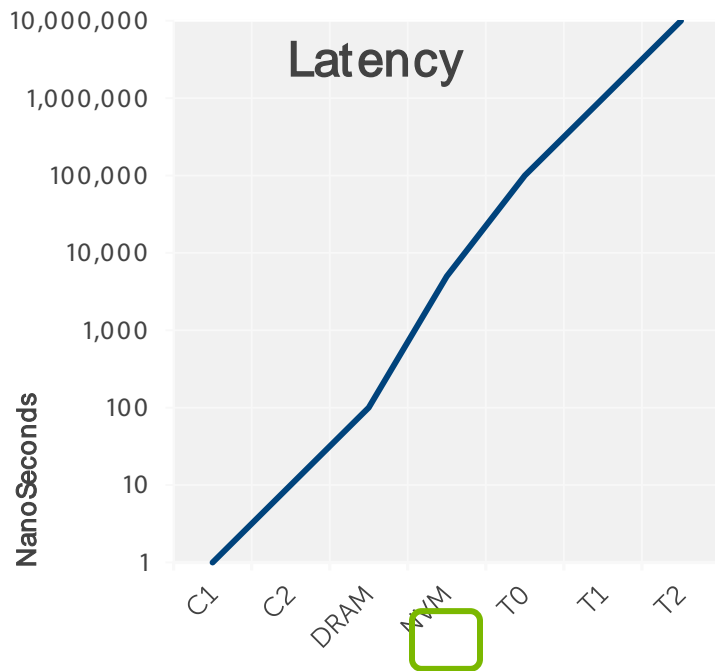
← Industry Focus



New Promise: ??? will close the "Performance Gap"

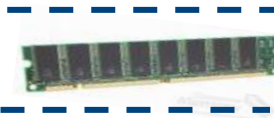
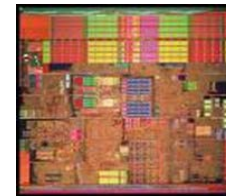


# New Promise toward Balanced End-to-End Solution Performance



Increasing Density

L1 Cache	1ns
L2 Cache	10ns
DRAM	100ns
NVM	1-10us
T0 (SSD)	100us
T1 Storage	1ms
T2 Storage	10ms



← Next Opportunity

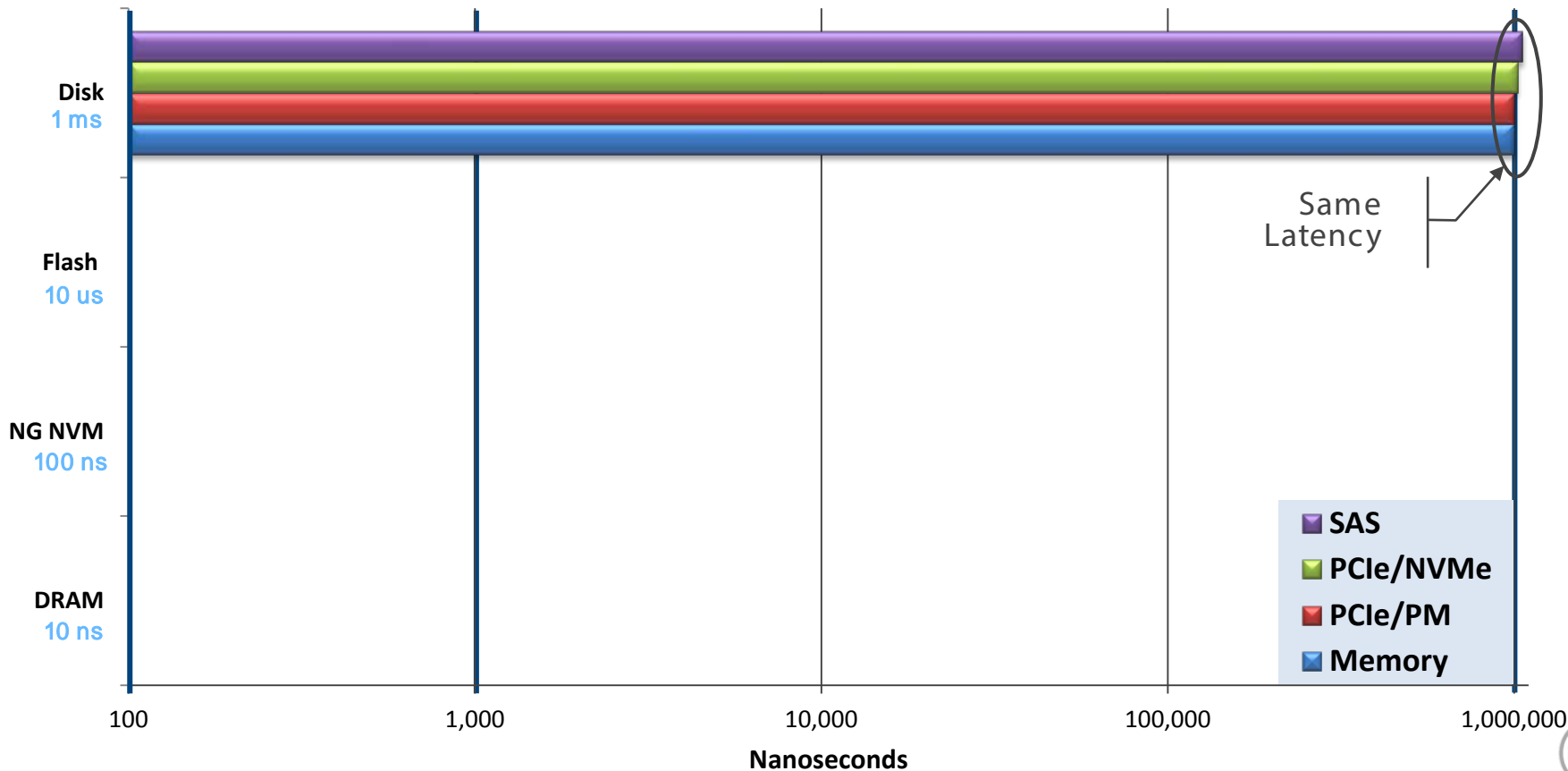
← Industry Focus



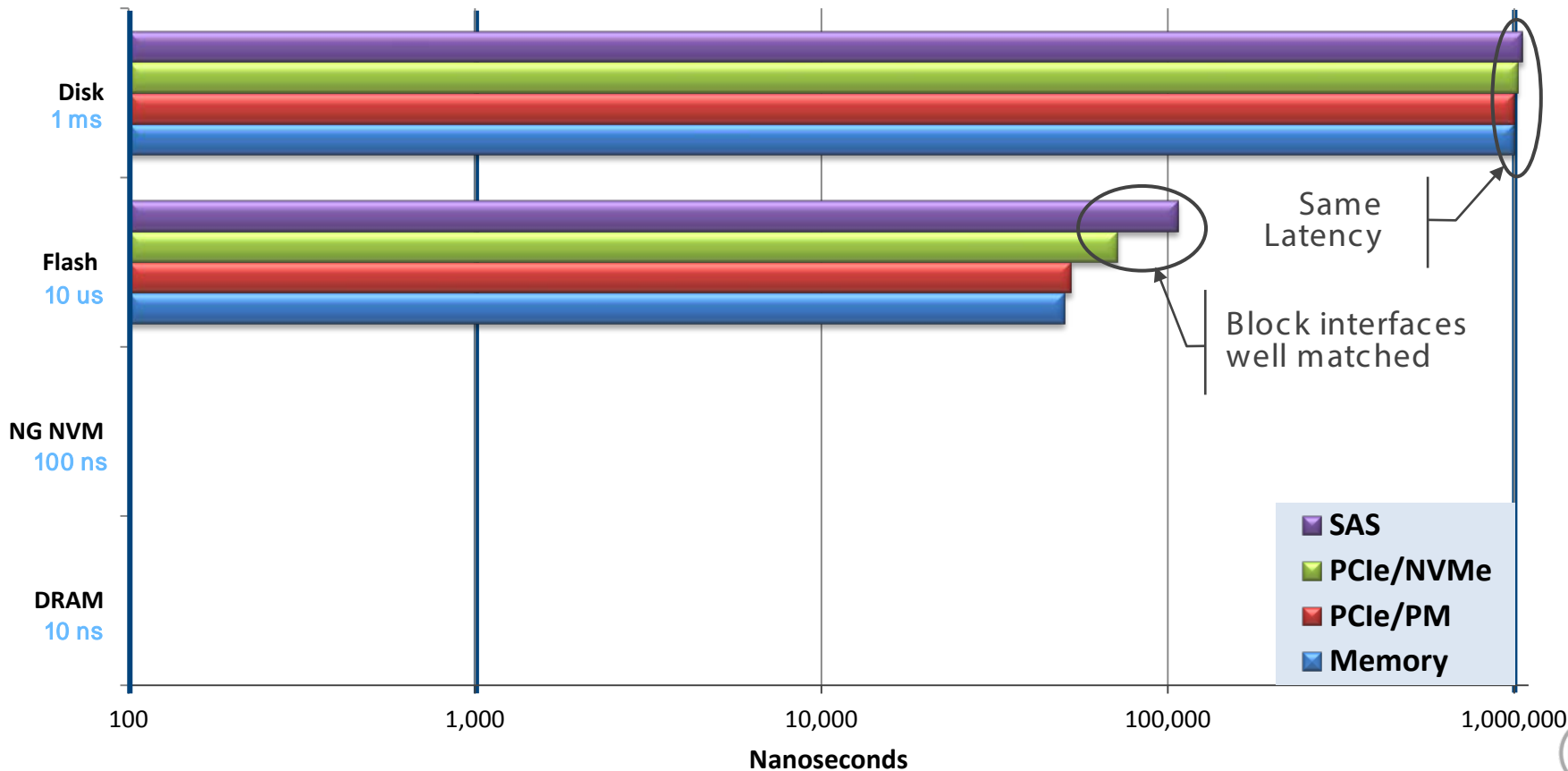
Fulfill the Promise: Closing the "Performance Gap"



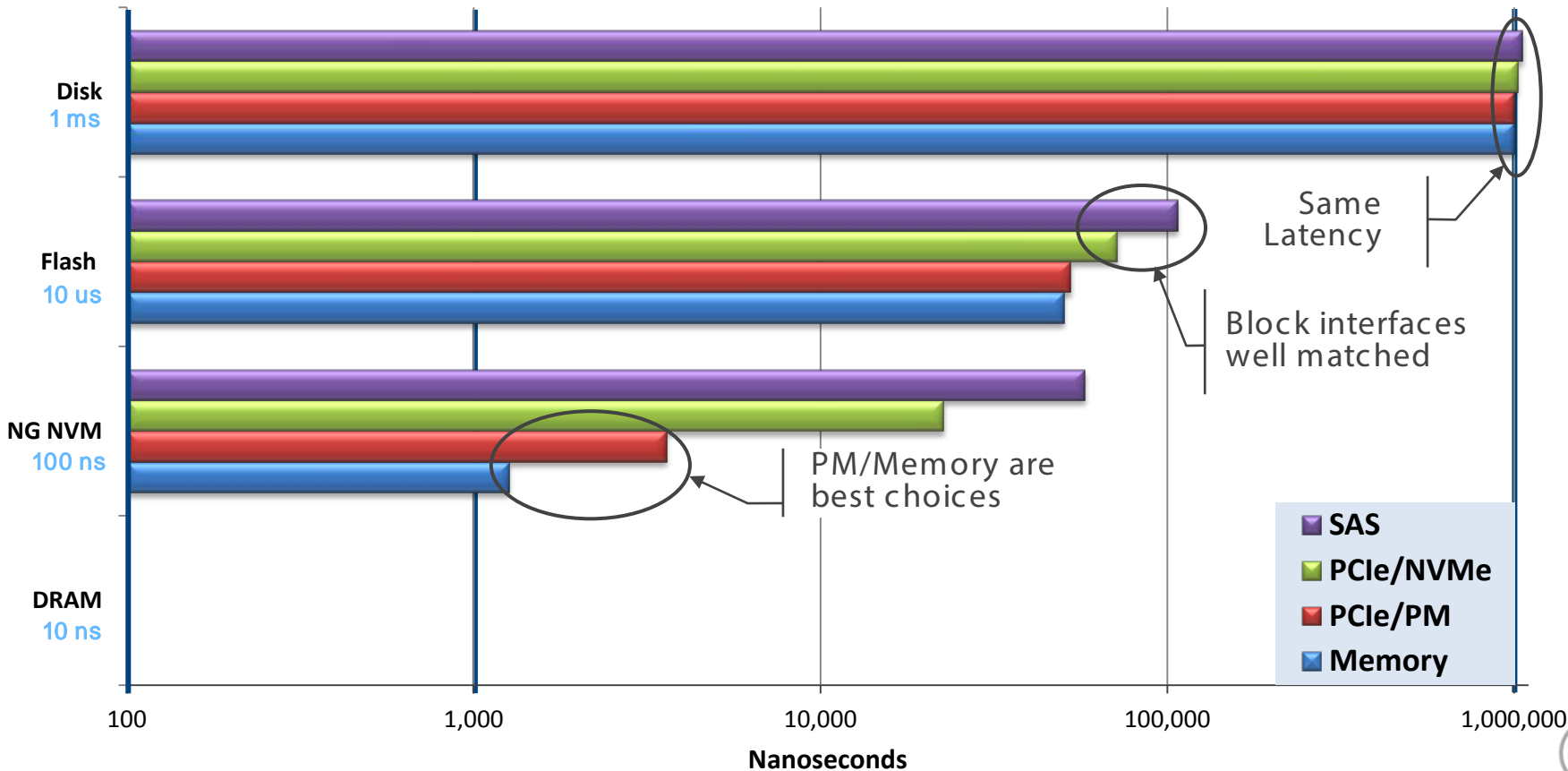
# Balanced End-to-End Latency (& Capacity)



# Balanced End-to-End Latency (& Capacity)

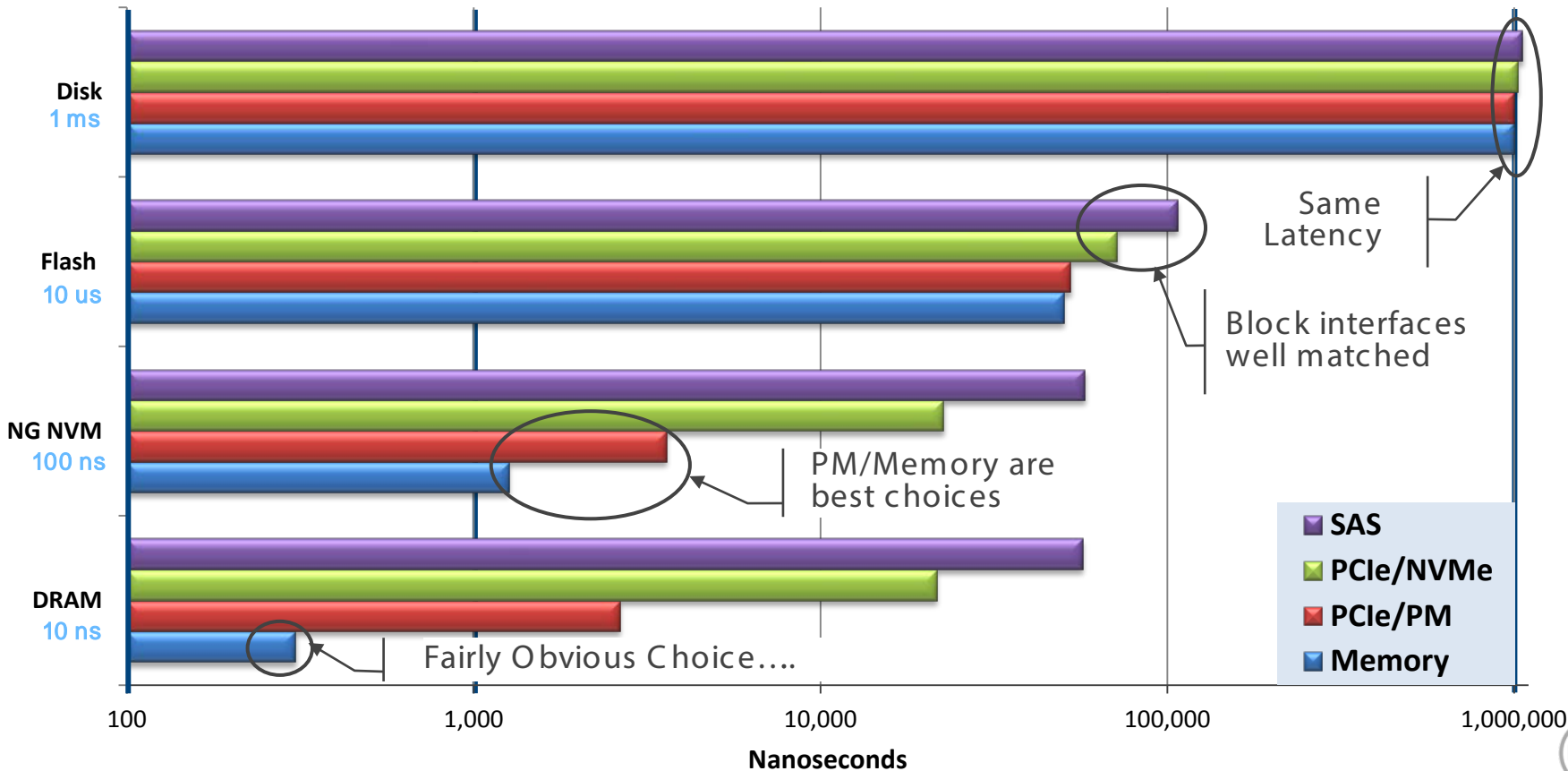


# Balanced End-to-End Latency (& Capacity)





# Balanced End-to-End Latency (& Capacity)



Get the bottleneck away from storage...

Needs End-to-End enablement to bring it home



# Enabling End to End

A blurred photograph of a multi-lane highway with several vehicles, including a white car and a blue truck, moving from left to right. The image is overlaid with a blue diagonal banner in the top-left corner and a dark grey rectangular box on the left side containing text.

Standards

Applications

Flash..Beyond  
Performance

# Embrace Standardization

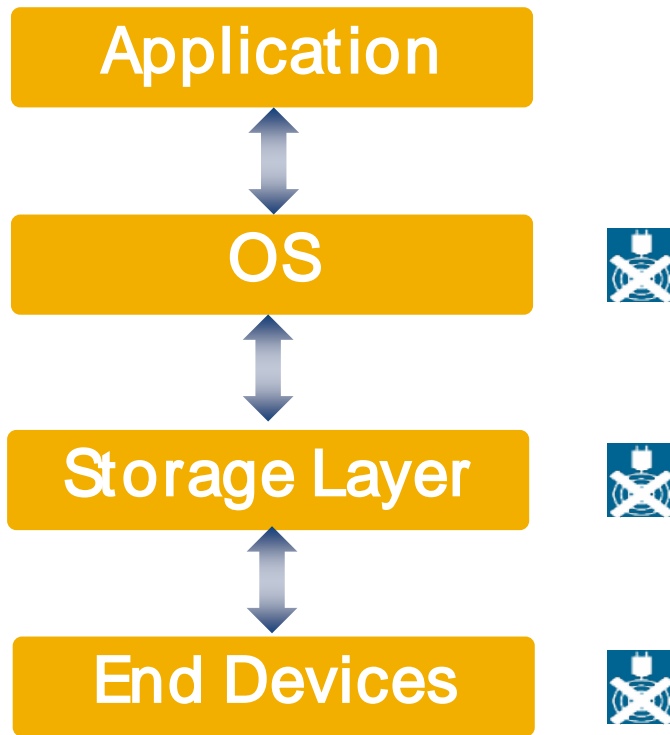


Client

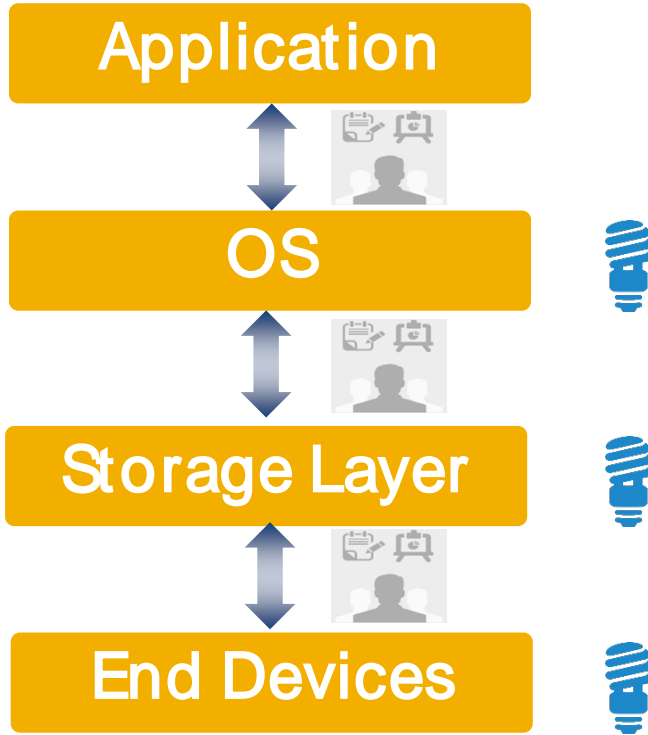
Enterprise



# Enable Application Intelligence



# Enable Application Intelligence



## Results in ...

- *Faster accesses*
- *Higher endurance*
- *Lower power*

# Flash Evolution: Storage Consolidation

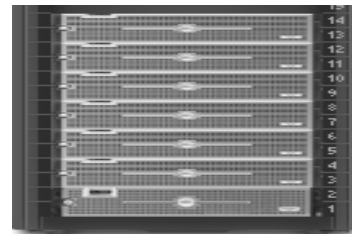


Today: Half Petabyte

7 - 2U Servers  
12 - 3.5" 6TB HDDs

*All Disks*

*All Flash*



Near Future: One Petabyte

7 - 2U Servers  
12 - 3.5" 12TB HDDs

**7x** Density  
**8x** Speed  
**6X** Lower P & C  
**8X** Lower weight

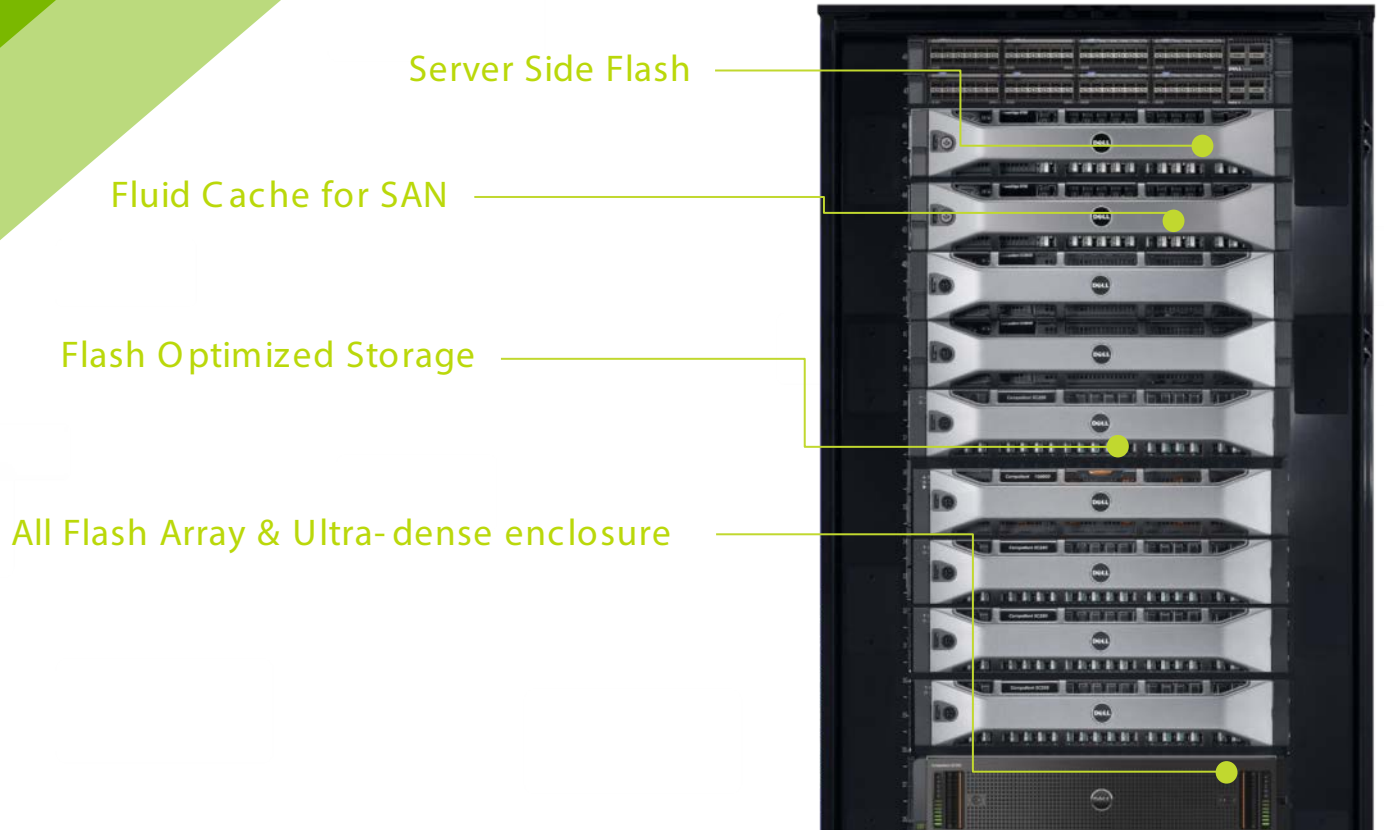


Near Future: One Petabyte

1 - 2U Servers  
24 - 2.5" 42TB SSDs



# Where we are Today





# Bridges yet ahead



Still early in standardization

Logical & Physical Interfaces

Application/OS Intelligence

Form Factors

Error Handling

Performance / Functionality

..creating opportunities for innovation

# Thank You