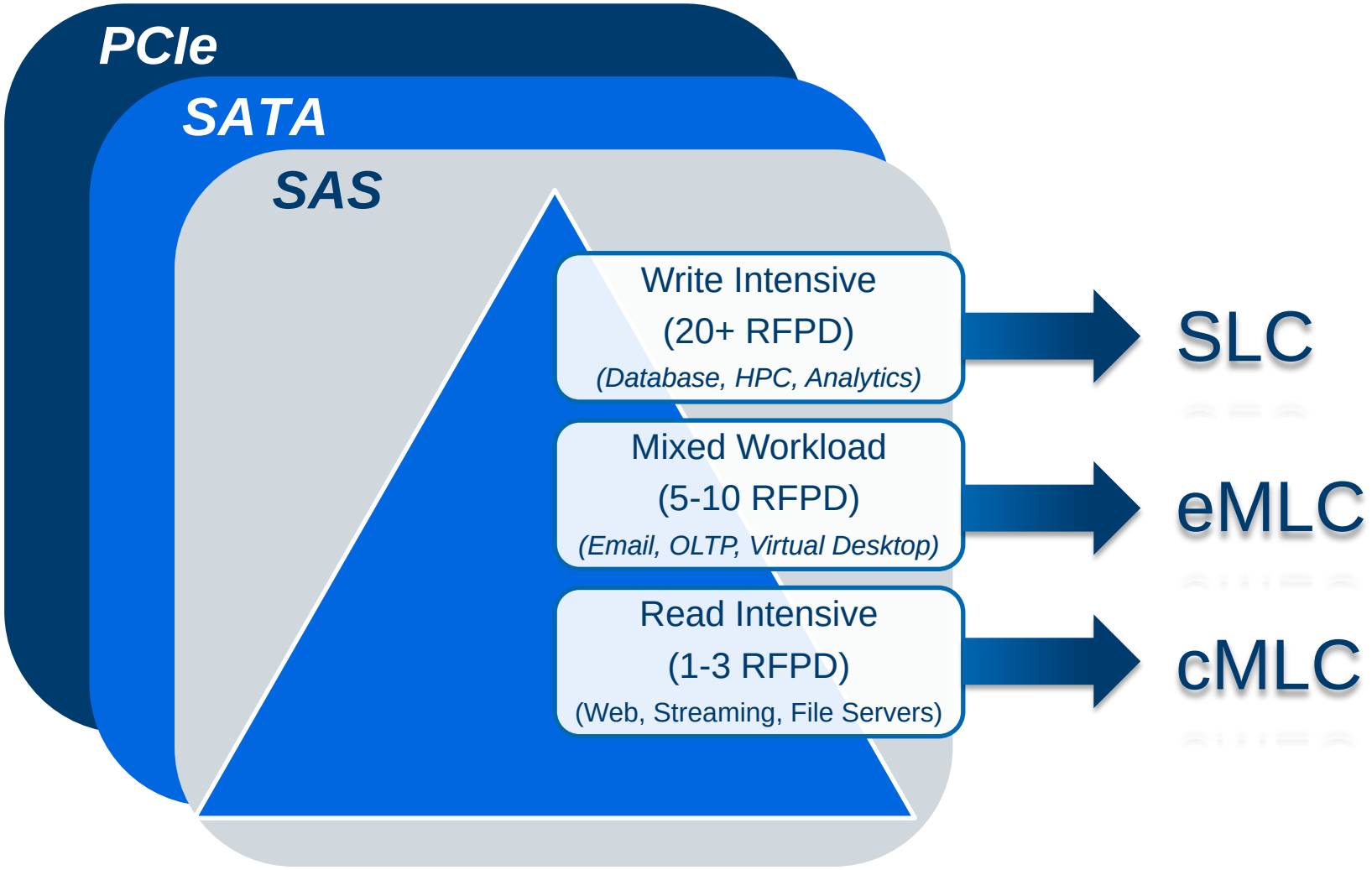
Enterprise SSDs & NAND

Rahul Advani, PhD
Director, Product Marketing
PMC-Sierra

Agenda

- In the beginning…
- How is the landscape changing?
- Challenges & Solutions
- Summary

In the Beginning…



What Changed?

1. The Rise of the Cloud

VOLUME

- 37% of 2016 servers
  12% in 2010 (IDC)
- WW growth
- Evolving business models

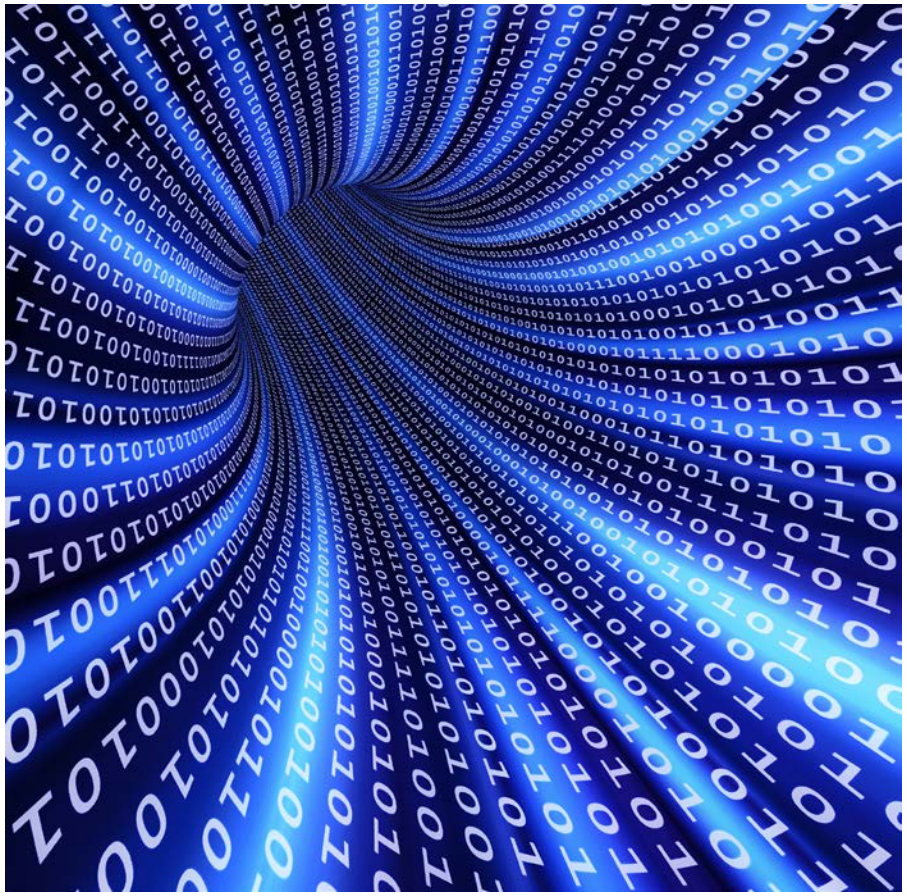
VELOCITY

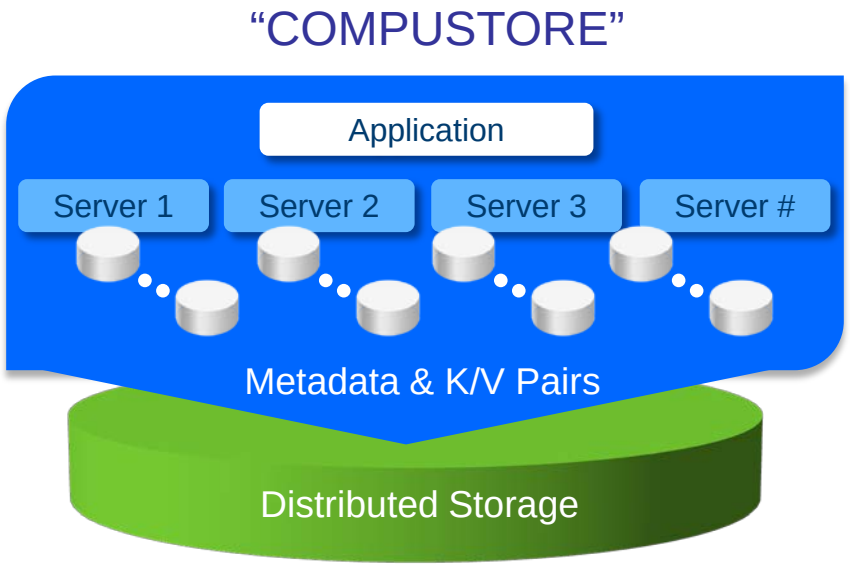
- Technical: Speed/Latency
- Business: Qual & Deployment
- Business Velocity

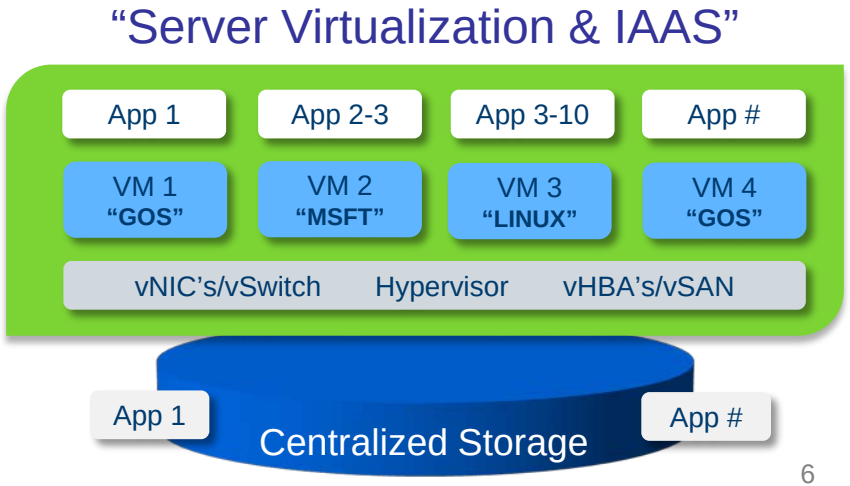
VARIETY

- Shorter life cycles
- Hybrid Pools
  Hot, Warm, Cold
- Scalability
  TB ➔ PB ➔ EB ➔ ZB

2. The Big Data Revolution



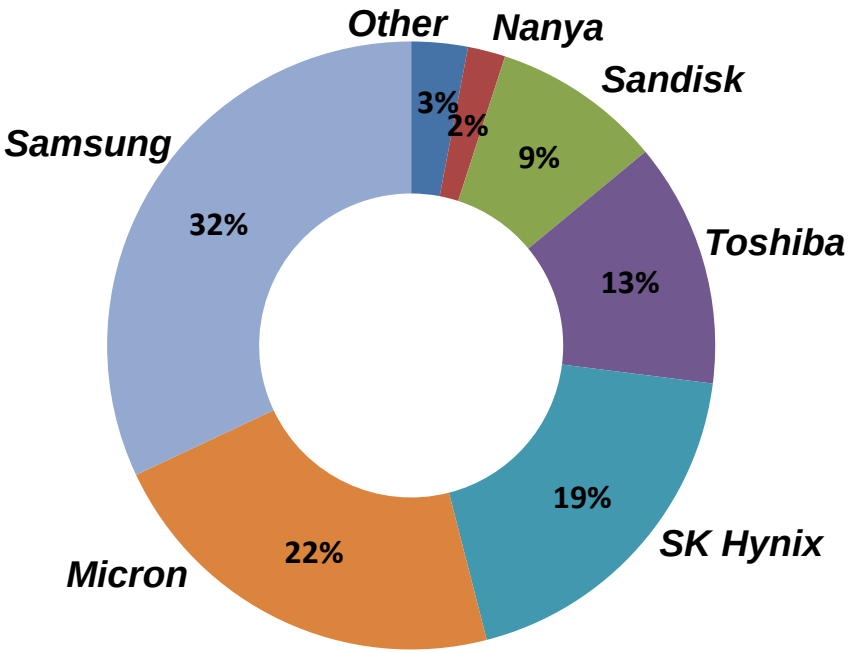




3. The Memory Industry Changed

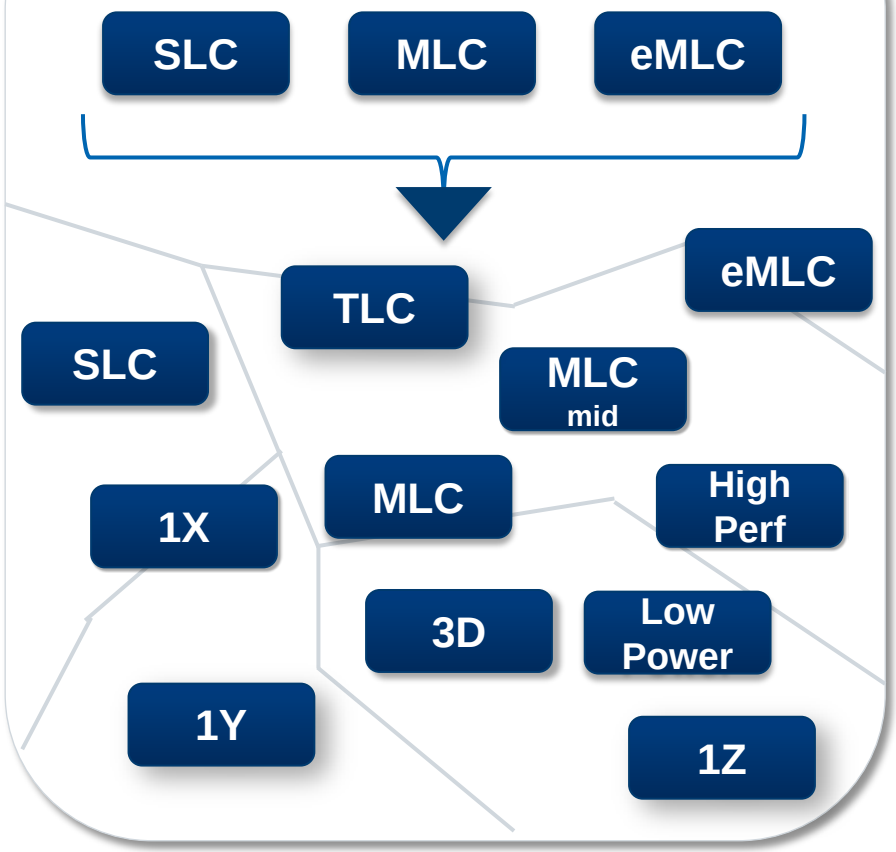
Consolidation

Memory Industry (Revenue)



Consolidation has changed Memory Industry dynamics

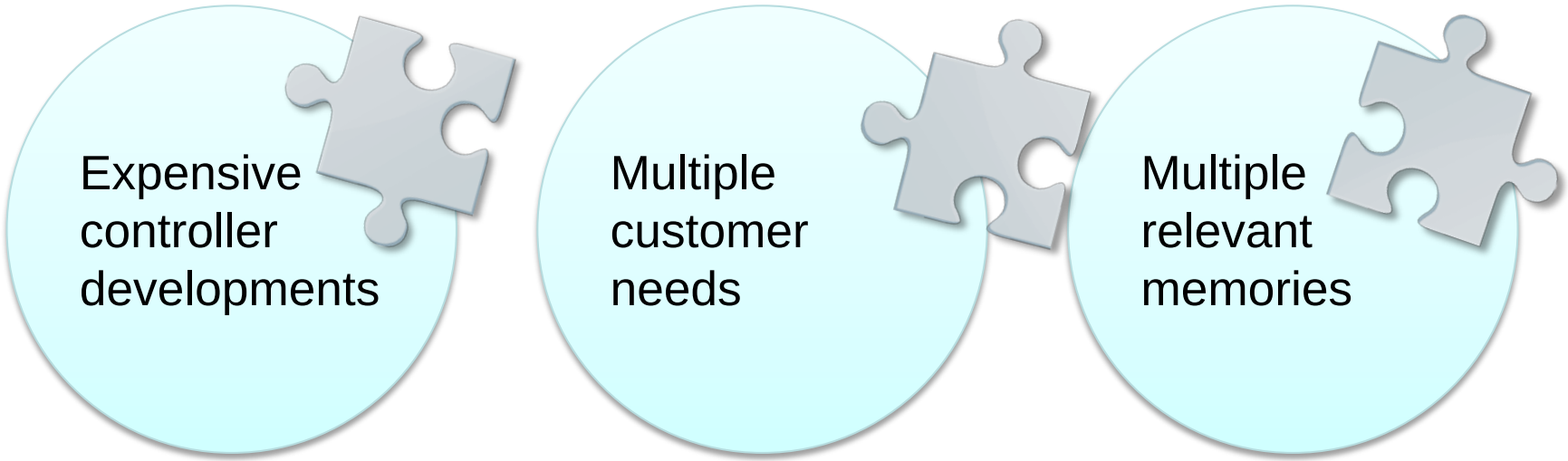
… and Fragmentation



Source: PMC marketing, yahoo.com

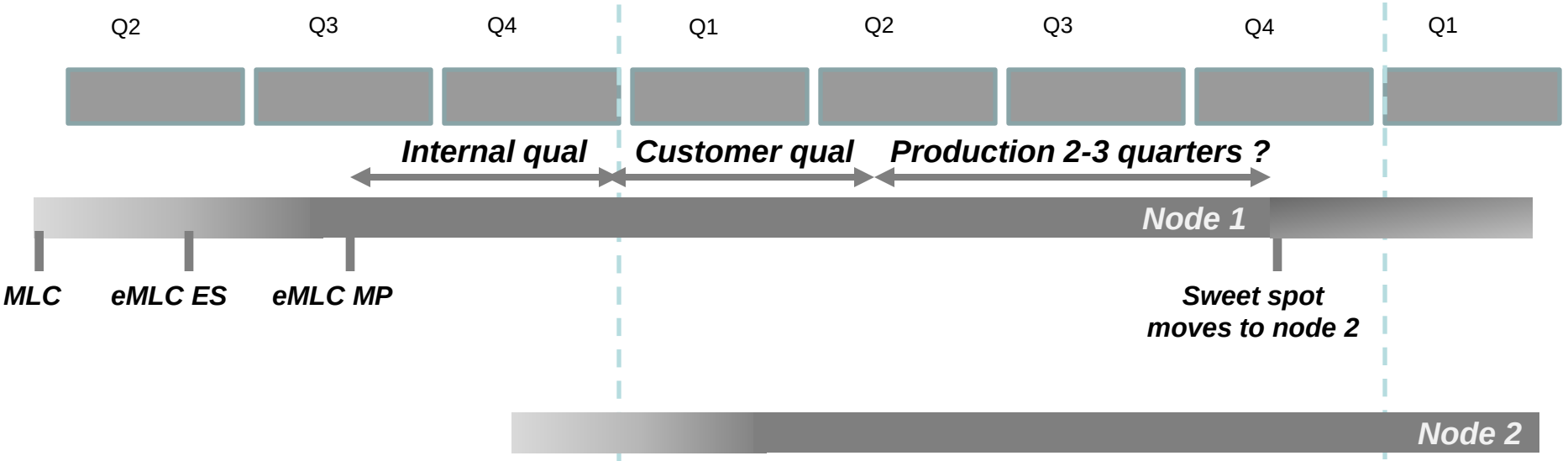
Challenges & Solutions

The Fundamental Challenge



How to satisfy customer needs cost effectively?

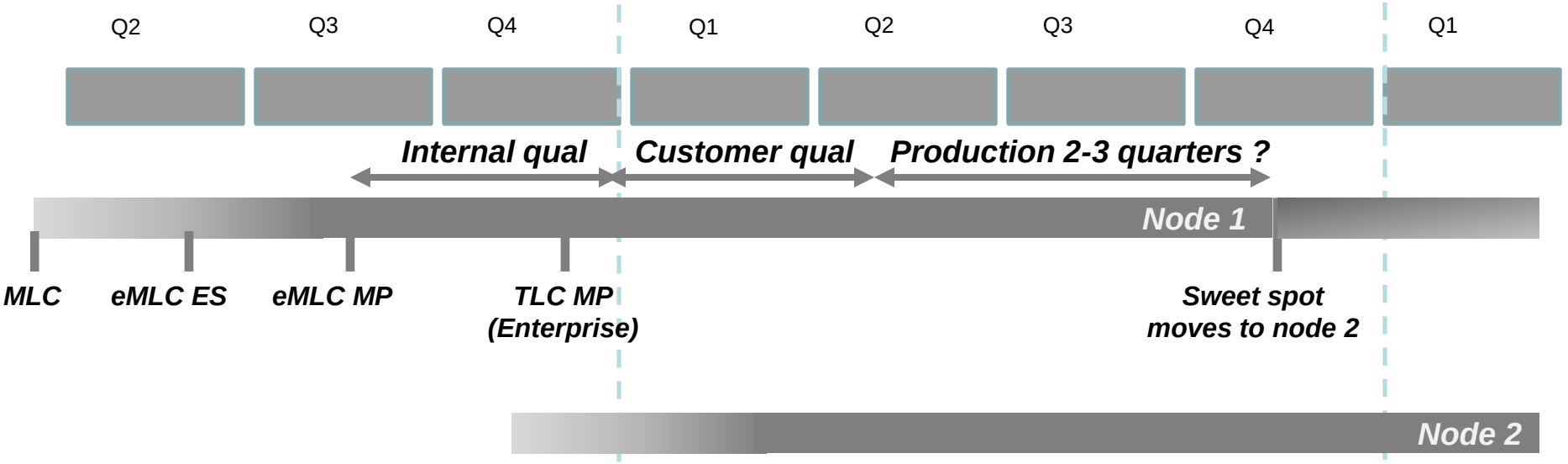
Challenge: NAND & enterprise cycles



Long Enterprise Cycles

Fast Memory Cycles

Challenge: TLC even more difficult…



TLC used in enterprise as cost differential declines versus node 2 MLC

	Performance	Endurance	Cost	Schedule
TLC (vs MLC)	~ 50% or lower	~ 25% or lower	0.8 (N1) ~1 (N2)	+ 2-3 quarters (BGA, ODP+)

Solution: Software Defined Flash

Applications	Platform "Knobs"				
	Power Used	DRAM Density	Flash Density	Flash Type/Cost	Host I/F BW
Cold Storage	○	○	●	○	◑
2.5" SSD (SAS/PCIe)	○	◑	◑	◑	◑
Low/Mid PCIe SSD	◑	◑	◑	◑	●
Enterprise PCIe SSD	●	●	●	●	●
Caching Adapter	●	●	○	●	●

○ **Low** ◑ **Medium** ● **High**

Software Defined Flash Requires a Flexible Architecture

Solution: Standards-based, Interoperable, Flexible Controllers

Standards-based & Interoperable

(RoCs, IoCs, Expanders; RAID, HBA)

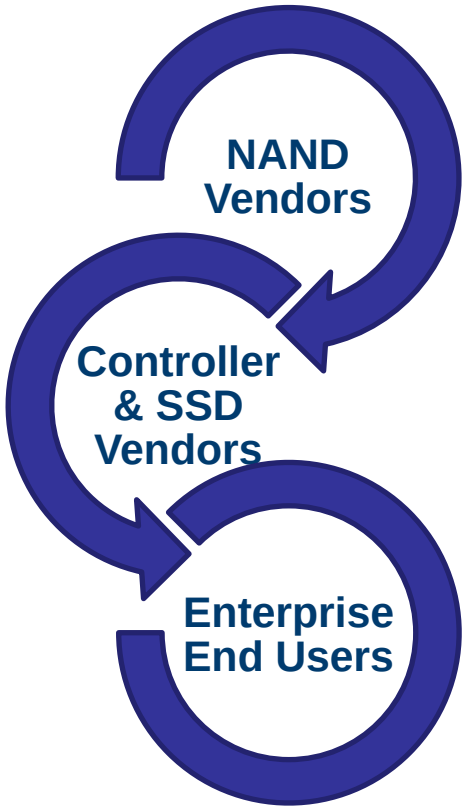
Strong Efficient ECC

(Supports TLC, MLC, eMLC; Planar, 3D)

Flexible Architecture

(Firmware, Channels, Power, Capacity)

Solution: Memory Alignments & Alliances



- Compatibility modes: consistent interface for controllers
- Skip nodes: early and elongated availability of specific
- Architectural: enterprise consistent interface (standards)

- Develop with early NAND
- Drive shorter internal/joint customer quals
- Use of Characterization data

- Memory ‘mini-quals’
- Qualify technologies and not just products

Success between the three is intertwined and dependent on working together to define solutions

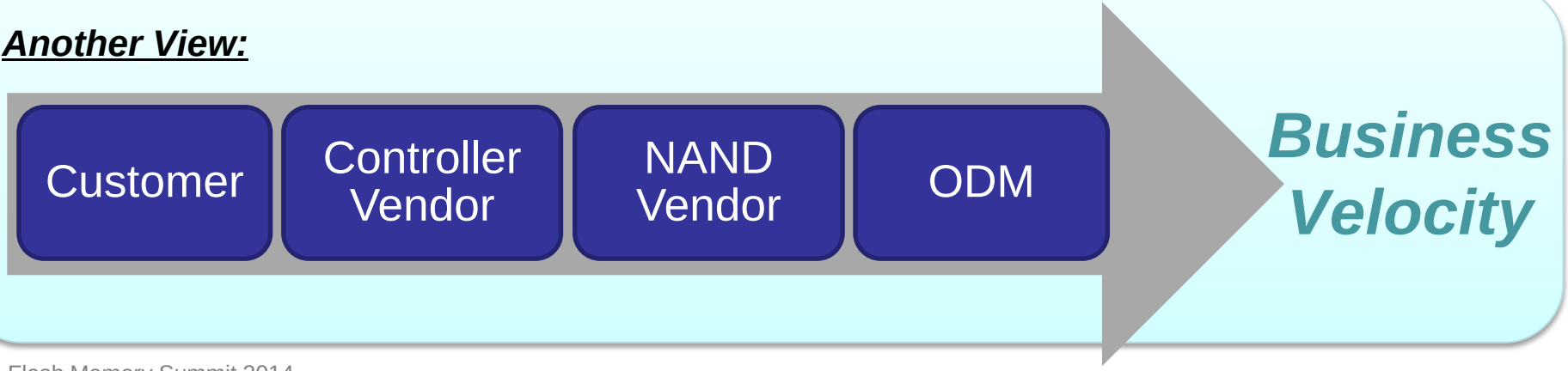
Solution: Business Velocity & TLC

Status: significant discussion in the industry around TLC in enterprise, but only a few point solutions

One View:

- TLC use expected to rise in 3D generation
- LDPC use to extend usage
- Hyperscale markets will lead → timelines & process need to be aligned

Another View:



Summary

Summary

Efficiency

Software Defined Flash

- Flexible Si controller architectures
- Software defined differentiation
- Standard, custom, semi-custom, enterprise, hyperscale

Alignment

Memory Alignments & Alliances

- NAND vendors → 'compatibility' modes; skip nodes
- SSD vendors → develop with early NAND, memory 'mini-quals', use of char data
- End users → memory 'mini-quals', qualify technologies

TLC

Business Velocity & TLC

- Is the goal low cost or TLC?
- Does the product timeline align to TLC?
- Does the business have the velocity (shorter lifecycles, application specific qual cycles)?

Thank You!

See us in booth # 416

www.pmcs.com

blog.pmcs.com @pmcsierra