

Using a Persistent Memory Cache With a High Speed Client SSD

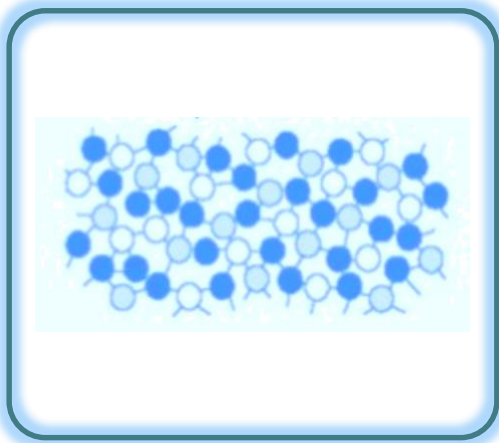


Stanley Huang

Director of Product Marketing

Types of Persistent Memory

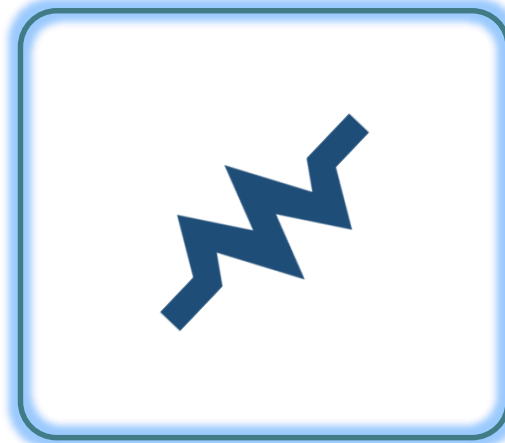
Intel 3DXpoint
(PCM)



M-RAM



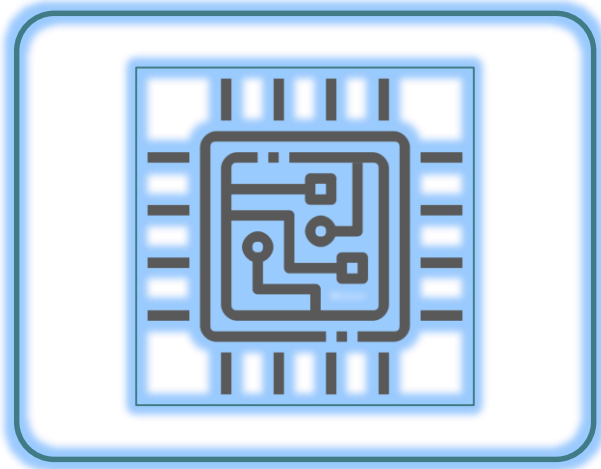
R-RAM



Low Latency
SLC NAND

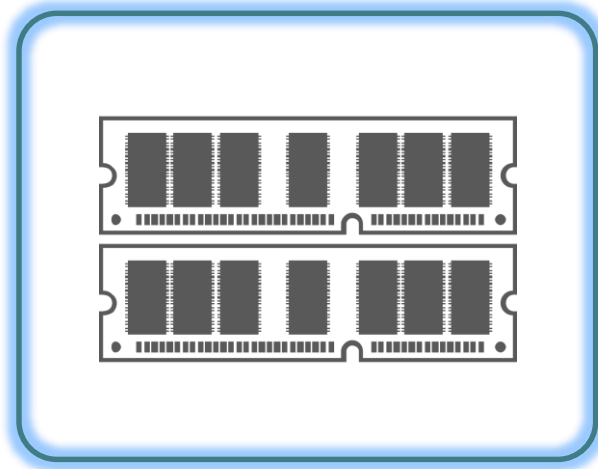
Z-NAND
XL-NAND

Where Do We Use Persistent Memory



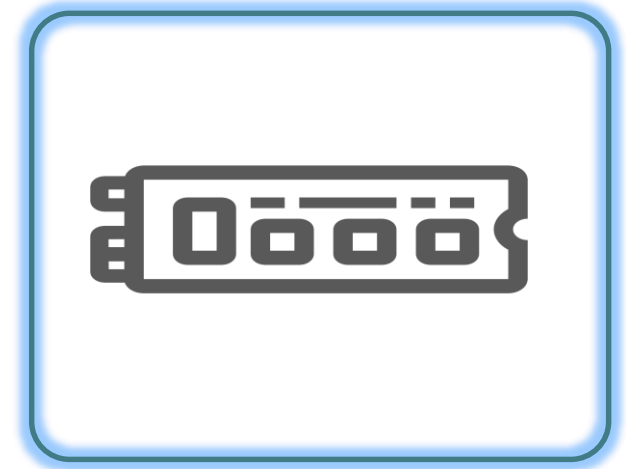
Embedded

e-Flash replacement



NV-DIMM

Storage Class Memory (SCM)

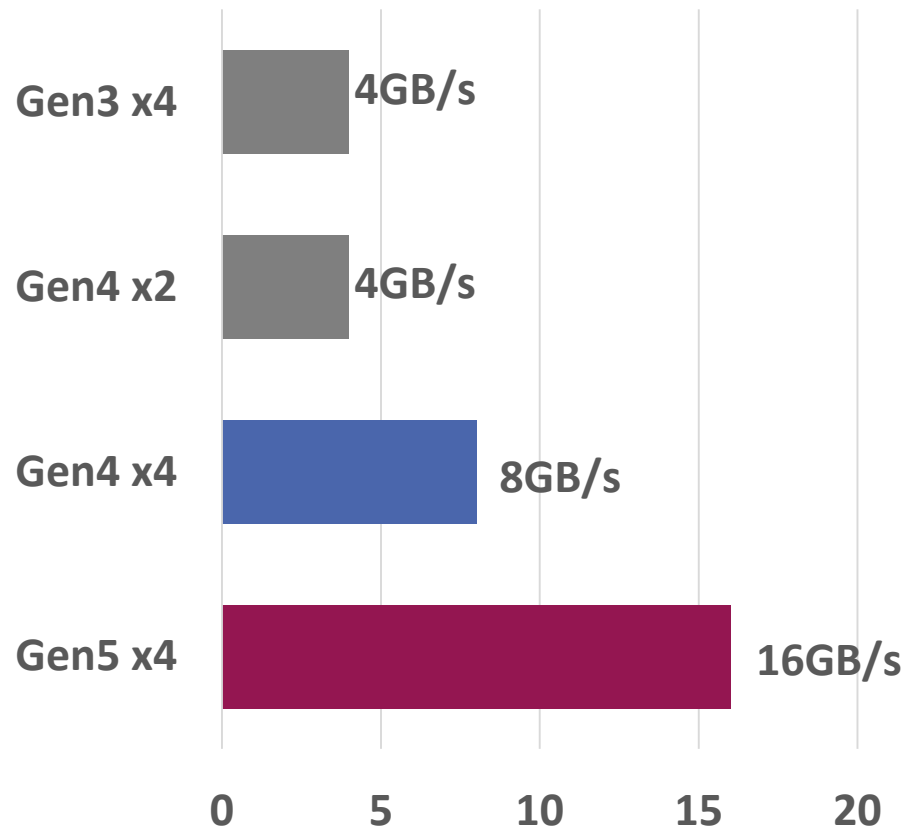


SSD

Low latency SSD

Why Do We Need Persistent Memory on SSD?

PCIe Theoretical Bandwidth

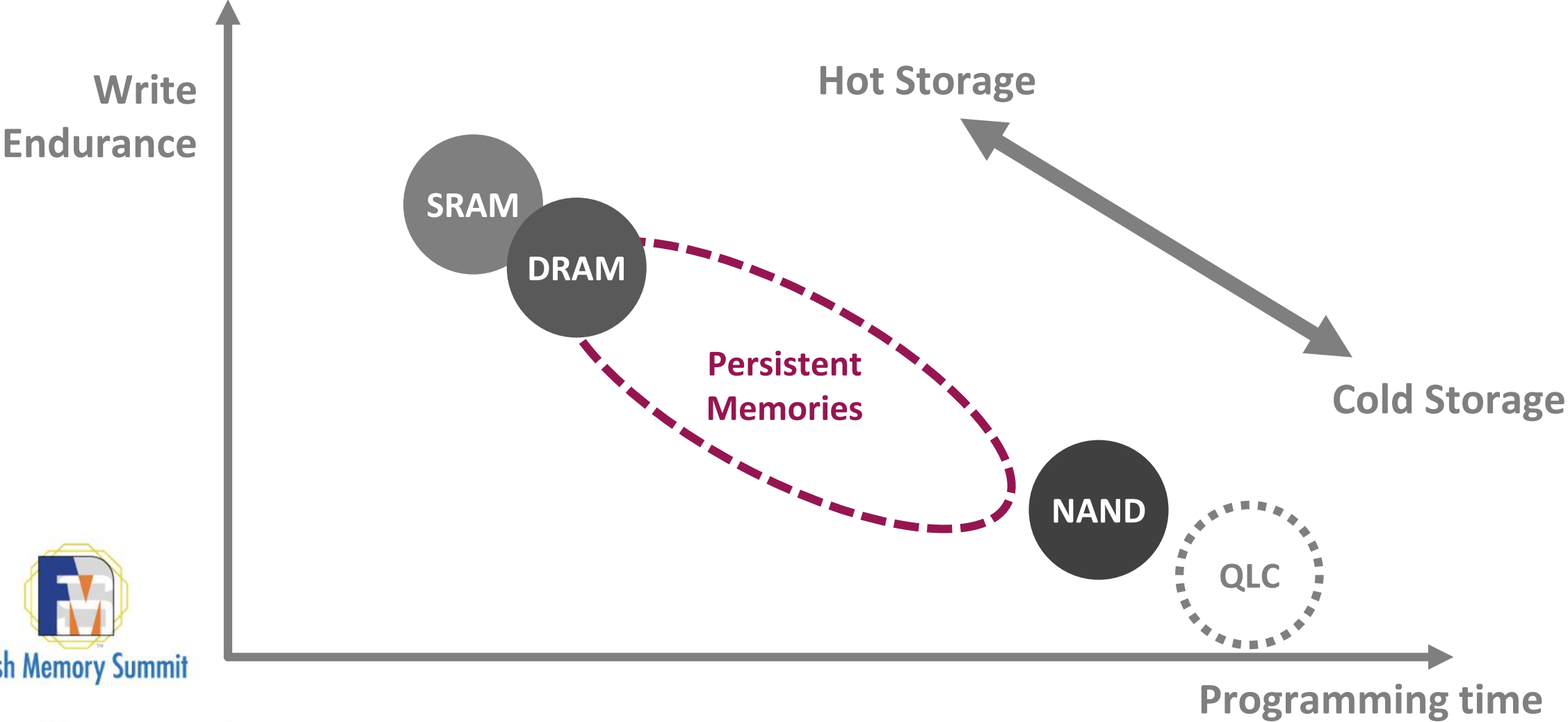


	96L 3D NAND (1)	96L 3D NAND (2)	Intel 3DXpoint	Low Latency SLC
Die Capacity	64GB	64GB	16GB	16GB
Page-Plane	16KB-4Plane	16KB-2Plane	-	4KB-4Plane
I/O	1,200MT/s	800MT/s	1,600MT/s	1200MT/s
tR	~80us	~80us	<100ns ^(*1)	<6us ^(*2)
Read Throughput	487MB/s	270MB/s	1,600MB/s	777MB/s
#Die (Capacity) for Gen4x4	15 (0.96TB)	27 (1.72TB)	5 (80GB)	10 (160GB)
#Die (Capacity) for Gen5x4	30 (1.92TB)	54 (3.45TB)	10 (160GB)	20 (320GB)

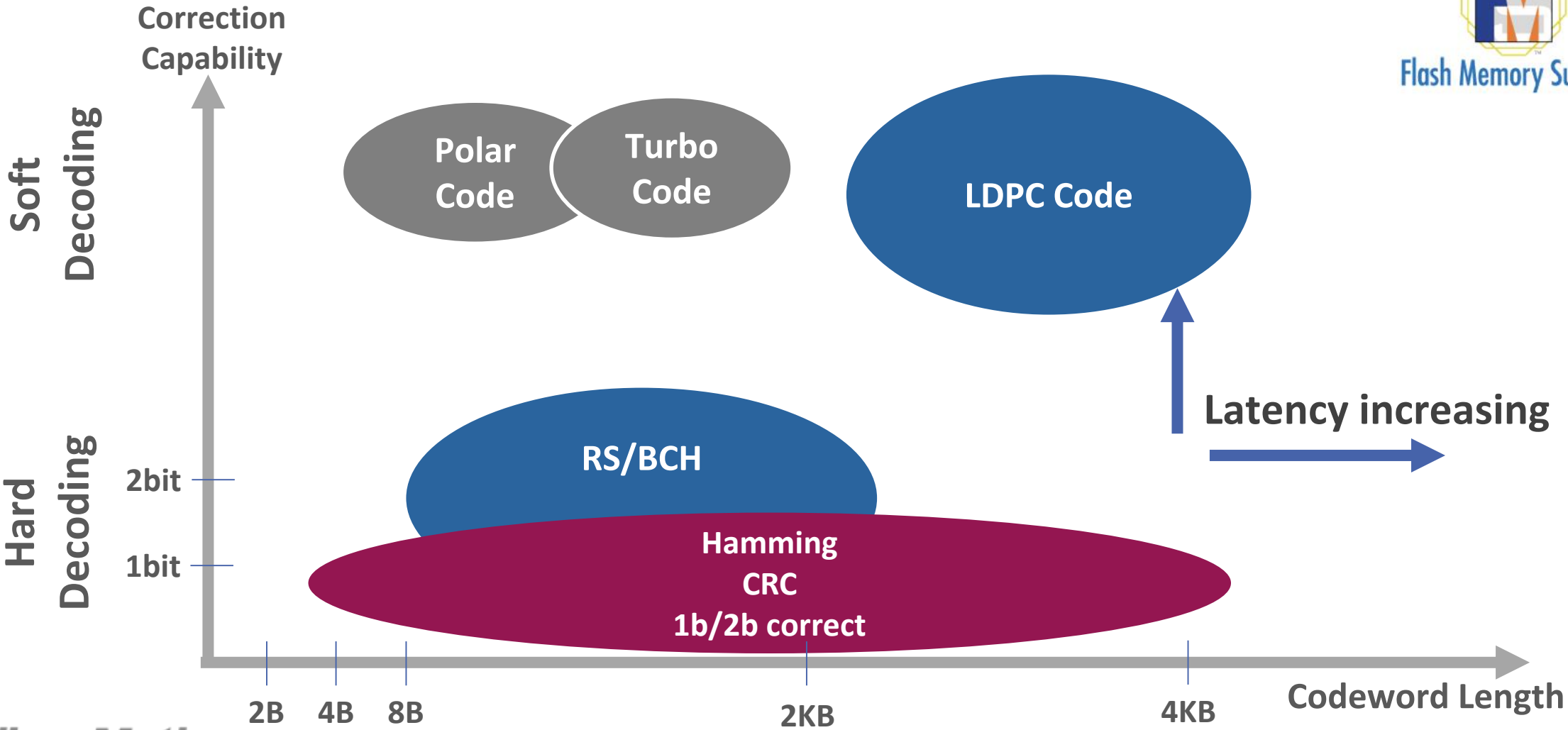
(*1): https://www.flashmemorysummit.com/English/Collaterals/Proceedings/2018/20180806_PreConC_Webb.pdf

(*2): FMS Keynote

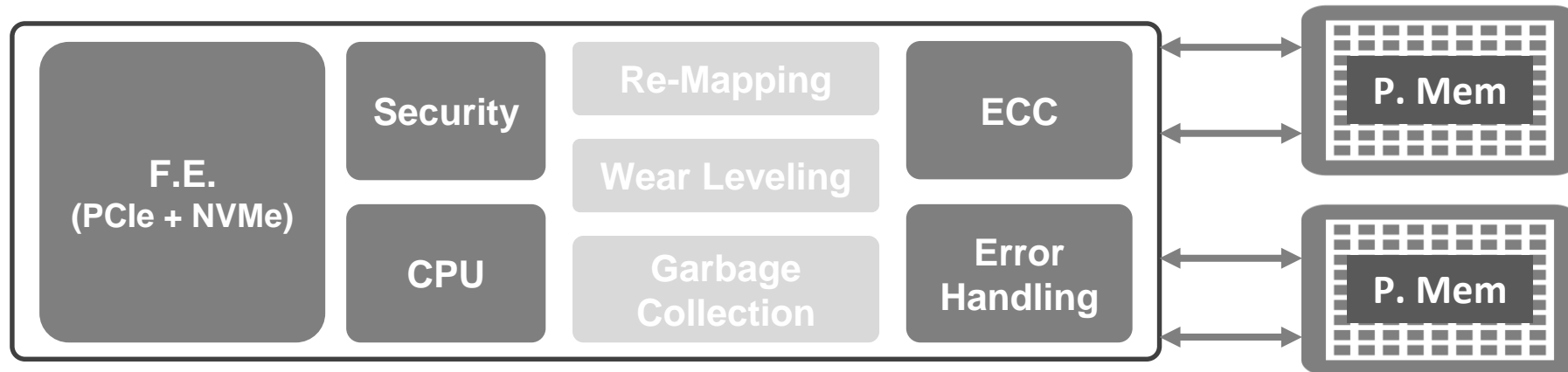
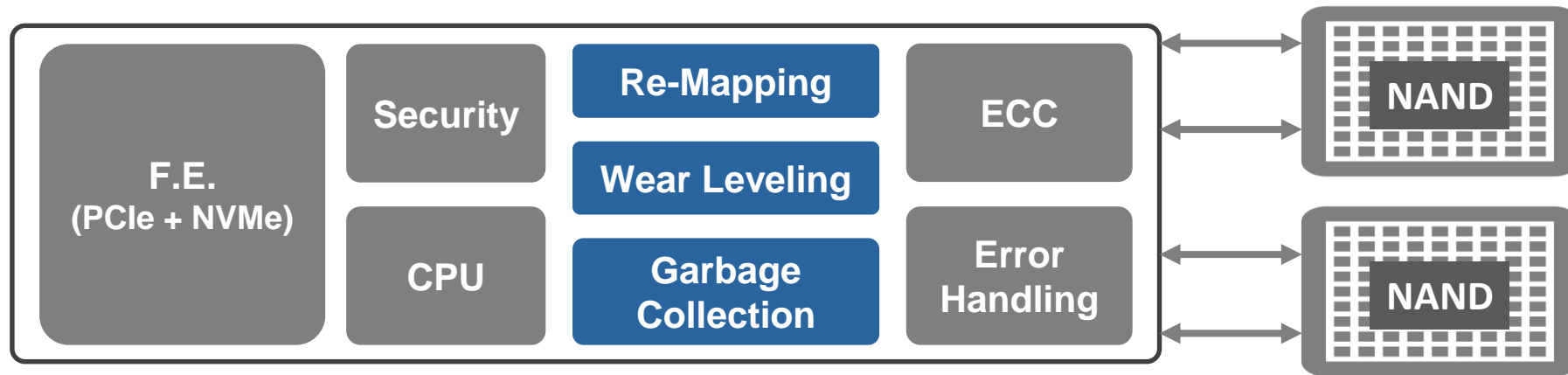
Endurance and Program Time of Different Memories



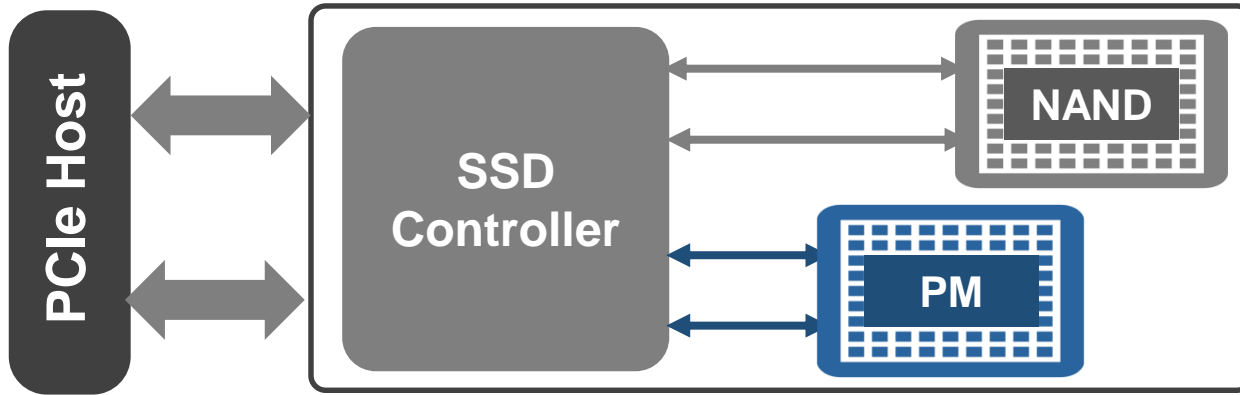
Persistent Memory Require Lighter ECC than NAND



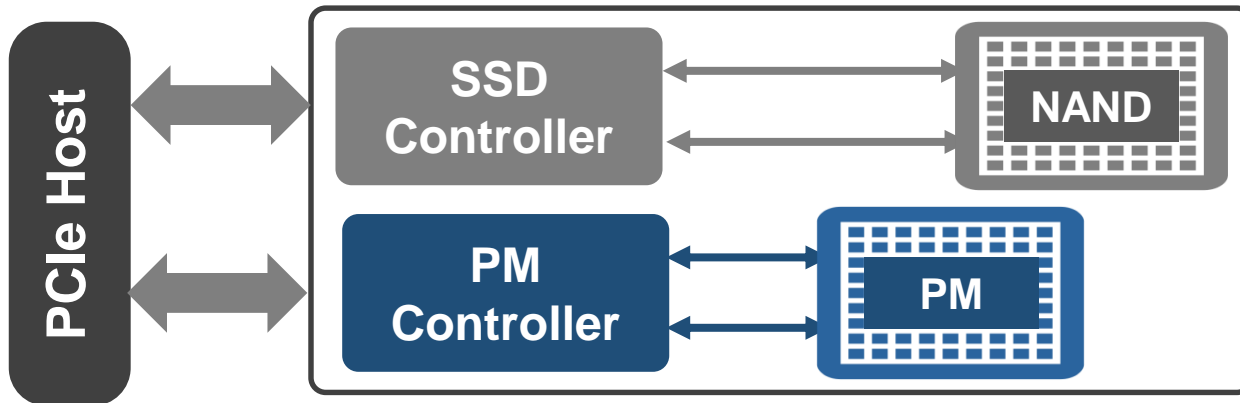
Persistent Memory and NAND Controller Structure



Using Persistent Memory Cache with NAND SSD



- DRAM replacement for table and data
- Bigger PM sustains peak performance longer
- Suitable for different platforms



- Cache operation done on host side
- Supported by specific host platforms
- Cache driver can be optimized continuously

The Concerns To Manage Different Persistent Memory

- Persistent Memory **Interfaces** are different
 - DDR4, Proprietary, NAND, CLX
- Persistent Memory **Controllers** are different
 - Command type, sequence, ECC
- Persistent Memory **Failure Mode** are different
 - Different type PM have totally different failure models

Summary



- 3D TLC/QLC NAND hardly saturate PCIe Gen4/Gen5 bandwidth
- 3DXpoint is known as the only one high density persistent memory
- Using persistent memory balances the performance and drive capacity
- No a single controller can support different persistent memory
- SMI welcomes the idea of working with persistent memory suppliers



SiliconMotion

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