A New Era in Embedded Flash Memory

by

Ariel Maislos, President

Anobit Technologies

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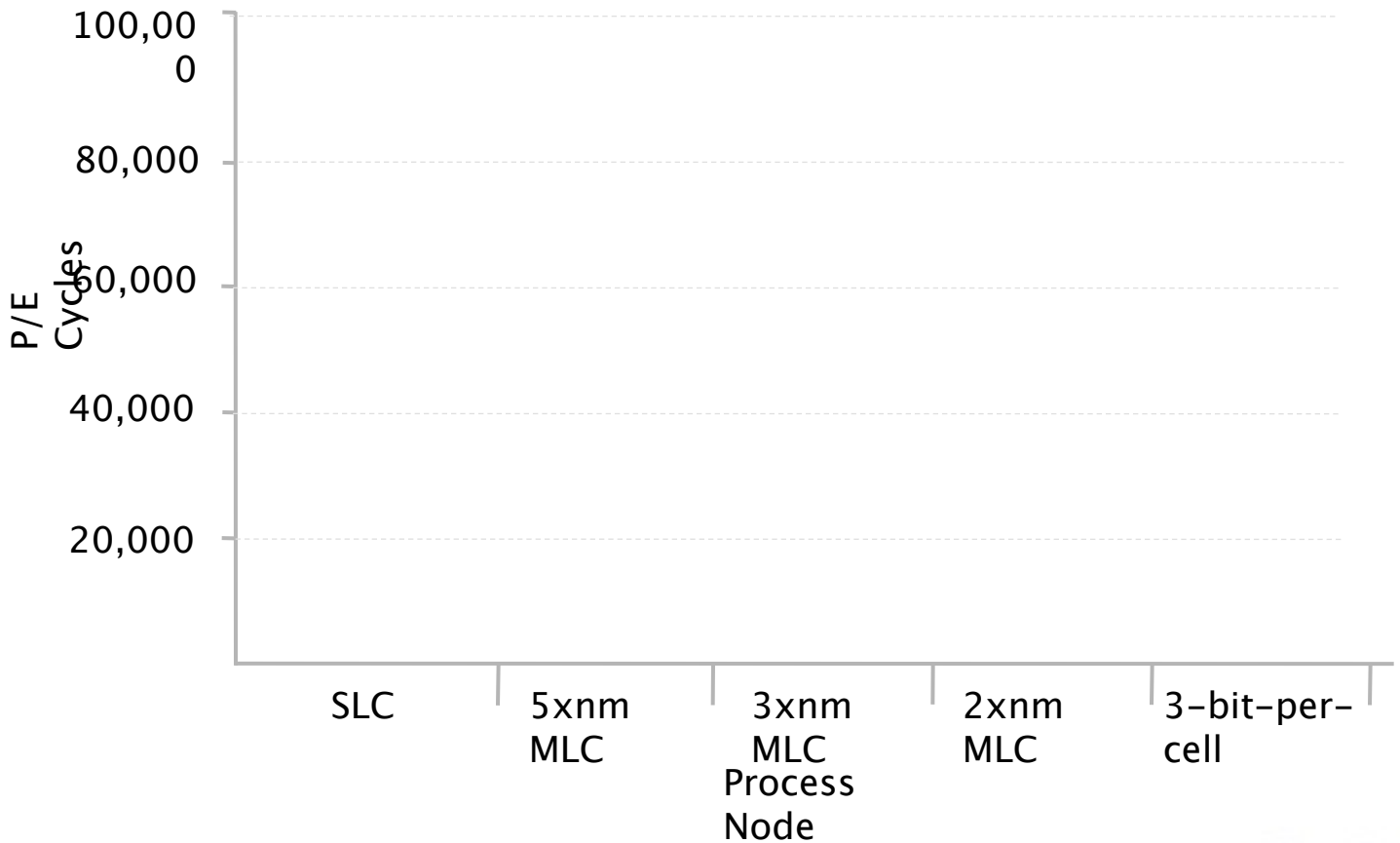
NAND Flash Evolution



Source: Morgan Stanley Research

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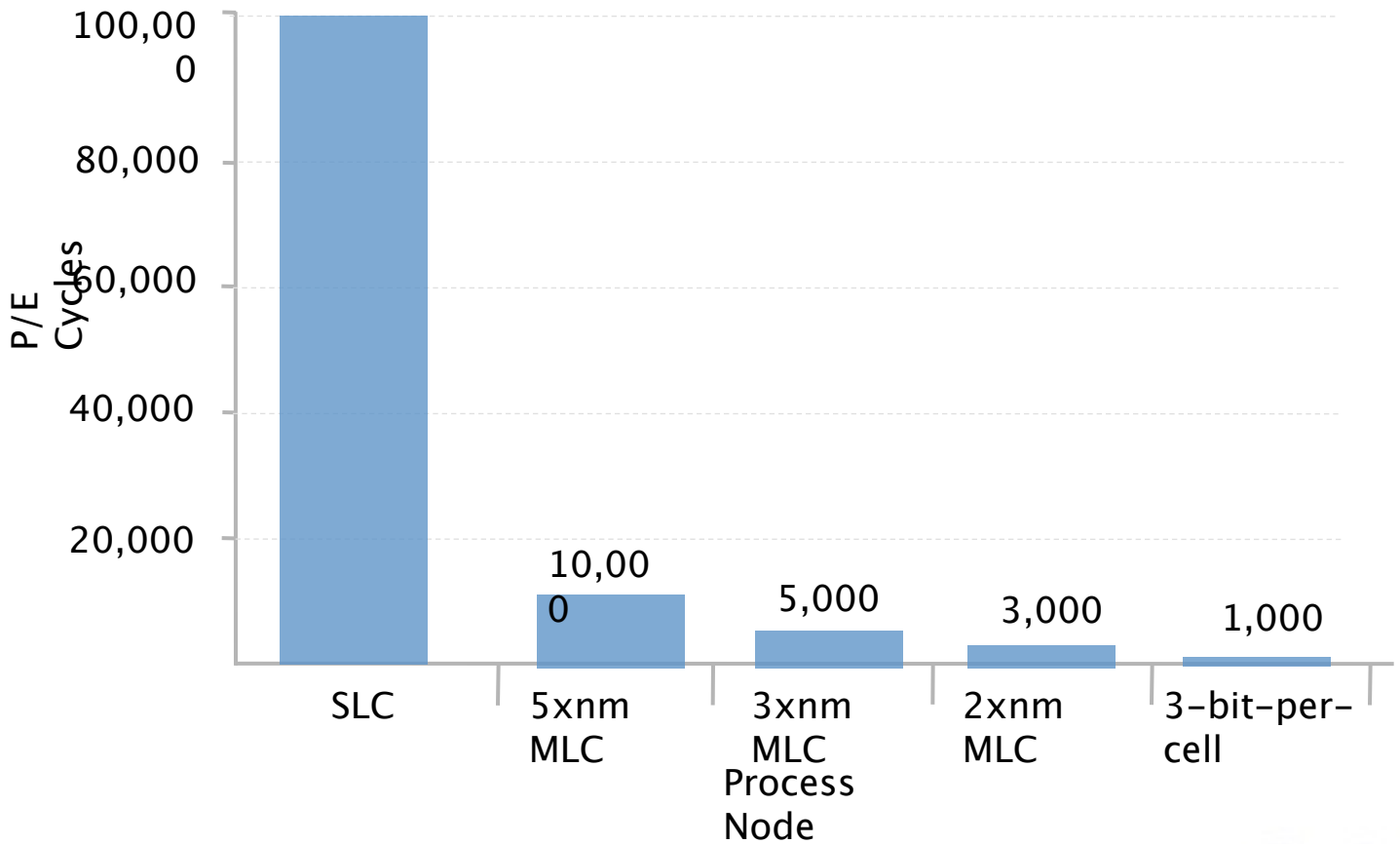
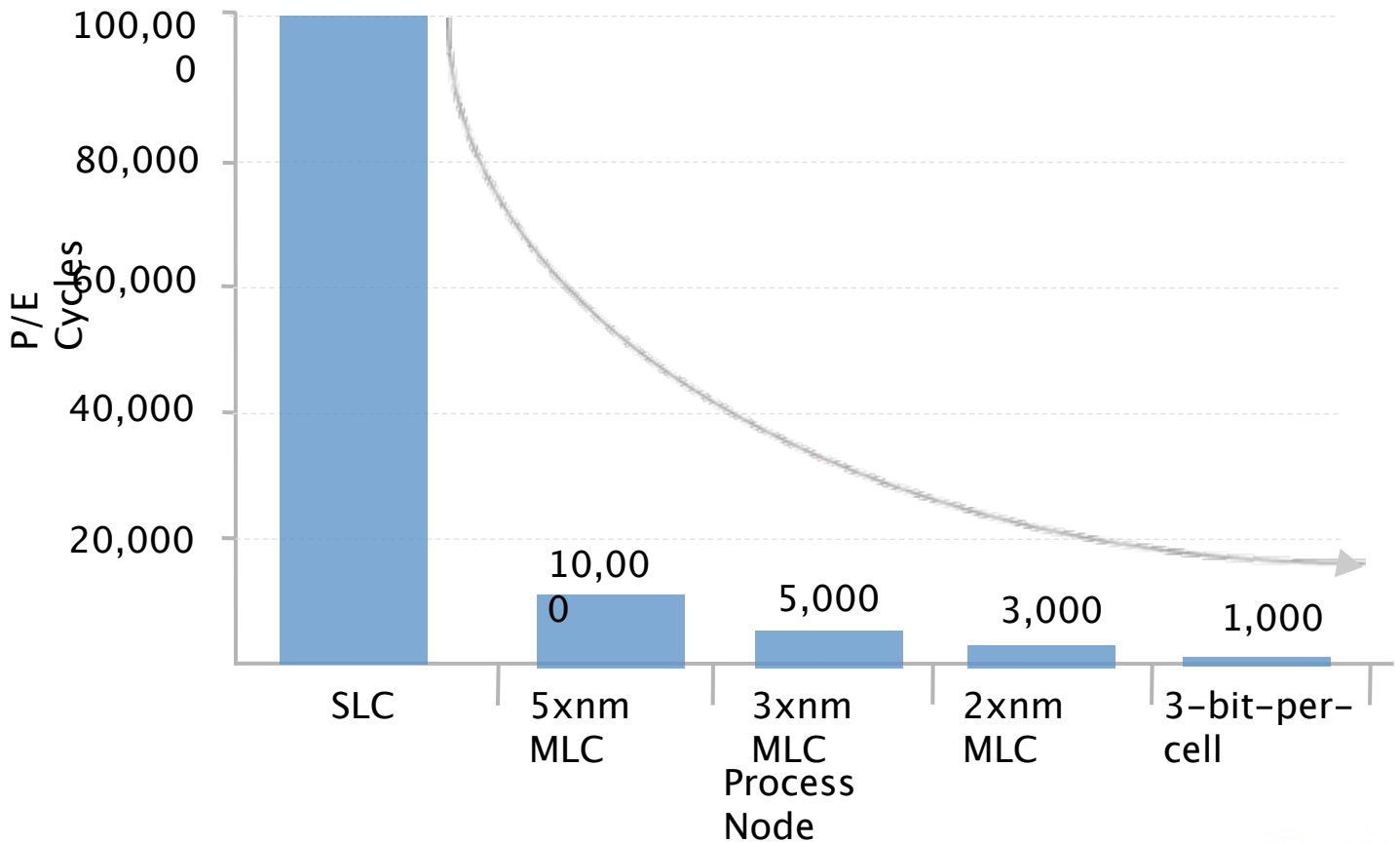
NAND Flash Evolution



Source: Morgan Stanley Research

NAND Flash Evolution



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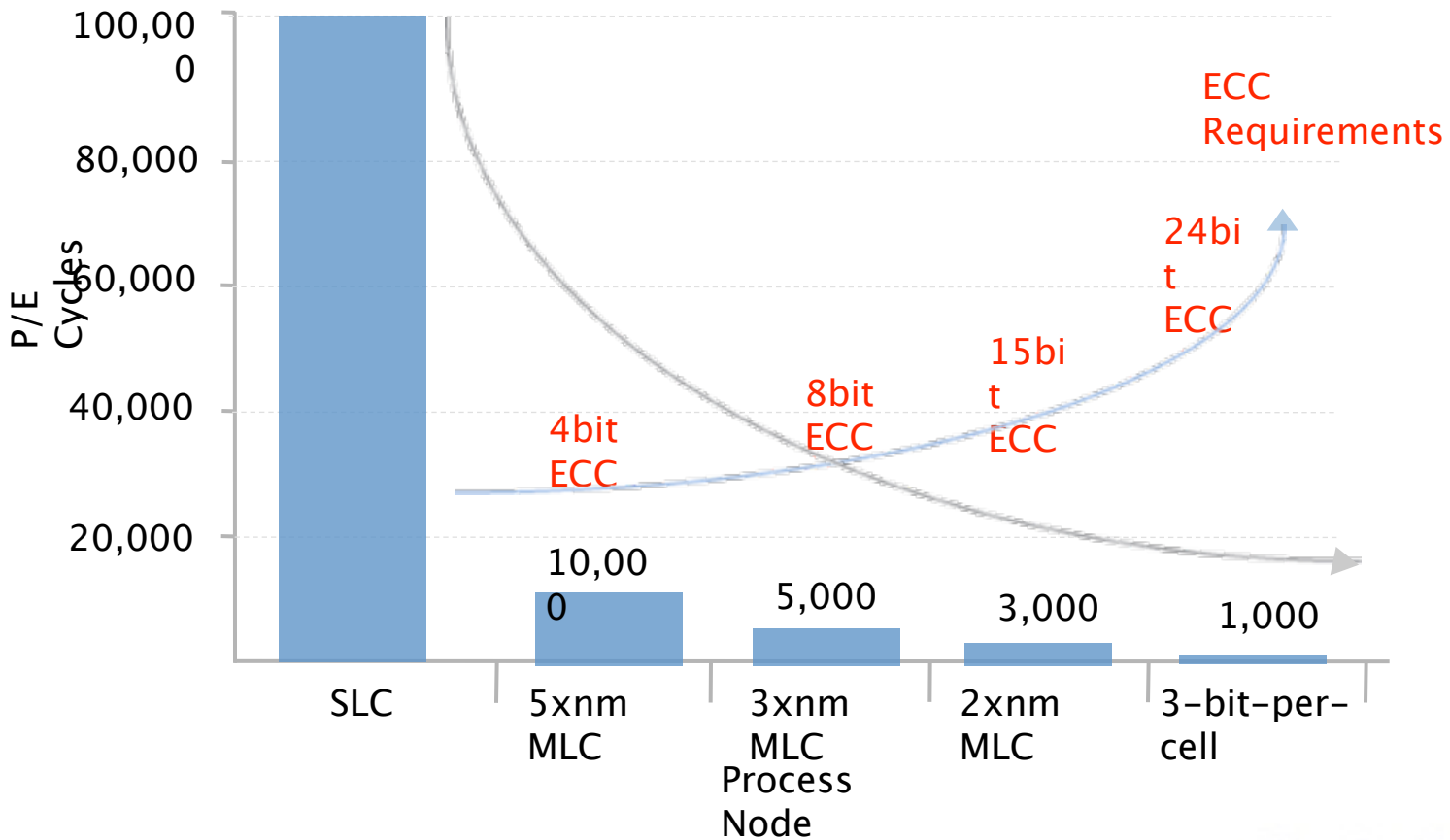
NAND Flash Evolution



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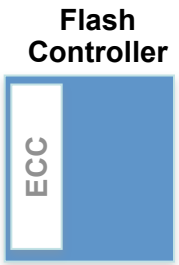
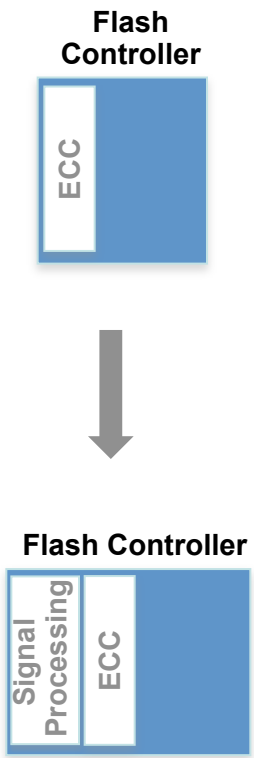
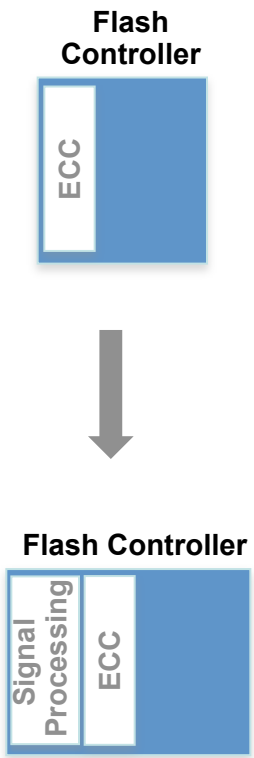
Flash Controller Evolution



Flash Controller Evolution

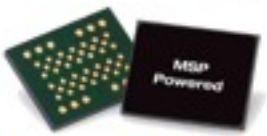


Flash Controller Evolution



MSP™ – Memory Signal Processing

77 patent applications (19 granted)



Boosting Endurance by X20

Error Reduction

- **Compensates for process and array impairments**
  Cross coupling, Read disturbs, Program disturbs, Data retention impairments, Endurance impairments

Error Correction

- **Advanced ECC with improved error correction capabilities**

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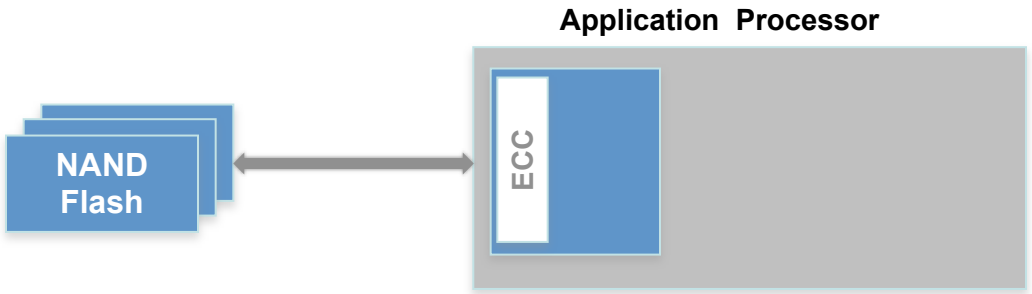
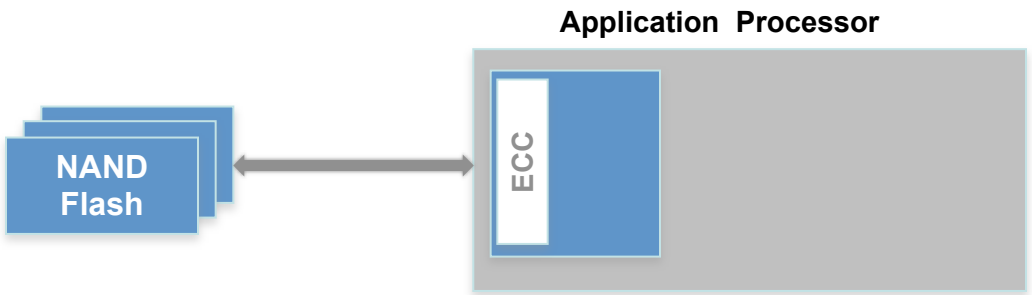
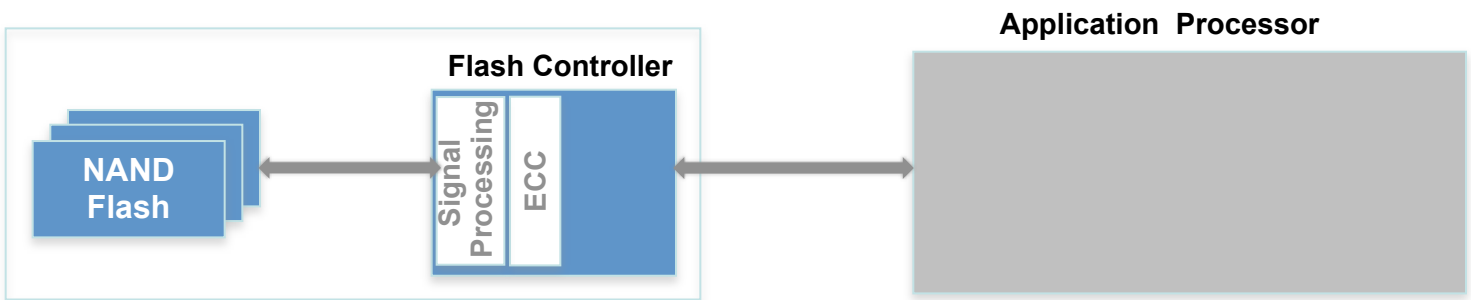
Architectural Changes

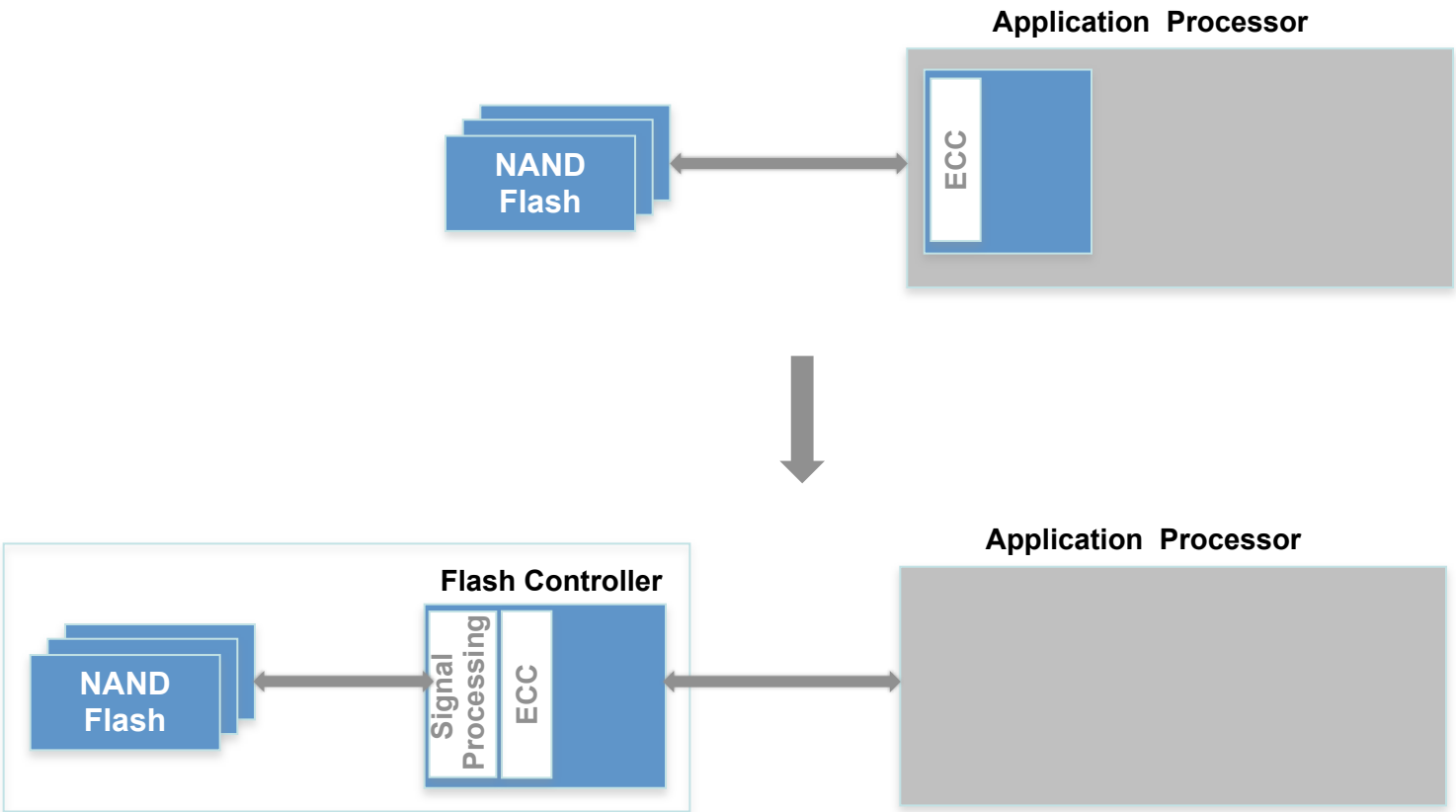


Architectural Changes



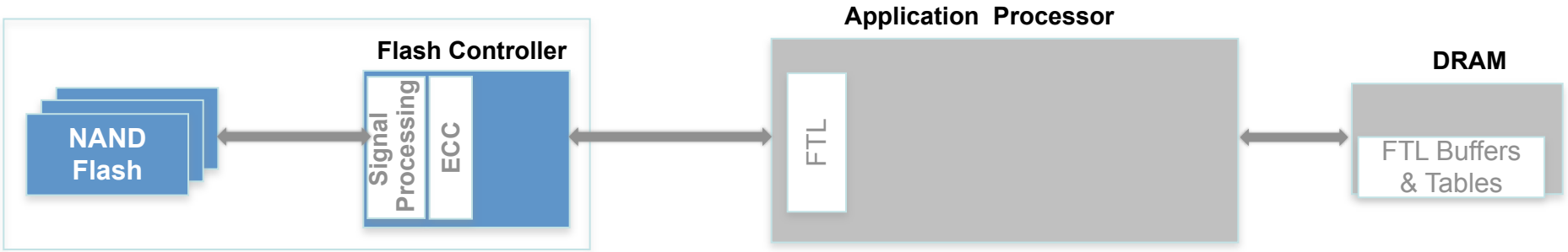


Architectural Changes

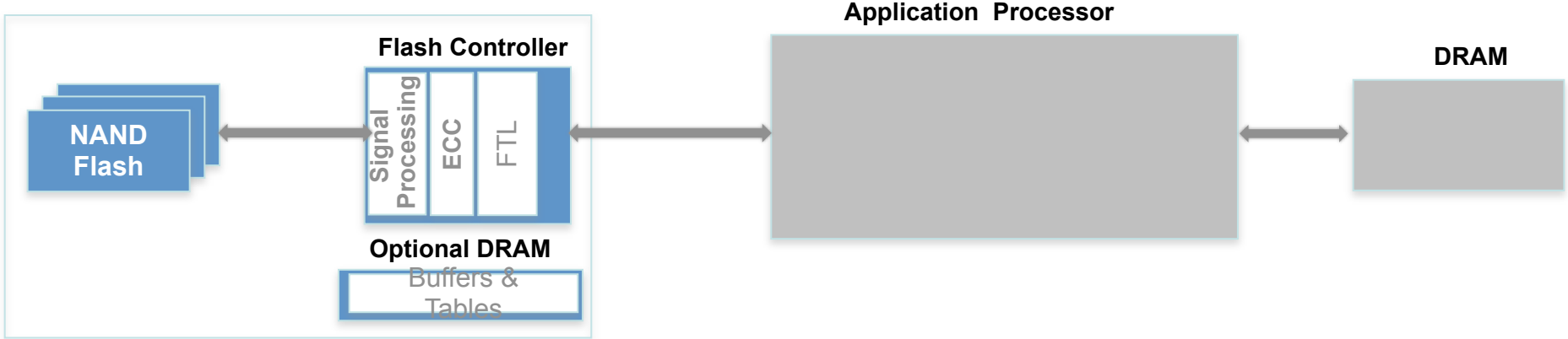


Architectural Changes (cont.)

Half-Managed NAND



Managed NAND

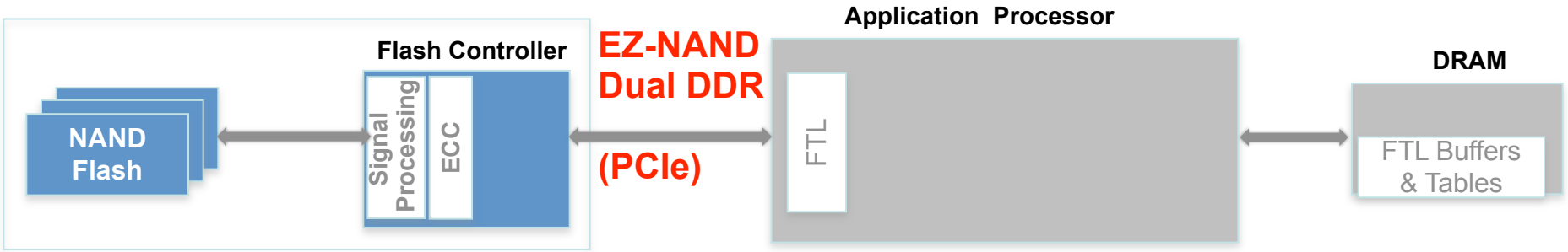


Architectural Changes (cont.)

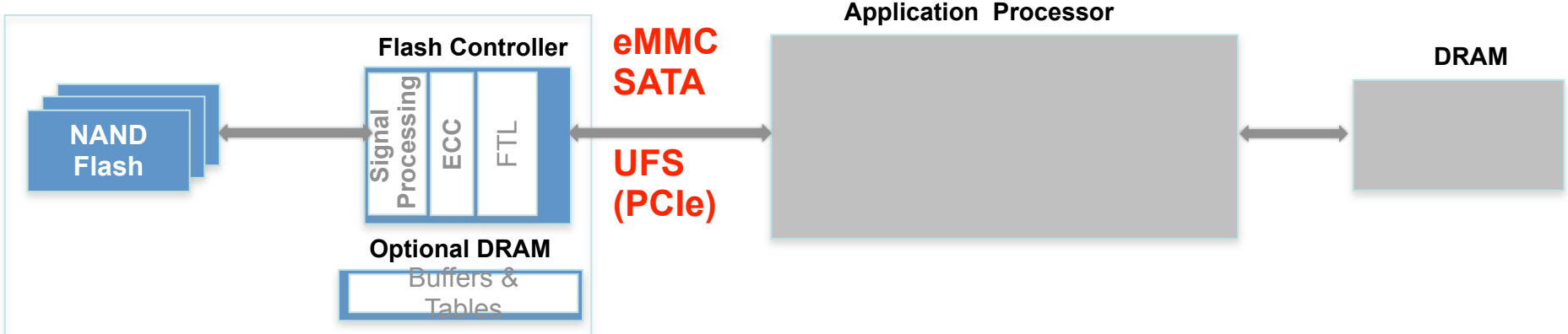
	Abstraction	Performance	Host DRAM	Power Efficiency (MIPS/Watt)
Unmanaged	Low	High	Yes	High
Half-Managed	Medium	High	Yes	High
Managed	High	Low	No	Medium

Interface Alternatives

Half-Managed NAND



Managed NAND



Comparison Table

		EZ-NAND	Dual DDR	eMMC4.5	SATA2	UFS	PCIe
Architecture		Half – Managed	Half – Managed	Managed	Managed	Managed	TBD
Throughput		200 to 400MBps	666MBps	200MBps	375MBps	375MBps Per lane	625MBps Per lane
I/F Power Consumption		Medium	Medium	Medium	High	Low	High
Pipeline	Pipeline	No	Yes	Yes	Yes	Yes	Yes
	Out Of Order	No	No	No	Partial (between tags)	Full	Full
RAM		Host	Host	Local	Local	Local	
Availability		Shippin	Shipping	Shipping	Shipping	Future	Future

Summary

- NAND scale-down results a severe degradation in cell endurance
- Advanced flash controller technologies are required
- A new era in embedded flash is emerging, based on managed and half-managed NAND architectures
- Current and future standards offer a tool-box for optimizing system performance

Thank You!

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