



NAND Flash for Mobile Consumer Products

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Mass Storage Interface Adoption: Overview for Thin and Light Products



Raw and ECC-free NAND: 2–64GB

- Media tablets: proprietary and Android® platforms; lowest-power
- FTL optimization required for high performance
- Allows for product differentiation (performance, reliability, etc.)



MMC/SD: 4–64GB

- Media tablets, Android, Windows®, proprietary platforms; low-power
- Perceived higher performance than raw NAND, but it is single-threaded
- Simple to use



Embedded SATA: 32–128GB

- Lower performance/power than standard SATA
- Highest performance/power consumption; low-power modes needed
- Targeting PC tablets, Windows platforms



Emerging Interfaces:

- USB 3.0
- UFS



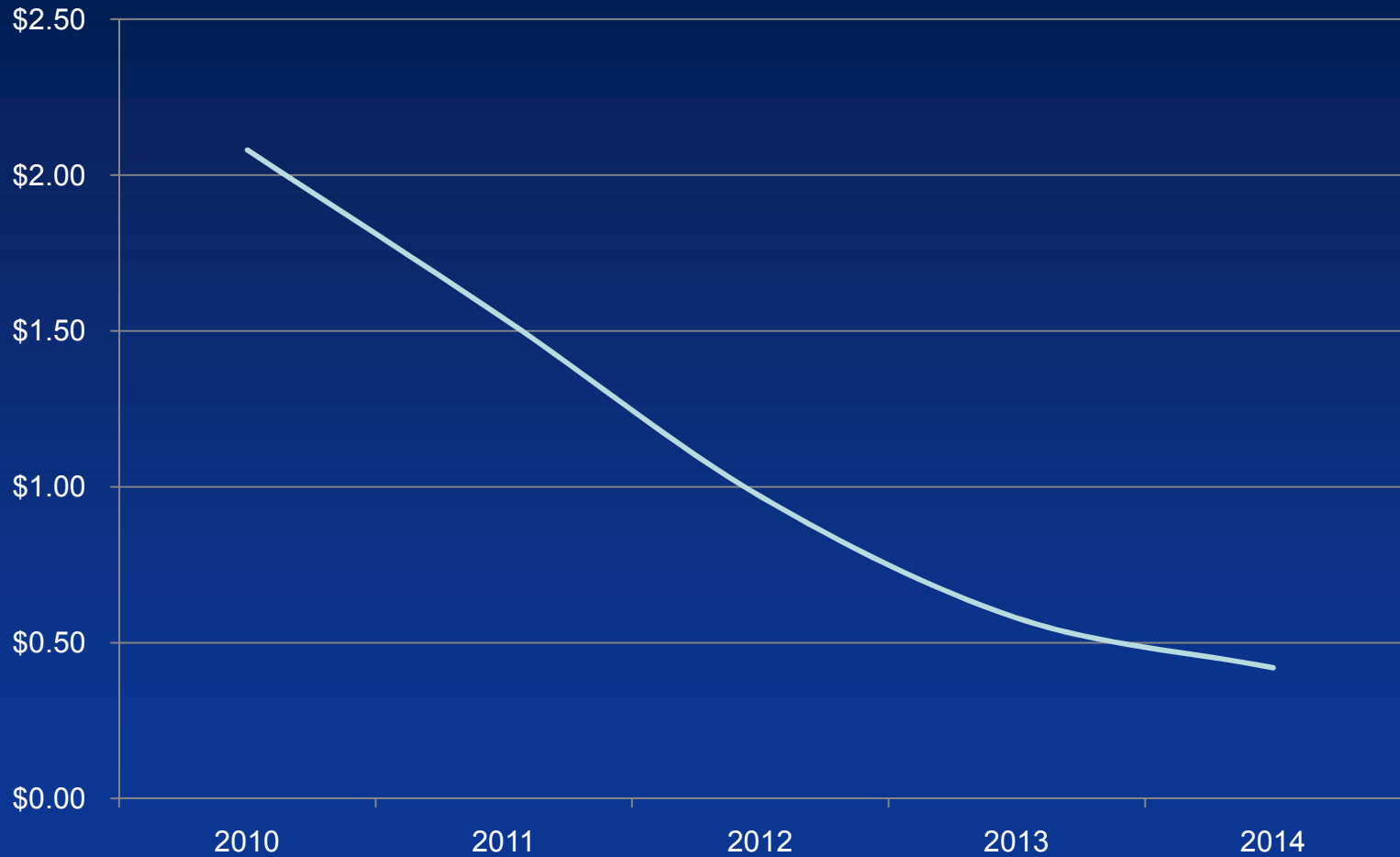
Do we have to worry whether Flash will wear out, and our programs and data will disappear?

- It depends—
 - NAND does have some challenges, but with proper care, it can provide reliable storage
- Proper care includes—
 - Wear leveling:
 - Spreading WRITES over the entire device
 - Preventing READ disturbs:
 - Setting ECC thresholds:
 - Rewrite the data READ if the ECC limit is exceeded
 - Doing background scrubs:
 - Scan the array, actively looking for ECC errors that need correcting

The Good, the Bad, and the Ugly

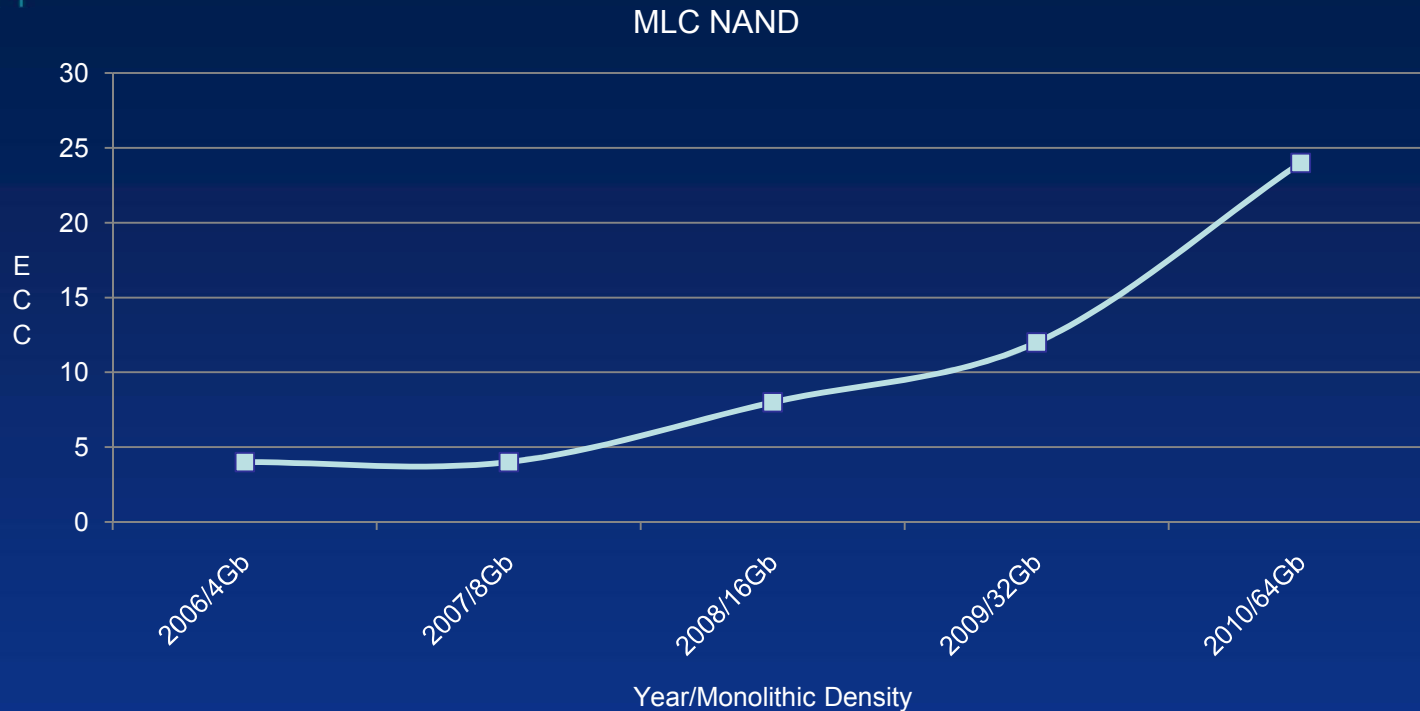
The Good

Client Price Projection (per Gigabyte in High Volume)



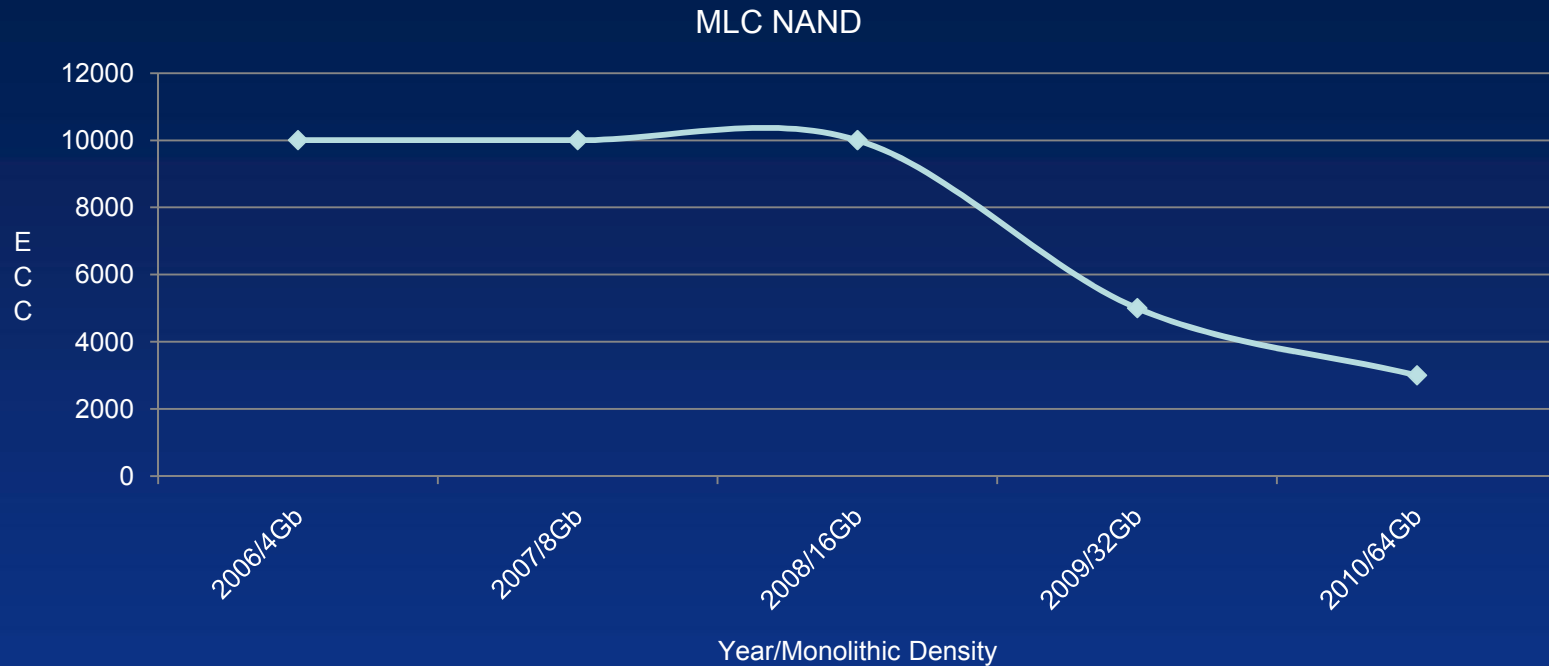
Source: Compilation from Forward Insights, Gartner Q1 ,2011

The Bad—a.k.a. ECC



- From 2006–2010, the ECC required by MLC NAND has increased from 4 bits to 24 bits
- The size of the data area (codeword) that requires correction has grown from 528 bytes to 1080 bytes

The Ugly—a.k.a. Endurance



- Endurance is the specified number of PROGRAM/ERASE operations
- From 2006–2010, the endurance for MLC NAND has decreased from 10,000 to 3,000 (1/3 of original)

How to Deal With the Bad and Ugly (The Makeover)

Addressing the Endurance Challenge

- From 2006–2010, device size (number of bytes stored) has increased from 4Gb to 64Gb (16 times the original)
- However, the endurance for a single block has been reduced by 66%
- By using good wear leveling, the newer, larger devices can actually last about 5 times longer, even though their endurance is lower

Addressing the ECC Challenge

- Work with quality-minded vendors, such as Micron, who can build ample error correction circuits into their products
- Use new “ECC-free” NAND devices with built-in correction, like Micron’s ClearNAND™ Flash

Conclusion

- Full or partially managed devices can address NAND's storage challenges
- Micron offers a full range of products, from enterprise and client SSDs down to memory components (supporting various performance, power, and size solutions)
- For more information, visit:

www.Micron.com

Thank You



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