Improving NAND Performance Using Upcoming Features

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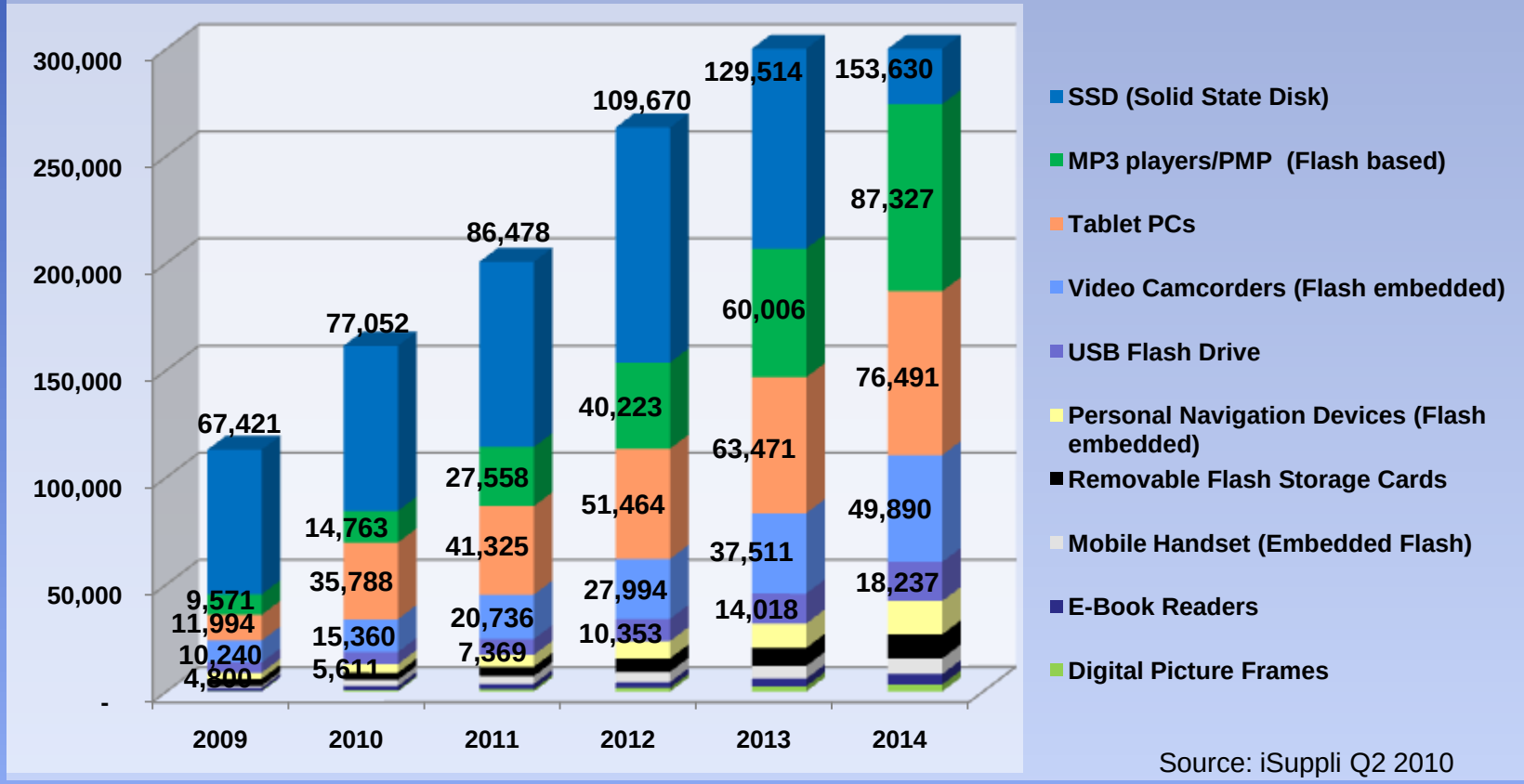
Overview

- NAND market and trends
- Hurdles for performance
- Overcoming the hurdles
- Conclusion

NAND Market: High-Density Apps

Megabytes per Unit – Top 10 Density Applications

(Clamped at 300K)



Source: iSuppli Q2 2010

NAND Trends

Density-hungry applications drive NAND trends

- Rapidly shrinking process technology
- Architecture - increasing NAND block sizes

Source: micron.com

8GB now available on ***single*** NAND MLC die!

Performance Hurdles

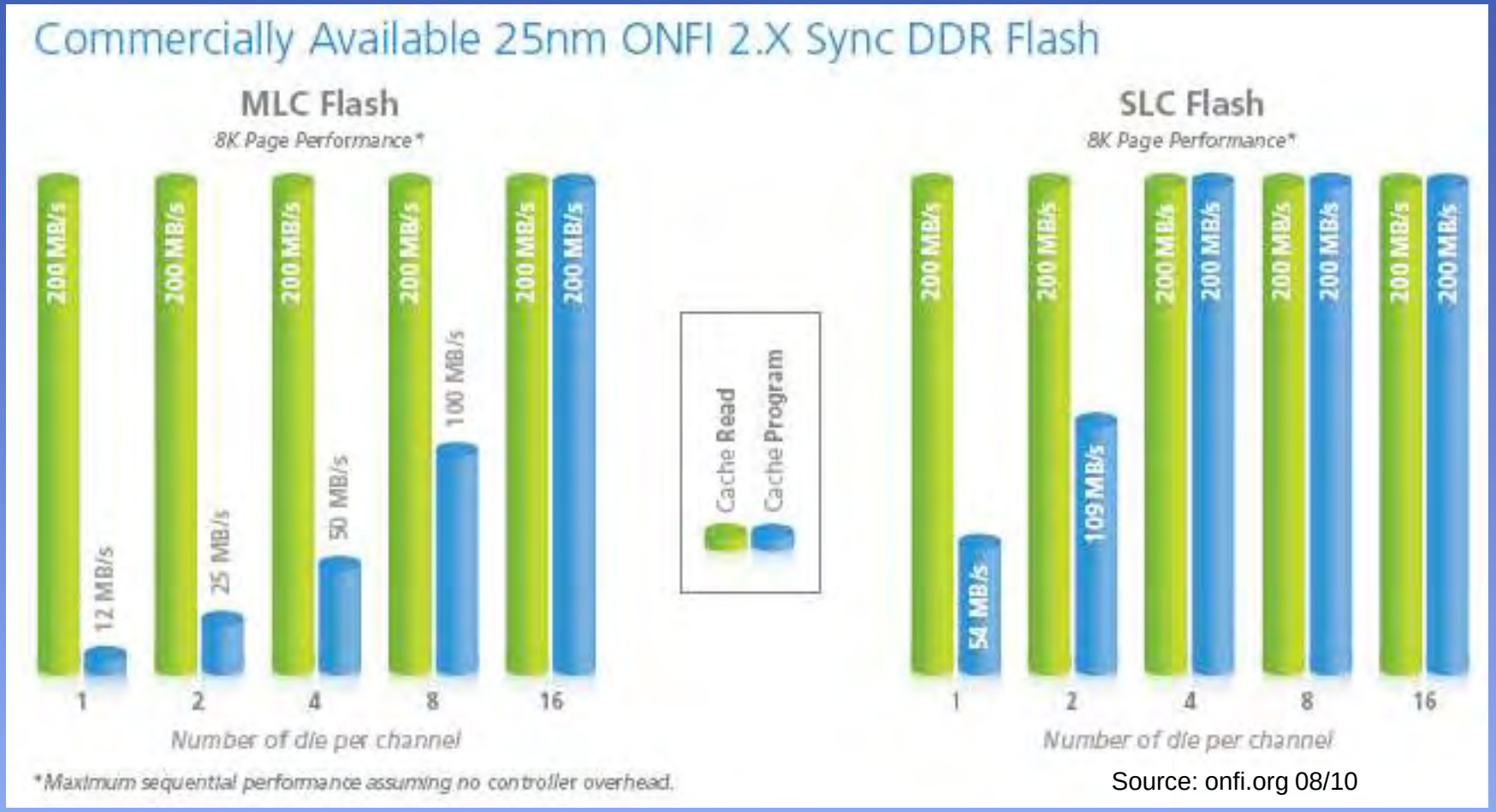
- The push for density results in:
  - Slower NAND array timings
  - Increase in ECC requirements
  - Longer block copy times
  - Lower program/erase endurance

- Density trends ***reduce*** NAND cost at the expense of performance and reliability

Overcoming the Hurdles

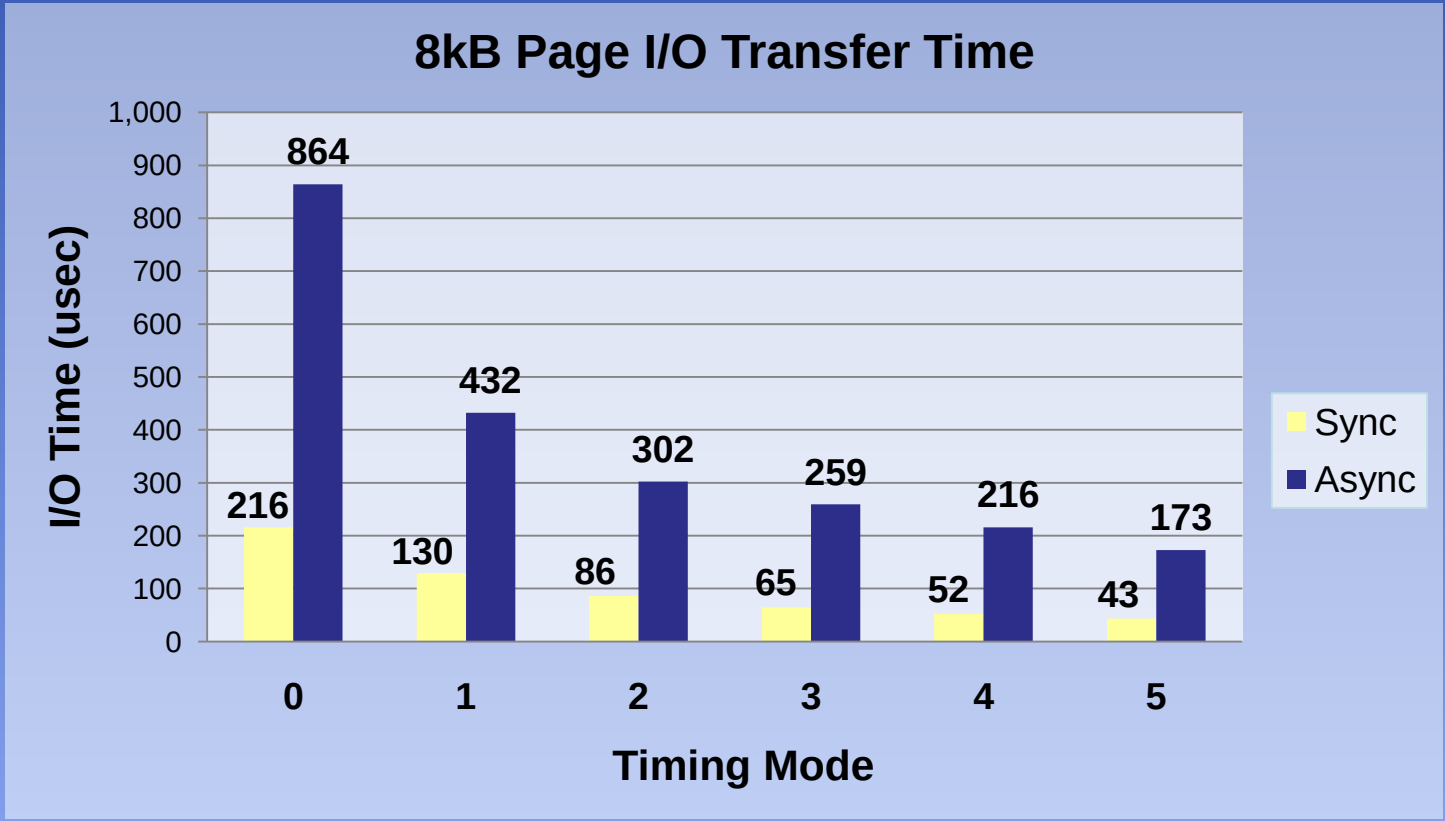
- Increase NAND interface speeds
  - ONFI 2.3 → 200 MB/sec
  - ONFI 3.0 → 400 MB/sec
- Issue simultaneous operations
  - Multi-plane operations
  - Interleaved operations via NAND scaling
- ECC solutions (EZ NAND)
  - Removes ECC system overhead

NAND Scaling and Interface



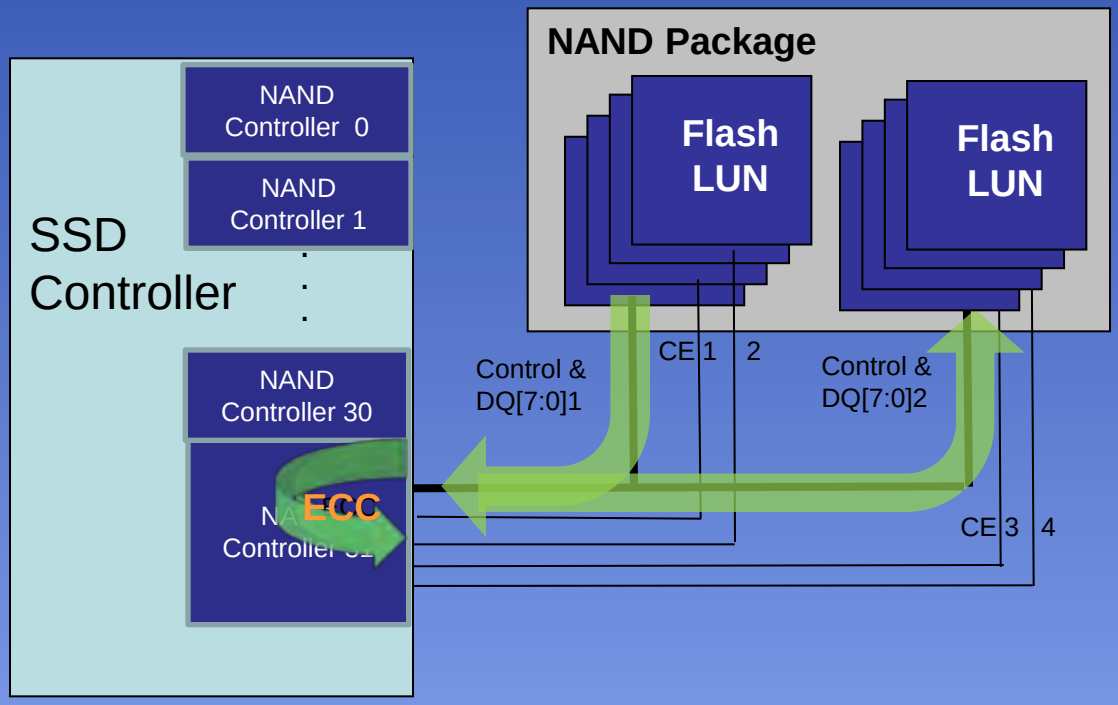
Source: onfi.org 08/10

Overcoming Performance Hurdles



Use fastest timing mode available (sync TM5)

Copyback Using Raw NAND



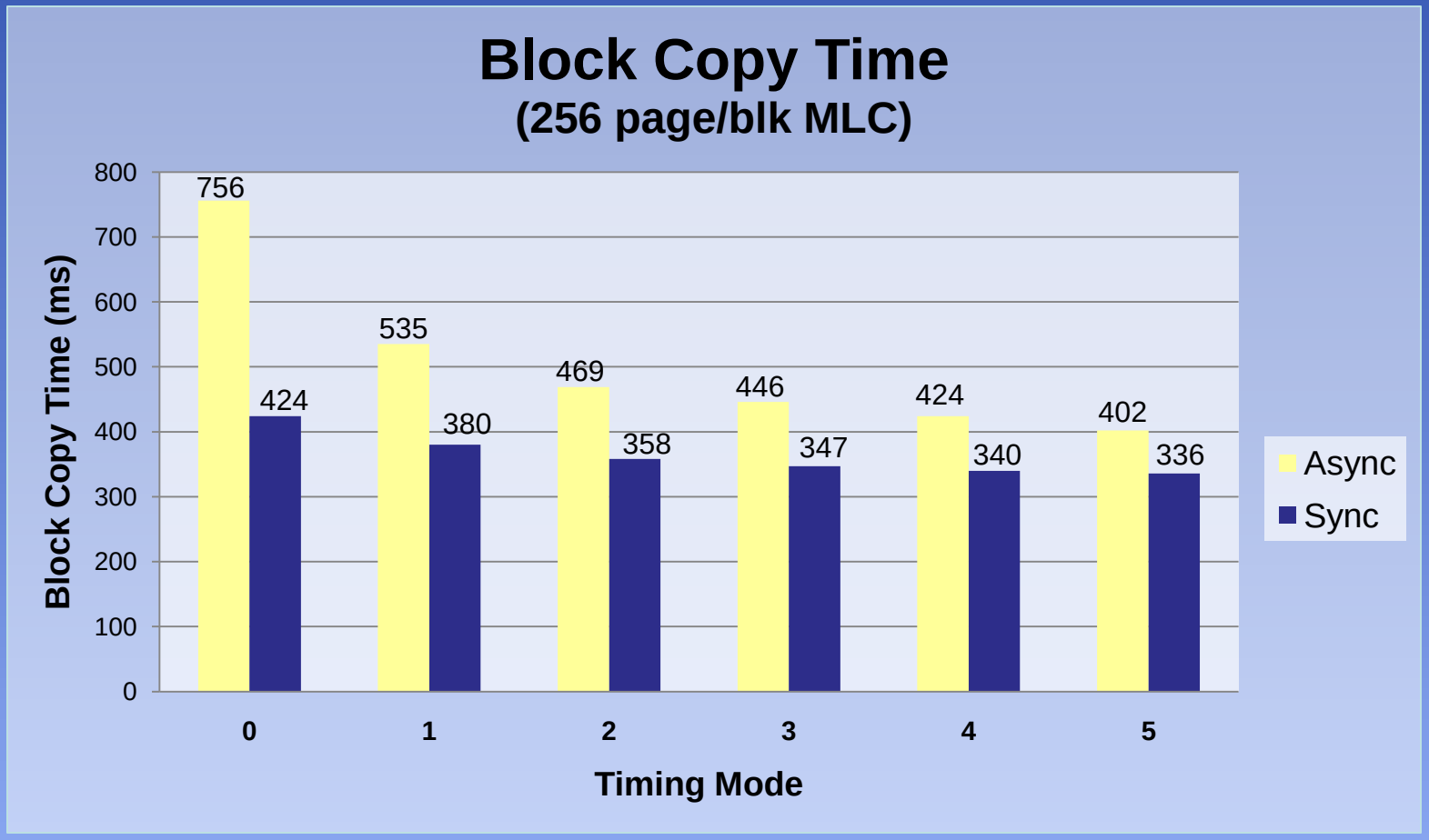
Copyback time = ^{t}R + Read I/O + ECC time + PGM I/O + ^{t}PROG

Sample BCH ECC overhead (83 MHz):

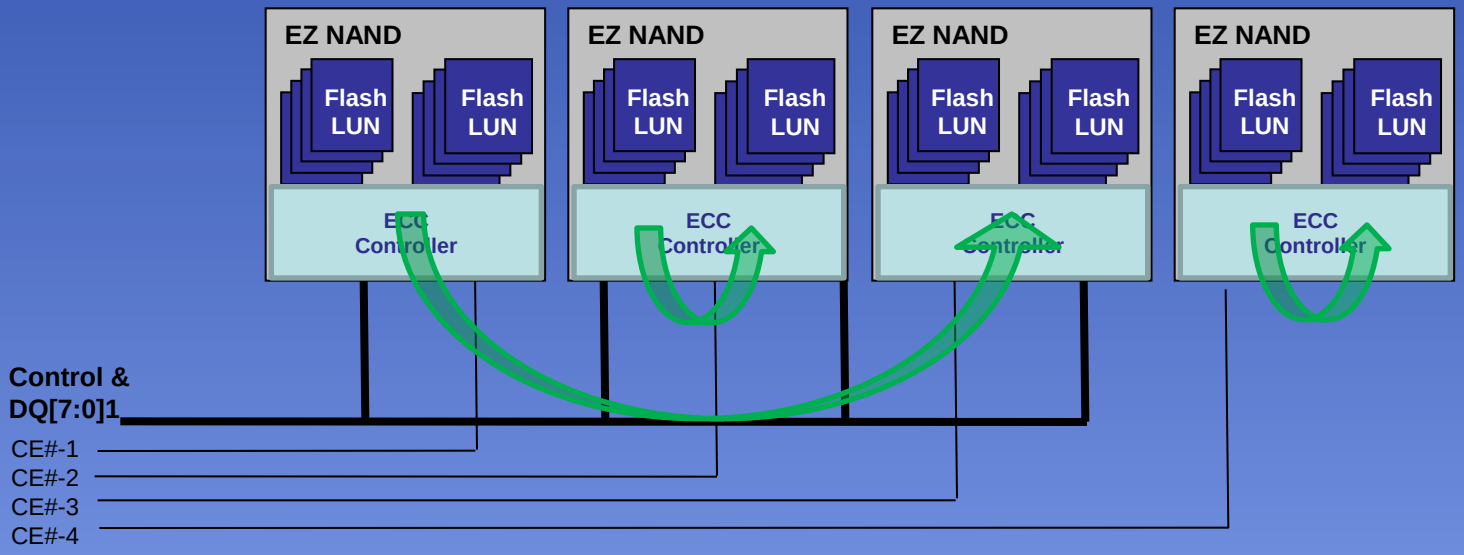
16-bit/512B ~74µs

32-bit /1kB ~186µs

Sample Copyback Performance



Copyback Using EZ NAND



- Copyback operation can be contained within the EZ NAND device
- Potential for simultaneous operations within each package

Conclusion

- NAND market is driving ***lowest cost***, highest density NAND
  - Results in challenges for NAND **performance**
- Must overcome NAND array challenges
  - Faster interface
  - NAND scaling
  - Improved NAND management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