

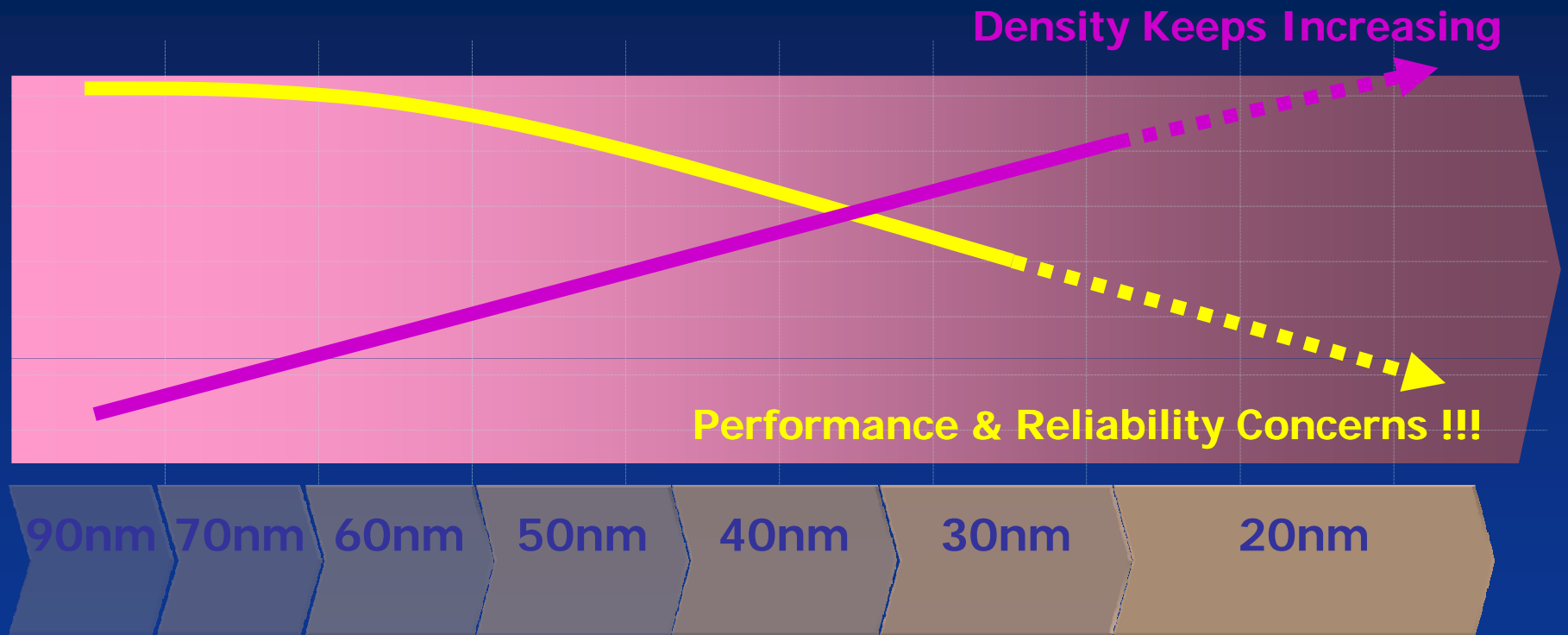


Toggle-Mode NAND to Fill Growing Need for Higher Performance

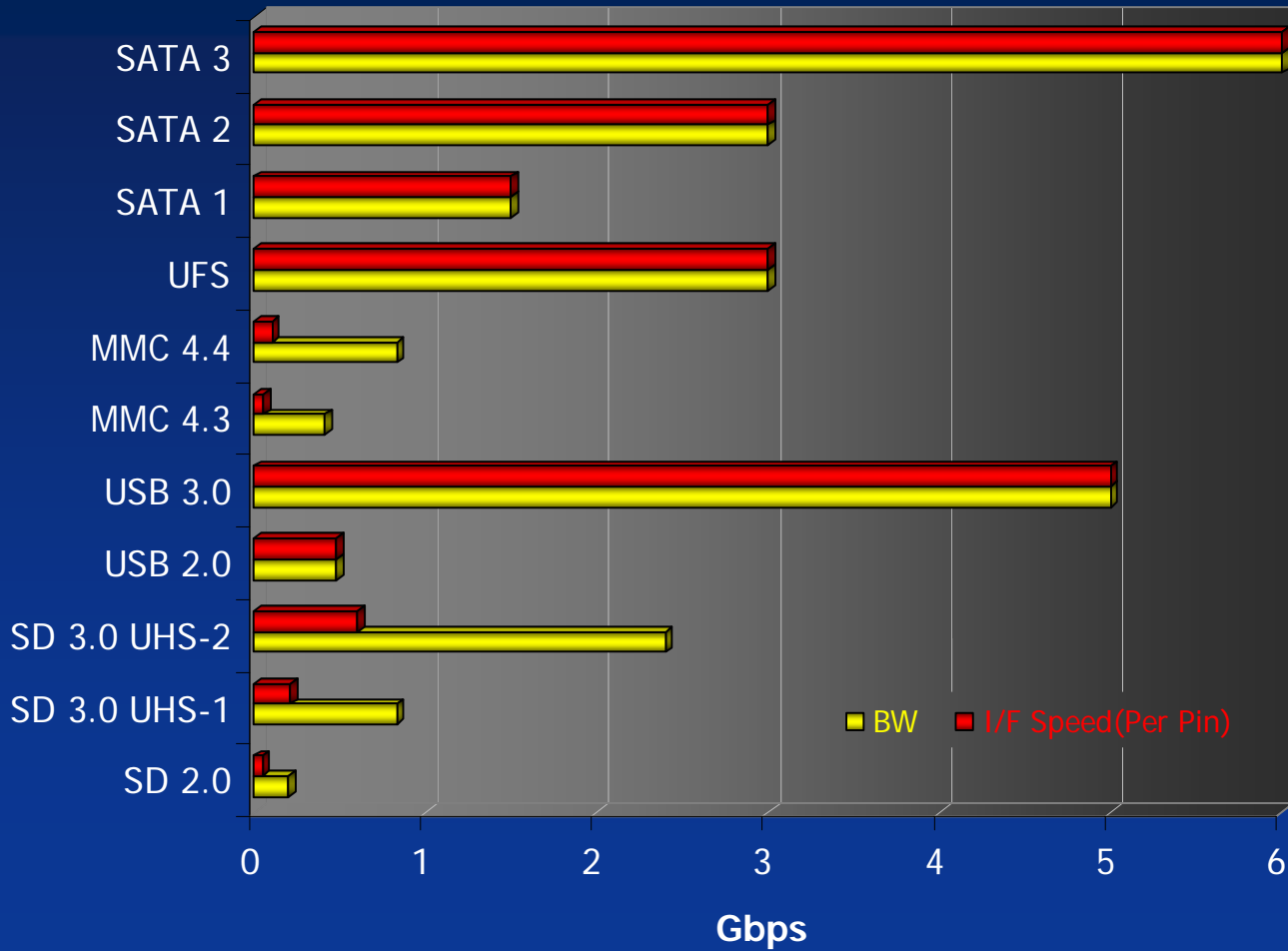
Ha Ryong (Harry) Yoon

Sr. Manager in Technical Marketing
Samsung Semiconductor Inc.

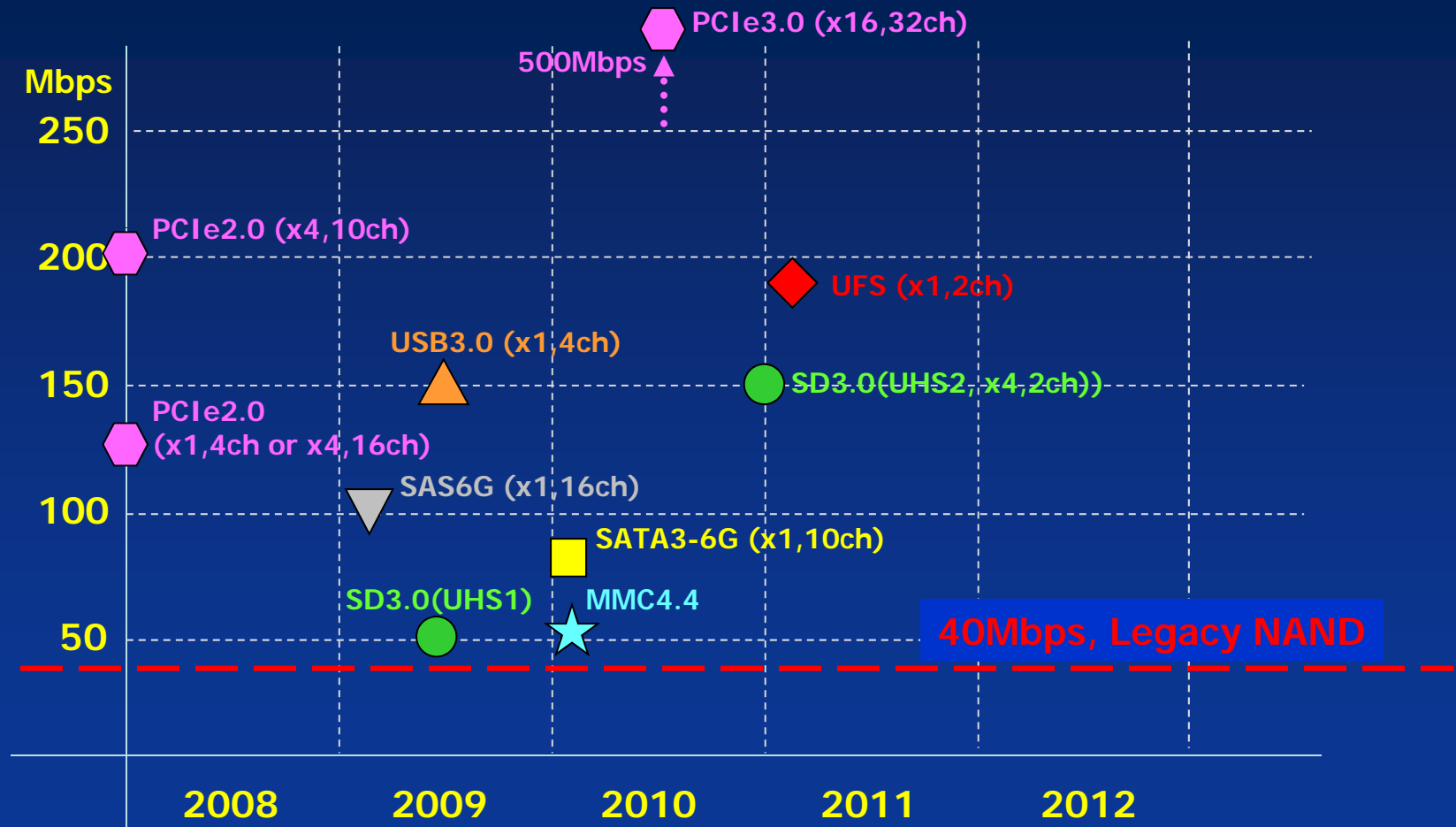
Process Technology Evolution



Growing Need for Higher Performance - Interface Speed Trend

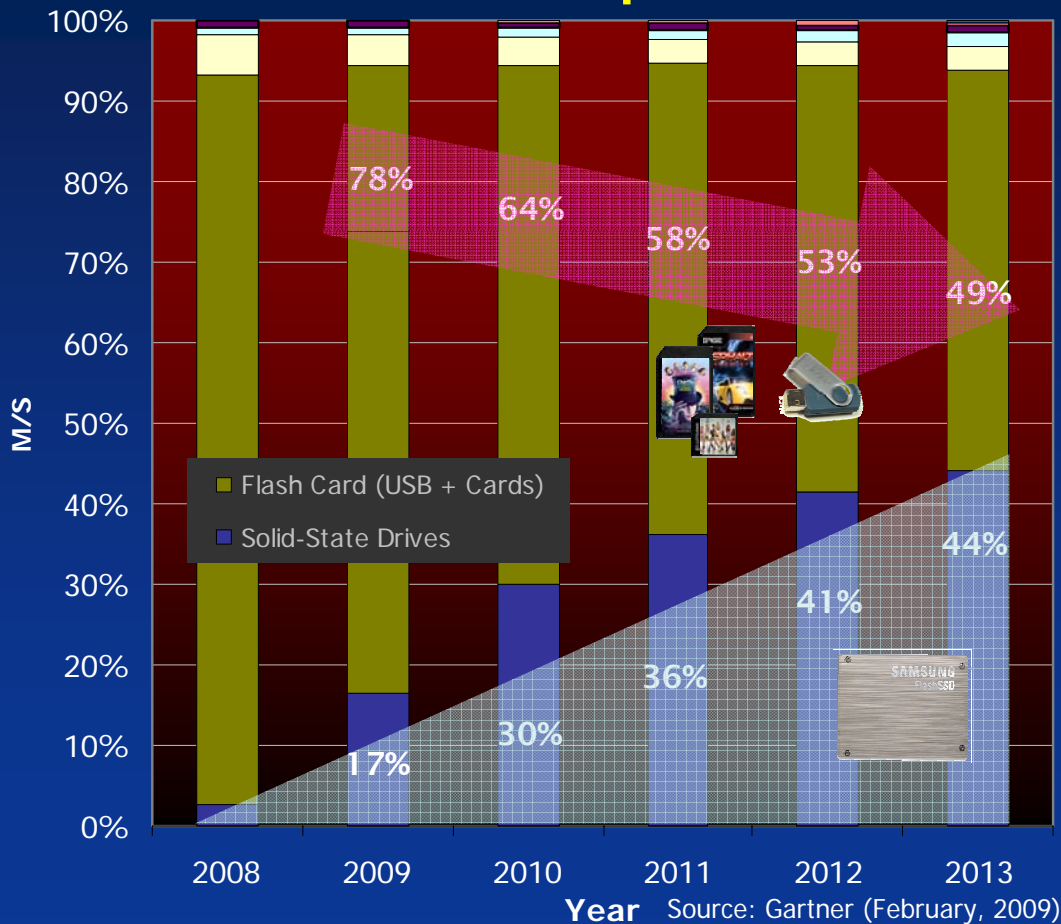


Growing Need for Higher Performance - NAND Performance Requirement



Market Expansion

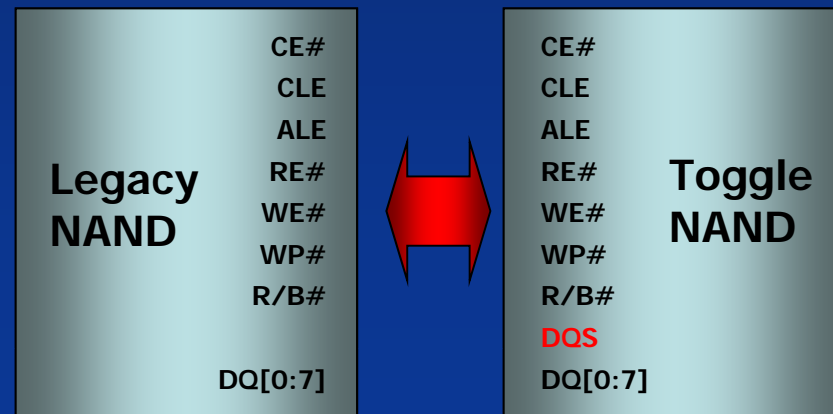
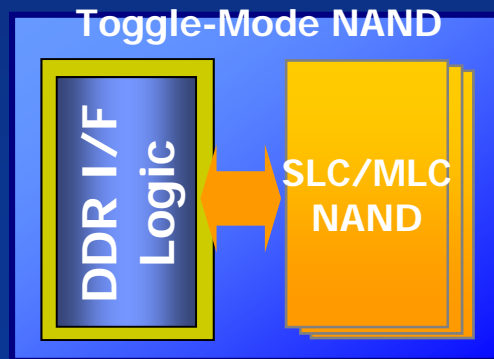
NAND Consumption in EDP



- Enterprise-class SSD (SATA3, SAS, PCIe) and high-speed card(USB3.0, UHS2, UFS) are fueling the need of higher performance NAND
- Enterprise SSD will take ~65% of SSD market at 2012
- USB will take ~14% of NAND market at 2012
- SD & uSD will take ~80% of flash card market at 2012

Toggle-Mode NAND?

- High speed “Toggle-Mode” operation
 - No clock – Asynchronous Double Data Rate
 - High performance by using the asynchronous interface for backward compatibility
 - Bidirectional DQS for read and write operations



Why Toggle-Mode NAND?

- High performance
 - Supports 133Mbps and higher
- Less power consumption
 - No free-running clock
- Flexibility of operating frequency
 - No additional mode change required
- Easy migration from legacy NAND
 - Same signal functionality as legacy NAND

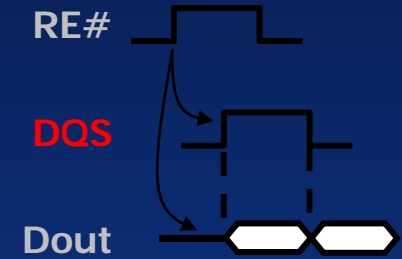
Differentiation from Others

- No free-running clock
 - Less power consumption
 - Free from IP issues
- Flexibility of operating frequency
 - No additional mode-set change required
- Simple adoption
 - Same signal functionality as legacy NAND

WRITE



READ



Development Status & Roadmap

- 1st Gen available 2H '09 at 133Mbps
- 2nd Gen(200Mbps) targeted for early'11, but entry time depends on market needs and requirements



Standardization Status in JEDEC

Item	Status	Comments
Packaging & Pin-out	On Going	Ball Configuration Done
Addressing & Bad Block Definition	Done	
Signal Definition	On Going	Under Documentation
AC Parameter	Done	
Initialization & Identification	Done	
Timing/Command Set	On Going	Basic Command Set Done
Interface & I/O Characteristics	On Going	AC/DC & Operating Condition Done
Parameter Page Definition	On Going	Byte[100:0] Done



Thank You !

For more information,
harry.yoon@ssi.samsung.com