Flash Memory Summit

SiliconMotion

More Reliable SSD and eMMC for Automotive and IoT solutions

Product Marketing Manager

Lancelot Hu

Background History: Silicon Motion Inc.

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1995 Silicon Motion established in San Jose, CA

1997 Feiya established in Taiwan

2002 Silicon Motion combined with Feiya

2005 NASDAQ IPO

2007 Acquisition of FCI (Korea)

2015 Acquisition of Shannon Systems (China)

Over 5 Billion NAND Controllers Shipped in the Last 10 years!

Before 2003

1997
1st graphics processor

1998
1st CF controller

2003
1st SD controller

2004
1st MicroSD controller

2005
1st PATA SSD controller

2006
1st SATA 2 SSD controller

2007
1st UHS-I controller
1st FerriSSD controller

2008
1st USB 3.0 controller
1st eMMC 4.41 controller

2009
1st eMMC 4.5 controller
1st SATA 3 SSD controller

2010
1st Ferri-eMMC
1st UHS-II controller
1st eMMC 5.0 controller

2011
1st eMMC 5.1 controller

2012
1st PCIe Gen3 x4 controller

2013
1st UFS 2.1 controller

2014

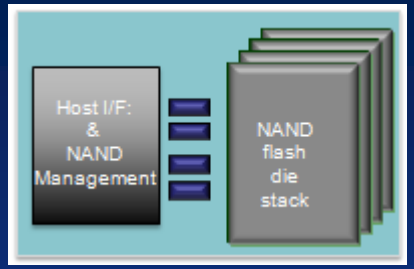
2015

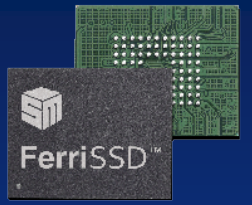
2016

2017

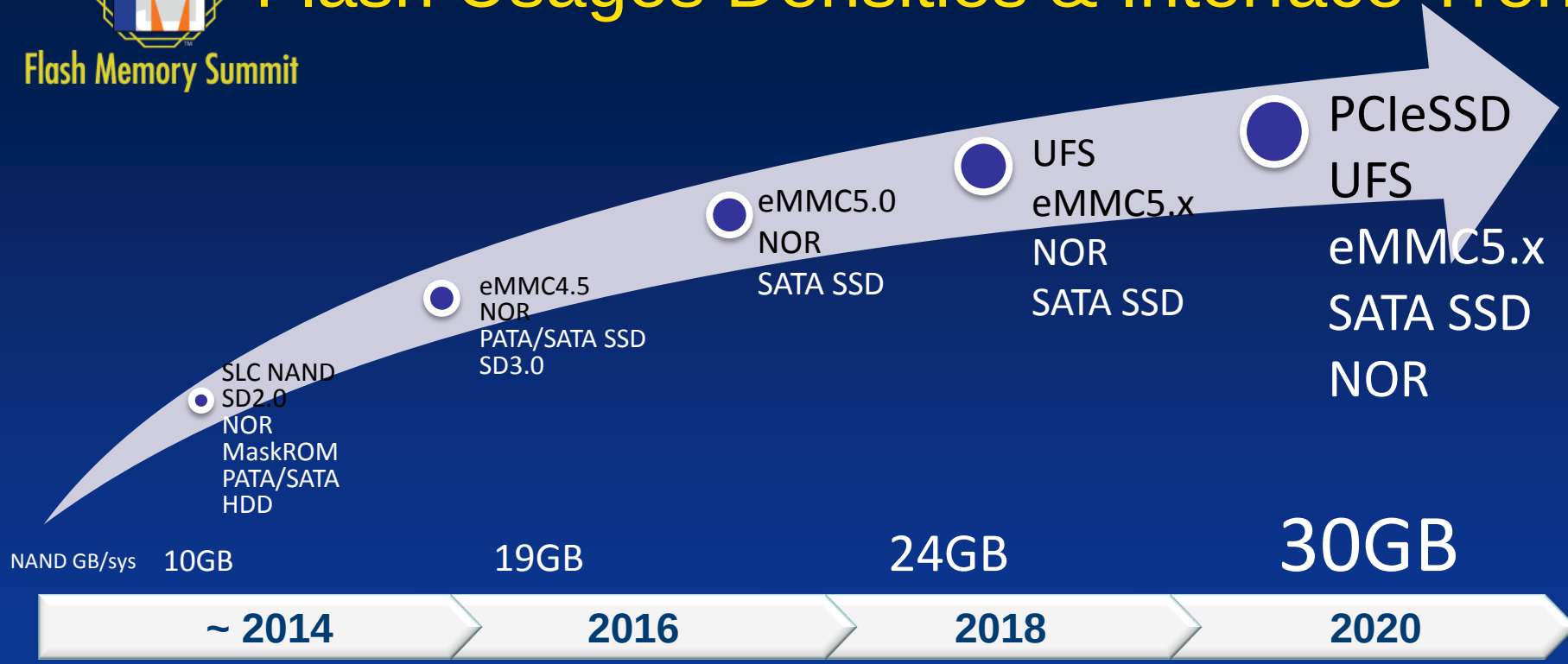
IoT / Automotive / Embedded challenges

- **Tailor-made-SSD/eMMC**
- **All host Interface**
- **Designed for Automotive / IoT**
- **Customizing for your needs!**





Flash Usages Densities & Interface Trends



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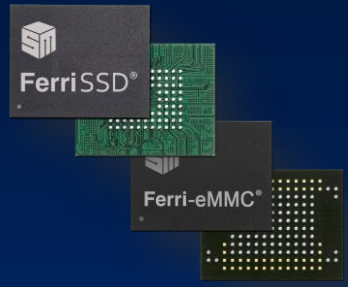


In
the future
NAND Flash ,

is
the
only
key to win

Quality

Automotive, IoT, Embedded

Low dPPM in Automotive / IoT

Products Review	Design Process	Manufacturing	Screening
• PDCA • DFMEA • Error Detection • Simulation	• Tightened process • Scrap criteria • Automotive grade • ECC	• PFMEA • Grade3, Grade2 • Low alpha compound • Traceability	• 100% test • Tightened screen • Extend temp. test • High/low voltage test

Target : Single Digit dPPM rate!

Different Application Reliability Assure

Program Intensive

Read Intensive

Drones

Surveillance

Self-Driving

ADAS

Navi

Digi-Cluster

Real Case Feedback

Drone / Car DVR user behavior model Target : 8~10 years life cycle

New

KB	Cnt
512	3613
160	1
64	10
32	89
31	1
25.5	1
20.5	16
20	2
17.5	1
16.5	2
16	2
13.5	1
12.5	2
12	2
10	1
9.5	2
8	2
7.5	1
6.5	1
5.5	1
4.5	2
4	2
3	194
2.5	4
2	2
1.5	4
1	6
0.5	240

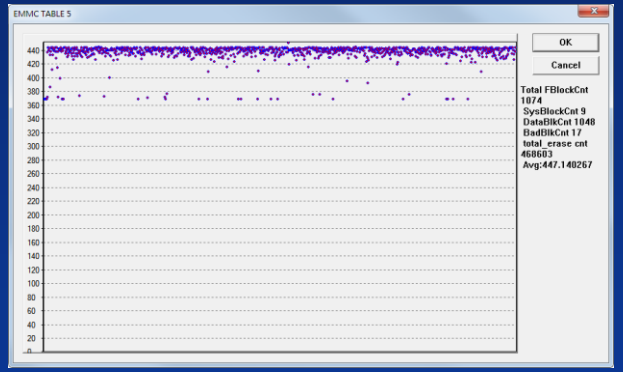
Original

KB	Cnt
512	3620
196	1
96	1
92	1
84	1
80	2
76	3
68	1
56	2
4	11
3.5	1
2.5	4
2	368
1.5	137
1	131
0.5	995

Delete

KB	Cnt
512	39
376	1
132	1
28	1
4	1
2.5	1
2	86
1.5	12
1	11
0.5	22

From host(sector)	From Host MB/Cycle	Total erase	WAI	Test time	Avg of PE cycle	Life (hrs)
211136526	103094	6931	1.08	24	6.5946	21836



All Data Wear-leveling

Based on 32GB BGA SSD

Real Case Feedback

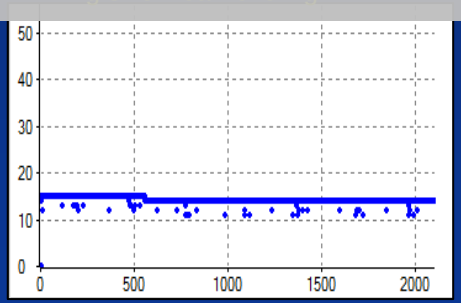
Real IVI user behavior model

File Category	Data Patterns	Program per Day	Zone PE counts	Total PE counts
Phone Connection /Car Play Data	4K log files	50MB	~15	
	8K log files	60MB	~15	
	16K log files	100MB	~15	
Map / Buildings / Virtualizations	Non-3D Data	200MB	~ 45	~ 1100
	3D Data	760MB	~ 135	
General data / Music / Video / OS system files	Scale files	860MB	~160	
	General Data	4100MB	~ 720	

Based on 64GB eMMC Storage

Storage May Survive than 15 years !!

Big size wear-leveling



Small size wear-leveling

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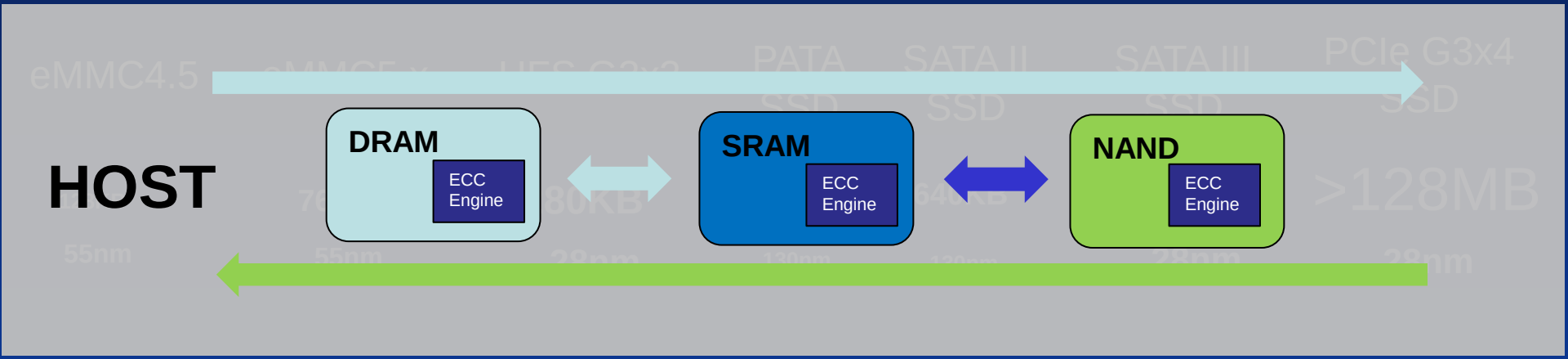
SRAM / DRAM Protection



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Keep Improving Quality

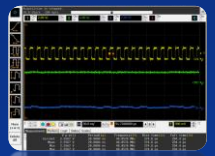
Custom Request
Field Feedback

Analysis

Design Review
Implement

Simulation
Qualification

MP line
verification
Implementation



- Quality at the Gate
- Quality on the Fly

Summary

- Quality is the key to win
- Design review , simulation & continues improvement
  - HW / FW guarantee: LDPC ; RAID ; Refresh/ Reclaim
  - Screening ; Tighten criteria
  - Case study , and improvement
- Different applications, different behaviors
  - Tailor-made solution to ensure reliability

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Thank You~

Visit SMI at the booth – #413

Email: ferri@siliconmotion.com

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