

# Tailor-made-SSD to overcome embedded storage challenges

**Jason J. Chien**

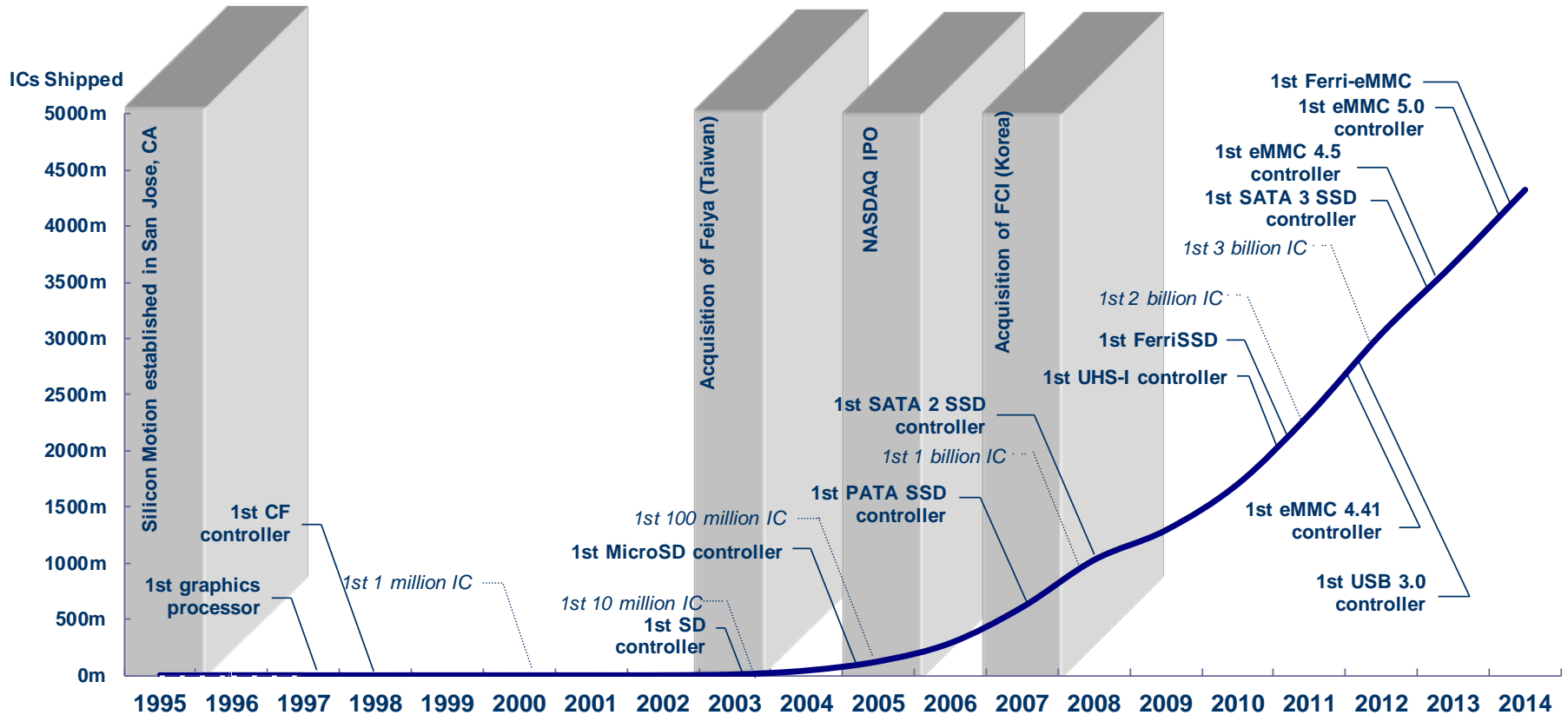
Product Marketing Manager

Silicon Motion, Inc.

- Background History
- Early SSD, Early Requirements
- Tailor-make SSD to overcome challenges
- Tailor-make SSD for future challenges
- Summary

# Background History...

## Silicon Motion Inc.: 10+ years of contribution in NAND flash storage



# Early SSD, Early Requirements.....

- Early (NAND Flash based) SSD was not much more from a Compact Flash card.
  - Mainly served as a boot drive..
    - Storing OS, Software, log files..
    - Very soon, different requirements began...
      - Transfer Mode Lock
        - UDMA, MwdMA, PIO mode, etc
      - Runtime badblock management,
      - Write Wear Leveling (WL), Read WL
        - Partition zone WL, cross die WL, etc

# Can one SSD fits every applications?

- A 256GB SLC SSD can probably satisfy 95% of the application requirements..
  - Best Performance, Endurance, Retention, Reliability...
    - Question is.. at what cost?

**Under construction!**

# Tailor-make-SSD for each application

## Usage /workload model

Read intensive:	90/10%	Read/Write ratio
Mixed usage	50/50%	Read/Write ratio
Write intensive:	20/80%	Read/Write ratio

**Under construction!**

# Tailor-made-SSD to overcome 'General' Challenges

Under construction!





# Tailor-made-SSD to overcome 'Physical' Challenges

## Challenges:

Small form factor application  
- Extreme IOPS

Heat dissipation

Environmental Requirement

**Under construction!**





# Tailor-made-SSD to overcome 'Read Intensive Application' Challenges

## **Challenges:**

Data Retention at high temperature  
Read Disturbance at high read application  
SLCmode for Read disturbance enhance

**Under construction!**



# Tailor-made-SSD to overcome: 'Special Requirement' Challenges

## **Challenges:**

AES Encryption

Extreme low dPPM

Hybrid-like..

**Under construction!**



# Tailor-made-SSD to overcome future challenges ... Upcoming Features

## Upcoming Features

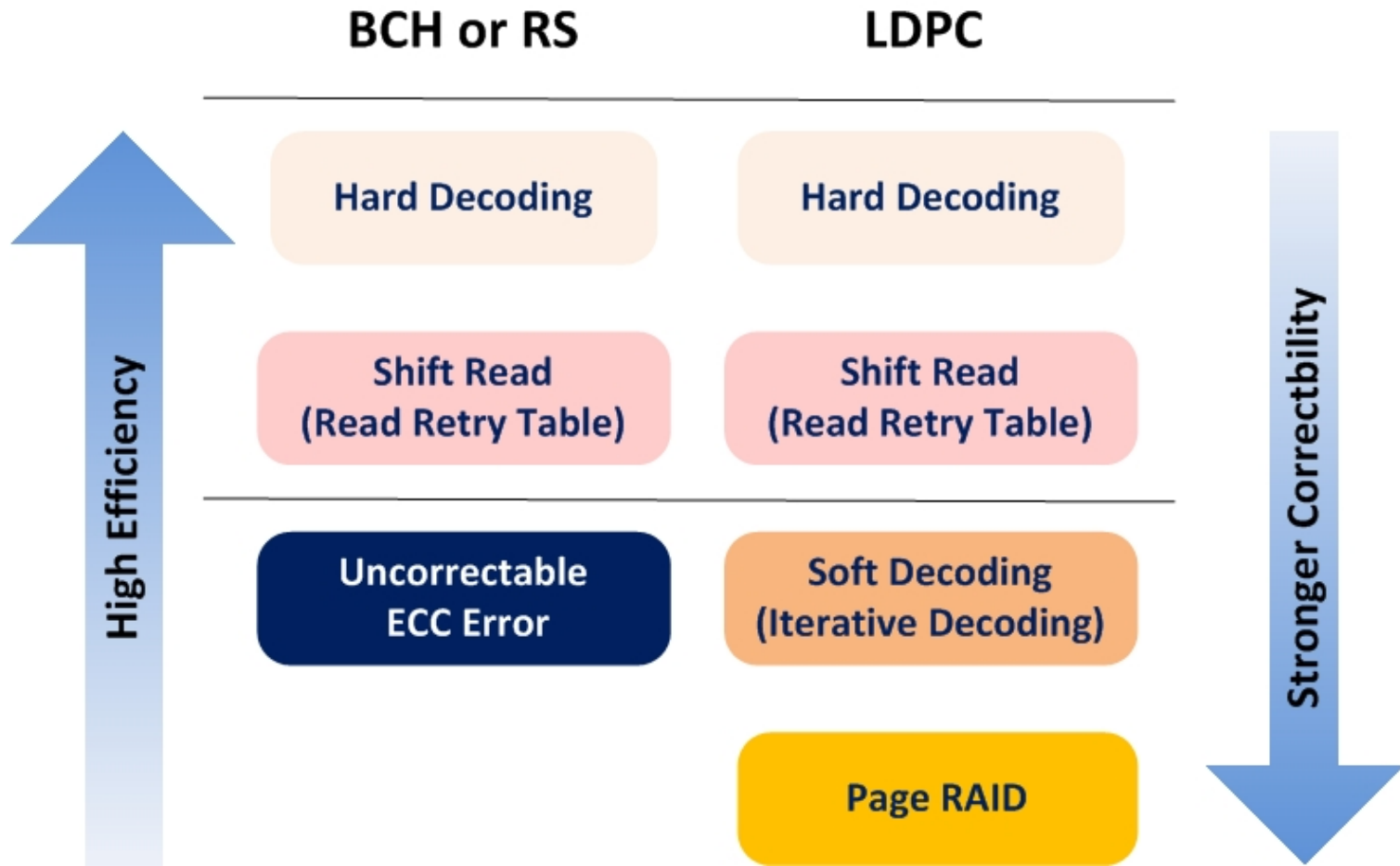
LDPC

Page RAID

Others..

**Under construction!**

# Tailor-made-SSD to overcome future challenges: No Data Lost



# Tailor-made-SSD to overcome future challenges: LDPC

**1KB BCH Protection**

Endurance	600	1200	1800	2400	3000	3600
84 hrs	○	X	X	X	X	X
74 hrs	○	X	X	X	X	X
68 hrs	○	X	X	X	X	X
60 hrs	○	X	X	X	X	X
52 hrs	○	X	X	X	X	X
44 hrs	○	X	X	X	X	X
36 hrs	○	X	X	X	X	X
28 hrs	○	X	X	X	X	X
24 hrs	○	X	X	X	X	X
20 hrs	○	X	X	X	X	X
16 hrs	○	X	X	X	X	X
12 hrs	○	○	X	X	X	X
8 hrs	○	○	X	X	X	X
4 hrs	○	○	○	X	X	X
Endurance	○	○	○	○	○	○

**1KB LDPC Protection**

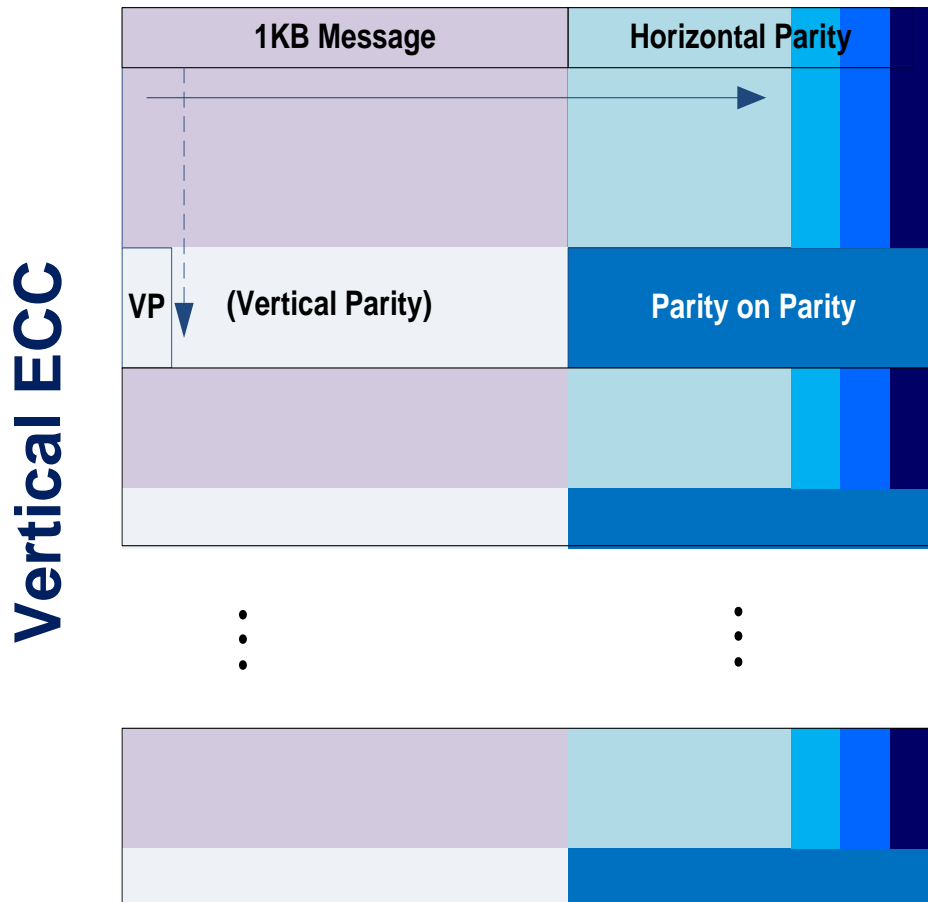
Endurance	600	1200	1800	2400	3000	3600
84 hrs	○	○	○	X	X	X
74 hrs	○	○	○	X	X	X
68 hrs	○	○	○	X	X	X
60 hrs	○	○	○	○	X	X
52 hrs	○	○	○	○	X	X
44 hrs	○	○	○	○	X	X
36 hrs	○	○	○	○	X	X
28 hrs	○	○	○	○	○	X
24 hrs	○	○	○	○	○	X
20 hrs	○	○	○	○	○	X
16 hrs	○	○	○	○	○	X
12 hrs	○	○	○	○	○	X
8 hrs	○	○	○	○	○	X
4 hrs	○	○	○	○	○	X
Endurance	○	○	○	○	○	○

- All data sectors are correctable
- At least one data sector is uncorrectable

Based on: 2ynm TLC, 120C baking

# Tailor-made-SSD to overcome future challenges: Page RAID

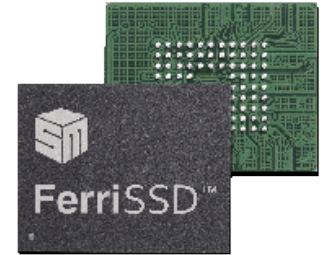
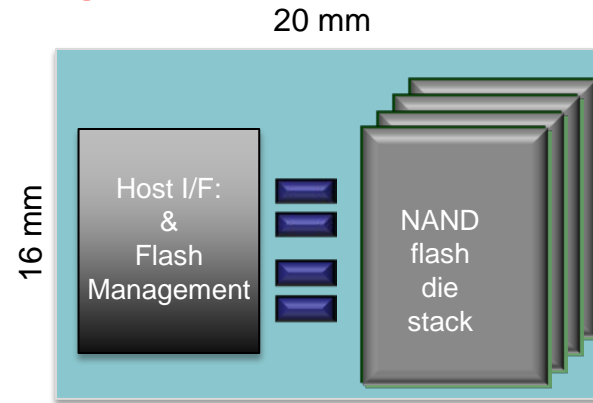
## Horizontal ECC: LDPC or BCH or RS



- Vertical ECC on a page base
- RAID5-Like
  - $(k, 1)$  by XOR,
- RAID6-Like
  - $(k, 2)$  by RS-code
  - $(2,2), (4,2), \dots, (253,2)$

# Tailor-made-SSD to overcome embedded storage challenges

- Tailor-made-SSD
- All available host Interface
- Designed for embedded market
- Customizing for your needs!



Telecom & server



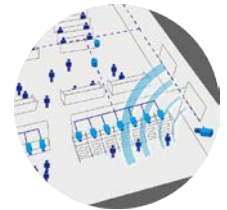
MFP



POS & Kiosk



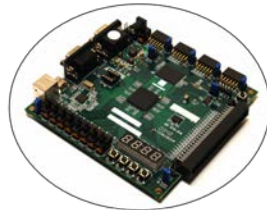
HMI/ Testing Instrument



Surveillance System



Thin Client



Ind. / Embedded MB



In Vehicle Infotainment



Medical Equipment



# THANK YOU!

## Q & A

Email: [ferri@siliconmotion.com](mailto:ferri@siliconmotion.com)

## Visit us at the booth - TBD

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