FMS2015 - Session 101C

UFS is Ready
To Power New Generation of Mobile Devices

Ben Wu
Technical Marketing Manager
SK hynix America
The best medicine for brain health

Is

Yawning

Source:
https://en.wikipedia.org
http://www.naturalnews.com/
Outline

- Mobile Storage Trend and UFS Development
- SK hynix UFS Product Announcement
- UFS Adoption on New Generation Mobile Product
UFS: The New Generation Mobile Storage Interface

- High Bandwidth and IOPS
- Bigger Storage Capacity
- Better Power Efficiency
- Stronger Computing Supportability

eMMC
- Low Power
- Boot/Security
- M-PHY/UniPro
- Easy for Host Design

SSD
- High Performance
- SCSI CMD

UFS

Flash Memory Summit
UFS Development Roadmap

- JEDEC UFS1.0 in 2011
- First Smartphone with UFS in 2015
- Multiple UFS device, SoC, OS support in 2016
- UFS combined package, external UFS, automotive UFS in near feature
Flash Storage Solution Interface Trend

- 2012
- 2013
- 2014
- 2015
- 2016

SAS
SAS4
2.4GB/s

UFS
UFS3.0 (TBD)
11.6 Gbps x 2L

PCIe
PCIe4.0
1.6GB/s

SATA

UFS1.1
2.9 Gbps x 2L

UFS2.0
5.8 Gbps x 2L

UFS2.1
5.8 Gbps x 2L

SATA3.0

UFS1.1
2.9 Gbps x 2L

PCIe3.0

UFS1.1
2.9 Gbps x 2L

eMMC

eMMC4.5

eMMC5.0

SATA3.0

PCIe3.0

eMMC5.1
SK hynix UFS 2.0 Announced In July 2015

UFS 2.0 (Gear3, 2 Lane)

- 16GB
- 32GB
- 64GB
- 128GB

Remarkable Performance

- Seq. Read 780MB/s
- Seq. Write 160MB/s
- Ran. Read 32K IOPS
- Ran. Write 17K IOPS

User Experience Improvement

- 3X Read
- 1.5X Write

Please visit Booth #107

NAND + CTRL + FW = UFS (In-house Solution)
SK hynix UFS2.0 Industry Leading Performance

- Read Priority Policy (example)
  - 32GB UFS2.0, 8GB preload
  - Read/Write Mix workload

- Performance Advantage
  - Minimize R.R degrading while background write
  - Sustain stable performance even less than 2GB free
  - 99% latency within 3ms (QoS)
### UFS Command Queuing Feature

**Benchmark Testing (Multi-tasking)**

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<tr>
<th>Apps</th>
<th>R/W</th>
<th>CNT/sec</th>
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- **UFS Design for multi-tasking**
- **Current applications do not take advantage of multiple queue feature**
- **Unleash application programming on storage IO request**

**Diagram Notes**
- Device is idle status
- 1st Req. executes immediately.
- 2nd Req. must come before clearing 1st Req.
  - 512KB chunk, 2nd Req. within 3ms.
  - 4KB chunk, 2nd Req. within 0.4ms.
High End Mobile Storage Market Technology Adoption

Interface Migration Trend
- Premium Smartphone adopt both UFS & eMMC5.1

UFS Demand Forecast
- 32/64GB major density

(Source: SK hynix Marketing)
Summary

- SK hynix industry leading UFS2.0 now sampling
- Premium smartphone UFS adoption >30% by end 2015
- Industry collaboration needed to unleash full potential of UFS
Thank you

BOOTH # 107

Keynote: Advances in Non-Volatile Memory Will Continue to Revolutionize Computing
Kyo-Won Jin, Senior Vice President, Head of NAND, Aug 12th 11:00-11:30 am

SK hynix speakers at FMS2015

<table>
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<th>Presenter</th>
<th>Schedule</th>
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<tbody>
<tr>
<td>Ben Wu</td>
<td>Aug 11th</td>
<td>8:30-9:35 am Session 101: Mobile Applications (Open Session)</td>
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<tr>
<td>Jetming Woo / Won Gyu Park</td>
<td>Aug 11th</td>
<td>9:45-10:50 am Session 102-A: 3D Flash The Next Dimension</td>
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<tr>
<td>Chris Wojslaw</td>
<td>Aug 11th</td>
<td>3:15-5:45 pm Forum C-12: Why DRAM Really Matters Inside SSDs</td>
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<tr>
<td>Santosh Kumar</td>
<td>Aug 13th</td>
<td>8:30-10:50 am Forum C-31: Enterprise Boot Drive SSD options</td>
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