Universal Flash Storage
- Ultimatum of next generation Storage -

Las Vegas, USA
7th of Jan, 2011

Sung H. Lee
Samsung Electronics Co. LTD
What are in your backpack?
What are in your backpack?

So many digital devices....
What is inside?

So many different types of storage ...
What do we do with...?
Enjoying multimedia...

Multimedia

SD
1.4 GB / 60 min

<

Full HD
3.7 GB / 60 min

<

Full HD + 3D
~ \times 2

[H.264 encoded]

Flash Forward @ CES 2011
Enjoying gizmos...

**Multimedia**

Performance

- Feature phone
  - Basic Call & SMS
  - MP3, Pictures

- Smartphone
  - HD contents, Full browsing
  - Applications and more

Flash Forward @ CES 2011
Enjoying Apps...

Multimedia Applications

24% of US adults use apps on their cellphones

OVER 250K apps on Apple’s & 80K on Android

What are the most popular types of apps?
% of Nielsen recent downloaders who have used each category of apps in the past month...

Games 60%
News/Weather 6.2%
Maps/Navigaiton/Sea... 51%
Social Networking 47%
Music 43%
Entertainment/Food 34%
Banking/Finance 28%
Sports 27%
Productivity 26%
Shopping/Retail 24%
Video/Movies 22%
Communication 21%
Travel/Lifestyle 18%
Other 3%

Source: The Nielsen App Playbook, December 2009. N=3,962 adults who have downloaded an app in the 30 days prior to the survey.

[Source: LA Times, Sept. 14, 2010]
Enjoying the flow of info...

Mobile web browsers usages

Enjoying freedom of multi-tasking...

Multi-tasking
Low latency is must for seamless user experience

Flash Forward @ CES 2011
What do we do with...

Multimedia

Applications

Smartphone

Mobile

Web browsing

Multi-tasking

and MORE!!
What do we come up with...?
What are we planning to do?

- High performance
- Serial interface
- Command queuing

SSD
What are we planning to do?

- Mobile usages friendly
- Flash memory oriented
- Low power

e-MMC
What are we planning to do?

SSD + e-MMC

Flash Forward @ CES 2011
What are we planning to do?

SSD + e-MMC = UFS
What is UFS?

Universal Flash Storage

• Embedded & Removable devices
• 300MB/s with future scalability
• Employ a multi-device chain topology
• Flexible protocol
• Leverage existing standards or works
What is UFS?

Universal Flash Storage

• Embedded & Removable devices
• 300MB/s with future scalability
• Employ a multi-device chain topology
• Flexible protocol
• Leverage existing standards or works

GOAL of UFS TG
Faster Interface

Congested parallel interface vs

Simple faster Serial Interface
Multi commands queuing

One command at a time

VS

Multiple commands queuing
Multi commands queuing

If NOT

Flash Forward @ CES 2011
How is it going to be?

- UFS is formed with simple 4 blocks

Device Manager

- Application Layer
  - UFS Command Layer
  - Task manager

- UFS Transport Protocol Layer (UTP)

- UFS Interconnect Layer (UIL)
  - UniPro
  - M-PHY
How is it going to be?

- Easy for hardware development
  - More than just for UFS

- Adoption of MIPI specification
  - M-PHY version 1.0 for PHY
    - Up to ~3Gbps for UFS 1.0
    - Over 5.8Gbs for UFS 2.0
  - Unipro1.4/1.5 for link
    - Simple but flexible link layers

MIPI specifications are on the final stage of release
How is it going to be?

• Easy to adopt in Software
  – Utilize exiting solutions; SCSI

  - Work with SCSI commands & Architecture
    - SPC, SBC and SAM
  - Min. options & features
    - Select & define for UFS specific usages cases
    - 10 ~ 15 commands

No overhead for OS
How is it going to be?

• Simple but effect driver stack for UFS
  – Flexible device management

• Mobile usages centric device management
  - While work with SCSI & MIPI, UFS still fully mobile & Flash oriented devices

• Work with SAM4

Few extra efforts are needed
How is it going to be?

- Support major e-MMC features and

  - Boot
  - Enhance Partitions
  - Write Protect
  - Multiple Partitions
  - RPMB (Security)
  - Dynamic Capacity
  - Sleep & Reset

  and more..
What are these means..?

- UFS 1.0
- eMMC 4.4 ~

- 150MB/s
- 80MB/s
- 40MB/s

Single Task: 2009, 2010
Multi-Task: 2011

Flash Forward @ CES 2011
Coming soon…

UFS

Coming soon…
THANK YOU