How to Continue
Mobile Device Evolution

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Memory Product Planning
Device Solution
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Contents

➢ Where We Were
➢ What are New Evolutions?
➢ Smartphones Continue to Grow?
➢ Devices’ Trends and Challenges
➢ Collaboration
Mobile is leading the evolution of computing
Blurry Boundary between SP, Tablet and PC
(like computing Capability)

User Scenario Analysis

- Information
- Office, e-book
- SNS
- Game
- Web-access
- Radio/MP3/MOVIE
- Camera
- Call/SMS

Energy Efficiency
Security
Compatibility
Connectivity

Enhanced User Experience

E-Mail/MMS
Web/Apps
Multi-Tasking
N-Screen
Mobile Computing
Transitioning to a Post-PC World

- The liberty of choice makes new diversities

Source: CISCO
What are new evolutions?
Mobile Device Evolvement

- Wearable devices may drive the next wave of mobility

- Sensor Enabled
- Environment-Aware
- Hands-Free
- Easy Access
- Always On/Always Connected
- Development Platforms
- Wider Markets/Applications

... And they all need memory!
Visual Quality Evolvement

Display Resolution
- 800x480
- 1920x1080
- 3840x2160

Camera Pixels
- 5Mp
- 13Mp
- 20Mp
- 4K

Video Quality
- 720p
- 1080p
- 1920x1080
- 3840x2160

2010  Now  2015~
Mobile Era Continues Evolving
Everything will be connected and operated intelligently to improve comfort, convenience, efficiency and security.

Mobility, Cloud, Big Data

- Cloud
- Big Data

Traffic, Oil, Gas station
Road construction
Car accident, Building fire
Others transportation etc

"By 6:00 pm"

"No problem"
IoT Applications

➢ Top 5 Business Models

- Population Aging
- Traffic Accident
- Emergency
- Health Care
- Smart Product Management
- Smart Factory
- Remote Factory/Farm Management
BYOD drives innovation

- This is not the future, it is the new normal...
- BYOD touches the entire business
- 38% Companies expect to stop providing to workers by 2016

Source: CISCO, Knox
The 3\textsuperscript{rd} Industrial Revolution

- 3D printing

Source: Vienna University of Technology, 2012
Just Take a Look at 3D Life
Evolving Mobile Environment
Then, Smartphones Continue to Grow?
Smartphones Market Overview

- Feature phones are being replaced by Smartphones
- 47% increase in sales of smartphones from 2012 to 2013

Mobile Phone Sales

First year smartphones outsell feature phone world wide @2013

Sources: Strategy Analytics, June 2013
Tablets Growing Faster Than Smartphones

- Tablet shipments surpassed DT/NB PC’s in Q4-12
- Large Screen and Computing Power are strongly required

Sources: KPCB, Morgan Stanley Research, Gartner
‘14 LTE expansion to Mid, L/E Segment

- Explosion of VOD and Cloud Service
’14 Smart Device H/W Trend

➢ Display & Camera

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➢ Converge to 5” Smart Phone Display

![Image of different smartphone displays]
’14 New Added Value

- Killer Applications through 3S: Security, Sensor & Screen

Security
- Authentication,
  - Bank, Shopping App

Sensor
- Health Care App

Screen
- Cloud, Wifi-D, UX
Mobile World Changes

- Contents Creation for Personal Cloud
  - Wearable Device: Health Care
  - Create Device: Music, M/V, SNS
  - Security Device: Finance, Payment

- Growth of Killer Applications
  - Security Sensor
  - NFC
  - Computing Power
  - Cloud (w/ Network)
Future mobile devices will be the hub for personal creation.
Devices’ Trends, Challenges
Processor Trend

- Mobile processors reach PC processors
Mobile GPUs are catching up rapidly
Memory Bandwidth Trend

- Face a challengeable BW in mobile DRAM
DRAM Scaling Challenges

- Scale-down will be very challengeable for the future
Form Factor Challenges

- Thinner smartphone requires thinner PKG
- Thinner PKG leads warpage challenge
Thermal Challenges

- Thermal management is another barrier for the performance improvement
Power Challenges

- Power consumption is a key

Power estimation condition: IDD4R@1.2V, Channel efficiency 100%, 120ohm ODT @ LP3E-2133, 40ohm Ron, Cload=5pF(WIO2=1.5pF)
Collaboration
Future Memory Considerations

Release Row Access

In DRAM Refresh

Remapping

Protocol

Physical Address

Logical Address

Host

DRAM/*
Future Storage Considerations

**Secure Storage**
- Home
- Office
- Host
  - Normal Free data
  - TrustZone Secure data
- Controller Encryption Engine
  - User Data Area
  - Security Key

**S/W Solutions**
- Samsung Magician
- File Manager
  - Device optimization
  - Total Bytes Written 3.4TB

**Super performance**
- High Speed
- Low Power
- SSD (SAS)
- eMMC
- UFS for Mobile

**Smart Solution**
- Improve Security, file management, and power efficiency
AP & Memory Collaboration

[Image of a diagram showing a schematic of a memory system with labels for SOC and Memory, along with logos for Snapdragon MSM8974 and APQ8084.]
LPDDR4 Collaboration

- Early Engagement
- Product Schedule Alignment
- JEDEC Drive
- Spec Alignment
- Joint Validation
Collaboration for Future Technique

Effective collaboration for the next generation

LPDDR5/UFS2.0
For Smart Mobile Life

Support New Mobile World with the Best Product
Thank you