JEDEC

Global Standards for the Microelectronics Industry

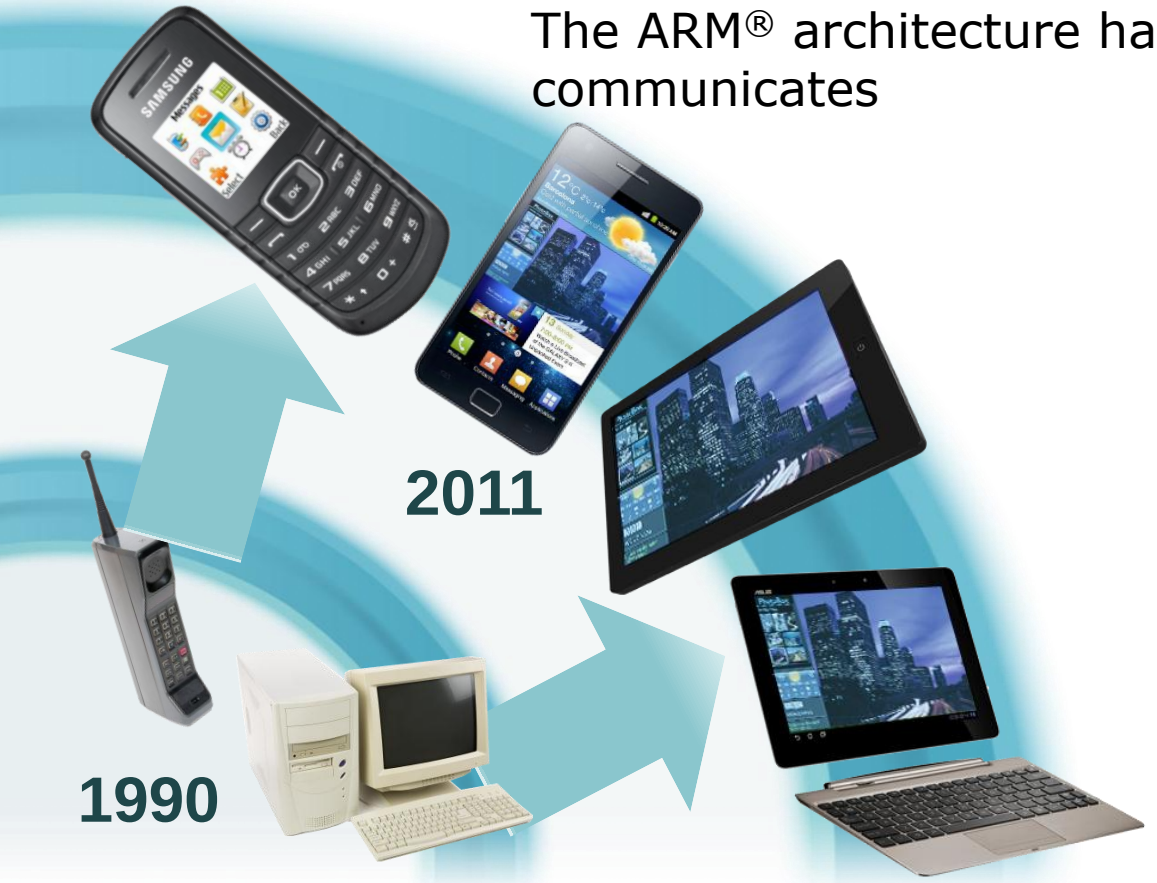
Mobile SoC Apps Processor Trends

ARM

Mobile Memory Forum Seoul 2012

Rapid Transformation in How We Communicate & Compute

The ARM® architecture has changed how the world communicates



>6Billion connected people

$10 price of worlds cheapest phone

Mobile devices outsell PC's

Always on, always connected

It's Not Just The Apps Processor

SIM
- SecurCore® SC300™

WiFi
- Cortex-M4

Bluetooth
- Cortex-M3
- Cortex-M0

Cellular Modem
- Cortex-R4
- Cortex-R5
- Cortex-R7

GPS
- Cortex-M3
- Cortex-M0

Apps Processor
- Cortex-A5
- Cortex-A7
- Cortex-A9
- Cortex-A15
- Mali™-300
- Mali-400
- Mali-T604
- Mali-T658

Flash Controller
- Cortex-M3

Touchscreen Controller
- Cortex-M0
- Cortex-M3

Power Mgmt
- Cortex-M3
- Cortex-M0

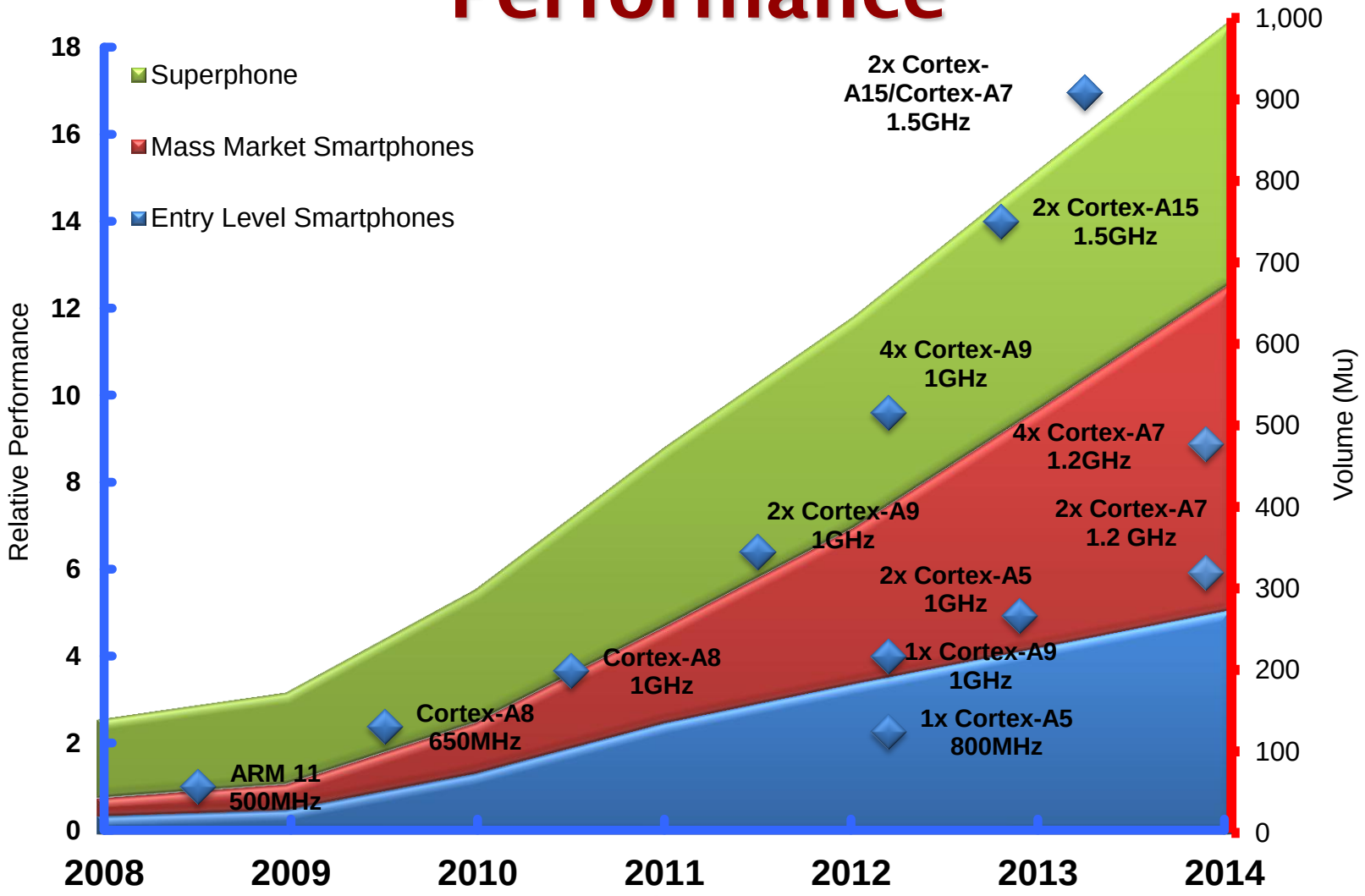
Ghosts of Smartphones Past

	2000 Nokia 6210	2004 HTC Typhoon	2008 T-Mobile G1	2011 Galaxy Nexus
Processor	40 MHz ARM 7	200 MHz ARM 9	528 MHz ARM 11	2x Cortex-A9 1.2GHz
RAM	Very Little	32MB	256 MB	1 GB
Screen	B/W	220x176	480 x 320	1280 x 720
Graphics	Stunning Greyscale	None	GLES 1.1	GLES 2.0
Video	None	None	QVGA+	1080p 60 fps
Modem	19 Kbps	256 Kbps	7 Mbps	21 Mbps

Memory Impacts User Experience

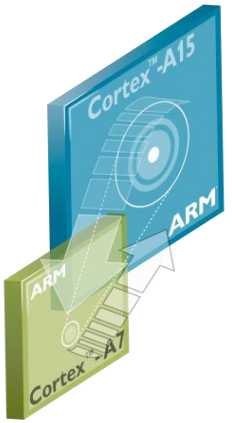
- Smartphone use cases are all about "multitasking"
- I can easily have 18+ open applications on my phone
- Consumers need to seamlessly switch between then with no lag
- Apps must be able to hibernate in memory
- Memory must support B/W requirements
- Battery life still critical

Rapid Increase in Smartphone Performance



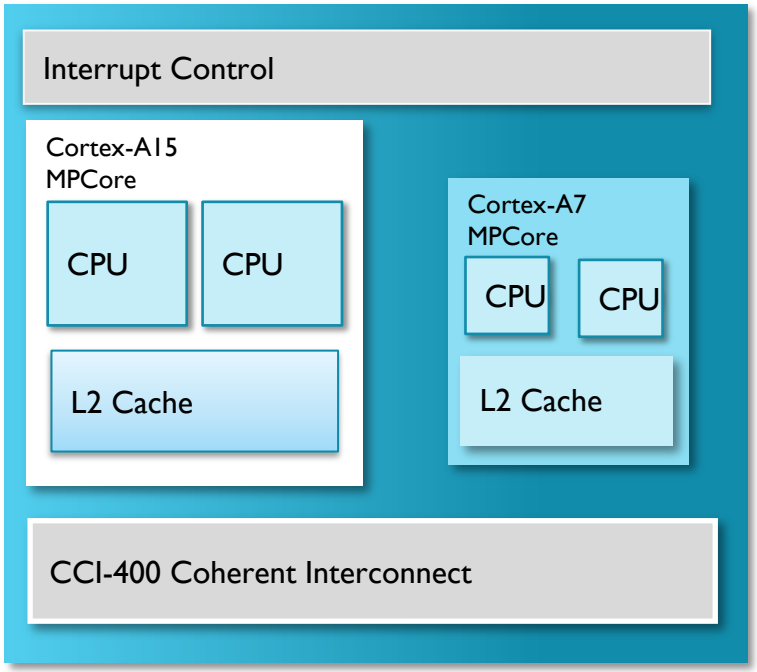
Source: Gartner Q3 2011 Forecast

big.LITTLE Processing



- Uses the right processor for the right job
- Up to 70% energy savings on common workloads
- Flexible and transparent to apps – seamless software handover
- Best of both worlds solution for high performance and low power

big



LITTLE

Visual Computing Drives Experience

User Interface

Augmented Reality

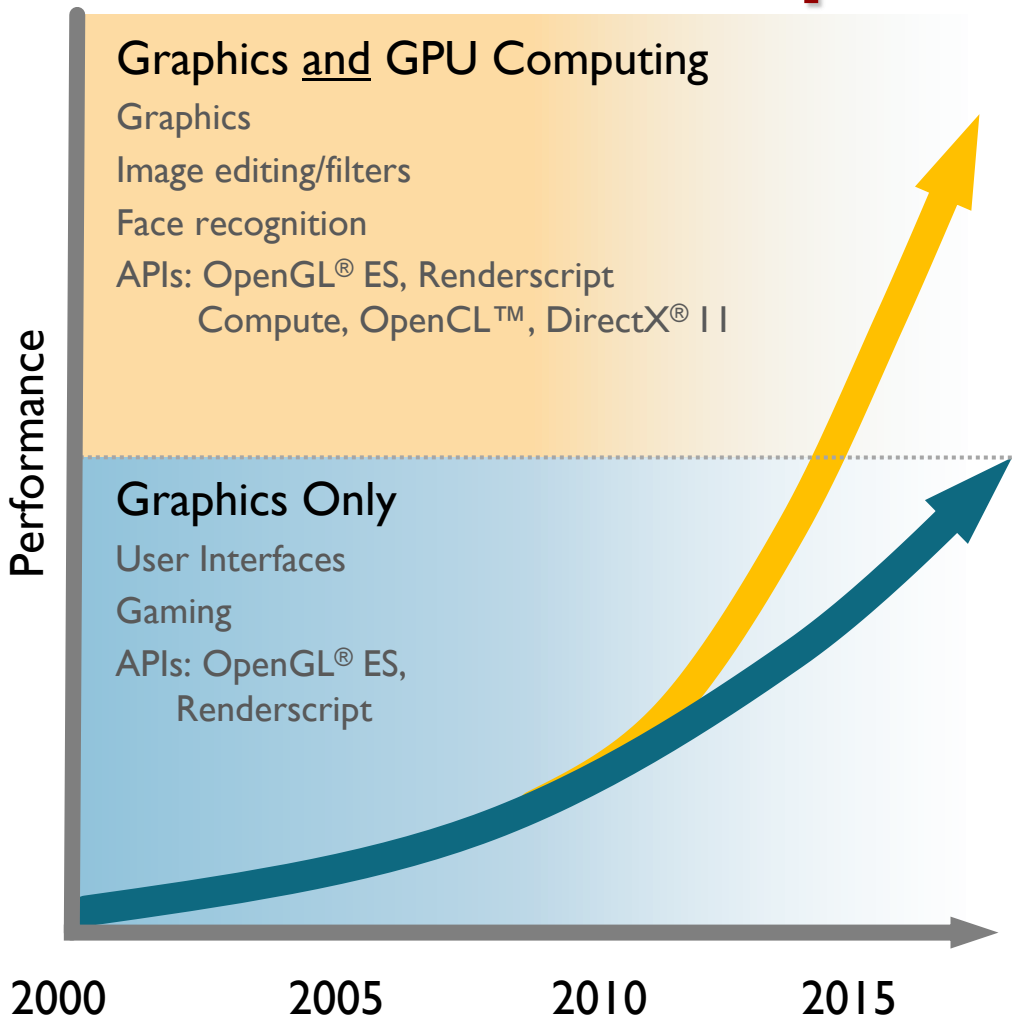
Image Recognition/ Processing

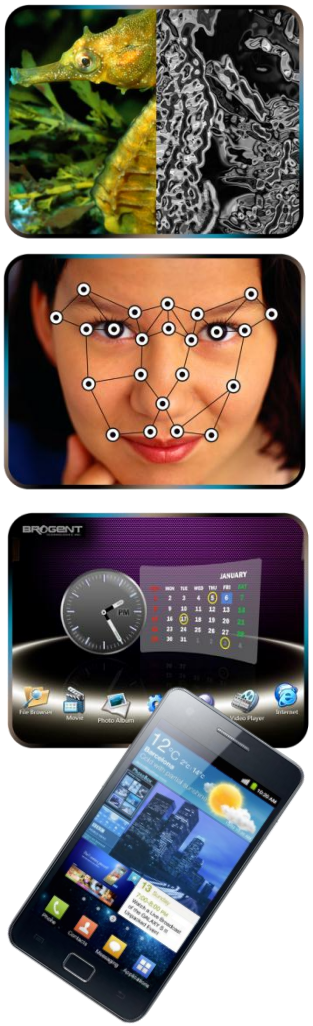
Advanced Gaming

Increasing screen resolutions

- Immersive UI
- Engaging gaming experience
- Content across multiple screens
- Video editing
- Interaction via facial recognition and gesture

Mali GPU for Broad Application Space





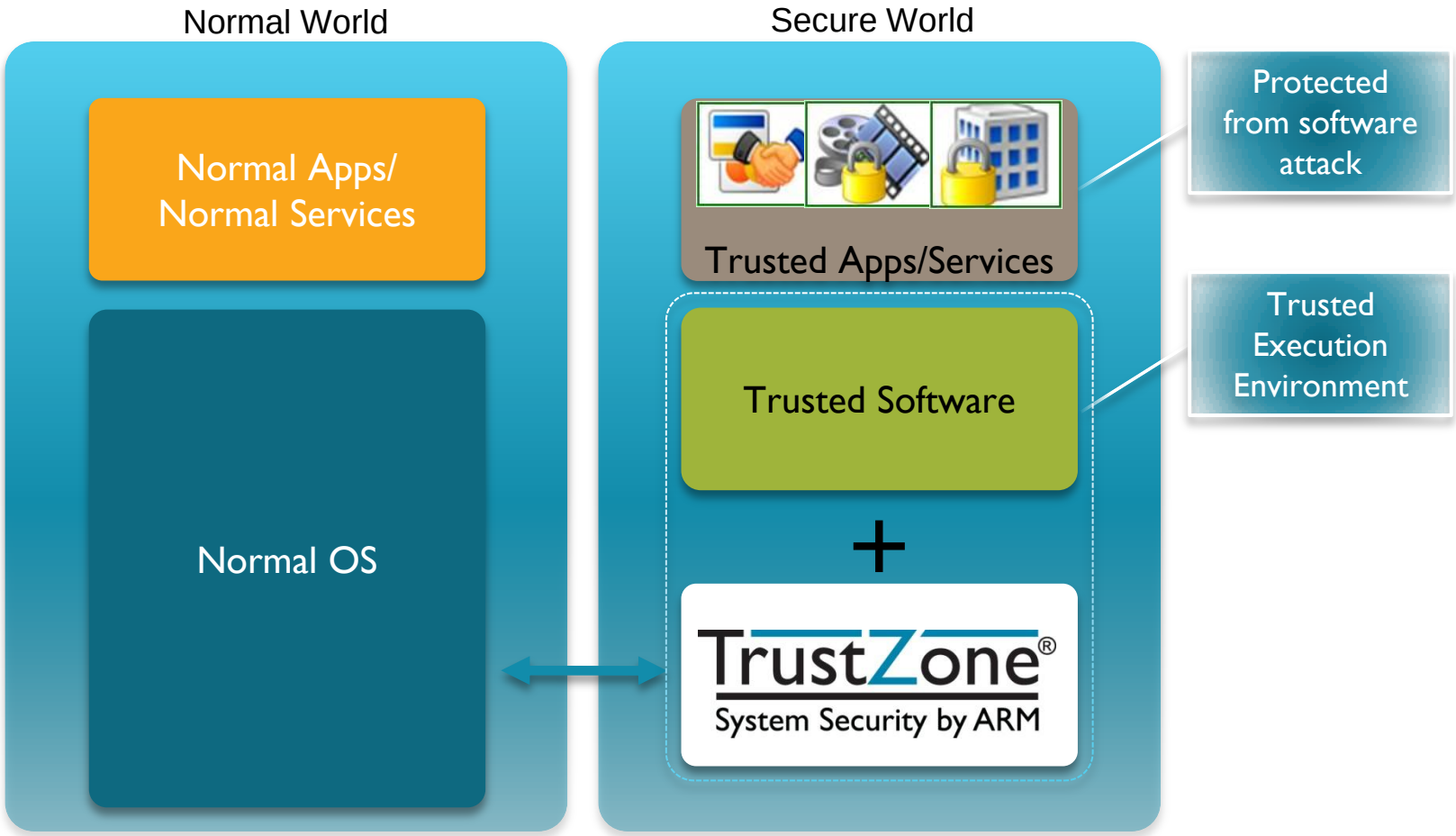
ARM Leadership

- Performance density for GPU Compute
- CPU/GPU smarter systems
- Scalable solutions

ARM Leadership

- Performance density
- Scalability – right sized performance

TrustZone Securing the System



Use Cases Driving Memory Usage

Superphone of 2014

Continued rapid platform innovation and performance increase

- TrustZone Security
- Your Primary Device
- Contextually Aware
- New UI Paradigms
- Multi-Screens
- LTE - Truly Connected

2x ARM Cortex-A15 +
2~4x Cortex-A7
“All the compute performance you need”

LTE and LTE+ modems with high data rates and low latency
100+ Mbps

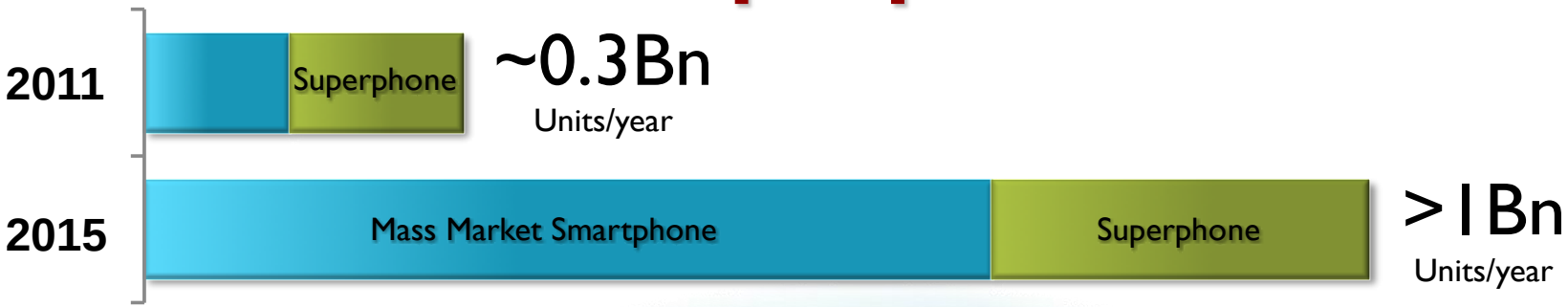
4x Mali-T6xx GPU &
GPU Compute core

Gigabit WiFi AC

Ability to drive 2.5K external screens and 720p screen on device

40 bit physical addressing support
4+Gbyte memory

Significant Growth Beyond the Superphone



Delivering Internet and Computing to the next 1+ Billion

- Strong local ecosystems
- Smartphone displacing PC's
- Mobile internet overtaking fixed line
- User experience of today's Superphone
- China overtake USA Smartphone users
- Emerging markets to shape app development

Mass Market Smartphones

Strongest sector for growth – Matching to the 2011 Superphone experience

- Great user experience
- Full HTML5 Browser
- Same OS as Superphone
- 1080P Video support
- 3D Gaming

- 2x or 4x 1GHz apps processors
- LTE Modem 100Mbps
- 1GB RAM to ensure OS and application compatibility
- 1080p GLES 2.0 graphics
- 1080P video support, & 1080p video out

The Smartphone Real Estate Challenge

- Larger batteries
- More antennae's
  - Multiple LTE frequencies
  - MIMO
  - NFC
- Thermal complexity
  - Xbox 360 capability in a phone
  - Docked modes
- Must be thin
  - 9mm is today’s standard

Is it a Laptop, STB, or is it Superphone?

Feature	Specification
CPU	2x Cortex-A15 + 2x Cortex-A7
Graphics	Xbox 360 class
Video support	1080p 120fps decode/encode
Screen support	Multiple 2.5K support
Imaging	32fps high mega pixel capture
Connection	100MBps LTE Gigabit WiFi AC
Memory	4GByte plus

Summary

- Smartphone market is going to bifurcate
  - Superphone or massmarket
- Superphone just demands more
  - Higher performance with CPUs/GPUs
  - Longer battery life with lower power consumption
  - 4+GByte memory & Higher bandwidth/IOPS
- Mass market smartphone just demand more for less
  - 1+ Gbyte in $150 phone expected in a couple of years
  - Low power with last year's high-end performance