Smartphone Hardware Architecture

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Agenda

• Architecture
  o ARM processor
  o Snapdragon
  o Comparison to PCs
• Developments
• Introduction and History
  o System On Chip
  o Multi-Core
• Challenges
  o Is hardware evolution slowing?
  o Moore’s law
  o Miniaturization vs improving performance
• Conclusion
Introduction

No standard exists to define what makes a phone a smartphone.

• GSM/CDMA/etc mobile phones
• run a high-level operating system
• Features:
  o WiFi
  o Bluetooth
  o internet access
  o custom application software
  o cameras
History

• 1997 - Term smartphone is coined

• 1999 - RIM begins making BlackBerries

• 2007 - iPhone 1 released

• 2008 - Android v1.0 released

• Now - iPhone 5 and Android v4.2
History

• 2007
  o smartphones are 12% of total sales of phone handsets

• 2012
  o smartphones are 37% of total sales of phone handsets
  o 45% of American adults own smartphones
  o In the age range of 18-29, the number is 66%
Architecture
• RISC Based Processor conceived in the 80s

• Android first utilized ARM in 2008

• Since 2008, 190 million Android devices shipped with ARM

• Great performance with low power costs

• NVIDIA Tegra 3 - 4 ARM Cortex A9 cores at 1.5 GHz on HTC One X Device
Architecture - ARM
Architecture - Snapdragon

• Similar to ARM processors, ARM Cortex A15

• Developed by Qualcomm

• Built with 28 nm process

• Uses ARMv7 ISA

• Up to 1.7 GHz quad core with 2MB L2
Architecture - PCs

- Smartphones constrained by power demands - battery vs. wall power
- Smartphones constrained by size
- PCs losing popularity due to increased portability
- Replace PCs in the future
Developments
Developments - SoC

• System on a Chip
  o Whole-system ICs
  o Reduced cost

• Contrast with microcontrollers
  o generalized
  o higher performance
  o matter of scale
Developments - Cores

- Dual and Quad core
  - Qualcomm Snapdragon
  - Nvidia Tegra 3
- Untested performance improvement
  - "The reality is that the quad-core could be better, it could be equal, or it could be appreciably worse."
    - Nick DiCarlo, VP Marketing at Samsung
  - "...the so-called dual-core, quad-core mobile phones can only waste batteries, but not be useful for consumers all the time."
    - Stephen Elop, CEO at Nokia
Challenges

• Hardware evolution is slowing
  o “it is becoming increasingly difficult for handset makers to differentiate their smartphones in terms of hardware specifications.”

• Moore's Law

• Consumer demands shifting away from hardware performance
Conclusion

• Demographics show smartphones are quickly permeating daily life

• Raw performance may be losing priority for new developments

• Portable computing may eliminate stationary/desktop computing for consumers
Questions?