Agenda

● Background:
  ○ Smartphones
  ○ System on a chip (SoC)

● Snapdragon:
  ○ History
  ○ Architecture
  ○ Features
  ○ Competitors
Smartphones

- What’s a smartphone?
  - Mobile communication device
    - Calling and texting your mates
    - Internet connection via Wifi or cell tower
  - A baby computer
    - Has a CPU, GPU, memory, etc
    - Application support
  - A multimedia device
    - Can take, store and view images and videos
    - Can generate and play audio files

- What came before it?
  - Cell phones
    - Just for making calls
    - Maybe a camera and texting
  - PDA
    - Personal organizer
    - Could surf the web and view media

- What makes it tick?
System on a chip (SoC)

- Tiny chip that performs a wide variety of tasks
  - Handles:
    - Graphics processing
    - General processing
    - Interfacing with sensors (camera, accelerometer, etc)
    - And more
- Used extensively in modern mobile devices
  - Smartphones
  - Tablets
  - Smartwatches
The Snapdragon
History

- The first product was released in 2007 as a part of the S1 Series of Snapdragons.
- The Snapdragon is a mobile SoC that is manufactured by Qualcomm.
  - Has several different series:
    - 200 - Entry level; gets the job done
    - 400 - Made for high volume smartphones on budget
    - 600 - Made for mid range devices
    - 800 - The best there is, made for high end devices
The dog days

- **Snapdragon S1 series**
  - First chip unleashed in 2007
- **Early S1 chips used an ARM1136 CPU**
  - MSM7227 SoC (2008)
  - Technology size: 65 nm
- **Also contains an Adreno 200 GPU**
  - Oh boy
The ARM1136 CPU

- Single core
- 8-stage integer pipeline
- Harvard-style 4-way set associative cache
  - Up to 64 KiB separate data and instruction L1 caches
- Supports an L2 cache
- Qualcomm implementation in the MSM7227:
  - 16 KiB L1 caches
  - 256 KiB L2 cache
The latest Snapdragon

- **Snapdragon 835 (2017)**
  - Featured in several high-tier smartphones
    - Samsung Galaxy Note 8, Sony Xperia XZ premium and the Google Pixel 2, among others
- **Octacore Kyro 280 CPU (4 cores at 2.45GHz and 4 cores clocked at 1.9GHz)**
  - Implements ARM’s big.LITTLE design
    - Some high-performing, energy-devouring CPU cores alongside energy efficient, lower performance cores
    - Less overall power consumption and longer battery life
Kryo 280 Efficiency Cluster Optimization

**Performance**
Up to 2.45GHz
2MB L2

20% performance uplift over range of use cases such as app load time, web browsing, VR

**Efficiency**
1.9GHz
1MB L2

80% of time is spent on efficiency cluster
Minimized memory transaction power with larger L2 cache
Snapdragon 835 continued

- CPU one of the first manufactured using 10 nm FinFET transistors
- So what?
  - Smaller transistors lets you cram more transistors on a chip
  - Snapdragon 835 contains over 3 billion transistors
Snapdragon 835 processor

Snapdragon X16 LTE
World's first announced gigabit-class LTE modem

Qualcomm® Hexagon™ DSP
Tensorflow and Hallide Support

Qualcomm® Kryo™ 280 CPU
Our most power efficient architecture to date

Qualcomm® Adreno™ Visual Processing
25% Faster Graphics Rendering
60x More Display Colors*

Qualcomm Spectra™ Camera ISP
Smooth Zoom
Fast-Autofocus
True to Life Colors

Qualcomm Haven™ Security
First to support full biometric suite

* Compared to Snapdragon 820
Qualcomm Adreno, Qualcomm Kryo, Qualcomm Hexagon, Qualcomm Spectra, Qualcomm Aqstic, Qualcomm iZat, and Qualcomm Haven are products of Qualcomm Technologies, Inc.
Snapdragon 835 continued

- Adreno 540 GPU

**PassMark PerformanceTest Mobile V1 - 3D Graphics Tests**

3409 Points (100%)

- Qualcomm Adreno 200 -90%
- Qualcomm Adreno 530 -36%
- Intel HD Graphics 615 -22%
- Qualcomm Adreno 540
CPU face off

- Exynos
- Apple A chips
- Snapdragon

<table>
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<th>Device</th>
<th>Score</th>
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<td>Samsung Galaxy S8+</td>
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What's next?

Snapdragon 845

- Releasing early 2018
  - First smartphone with the latest Snapdragon 845 will be the Samsung Galaxy S9
- Rumors suggest it will be built with 7nm technology size
- Should have more performance and a better battery life
  - Around 10% more performance and 15% efficiency
- Adreno 630
Questions?