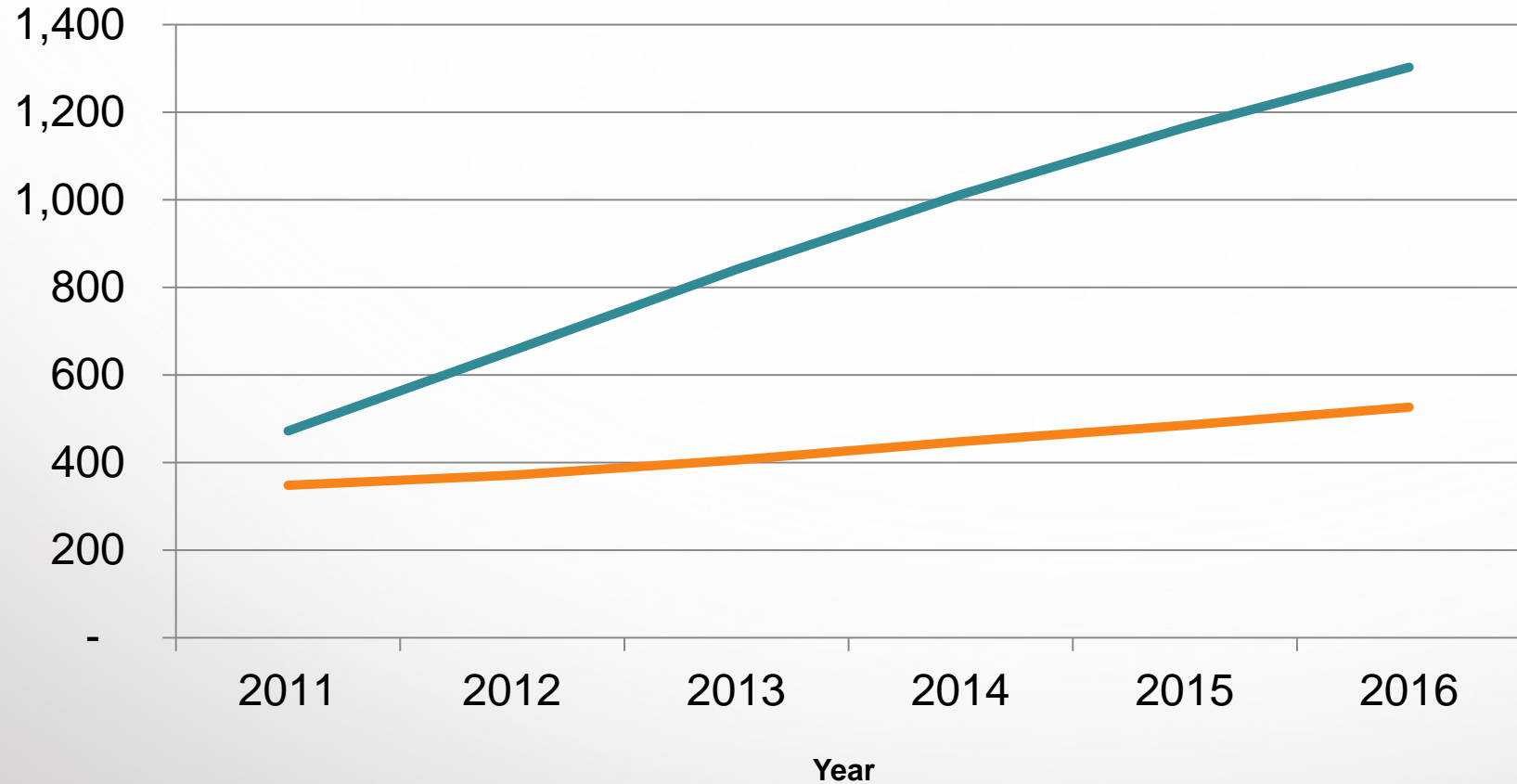# QUALCOMM®

GPU & API Trends

Andy Gruber
Senior Director of GPU Technology
Qualcomm

Smartphones have become the leading computing platform

Annual Smartphone shipments exceeded PCs in 2011, and are growing at a much faster rate

Millions of Units

Smartphone unit volume expected to be nearly 3x higher than PC volume by 2016
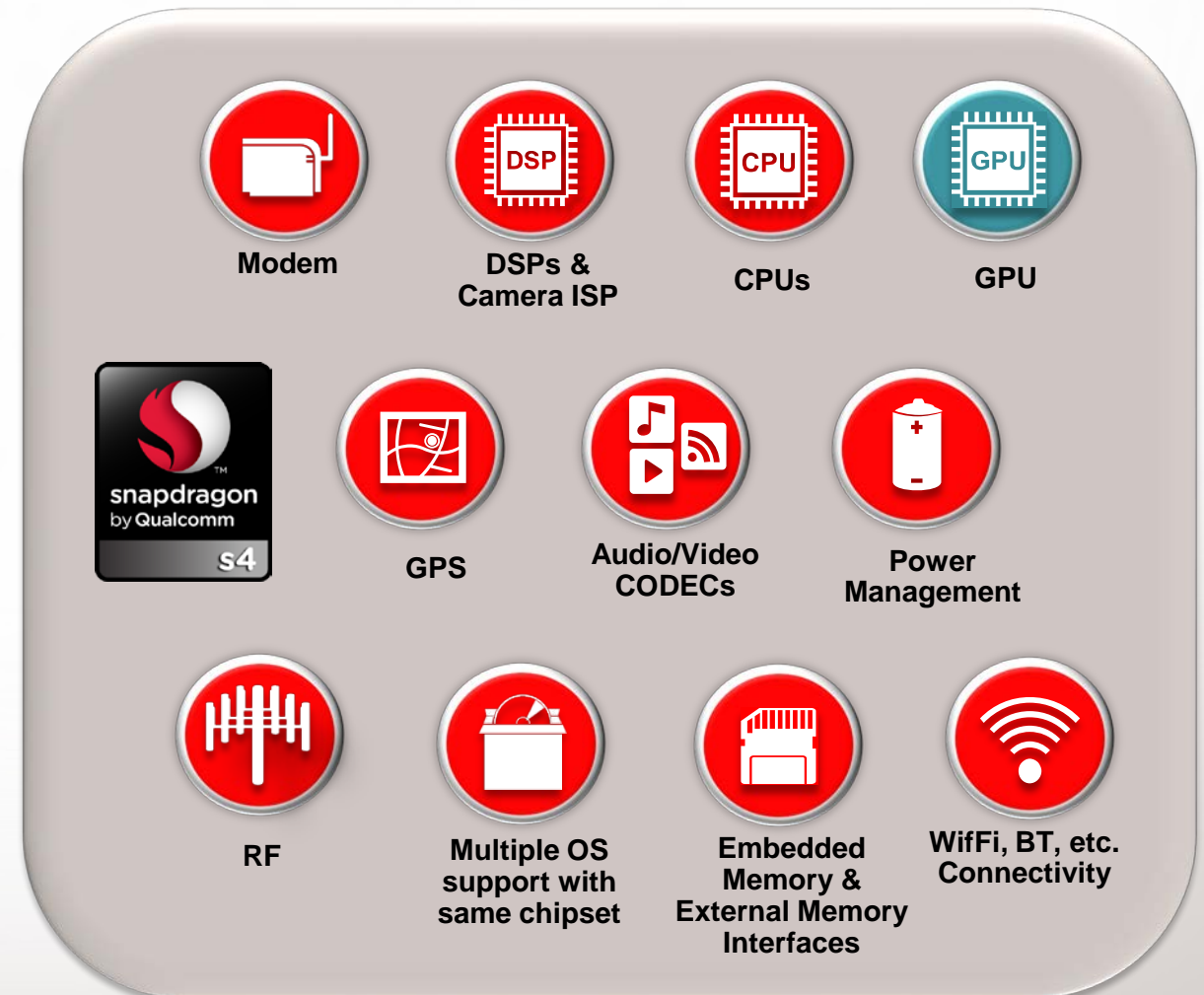
— Smartphone
— PC

	2011	2012	2013	2014	2015	2016

Year

Mobile Hardware Convergence

Each new Qualcomm mobile chipset contains more integration of previously separate & discrete functions

Power & Memory Usage matter in Mobile!

- More concurrency, but less power for Mobile
  - Mobile use cases tend to invoke more concurrency than desktop use cases
  - Yet mobile form factors have more stringent power consumption & thermal constraints

- More Memory Constraints for Mobile
  - Less available memory bandwidth per unit of compute in mobile devices than in desktop
  - Tighter cost constraints on total Mbytes of memory usage per mobile system
  - Mobile display resolutions are rapidly increasing, putting even more demands on reducing memory bandwith & memory footprint
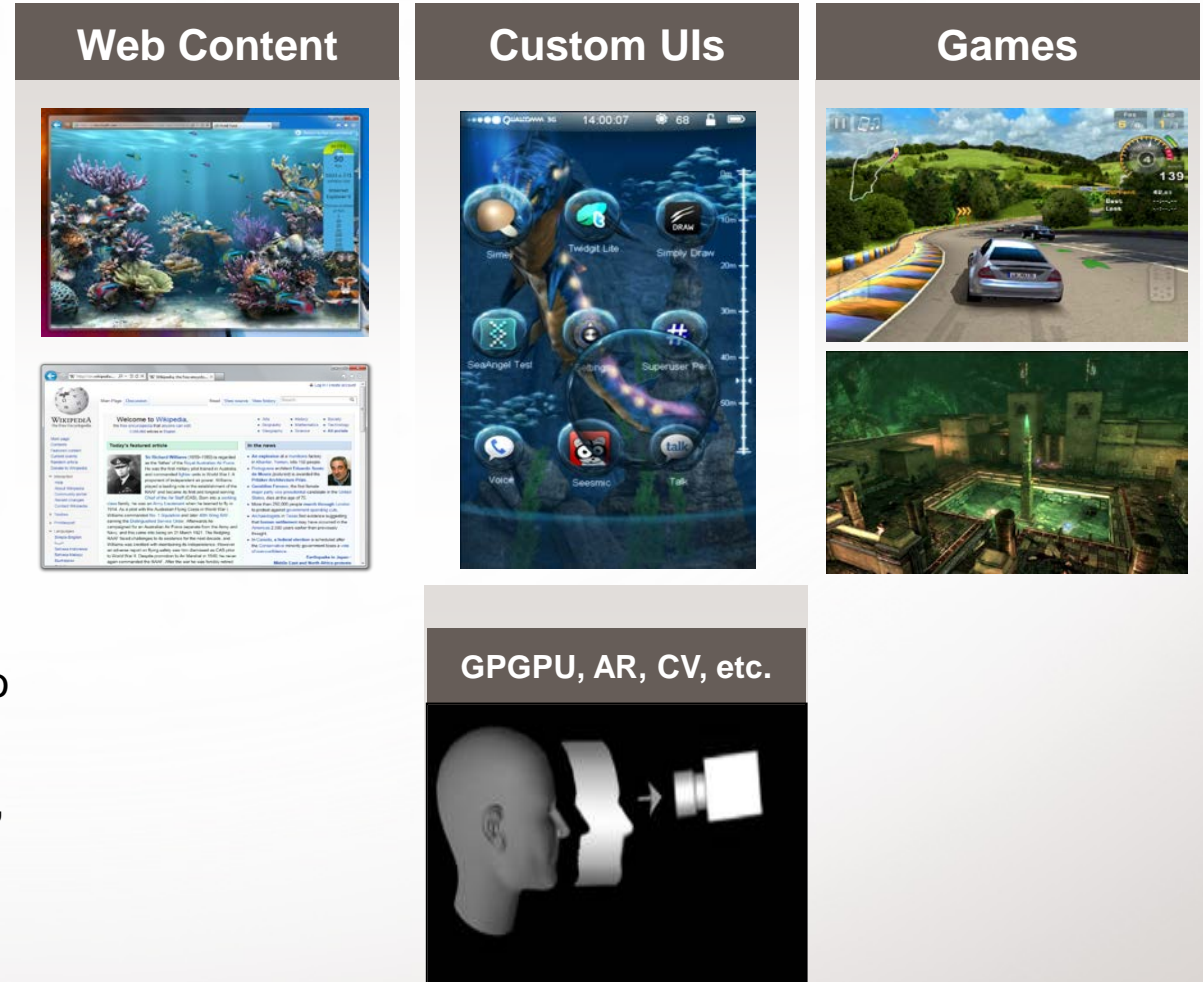

Modem

DSPs & Camera ISP

CPUs

GPU

snapdragon by Qualcomm s4

GPS

Audio/Video CODECs

Power Management

RF

Multiple OS support with same chipset

Embedded Memory & External Memory Interfaces

WifFi, BT, etc. Connectivity

Graphics API Convergence

What's the best API for future devices?

- Desktop Graphics APIs blazed the trail…
  - E.g Desktop OpenGL in the mid/late 90's
  - But these APIs for workstation GPUs were not designed with today's mobile constraints in mind
  - Even Desktop is becoming power and memory constrained, partly due to inefficient APIs
- Mobile Graphics APIs for the Mobile World
  - OpenGL ES & EGL are not perfect but they are designed specifically for today's mobile use cases
  - Future APIs should advance quality in a way that also minimizes power and memory bandwidth & footprint
  - Mobile is the future. That's what is driving the market, and we need to be focused on it.

Web Content

Custom UIs

Games

GPGPU, AR, CV, etc.

Thank You