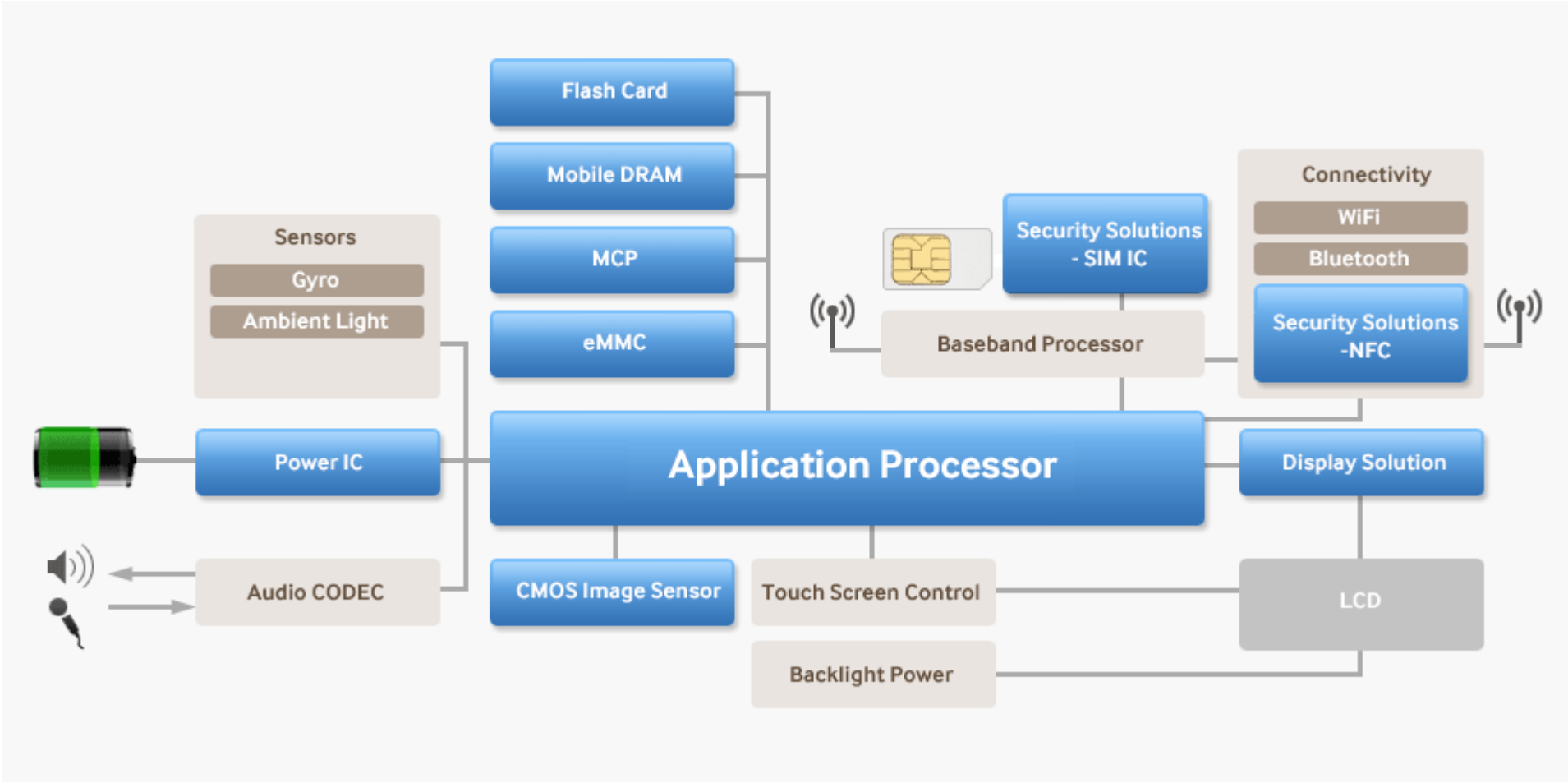
An Overview of Mobile Devices

IIIT Sri City

Image source: comodo.com

Dr. Shiv Ram Dubey

Main PCB Architecture



Source: Dong Xuan

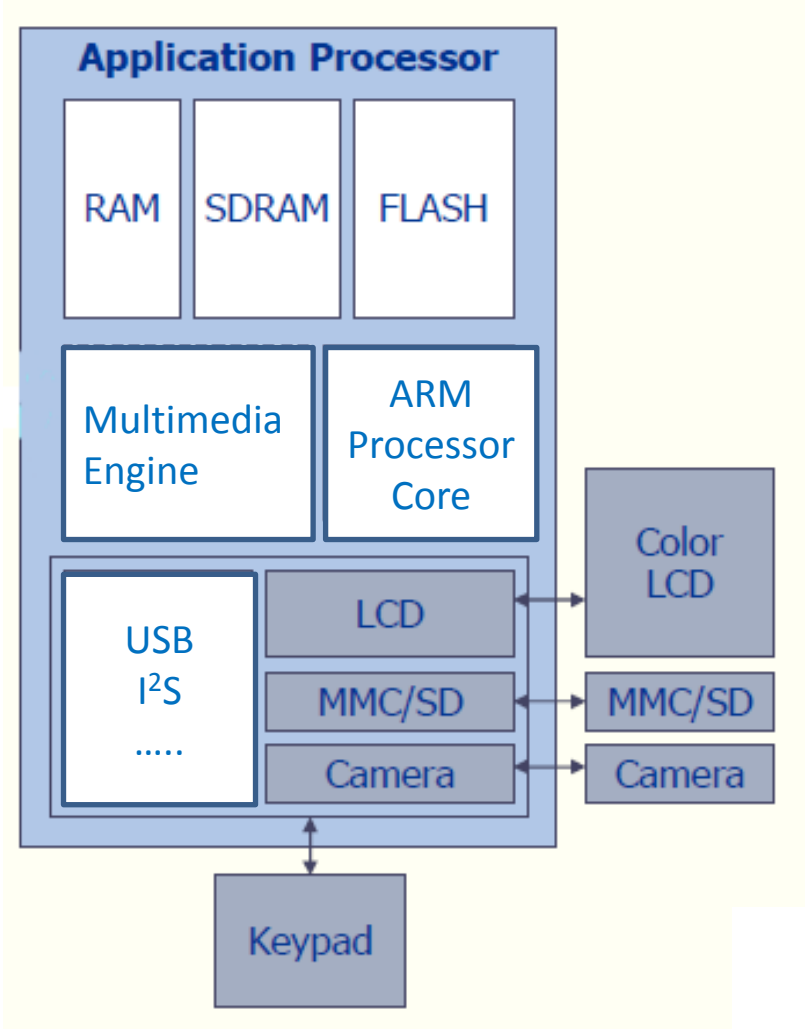
Application Processor: Overview

- A dedicated processor which enables smartphone to run mainstream OS such as Android, iOS and Windows Mobile etc.
- Optimized to run a number of user applications
- Emphasize multimedia processing (audio/video/still image/2D/3D)
- Do not handle “baseband” (wireless communications)

Application Processor: Components

- **Processor core** (e.g. ARM based processor)
  - which is specifically optimized for minimal power consumption
- **Multimedia engine**
  - which is hardware implementation of one or more multimedia standards (e.g. JPEG module, MPEG module, Audio module)
- **Device interfaces**
  - which are used to communicate with peripheral device (e.g. USB, camera, display)

Application Processor: Structure



Source: Dong Xuan

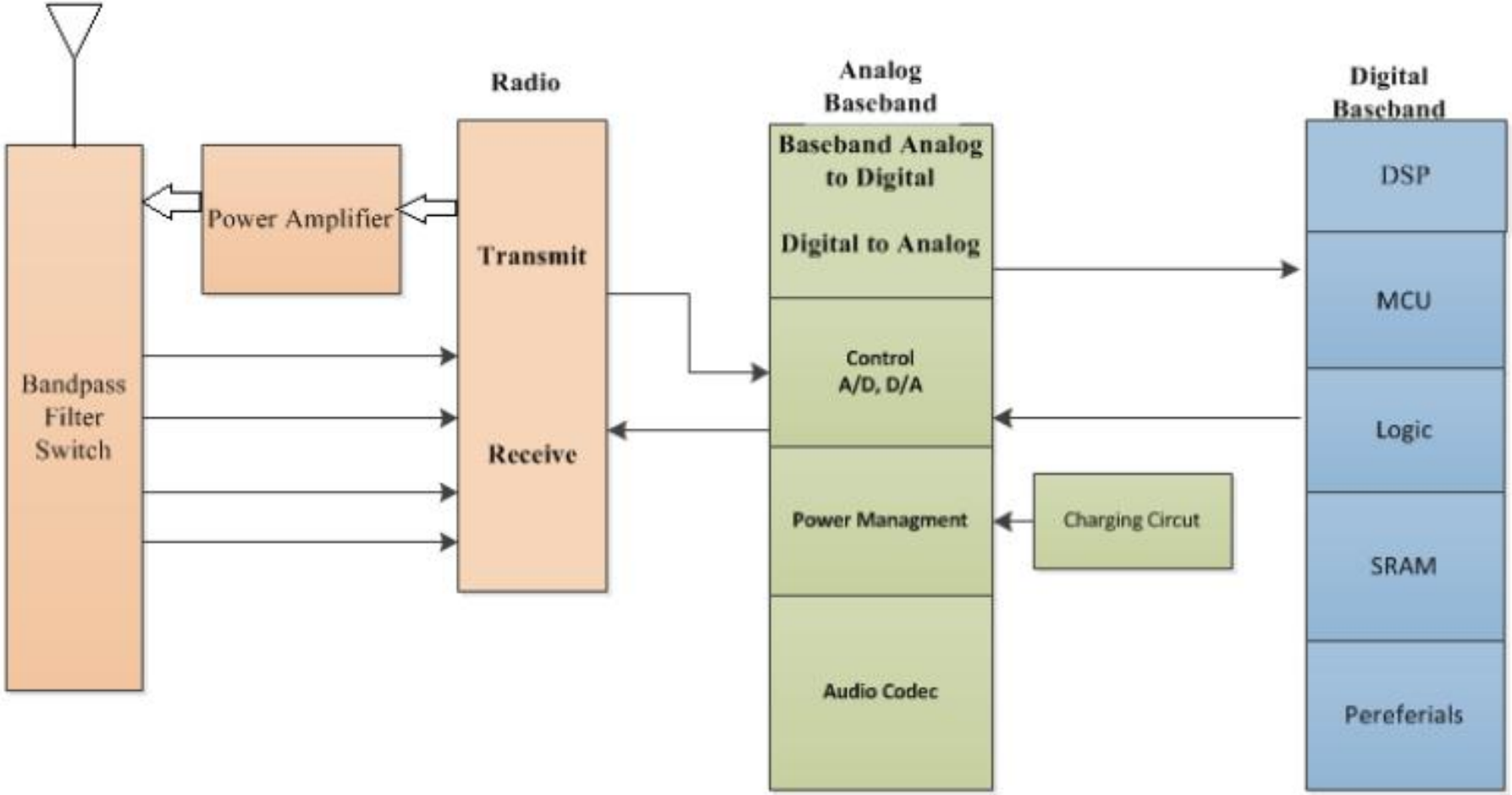
Baseband Processor: Overview

- It has a communication protocol stack which enables different types of wireless technologies such as LTE, CDMA, ZigBee, Bluetooth, Wi-Fi, etc.
- It provides radio communication related functions: signal modulation, RF shifting, encoding/decoding, etc.

Baseband Processor: Components

- **RF front end:**
  - a component for receiving and transmitting on different frequencies
- **Analog baseband:**
  - an interface between the digital domain and the analog domain
- **Digital baseband:**
  - a component which handles higher layers of the protocols by using Digital Signal Processors

Baseband Processor: Structure



Source: Dong Xuan

Processor Vendors

Vendor	Notes
ARM	Family of GPP cores used in most application processors
AMD	Family of MIPS-based application processors
Intel	PXA family of application, application/baseband processors
MIPS	Family of GPP cores used in some application processors
MediaQ	Katana family of application processors
Motorola	Several families of application, application/baseband processors
NeoMagic	MiMagic family of application processors
Qualcomm	MSM7xxx family of application/baseband processors
Renesas	Family of SH-based application processors
Samsung	S3Cxxxx family of application processors
STMicro	OMAPI-compatible Nomadik application processors
TI	OMAP families of application, application/baseband processors

Source: Dong Xuan

Mobile Operating Systems (Mobile OS)

- Currently, handsets run several OSes:
  - Google Android
  - Apple iOS (Renamed in 2010 from iPhone OS)
  - Windows Phone

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- Early Mobile OSes:
  - Symbian OS
  - Palm OS
  - BlackBerry OS
  - Linux
  - MXI

Android

Developer	Google, Open Handset Alliance
Written in	Java (UI), C (core), C++ and others
OS family	Unix-like (Modified Linux kernel)
Initial release	September 23, 2008; 10 years ago
Latest release	9 "Pie" / August 6, 2018; 3 months ago

Source: wikipedia

Open Handset Alliance

Open Handset Alliance (OHA)

a consortium of 84 firms to develop open standards for mobile devices.

Member firms include

HTC, Sony, Dell, Intel, Motorola, Qualcomm, Texas Instruments, Google, Samsung Electronics, LG Electronics, T-Mobile, Sprint Corporation, Nvidia, Wind River Systems, etc.

Source: wikipedia

Android Versions

Version	Code name	Release date
9	Pie	August 6, 2018
8.1	Oreo	December 5, 2017
8.0		August 21, 2017
7.1	Nougat	October 4, 2016
7.0		August 22, 2016
6.0	Marshmallow	October 5, 2015
5.1	Lollipop	March 9, 2015
5.0		November 3, 2014
4.4	KitKat	October 31, 2013
4.3	Jelly Bean	July 24, 2013
4.2		November 13, 2012
4.1		July 9, 2012
4.0	Ice Cream Sandwich	October 19, 2011
2.3	Gingerbread	February 9, 2011

Source: wikipedia

A Quick Summary on Handset OSes

	iOS	Android	Windows Phone	BlackBerry OS	Symbian OS
Company	Apple	Open Handset Alliance, Google	Microsoft	Research in Motion	Accenture on behalf of Nokia
Open Source?	No	Yes	No	No	Yes
OS Family	Darwin (Unix-like)	Linux	Windows NT	QNX	Psion's EPOC
Supported CPU Architecture	ARM, ARM64	ARM, x86, MIPS, 64-bit variants of each	ARM	ARM	ARM, x86
Programming Language	C, C++, Objective-C, Swift	C, C++, Java	C# (.NET), VB.NET, C, C++, DirectX	C, C++, HTML5, JavaScript, Java ME	C, C++, Java ME, Python
Development Cost	$0 (univ.), $99/yr. (person), $299/yr. (corp.)	$0	$0	$0	$0
App Store Publishing cost	Included in dev. cost	$25 one-time	$0 (1 yr., student) $19/yr. (person), $99/yr. (corp.)	$0	$0

Source: Dong Xuan

All the Sensors in Your Smartphone

Image Source: https://www.ifixit.com/Teardown/iPhone+7+Teardown/67382

Accelerometer

Image Source: gizmodo.com

Gyroscope

Image Source: gearbest.com

Magnetometer

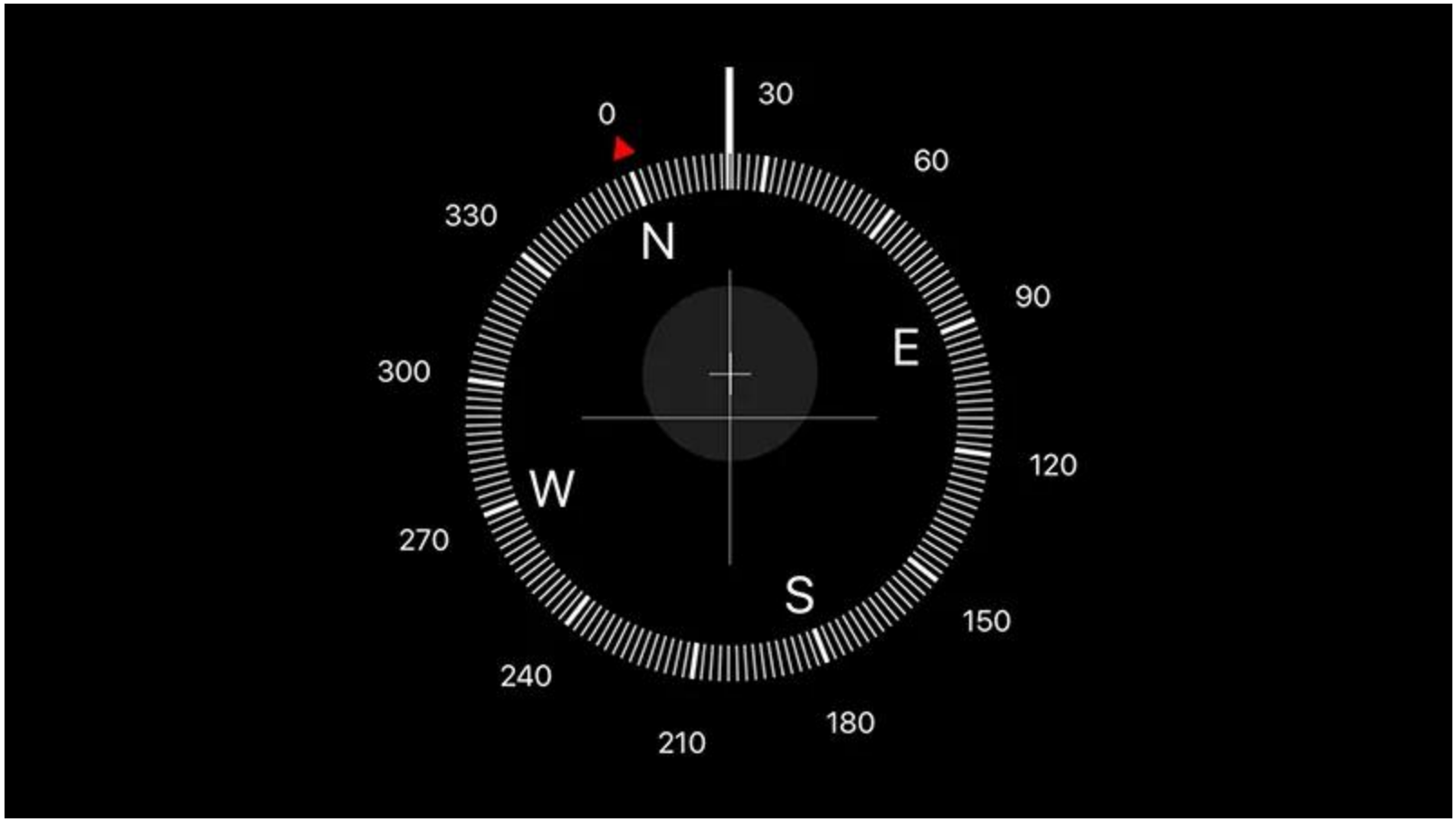

Image Source: gizmodo.com

Global Positioning System (GPS)

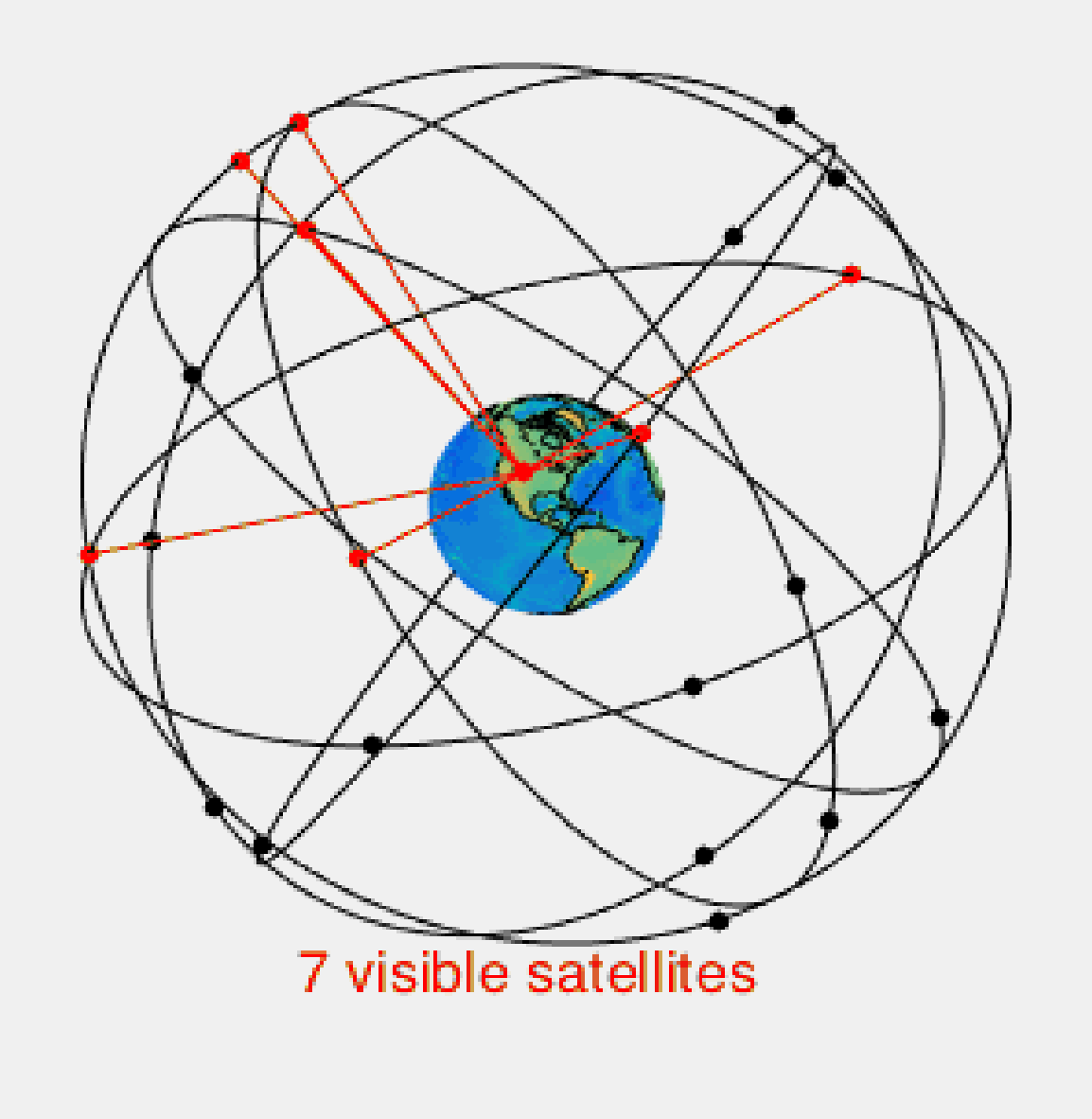

Image Source: wikipedia

Global Positioning System (GPS)

Trilateration

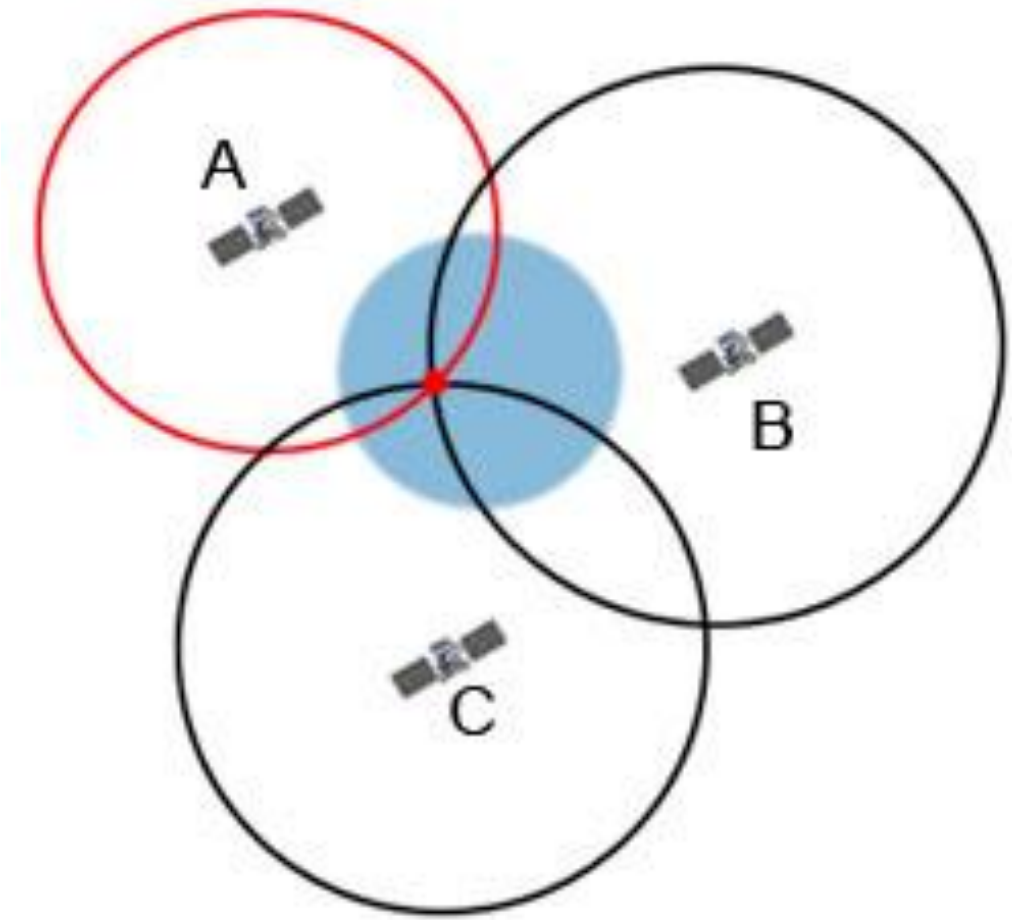

Image Source: physics.org

Barometer

Image Source: iPhoneTricks.org

Proximity Sensor

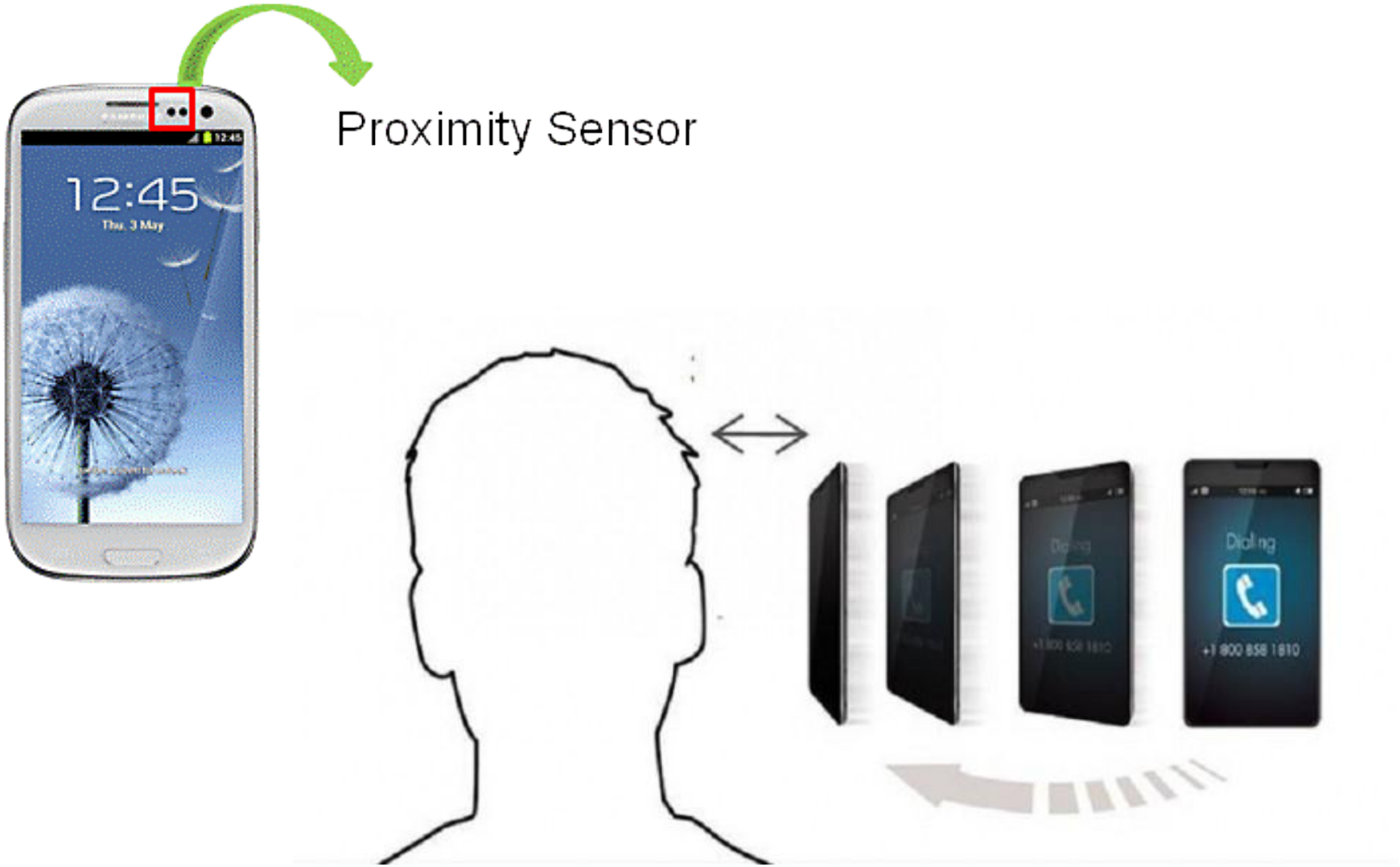

Image Source: samsung.com, mi.com

Ambient Light Sensor

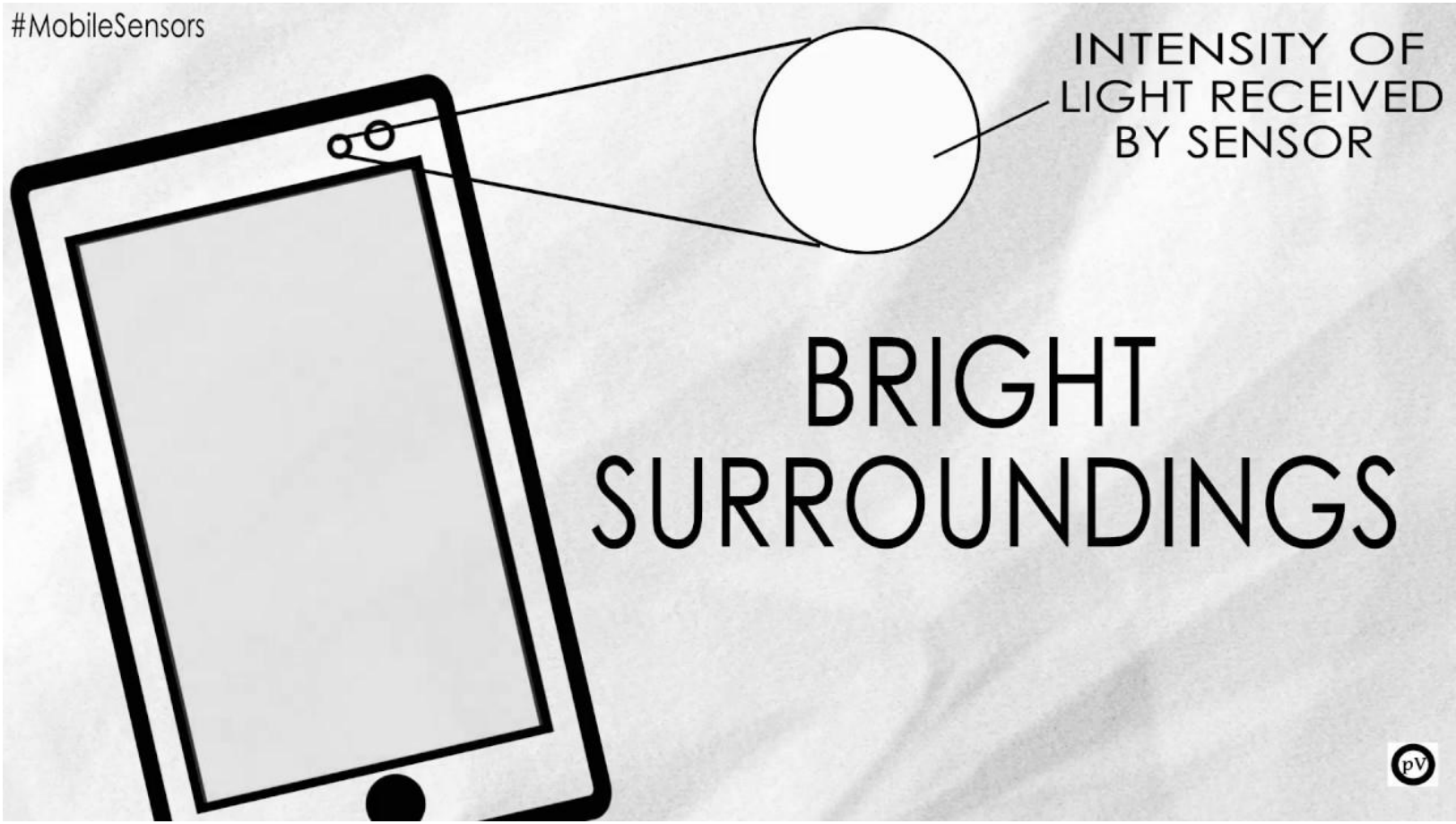

Image Source: youtube

Fingerprint Sensor

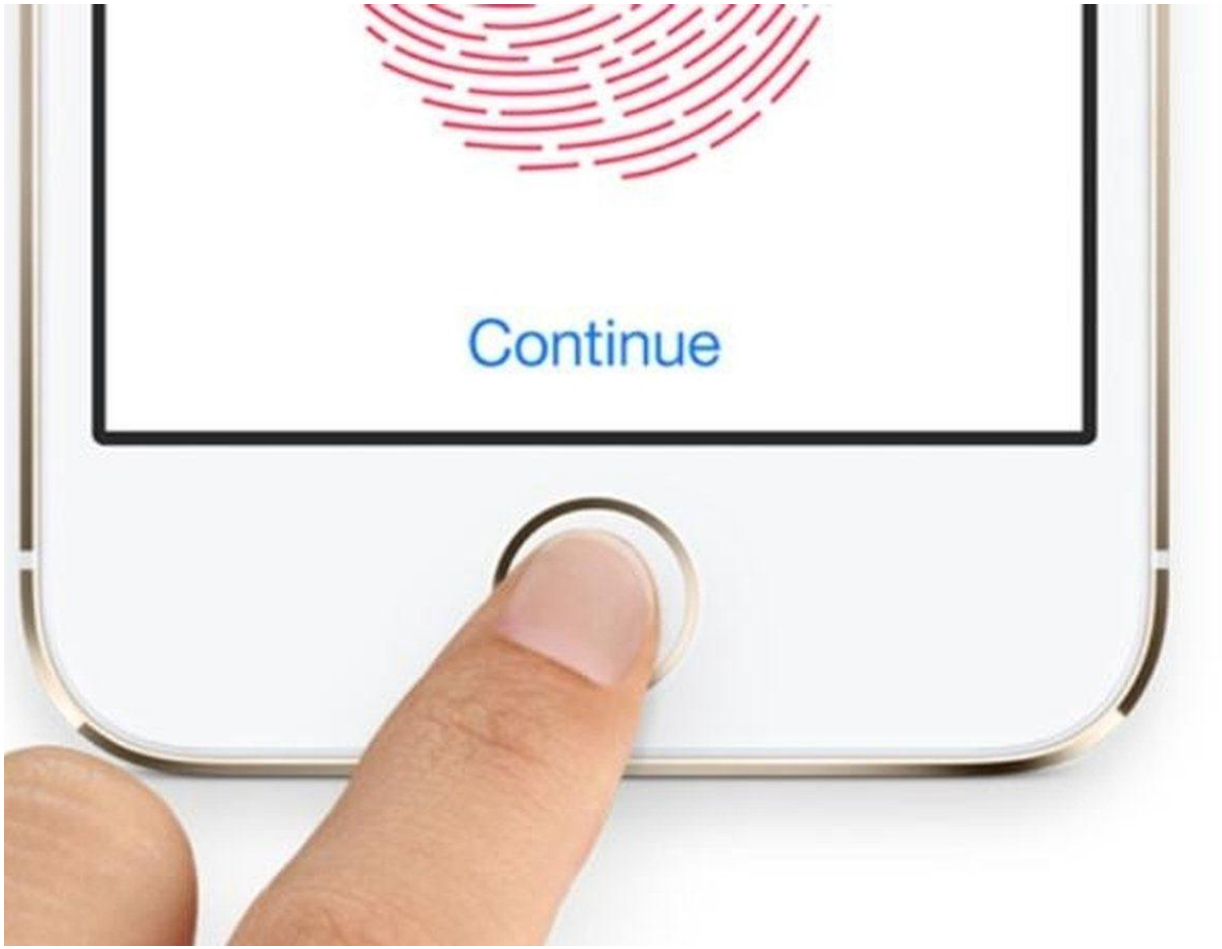

Image Source: macworld

Thanks