Description of Processors Used in Mobile Phones

BENNETT UNIVERSITY

TIMES OF INDIA GROUP

Presented by
Dr. Tanmay Bhomik
Dr. Ishan Budhiraja

Contents

- What is processor?
- What does core's represents in smartphones processor?
- List of Smartphone Processors
- Qualcomm Snapdragon Processor
- Introduction
  - Difference Between Scorpion and Krait
  - Series or Family of Snapdragon Processors.

What is Processor?

- In an easy word, processor basically a head of small brains in smartphones which is in the form of chipsets (SOC).
- All the major decisions, executing a program or anything that you want from your mobile is always controlled by smartphone processor.
- Its the only one who send commands and control the whole smartphone working.

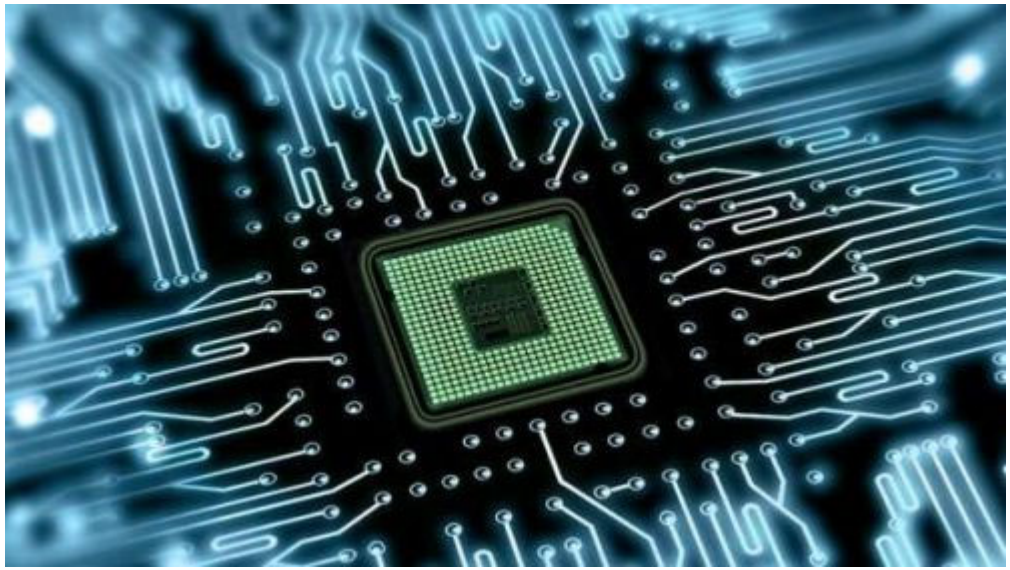


Fig.1 Image of Processor

What does core's represents in smartphone processor?

- In simple words, cores are a tiny processor bit that has a work to execute operations, performs the calculation, and every required information to perform with power.
- Every smartphone gadget is made up of multiple cores to provide ultimate performance in a processor that helps to run high graphics apps, gives smooth performance & less device heating.
- A processor comes with several cores. For instance, if the smartphone processor has two cores in it then it's a dual-core processor, with having four cores then quad-core, six cores called Hexacore, and same as eight-core called octa-core processor.

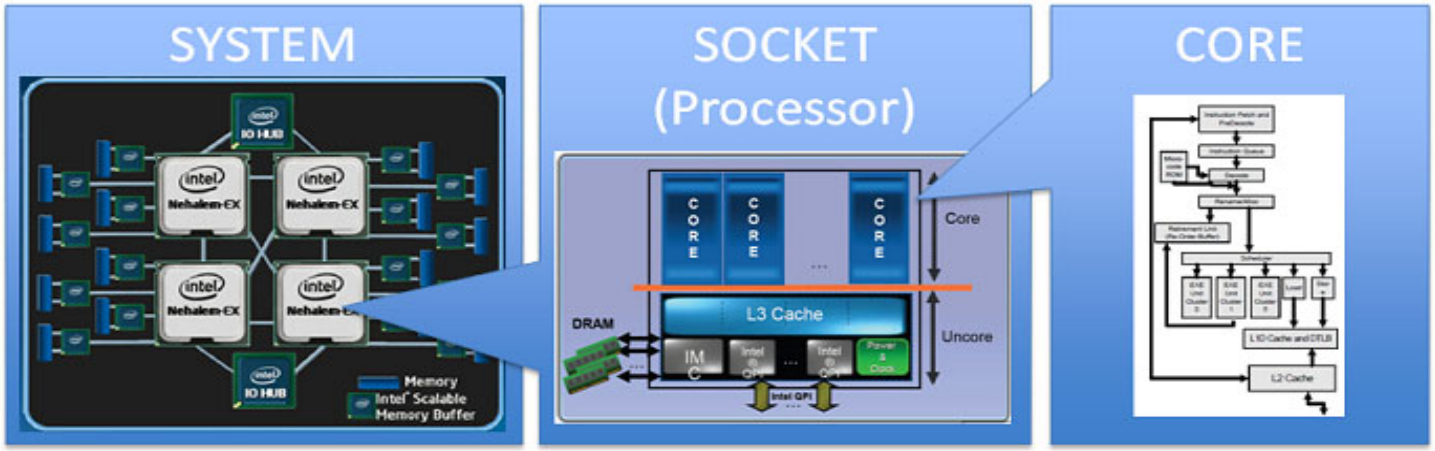


Fig. 2 Core Overview

List of Smartphones Processors

Types Of Smartphones Processors	Processors Series or Generation
1. Qualcomm Snapdragon Processor	**2 Series** 4 Series 6 Series 7 Series **8 Series** (Latest)
2. Apple processors	**A4 Series** A5 Series A6 Series A7 Series A8 Series A9 Series A10 Series A11 **Bionic** Series A12 **Bionic** Series A13 **Bionic** Series (Latest)

List of Smartphones Processors (Contd.)

3. MediaTek Processors	MediaTek Helio A MediaTek Helio P MediaTek Helio X MediaTek Helio G MediaTek Density 5G (Latest)
4. Exynos Processors	Exynos 7 Dual Exynos 7 Quad Exynos 7 Octa Exynos 8 Octa Exynos 5 Series Exynos 7 Series Exynos 9 Series (Latest)
5. Kirin Processors	Kirin 600 Series Kirin 700 Series Kirin 800 Series Kirin 900 Series (Latest)

Qualcomm Snapdragon Processor

Introduction

- Qualcomm Incorporated is an American global semiconductor company that designs and markets wireless telecommunications products and services.
- Snapdragon is a family of mobile systems on a chip (SoC) by Qualcomm.
- Qualcomm considers Snapdragon a "platform" for use in smartphones, tablets, and smart book devices.
- The original Snapdragon CPU, dubbed Scorpion is Qualcomm's own design.
- It has many features similar to those of the ARM CortexA8 core and it is based on the ARMv7 instruction set.
- The successor to Scorpion, found in S4 Snapdragon SoCs, is named Krait and has many similarities with the ARM Cortex-A15 CPU and is also based on the ARMv7 instruction set.
- The majority of Snapdragon processors contain the circuitry to decode high definition video (HD) resolution at 720p or 1080p depending on the Snapdragon chip Adreno, the company's proprietary GPU series, integrated into Snapdragon chips is Qualcomm's own design.
- All Snapdragons feature one or more DSPs called Hexagon , The multimedia Hexagons are mostly used for audio encoding/decoding, the newer Snapdragons have a hardware block called Venus for video encoding/decoding.

Scorpion v/s Krait

Scorpion	Krait
Scorpion is a central processing unit (CPU) core designed by Qualcomm for use in their Snapdragon mobile systems on chips (SoCs).	Krait is an ARM-based central processing unit included in Qualcomm Snapdragon S4 and Snapdragon 400/600/800 (Krait 200, Krait 300, Krait 400 and Krait 450) SoC.
It is designed in-house, but has many architectural similarities with the ARM Cortex-A8 and Cortex-A9 CPU cores.	It was introduced in 2012 as a successor to the Scorpion CPU and has architectural similarities to ARM Cortex-A15
10/12 stage integer pipeline with 2-way decode, 3-way out-of-order speculatively issued superscalar execution.	11 stage integer pipeline with 3-way decode and 4-way out-of-order speculative issue superscalar execution
Pipelined VFPv3 and 128-bit wide NEON (SIMD)	Pipelined VFPv4 and 128-bit wide NEON (SIMD)
32 KB + 32 KB L1 cache	4 KB + 4 KB L0 cache
256 KB (single-core) or 512 KB (dualcore) L2 cache	16 KB + 16 KB 4-way set associative L1 cache
Single or dual-core configuration	Dual or quad-core configurations

Series of Qualcomm Snapdragon Processors

Snapdragon devices

1. Snapdragon S1
2. Snapdragon S2
3. Snapdragon S3
4. Snapdragon S4
5. Snapdragon 200 series
6. Snapdragon 400 series
7. Snapdragon 600 series
8. Snapdragon 800 series

Snapdragon S1

Semiconductor Technology	65 nm/45 nm
CPU instruction set	ARMv6/ARMv7
CPU Speed	From 528 MHz, Up to 1 GHz
CPU	ARM11,Cortex-A5 and Scorpion
CPU Cache Type	L2
CPU Cache	Max 256 KB
GPU	Adreno 200
GPU Support	2D support
RAM Technology	200 MHz LPDDR1
RAM Speed	200 MHz
Bluetooth	-

Snapdragon S2

Semiconductor Technology	65 nm/45 nm
CPU instruction set	ARMv6/ARMv7
CPU Speed	From 528 MHz, Up to 1 GHz
CPU	ARM11,Cortex-A5 and Scorpion
CPU Cache Type	L2
CPU Cache	Max 256 KB
GPU	Adreno 200
GPU Support	2D support
RAM Technology	200 MHz LPDDR1
RAM Speed	200 MHz
Bluetooth	-

Snapdragon S3

Semiconductor Technology	45 nm
CPU instruction set	ARMv7
CPU Speed	Up to 1.7 GHz
CPU	Dual-core Scorpion
CPU Cache Type	L2
CPU Cache	L2 512 KB
GPU	Adreno 220
GPU Support	2D support
RAM Technology	Single-channel 500 MHz/333 MHz LPDDR2
RAM Speed	200 MHz
Bluetooth	-

Snapdragon S4

Semiconductor Technology	45 nm/28 nm LP
CPU instruction set	ARMv7
CPU Speed	Up to 1.7 GHz
CPU	Dual-core Krait/quad-core Krait
CPU Cache Type	L0, L1, L2
CPU Cache	Upto 2MB
GPU	Quad-core Adreno 320
GPU Support	FHD/1080p and FWVGA/720p
RAM Technology	Dual-channel 500 MHz LPDDR2
RAM Speed	200 MHz
Bluetooth	Bluetooth 4.0

Snapdragon 200 Series

Semiconductor Technology	45 nm LP/28 nm LP
CPU instruction set	ARMv7
CPU Speed	Quad-core Up to 1.4 GHz
CPU	Quad-core Cortex-A7
CPU Cache Type	L0, L1, L2
CPU Cache	Up to 2 MB
GPU	Adreno 304
GPU Support	WXGA/720p
RAM Technology	LPDDR2/LPDDR3 533 MHz
Bluetooth	Bluetooth 4.1
WiFi	-
Other	

Snapdragon 400 Series

Semiconductor Technology	28 nm LP
CPU instruction set	ARMv8
CPU Speed	Up to 1.7 GHz Octa-core
CPU	Octa-core Cortex-A53
CPU Cache Type	L1,L2
CPU Cache	Up to 2 MB
GPU	Adreno 405
GPU Support	Up to FHD 1080p
RAM Technology	LPDDR3 933 MHz
Bluetooth	Bluetooth 4.1
WiFi	Multi-User MIMO (MU-MIMO) WiFi
Other	GPS

Snapdragon 600 Series

Semiconductor Technology	28 nm LP
CPU instruction set	ARMv8
CPU Speed	Up to 1.7 GHz Quad-core
CPU	Dual-core+Quad-core Cortex-A53
CPU Cache Type	L0,L1,L2
CPU Cache	Up to 2 MB
GPU	Adreno 510
GPU Support	Quad HD2560x1600
RAM Technology	Dual-channel LPDDR3 933 MHz
Bluetooth	Bluetooth Smart v4.1
WiFi	VIVE 1-stream 802.11ac WiFi
Other	GPS

Snapdragon 800 Series

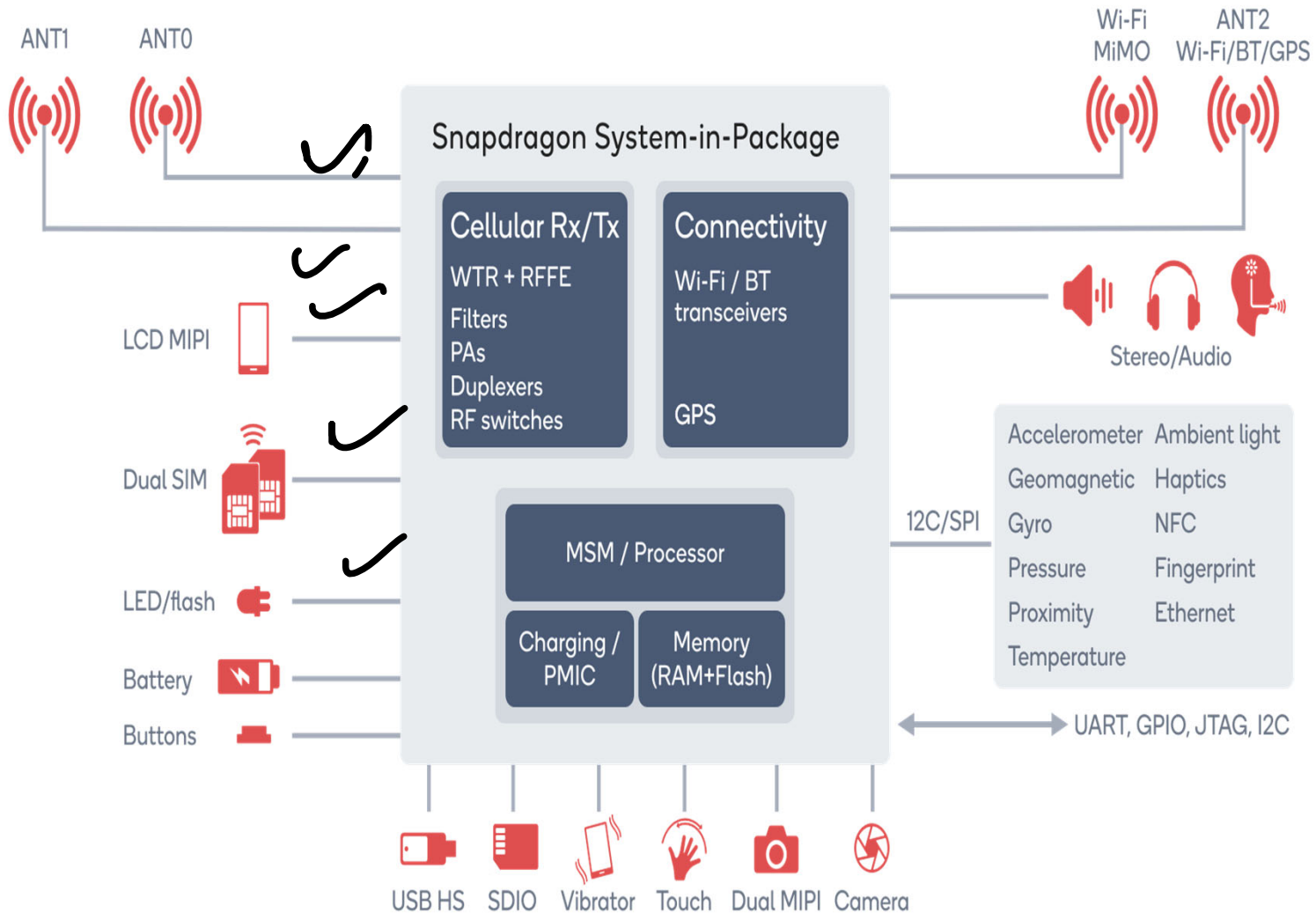
Semiconductor Technology	14 nm FinFET
CPU instruction set	ARMv7/ARMv8-A
CPU Speed	2.0 + 1.55 GHz Quad-core
CPU	4+4 cores Hydra and Cortex
CPU Cache Type	L2
CPU Cache	Up to 2 MB
GPU	Adreno 530
GPU Support	4K UHD video upscale
RAM Technology	LPDDR4 1866 MHz
Bluetooth	Native Bluetooth 4.1 support
WiFi	802.11ac (2.4 and 5 GHz) WiFi
Other	Native 4K Support, HDMI 2.0,USB 2.0 and 3.0,64-bit Architecture

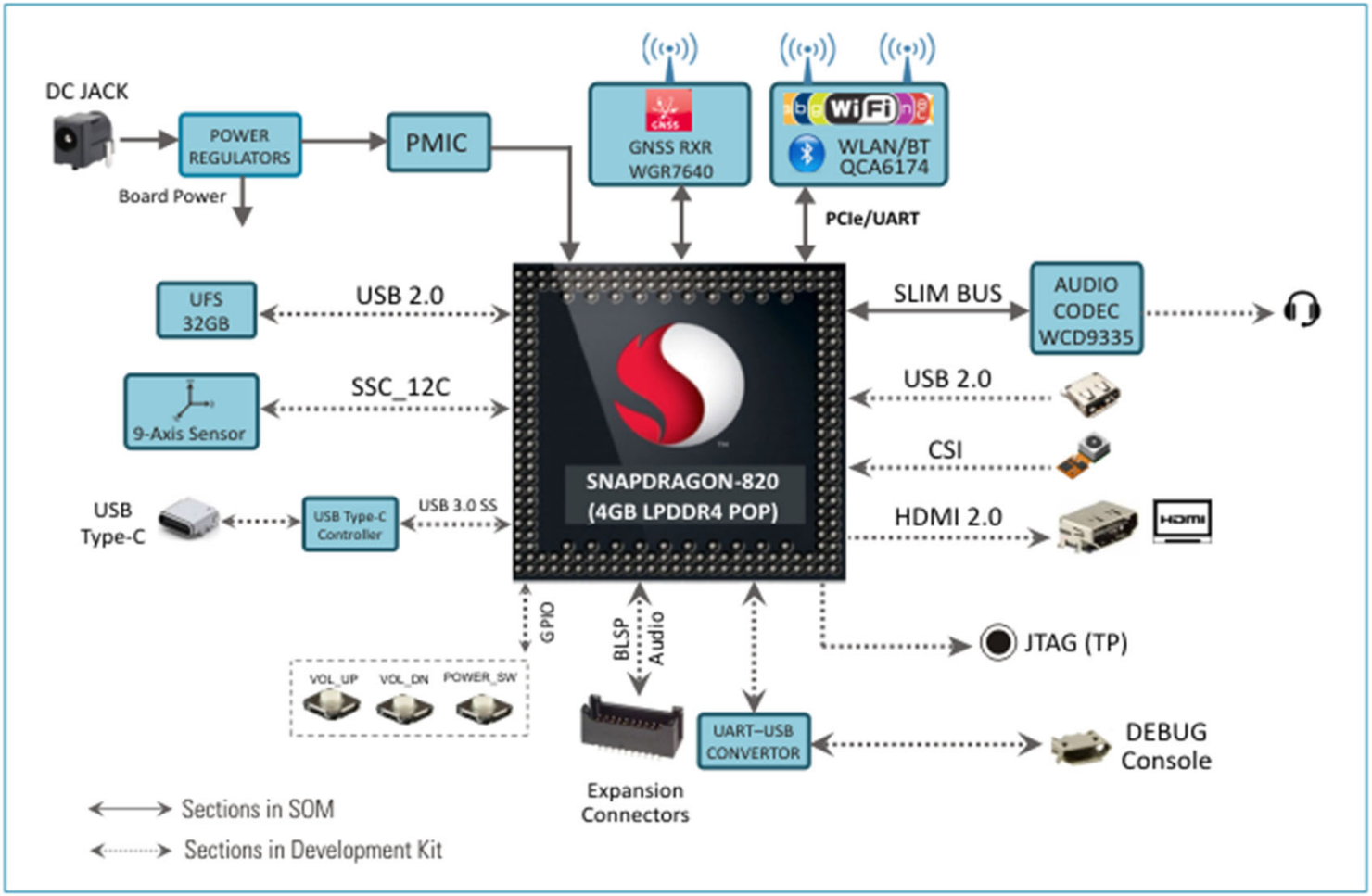
Technology	Snapdragon S1	Snapdragon S2	Snapdragon S3	Snapdragon S4
Semiconductor Technology	65 nm/45 nm	45 nm	45 nm	45 nm/28 nm LP
CPU instruction set	ARMv6/ARMv7	ARMv7	ARMv7	ARMv7
CPU Speed	From 528 MHz, Up to 1 GHz	From 800 MHz, Up to 1.5 GHz	Up to 1.7 GHz	Up to 1.7 GHz
CPU	ARM11,Cortex-A5 and Scorpion	Scorpion	Dual-core Scorpion	Dual-core Krait/quad-core Krait
CPU Cache Type	L2	L2	L2	L0,L1,L2
CPU Cache	Max 256 KB	Min 256 KB Max. 384 KB	512 KB	Up to 2 MB
GPU	Adreno 200	Adreno 205	Adreno 220	Quad-core Adreno 320
GPU Support	2D support	2D support	2D support	FHD/1080p and FWVGA/720p
RAM Technology	200 MHz LPDDR1	333 MHz Dual-channel LPDDR2	Single-channel 500 MHz/333 MHz LPDDR2	Dual-channel 500 MHz LPDDR2
Bluetooth	-	-	-	Bluetooth 4.0
WiFi	-	-	-	-

Technology	Snapdragon 200 Series	Snapdragon 400 Series	Snapdragon 600 Series	Snapdragon 800 Series
Semiconductor Technology	45 nm LP/ 28 nm LP	28 nm LP	28 nm LP	14 nm FinFET
CPU instruction set	ARMv7	ARMv8	ARMv8	ARMv7/ARMv8-A
CPU Speed	Quad-core Up to 1.4 GHz	Up to 1.7 GHz Octa-core	Up to 1.7 GHz Quad-core	2.0 + 1.55 GHz Quad-core
CPU	Quad-core Cortex-A7	Octa-core Cortex-A53	Dual-core+Quad-core Cortex-A53	4+4 cores Hydra and Cortex
CPU Cache Type	L0,L1,L2	L1,L2	L0,L1,L2	L2
CPU Cache	Up to 2 MB	Up to 2 MB	Up to 2 MB	Up to 2 MB
GPU	Adreno 304	Adreno 405	Adreno 510	Adreno 530
GPU Support	WXGA/720p	Up to FHD 1080p	Quad HD2560x1600	4K UHD video upscale
RAM Technology	LPDDR2/LPDDR3 533 MHz	LPDDR3 933 MHz	Dual-channel LPDDR3 933 MHz	LPDDR4 1866 MHz
Bluetooth	Bluetooth 4.1	Bluetooth 4.1	Bluetooth Smart v4.1	Native Bluetooth 4.1 support
WiFi	-	Multi-User MIMO (MU-MIMO) WiFi	VIVE 1-stream 802.11ac WiFi	802.11ac (2.4 and 5 GHz) WiFi
Other		GPS	GPS	Native 4K Support, HDMI 2.0,USB 2.0 and 3.0,64-bit Architecture

Block Diagram of Snapdragon Processor

Snapdragon: System-in-Package: Qualcomm




DC JACK
POWER REGULATORS
Board Power
PMIC
GNSS RXR WGR7640
WLAN/BT QCA6174
PCIe/UART
UFS 32GB
USB 2.0
SLIM BUS
AUDIO CODEC WCD9335
9-Axis Sensor
SSC_12C
USB 2.0
CSI
SNAPDRAGON-820 (4GB LPDDR4 POP)
USB Type-C
USB Type-C Controller
USB 3.0 SS
HDMI 2.0
GPIO
BLSP Audio
JTAG (TP)
VOL_UP
VOL_DN
POWER_SW
UART–USB CONVERTOR
DEBUG Console
Expansion Connectors
Sections in SOM
Sections in Development Kit