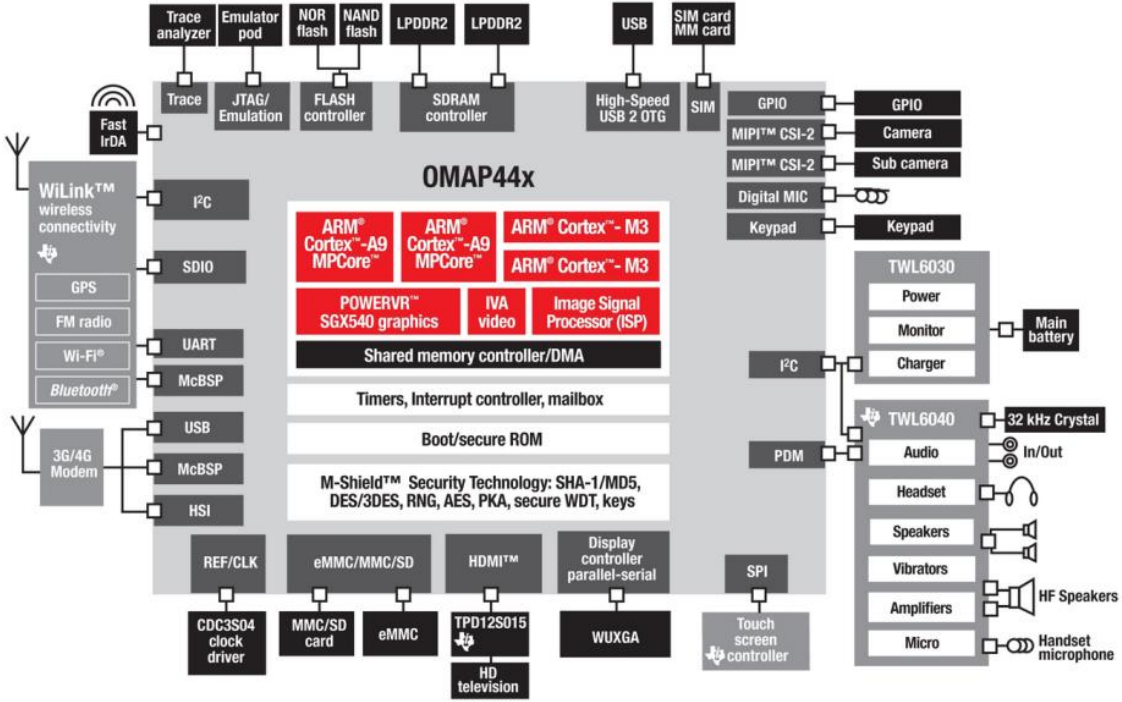
Universität Rostock Traditio et Innovatio

Evolutionary Design – Real Life Examples

Institute of Applied Microelectronics and Computer Engineering

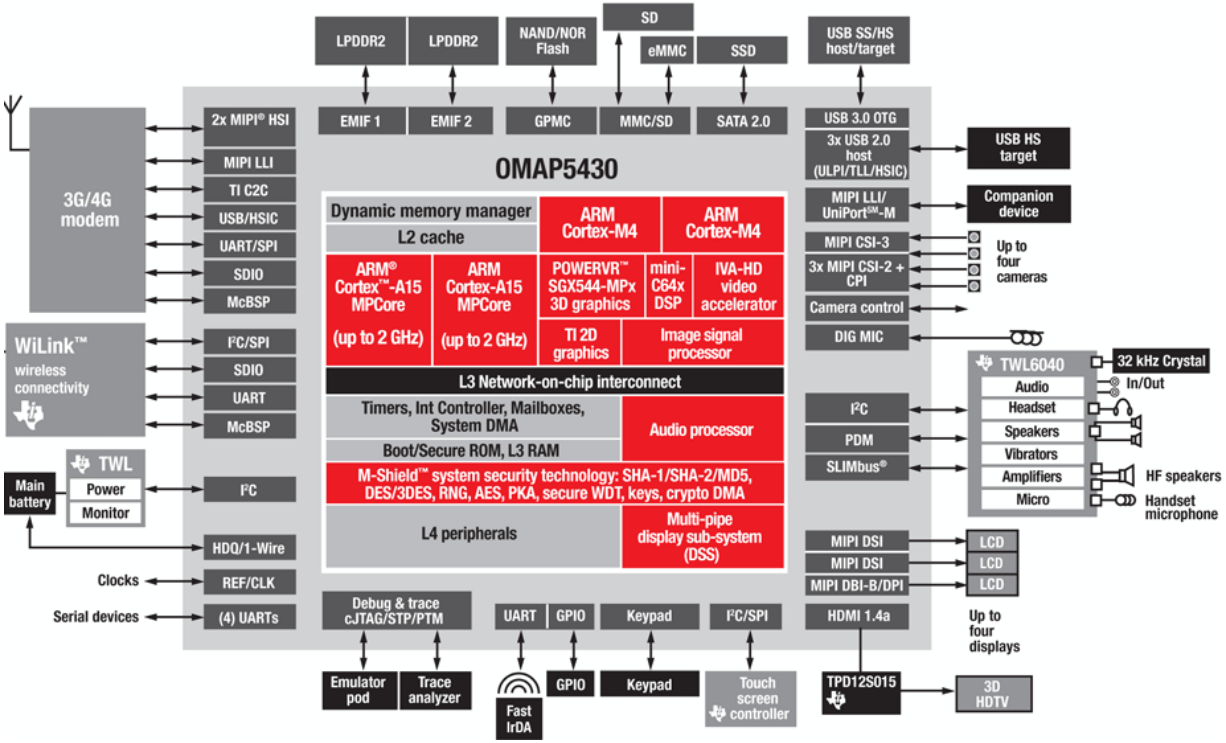
TI – OMAP

4470


Trace analyzer
Emulator pod
NOR flash
NAND flash
LPDDR2
LPDDR2
USB
SIM card MM card
Trace
JTAG/ Emulation
FLASH controller
SDRAM controller
High-Speed USB 2 OTG
SIM
Fast IrDA
GPIO
GPIO
MIPI™ CSI-2
Camera
MIPI™ CSI-2
Sub camera
Digital MIC
Keypad
Keypad
WiLink™ wireless connectivity
GPS
FM radio
Wi-Fi®
Bluetooth®
I²C
SDIO
UART
McBSP
USB
McBSP
HSI
3G/4G Modem
OMAP44x
ARM® Cortex™-A9 MPCore™
ARM® Cortex™-A9 MPCore™
ARM® Cortex™- M3
ARM® Cortex™- M3
POWERVR™ SGX540 graphics
IVA video
Image Signal Processor (ISP)
Shared memory controller/DMA
Timers, Interrupt controller, mailbox
Boot/secure ROM
M-Shield™ Security Technology: SHA-1/MD5, DES/3DES, RNG, AES, PKA, secure WDT, keys
REF/CLK
eMMC/MMC/SD
HDMI™
Display controller parallel-serial
SPI
CDC3S04 clock driver
MMC/SD card
eMMC
TPD12S015
HD television
WUXGA
Touch screen controller
TWL6030
Power
Monitor
Charger
Main battery
I²C
TWL6040
32 kHz Crystal
PDM
Audio
In/Out
Headset
Speakers
Vibrators
Amplifiers
HF Speakers
Micro
Handset microphone

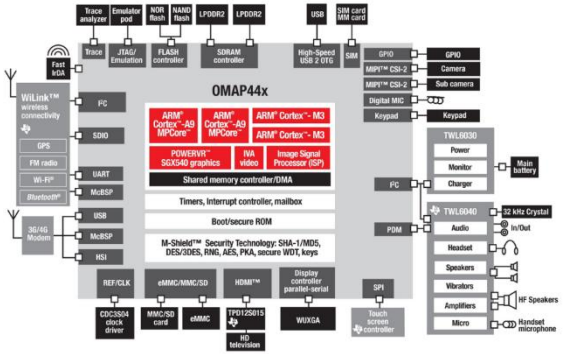
TI – OMAP

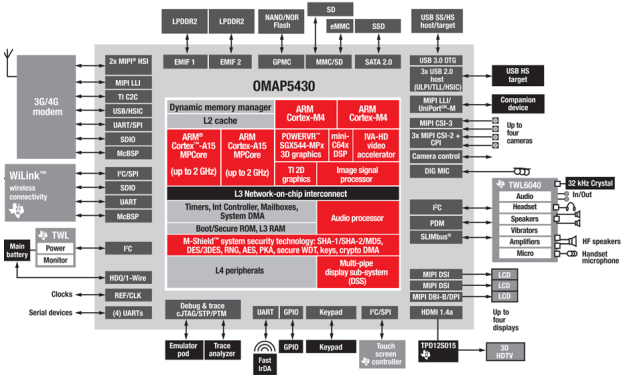
5430


LPDDR2
LPDDR2
NAND/NOR Flash
SD
eMMC
SSD
USB SS/HS host/target
OMAP5430
EMIF 1
EMIF 2
GPMC
MMC/SD
SATA 2.0
USB 3.0 OTG
3G/4G modem
2x MIPI® HSI
MIPI LLI
TI C2C
USB/HSIC
UART/SPI
SDIO
McBSP
Dynamic memory manager
L2 cache
ARM Cortex-M4
ARM Cortex-M4
ARM® Cortex™-A15 MPCore (up to 2 GHz)
ARM Cortex-A15 MPCore (up to 2 GHz)
POWERVR™ SGX544-MPx 3D graphics
mini-C64x DSP
IVA-HD video accelerator
TI 2D graphics
Image signal processor
L3 Network-on-chip interconnect
Timers, Int Controller, Mailboxes, System DMA
Audio processor
Boot/Secure ROM, L3 RAM
M-Shield™ system security technology: SHA-1/SHA-2/MD5, DES/3DES, RNG, AES, PKA, secure WDT, keys, crypto DMA
L4 peripherals
Multi-pipe display sub-system (DSS)
3x USB 2.0 host (ULPI/TLL/HSIC)
USB HS target
MIPI LLI/ UniPort™-M
Companion device
MIPI CSI-3
3x MIPI CSI-2 + CPI
Up to four cameras
Camera control
DIG MIC
WiLink™ wireless connectivity
I²C/SPI
SDIO
UART
McBSP
TWL6040
32 kHz Crystal
In/Out
Audio
Headset
Speakers
Vibrators
Amplifiers
Micro
HF speakers
Handset microphone
I²C
PDM
SLIMbus®
TWL
Main battery
Power
Monitor
I²C
HDQ/1-Wire
Clocks
REF/CLK
Serial devices
(4) UARTs
MIPI DSI
MIPI DSI
MIPI DBI-B/DPI
LCD
LCD
LCD
Up to four displays
Debug & trace cJTAG/STP/PTM
UART
GPIO
Keypad
I²C/SPI
HDMI 1.4a
Emulator pod
Trace analyzer
Fast IrDA
GPIO
Keypad
Touch screen controller
TPD12S015
3D HDTV

TI – OMAP

Comparison



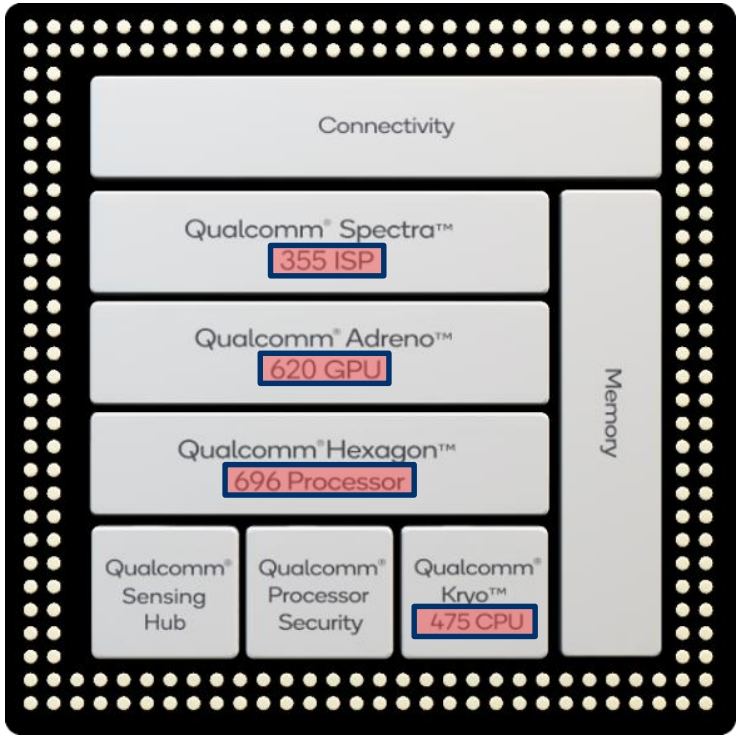


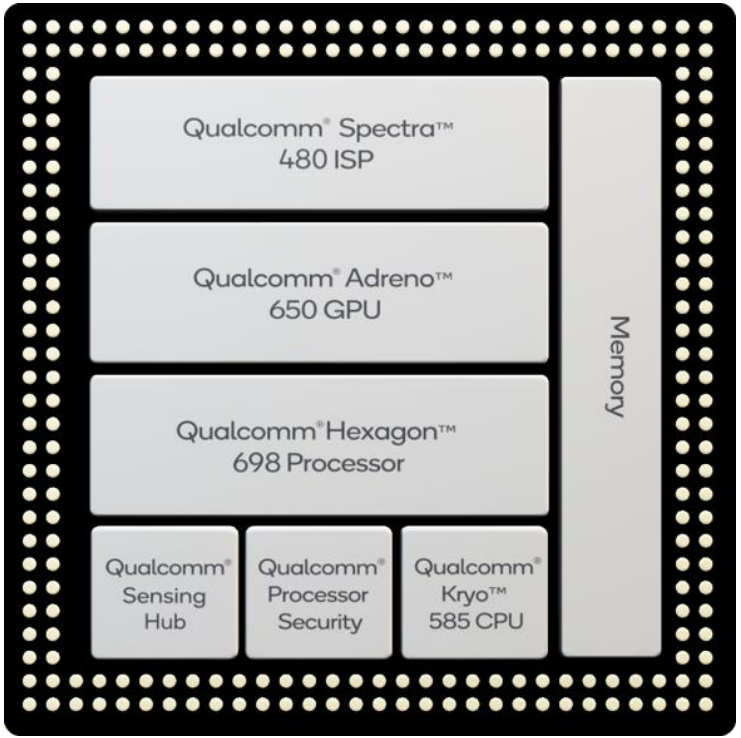
- New processor versions (Cortex A9 →Cortex A15; Cortex M3 → Cortex M4; SGX40 → SGX44, …)
- Updated USB Protocol to version 3
- More accelerators in general (audio processors, video accelerator, display sub-system, DSP)
- Krypto Cores were updated

- Conclusion: Most of the internal hardware changed between two versions

Qualcomm – Snapdragon

765 to 865

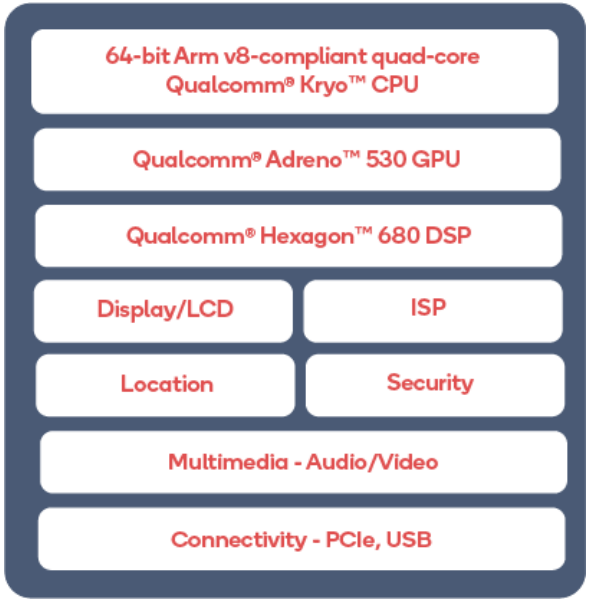




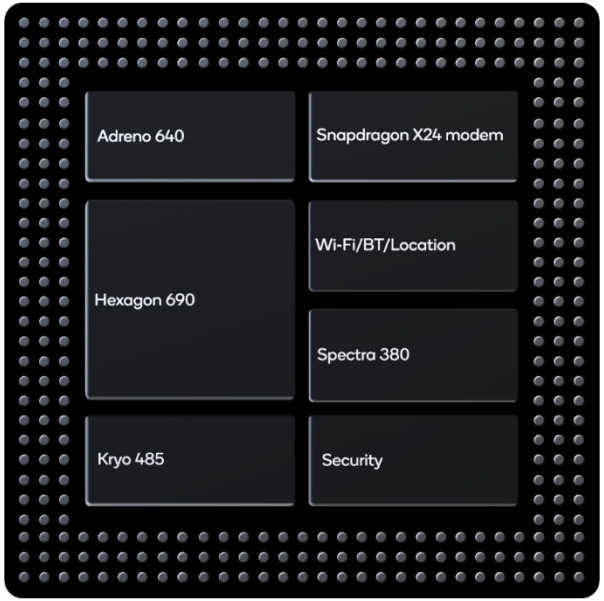
Qualcomm – Snapdragon

Series 8

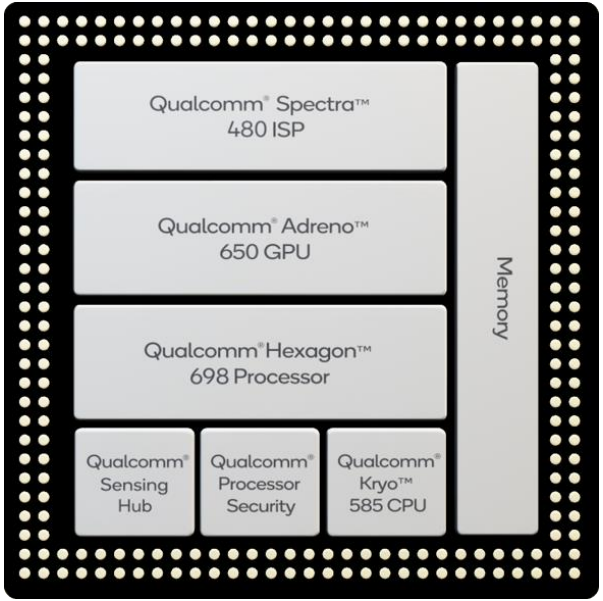
820E



855



865

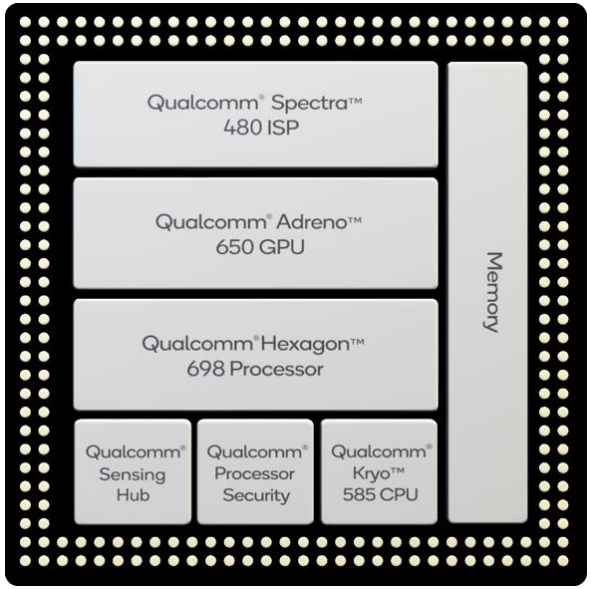


- Low Cost (no ISP, no BT)
- CPU (DSP,ISP, etc) Versions change but infrastructure and peripheries are kept

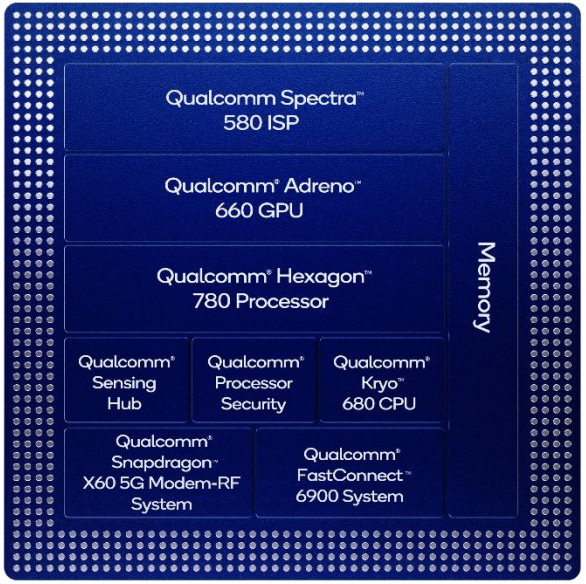
Qualcomm – Snapdragon

Series 8

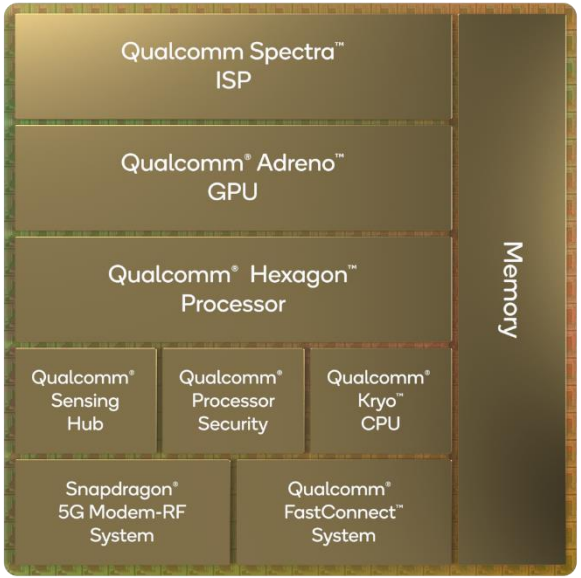
865



888



8 – Gen 1



- no version numbers anymore

Qualcomm – Snapdragon

Conclusion

- Basic Architecture is kept throughout versions of snapdragon
- Marginal increments in internal modules (CPUs, DSPs, etc.)
- Low-Cost SoCs have less features (e.g., no ISP)
  - must be computed in SW
  - impacts binding
- Evolutionary Design is well-visible
- Other examples at:
  - STM: https://www.st.com/en/applications/automotive.html
  - NXP: https://www.electronicproducts.com/nxps-automotive-telematics-block-diagram/