

An aerial night view of a city street. The street is illuminated by streetlights and building lights. Several cars are visible, including a white car in the foreground, a blue car, and a white bus. Pedestrians are walking on the sidewalks. Buildings with lit windows line the street. A digital sign with a 'Q' logo is visible on the left side of the street.

Oct 2022

Digital Chassis

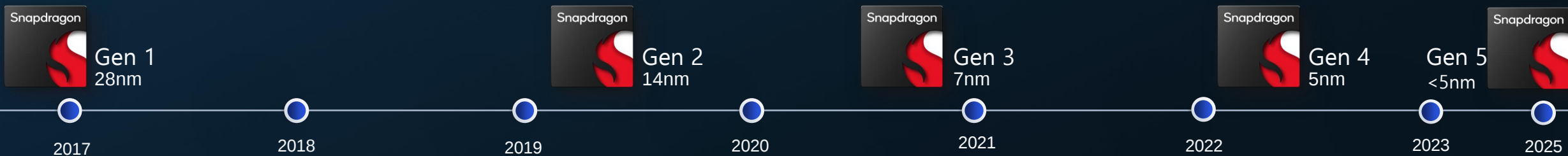
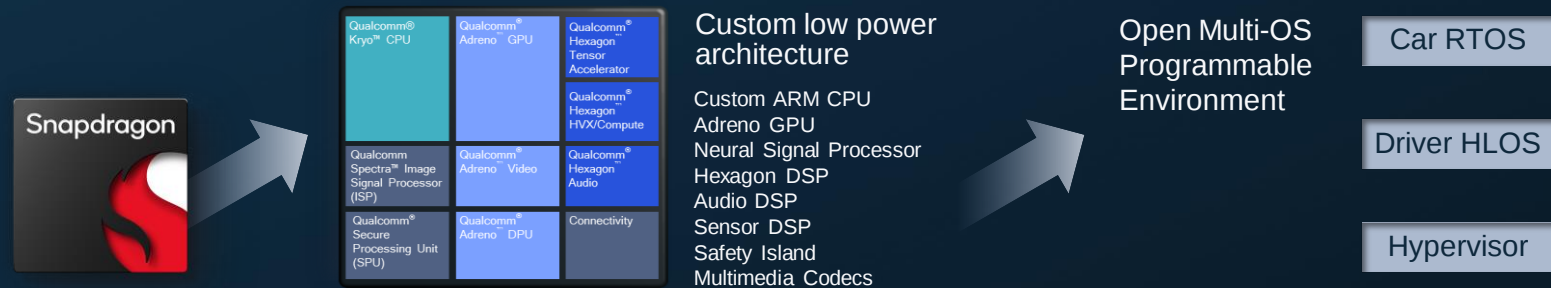
Qualcomm Automotive

Driving technology for the road ahead
Qualcomm Automotive Team



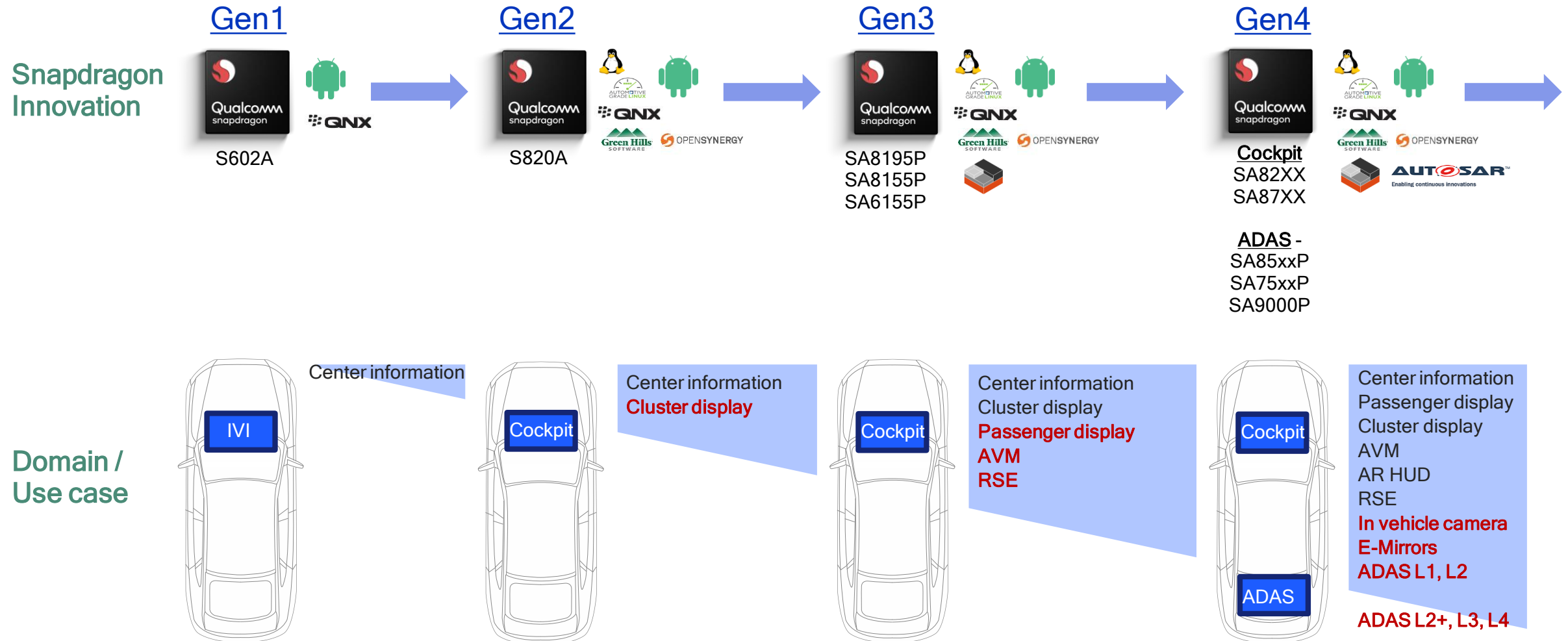
Snapdragon

cockpit platform



Qualcomm Snapdragon Compute Innovation

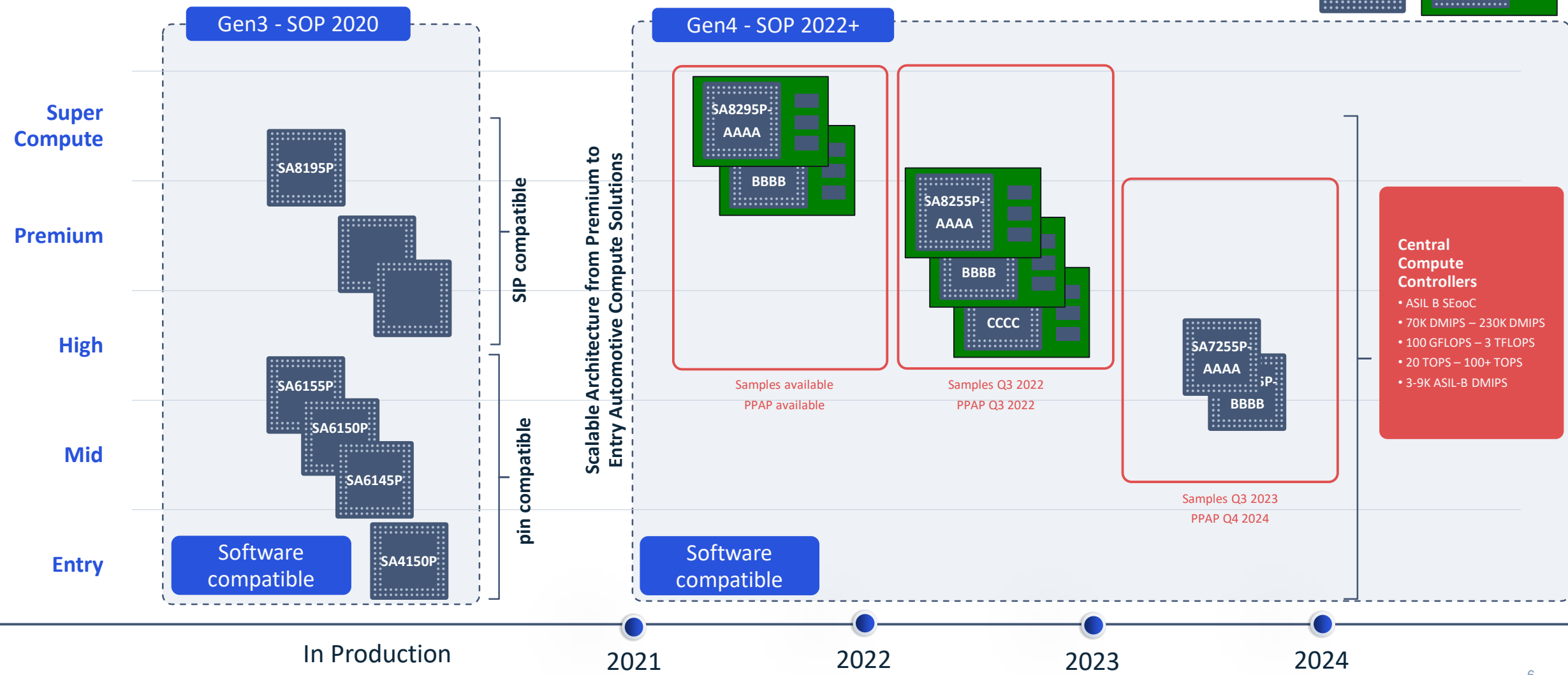
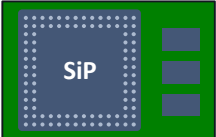
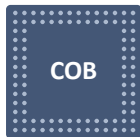
Qualcomm continues to innovate Snapdragon Solution to create Future Auto Compute with OEMs



SoC lineup

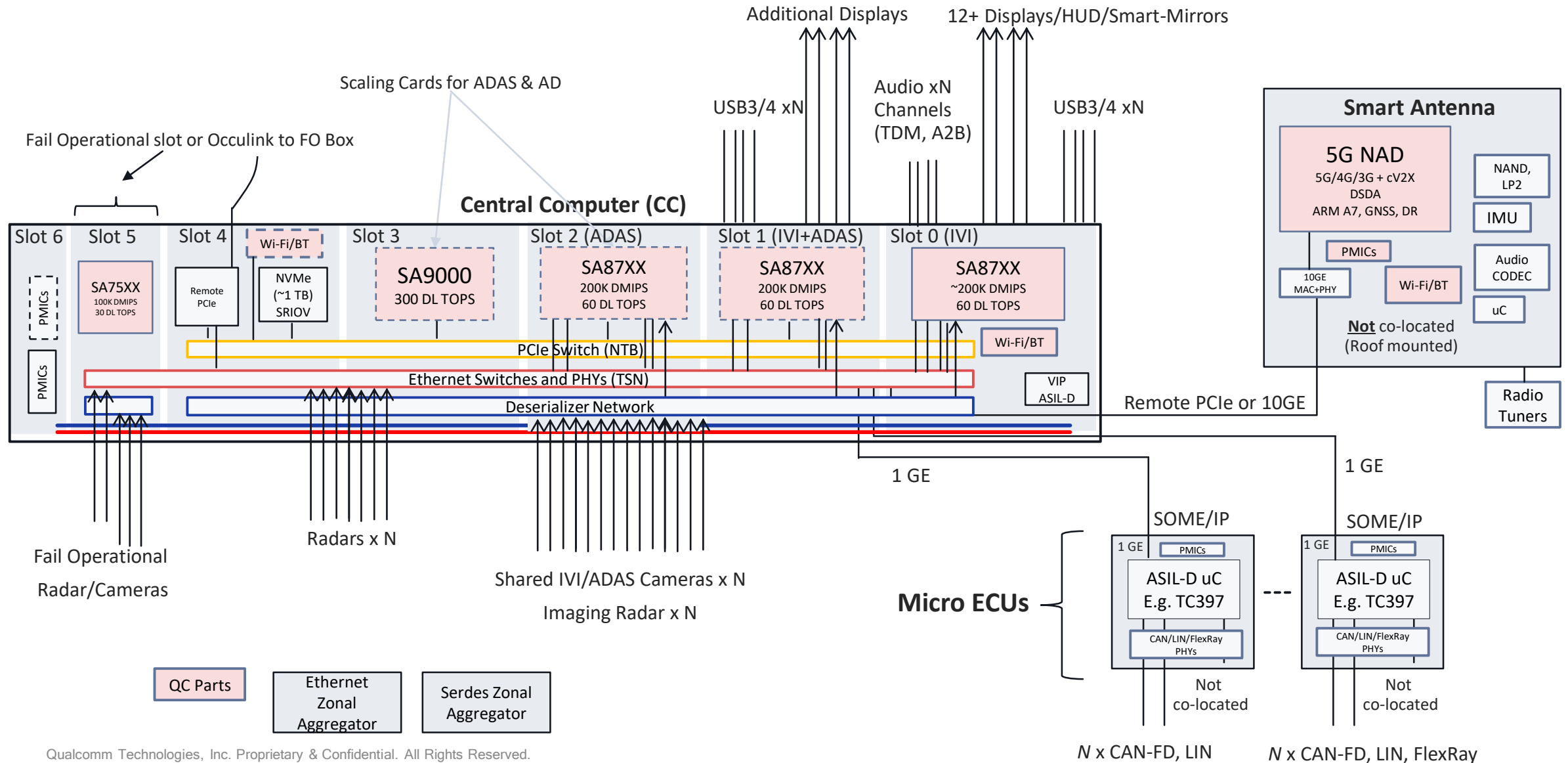
Qualcomm Automotive Cockpit Compute Roadmap

Multi-Generation Automotive Platforms—designed for Cockpit, ADAS, AD & Safety Integration



Homogenous Central Compute Platform

Multi-domain supported with Snapdragon Fusion, ADAS and Telematics SoCs



Qualcomm Automotive compute SKUs

* - With external SERDES (Superframe over DSI, 2x/4x Superframe over DP MST)
** - DMIPS is not an estimate of true performance. Estimated only
*** - HMX- Hexagon Matrix eXtension

Chipsets	SA8295P-BAAA SiP only	SA8255P-AAAA SiP only	SA7255P-AAAA COB or SiP	SA6155P COB only
CPU	Octa Core Kryo Gen6	Octa Core Kryo Gen6	Octa Core Kryo Gen6	Octa Core Kryo Gen 4
DMIPS*	184k	184k	100k	50k
DMIPS with compiler optimizations*	230K	230K	120k	64K
GPU	245fps Man3.0 ~3.0 TFLOPS (32)/ 6.0 TFLOPS (16)	195fps Man3.0 ~1.5 TFLOPS (32)/ 3.0 TFLOPS (16)	68fps Man3.0 420 GFLOPS (32)/ 840 GFLOPS (16)	14fps Man3.0 110 GFLOPS (32)/ 220 GFLOPS (16)
Memory	8x16 LPDDR4x @ 2100 MHz	6x16 LPDDR5 @ 3200 MHz	4x16 LPDDR5/5x @ 3200 MHz	2x16 LPDDR4x @ 1555 MHz
Memory Bandwidth (With UBWC)	>200 GB/s (incl. x3 gain)	>240 GB/s (incl. x3 gain)	150 GB/s (incl. x3 gain)	26 GB/s (incl. x2 gain)
Memory Footprint	Up to 32 GB with inline ECC	Up to 36 GB with inline ECC	Up to 32 GB with inline ECC	Up to 8 GB
Audio DSP (LPASS)	Q6 DSP @ 1.5 GHz	Q6 DSP @ 1.5 GHz	Q6 DSP @ 1.5 GHz	Q6 DSP @ 1.0 GHz
Deep Learning/AI TOPS	Q6 DSP with 4xHVX + HMX*** ~46 TOPS for 8-bit FP	Q6 DSP with 4xHVX + HMX*** ~24 TOPS for 8-bit FP	Q6 DSP with 4xHVX + HMX*** ~10 TOPS for 8-bit FP	Optional: Q6 DSP with 2x HVX @ 1.1 GHz
# of Concurrent Displays*	Up to 28	Up to 28	Up to 10	Up to 6
Display Interfaces	2x DSI 5x DP 1.4 (2-MST) 2x DP 1.4 (SST)	2x DSI 2x DP 1.4 (4-MST) 2x DP 1.4 (2-MST)	1x DSI (4-lanes), 1x DP1.4 (4-MST)	1x DSI (4-lanes), 1x DP1.4 (2-MST)
Typ. Pixel/Resolution Supported	Typical 48 Mpix - 6x4k	Typical 48 Mpix - 5x4k	Typical 12 Mpix - 1x4K + 2x1920x1080	Typical 5 Mpix - 2x1080p + 1280x720
Typ. Video Decode/Encode	4k240/4k120	4k240/4k120	4k120/4k60 (TBD)	4k60/1080p60

Qualcomm Automotive compute SKUs

Chipsets	SA8295P-BAAA SiP only	SA8255P-AAAA SiP only	SA7255P-AAAA COB or SiP	SA6155P COB only
Camera	Up to 16 cameras 4x CSI2 4-lane	Up to 16 cameras 4x CSI2 4-lane	Up to 12 cameras 3x CSI2 4-lane	Up to 10 cameras 3x 4-lane CSI-2 v1.3
Auto Peripherals	4x PCIe Ports - 1x4+2x2+1x1 (Gen3) 2x 1GbE w/ TSN (2 x RGMII) 1x QSPI	2x PCIe Ports - 1x2 + 1x4 (Gen4) 2x 2.5 GbE w/ TSN (2 x SGMII) 1x QSPI	2x PCIe Ports - 2x 2-lane (Gen4) 1x 2.5 GbE (1x SGMII) 1x QSPI	1x 1-lane PCIe 2.0 (RC/EP), 1x GbE (RGMII/RMII), 1x QSPI
USB Support	4 concurrent ports - 1x USB4 3x USB3.1 (SS) 6x USB 2.0 (HS)	3 concurrent ports 2x USB 3.1 1x USB 3.0 3x USB2.0 (HS)	1x USB3.1 Gen1, 1x USB2.0 (HS)	1x USB3.1 Gen1, 1x USB2.0 (HS)
Storage	2x UFS 3.1 G4 2-lanes, 1x SDIO 1x NVMe over PCIe	2x UFS 3.1 G4 2-lanes, 1x 8-bit SDCC5, 1x NVMe over PCIe	1x UFS 3.1 G4 2-lanes, 1x 8-bit SDCC5 1x eMMC 5.1	1x UFS2.1 Gear 3, 1x SD3.0, 1x eMMC 5.1
Audio Support	7xTDM/I2S + 3x High Speed I2S for Radio Front-end	7xTDM/I2S + 3x High Speed I2S for Radio Front-end	7xTDM/I2S + 3x High Speed I2S for Radio Front-end	5x TDM/I2S (4x 2 data lanes, 1x 4 data lanes), 1x SLIMBus, 2x High Speed I2S for Radio Front-end
Other Peripherals	32x Serial Interfaces, up to 228 GPIOs	25x Serial Interfaces, up to 150 GPIOs	16x Serial interfaces, up to (tbc) GPIOs	14x Serial interfaces, up to 155 GPIOs
Power Management	4x PMM8295AU + 1x 3rd party PMIC	1x PMM8250AU + 3x PMM8251AU	2x PMM7255AU	1x PMM6155AU
Safety support	ASIL-B SMSS	ASIL-B SMSS w/ 8x CAN FD + 1x 1GbE (1x RGMII)	ASIL-B SMSS w/ 4x CAN FD + 1x 1GbE (1x RGMII)	system level ASIL-A & ASIL-B
Qualification	AEC-Q100 level 3	AEC-Q100 level 3	AEC-Q100 level 3	AEC-Q100 level 3

SA7255P & SA8255P - SoftSKUs

SA7255P	X	X	X	X
	CPU*	GPU**	ML / AI	Display
A	120k	420 GFLOPS	10 TOPS	12 MP
B	96k	300 GFLOPS	5 TOPS	10 MP

SA8255P	X	X	X	X
	CPU*	GPU**	ML / AI	Display
A	230k	1.3 TFLOPS	20 TOPS	48 MP
B	206k	1.2 TFLOPS	15 TOPS	40 MP
C	189k	1.1 TFLOPS	10 TOPS	24 MP

*- DMIPS is not an estimate of true performance. Estimated only with inline and optimized compiler option

** - GFLOPS is not an estimate of true performance. Turbo mode for GPU assumed. Sustained GFLOPS will be lower

SoftSKU definitions are preliminary
and subject to change

Qualcomm Automotive Compute SKUs

Generation 4 samples & qualification schedule

Milestones	SA8295P (SIP module)	SA8255P (SIP module)	SA7255P	Comments
First Samples	available	Q3 2022*	Q3 2023*	Used for early HW testing & SW enablement
Final Samples	available	Feb 2023*	Q4 2023*	Final Package & Silicon
Auto Grade Production Samples	available ¹	Feb 2024*	Q4 2024*	PPAP Production Release

¹ - MSL re-qual early Q4'22

*- Under planning subject to change

SW Support

Qualcomm Automotive Software

Flexibility & Scalability

Qualcomm provides Board Support Packages (BSPs) for many software configurations:

‘To The Metal’ RTOS & HLOS BSP deliveries:

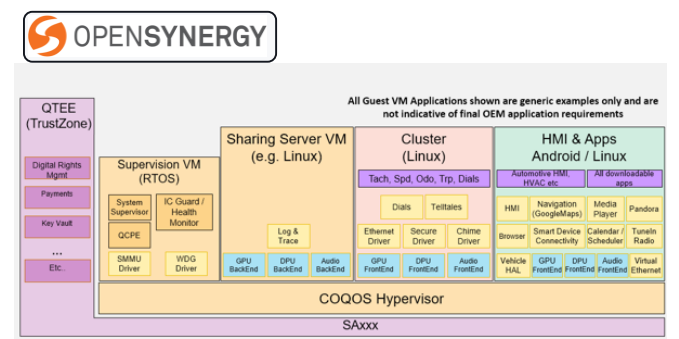
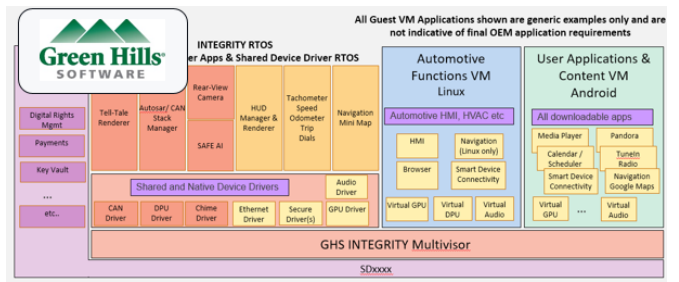
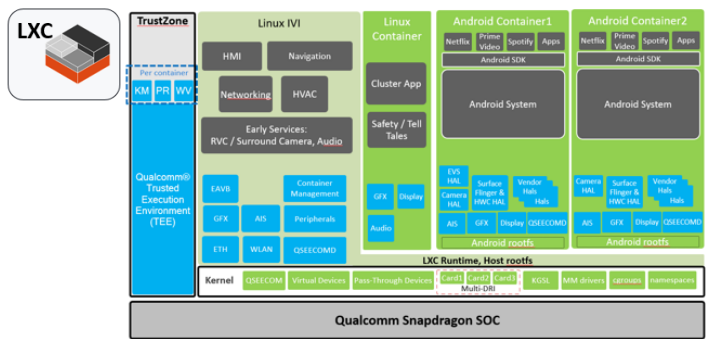
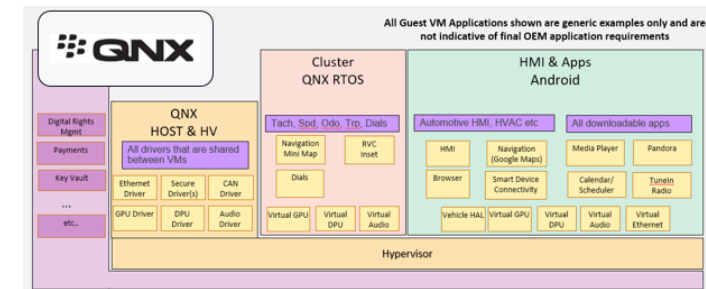
- LA - Linux/Android
- LV - Linux/AGL/Yocto
- QX - QNX Neutrino kernel & software stacks
- GH - Green Hills Software INTEGRITY RTOS

Hypervisor and multi-OS configurations:

- HQX - QNX Hypervisor
- HGH - Green Hills Software Multivisor
- HOS - Open Synergy COQOS Hypervisor
- LXC - Linux Containers (inc. Android)

Software Defined Vehicle - SOA & Microservices:
Qualcomm is working with partners on next gen SW configurations to support Cloud Native Edge applications

Virtual Platform Development: Qemu, Virtual SoC and RTL simulation options for development and testing without silicon. Working with OEMs to define different approaches depending on Model Fidelity, Performance, Cost, Flexibility.

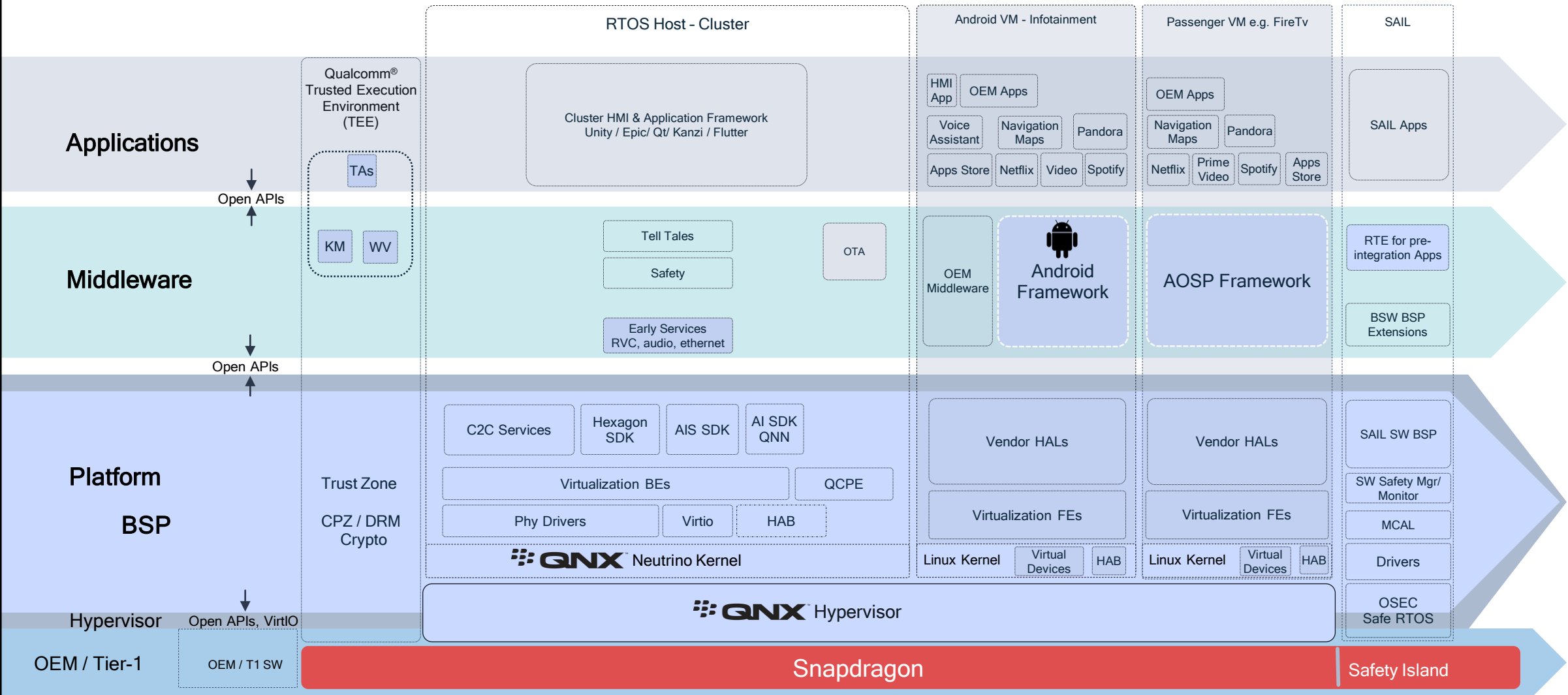


Collaboration with OEMs, Tier1s and SW and HW partners

- Co-development with OEM & T1 ‘Software Factories’ – Agile development models, continuous Integration, Build & Test
- Developing Functional Safety Concepts with customers (FMEA/DIA/FTA ASIL and ISO26262)
- Pre-integrating and Optimizing state-of-the-art SW and HW solutions:
 - 3D UI Engines, Multi-Mic, Noise Reduction, Multi-Zonal Pre- and Post-processed Audio, Automotive Camera & Surrounds View Sensors
 - Fully immersive cabin display technologies
 - Digital Cockpit HV & ADAS Stack SW Pre-integration

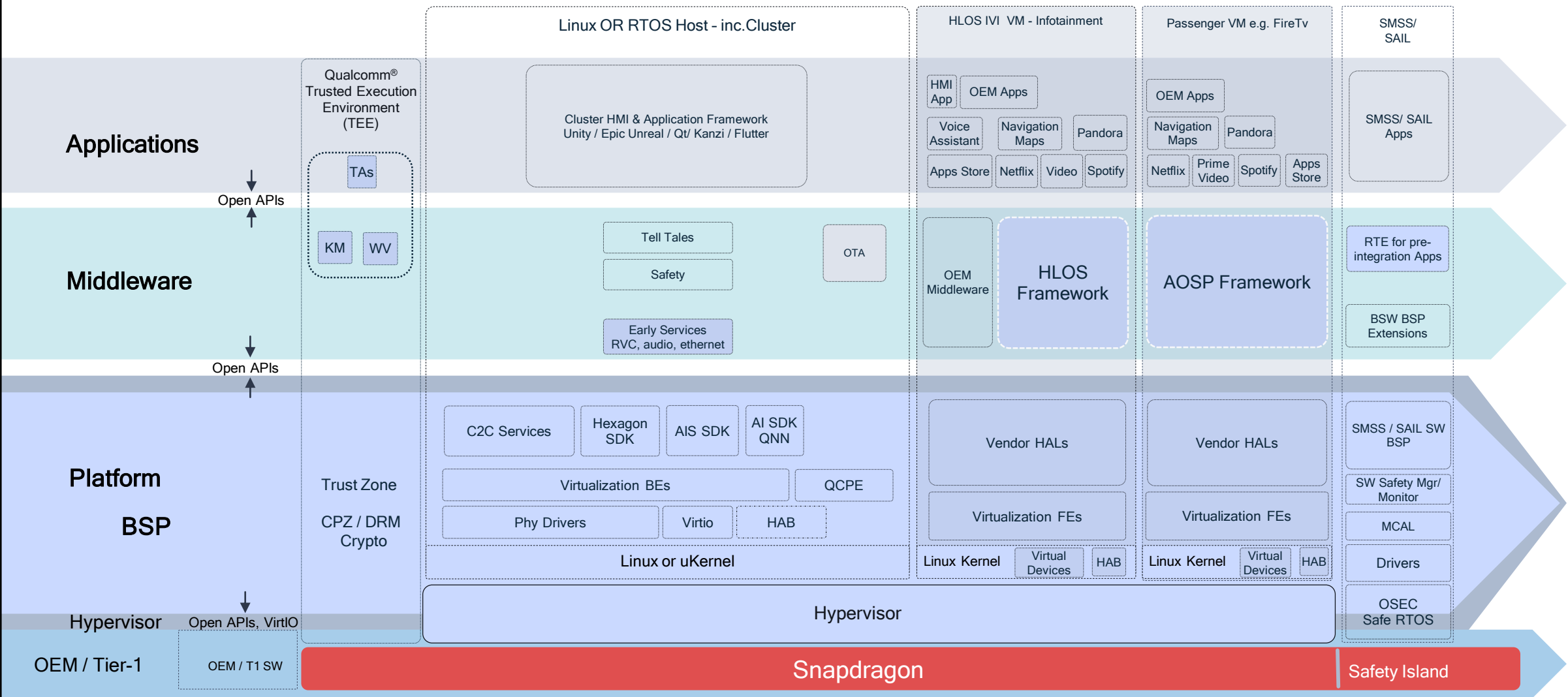
Automotive SW Product: Digital Cockpit & Passenger

RTOS Host + Type-2 HV + Android Guest VM + Passenger VM [Optional]



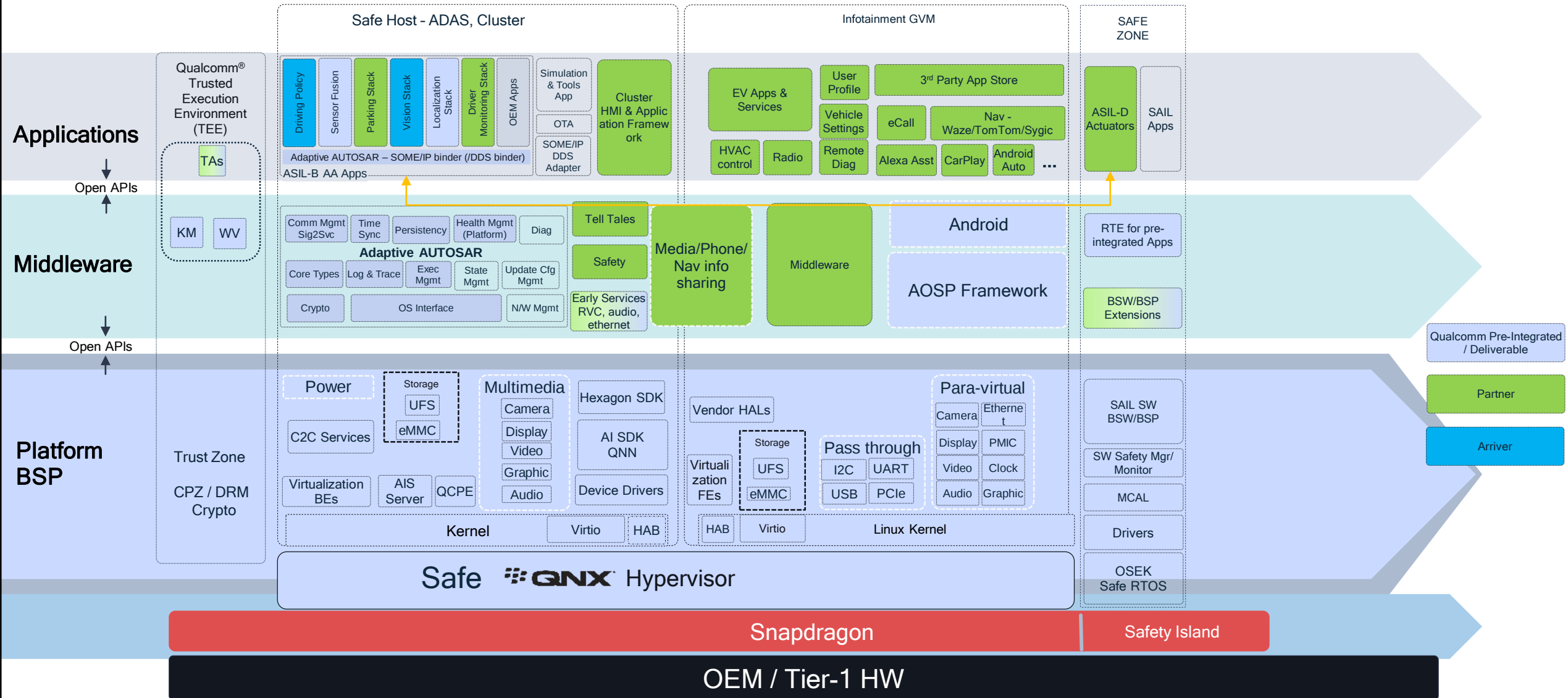
Automotive SW Product: Digital Cockpit & Passenger

Linux PVM or RTOS HOST + HV + IVI Guest VM + Passenger VM [Optional]



SA87x5P Single SOC Digital Cockpit + ADAS

QNX Hypervisor + Host (Cluster) + Android Guest VM



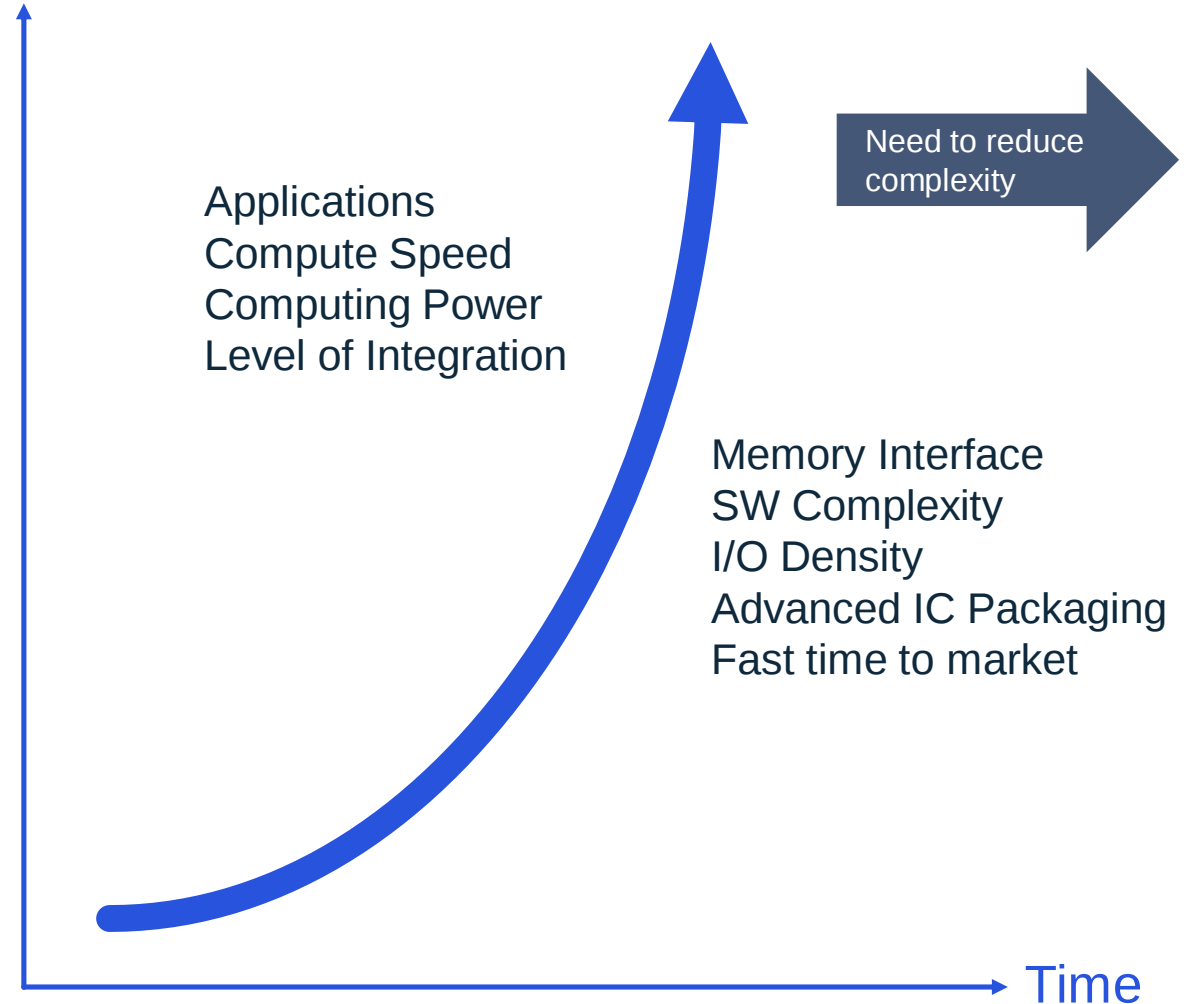
Qualcomm Automotive Modules

Qualcomm Automotive Modules

Next level of integration for advanced cockpit and ADAS applications

- Designs Complexity increasing at an unprecedented rate and involves extensive modeling and simulation
- Optimum Design for Performance and Power require tight integration with and between silicon components
- Extensive testing on a single design and resolution of common issues seen across multiple customer designs
- High Speed I/O and memory interfaces make Signal Integrity & Product Validation more critical than ever
- Consistent Performance best done through optimized, reusable, modular sub-systems
- Leverage the buying power of Qualcomm for reduced cost

Complexity



QAM8255P Module Product Features

Qualcomm Chipset included on Module:

- SA8255P Snapdragon Auto SoC w/ ASIL B AP, ASIL B Safety Island
- PMM8250AU + 3x PMM8251AU
 - Power regulation for Compute SoC & LPDDR5 DRAMs & other off-board components (UFS)
 - Full system clocking for Compute SoC

Memory Support

- 3x 315-ball, 2x16-bit, 3rd party LPDDR5 DRAMs on module
 - 6 Channel x16-bit, 3200MHz, up to 36GB total system memory
- Support 2x external UFS devices
- Support external SD Card
- Support external NVMe (non-bootable) via PCIe

Primary Power:

- Input: 3.3V
- Output: 1.2/1.8V/2.5V voltage regulation for external use
 - Supplies for UFS for primary boot (UFS device not on module)

Package Type & Size

- Type: 1573 BGA Module
- Size: 65x65 mm²

Auto Qualification: AEC-Q104 Grade3, ASIL B rated

- Temp: Ta +85C, Tj 115C max
- AEC-Q100 Grade 3 for Qualcomm SoC + PMICs
- AEC-Q200 for Passive BOM

Full-Featured SA8255P Compute SoC performance:

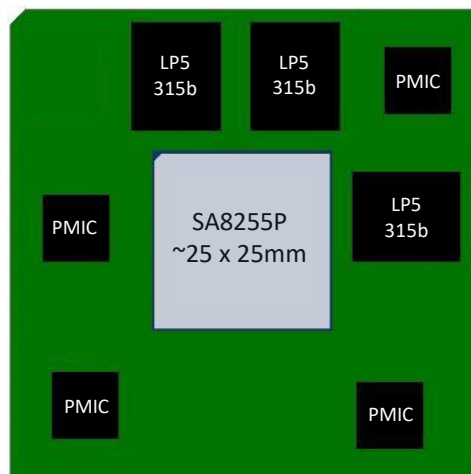
- Kryo 6xx Gen6 CPU Octa-Cores
- Adreno 6xx GPU
- HTP3 with Quad-HVX & Dual-HMX
- Dedicated Safety Island w/ Safety Compute & Health Monitoring
- Always-On Subsystem w/ Always-On Processor
- Multi-Media:
 - Spectra 690 Camera ISP (Image Signal Processing)
 - Adreno 6xx Gen5 VPU (Video Processing Unit)
 - Dual Display Processing Unit with up to 6 ports
 - Multi Audio DSP (x3) for Audio pre and post processing

External Connectivity / High-Speed Interface Support

- 6-Lane PCIe Gen4 – 1x 4-Lane, 1x 2-Lane
- 4xDP + 2xDSI – 4x or 2x MST supported on DP ports
- 4x 4-lane CSI Camera ports (DPHY & CPHY support)
- 3x USB - 2x USB3.1 Gen2 (HS+SS) + 1x USB2.0
- 2x Ethernet ports – 2x SGMII Gbe/2.5Gbe
- 2x 2-lane UFS3.1 Gear4 to support boot and mass storage
- 7x TDM Ports + 3x HS I2S for Software Defined Radio support
- 1x 8-bit SDCC5 to support SDIO
- 25 Serial engines (configurable as SPI/I2C/UART), 150+ GPIOs

Note: Specific memory configuration dependent on SOC SKU + Memory Density

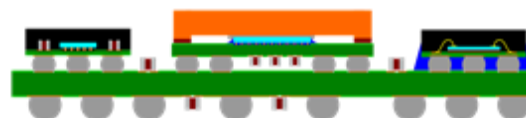
Module	
Package Type	BGA Module
Package Size	65x65 mm
Mold Cap	NA
Module Thermal Lid	NA
Total Height	TBD max
BGA Pitch	1.27 mm
BGA SRO	630 um
Mainboard Pad	630 um (NSMD)
BGA Alloy	SAC305
BGA Count	1573
Shielding	No
Underfilled Component	DRAM



Floor Plan (Preliminary)

Component Details	
APQ	SA8255P Qty: 1 25x25mm FCBGA
LPDDR5	Auto Grade Qty: 3 12.4x15 0.7 pitch
PMIC	Design scoping in progress
Components	Design scoping in progress
Components Count	Top Side: ~250 BGA Side: ~100 0201 Total: ~350
Tallest Component	SA8255P

Assembly Materials	
Solder paste	SAC305
BGA UF	Non-reworkable



Dimensions: 65x65mm

Substrate	
Substrate Technology	HDI
Substrate Stackup	5-2-5
Layer Count	12 L
PCB Thickness	1.6 mm

SR	
L1	
PPG	
L2	
PPG	
L3	
PPG	
L4	
PPG	
L5	
PPG	
L6	
Core	
L7	
PPG	
L8	
PPG	
L9	
PPG	
L10	
PPG	
L11	
PPG	
L12	
SR	

QAM8255P Module Design Attributes (preliminary)

For early development, use QAM8295P as reference and discuss with Qualcomm for detailed review

QAM8775P Module Product Features

Qualcomm Chipset included on Module:

- SA8775P Snapdragon Auto SoC w/ ASIL B AP, ASIL D Safety Island
- PMM8255AU + 3x PMM8256AU + 3rd Party PMIC
 - Power regulation for Compute SoC & LPDDR5 DRAMs
 - Full system clocking for Compute SoC

Memory Support

- 3x 315-ball, 2x16-bit, 3rd party LPDDR5 DRAMs on module
 - 6 Channel x16-bit, 3200MHz, up to 36GB total system memory
- Support 2x external UFS devices
- Support external SD Card/eMMC
- Support external NVMe (non-bootable) via PCIe

Primary Power:

- Input: 3.3V
- Output: 0.9/1.2/1.8V voltage regulation for external use
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- Type: 1573 BGA Module
- Size: 65x65 mm²

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- AEC-Q200 for Passive BOM

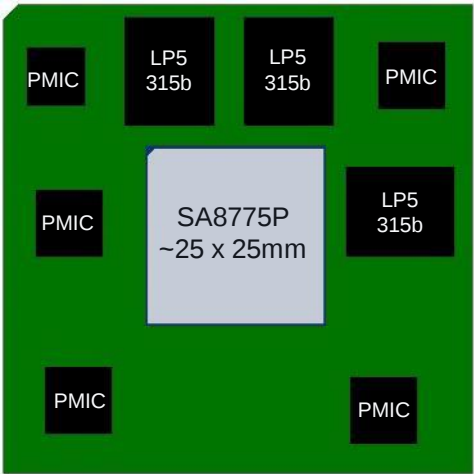
Full-Featured SA8775P Compute SoC performance:

- Kryo 6xx Gen6 CPU Octa-Cores
- Adreno 6xx GPU
- Dual-NSP3 with Quad-HVX & Dual-HMX DSPs
- Dedicated Safety Island w/ Safety Compute & Health Monitoring
- Always-On Subsystem w/ Always-On Processor
- Multi-Media:
 - Spectra 690 Camera ISP (Image Signal Processing)
 - Adreno 6xx Gen5 VPU (Video Processing Unit)
 - Adreno 1199 dual-DPUs (Display Processing up to 48MP)
- LPASS (Low-Power Audio Sub-system)

External Connectivity / High-Speed Interface Support

- 6-Lane PCIe Gen4 – 1x 4-Lane, 1x 2-Lane
- 4x 4-lane CSI Camera ports (DPHY & CPHY support)
- 2x DSI + 4x eDP supporting up to 48MPixels
- 3x USB - 1x USB2 (HS), 2x USB3.1 Gen2 (HS+SS)
- 3x Ethernet ports – 2x SGMII Gbe/2.5Gbe, 1x RGMII (SAIL)
- 2x 2-lane UFS3.1 Gear4 to support boot and mass storage
- 1x 8-bit SDCC5 to support SD Card / eMMC
- 2x Network + 6x Sensor CAN-FD (SAIL)
- 143x GPIOs + 74 SAIL GPIOs
 - 25 GPIO-based QuP (Qualcomm Universal Peripheral) Serial Engines
- Note: Specific memory configuration dependent on SOC SKU + Memory Density

Module	
Package Type	BGA Module
Package Size	65x65 mm
Mold Cap	NA
Module Thermal Lid	NA
Total Height	TBD max
BGA Pitch	1.27 mm
BGA SRO	630 um
Mainboard Pad	630 um (NSMD)
BGA Alloy	SAC305
BGA Count	1573
Shielding	No
Underfilled Component	DRAM



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PMIC	Design scoping in progress
Components	Design scoping in progress
Components Count	Top Side: ~250 BGA Side: ~100 0201 Total: ~350
Tallest Component	SA8775P

Assembly Materials	
Solder paste	SAC305
BGA UF	Non-reworkable



Dimensions: 65x65mm

Substrate	
Substrate Technology	HDI
Substrate Stackup	5-2-5
Layer Count	12 L
PCB Thickness	1.6 mm

SR	
L1	
PPG	
L2	
PPG	
L3	
PPG	
L4	
PPG	
L5	
PPG	
L6	
Core	
L7	
PPG	
L8	
PPG	
L9	
PPG	
L10	
PPG	
L11	
PPG	
L12	
SR	

QAM8775P Module Design Attributes (preliminary)



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