



Towards Hardware-Agnostic ADAS Implementations for Software-Defined Vehicles

Frank Moesle

Software Department Manager

Valeo



About Valeo

- Valeo is a French global automotive supplier, founded 1923 and headquartered in France
- The group employs more than 110,000 people in 29 countries worldwide
- German city Bietigheim (close to Stuttgart) is the center of “anSWer”, Valeo’s automotive software product line



What is ADAS?

- **Advanced driver-assistance systems (ADAS) are technologies that assist drivers with the safe operation of a vehicle** (*Wikipedia*)
- They are usually classified into 6 categories (“SAE levels”)
 - Level 0 - Level 2: Driver is in charge
 - Level 3 - Level 5: Vehicle is in charge

Level 3 Driving:
Mercedes Drive Pilot



<https://www.mbusa.com>

Level 3 Parking:
Valeo Park4U

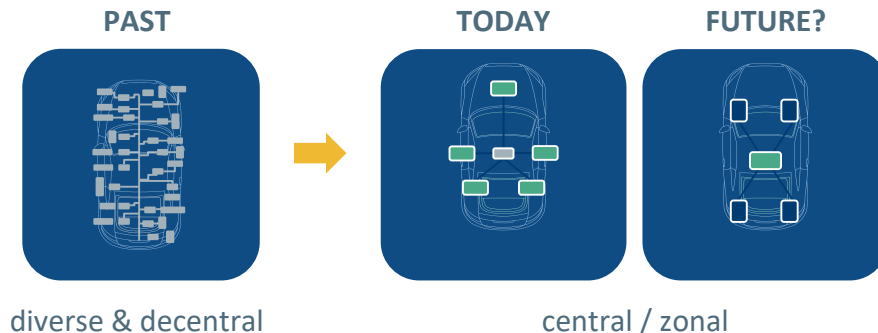
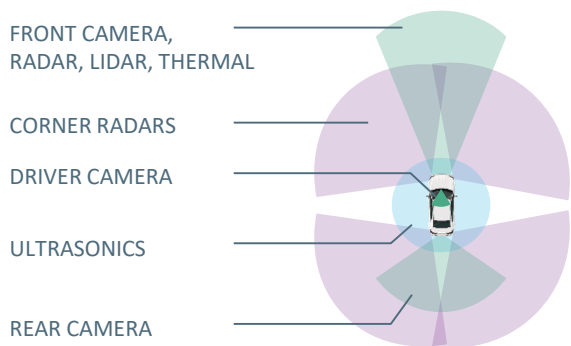


<https://www.valeo.com>

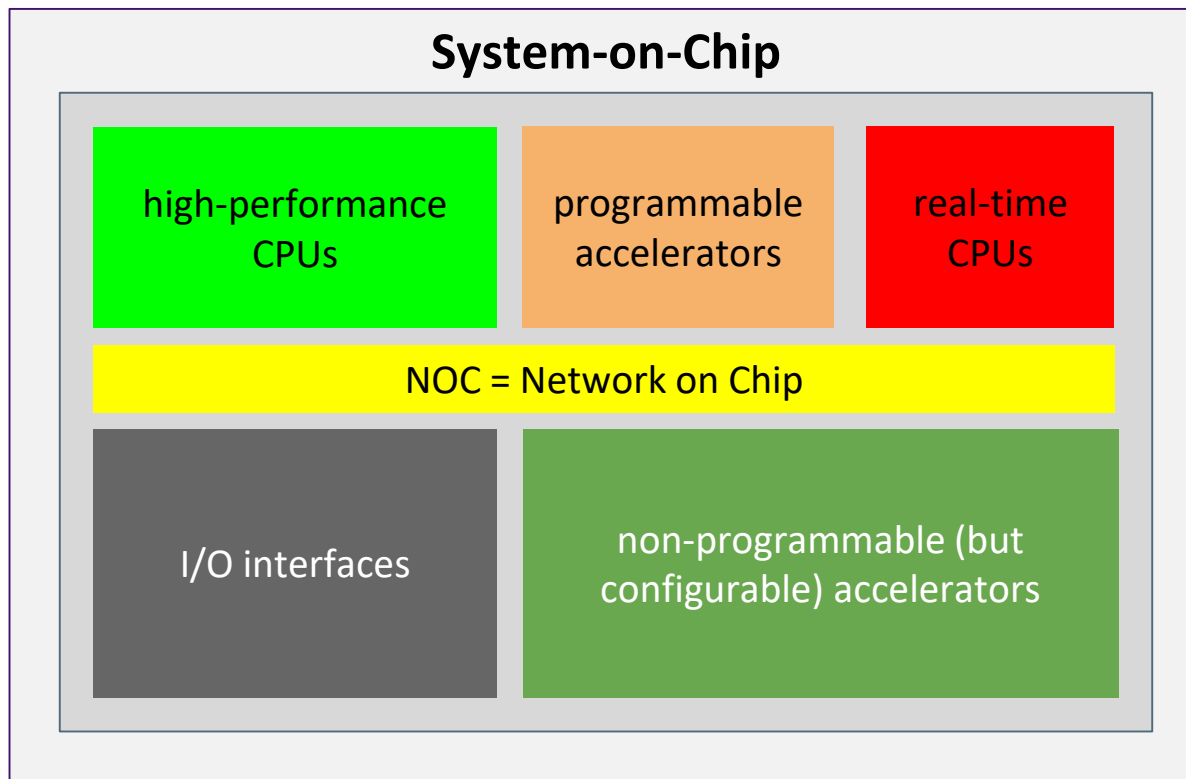
- There's a wide variety of sensors used for this; **vision** is the dominant one

Sensor and SOC set for ADAS

- Historically, each sensor had its dedicated signal processor (SOC = system on chip)
- As the car infrastructure got more and more complex, auto manufacturers started to combine, reduce and centralize the amount of the SOCs

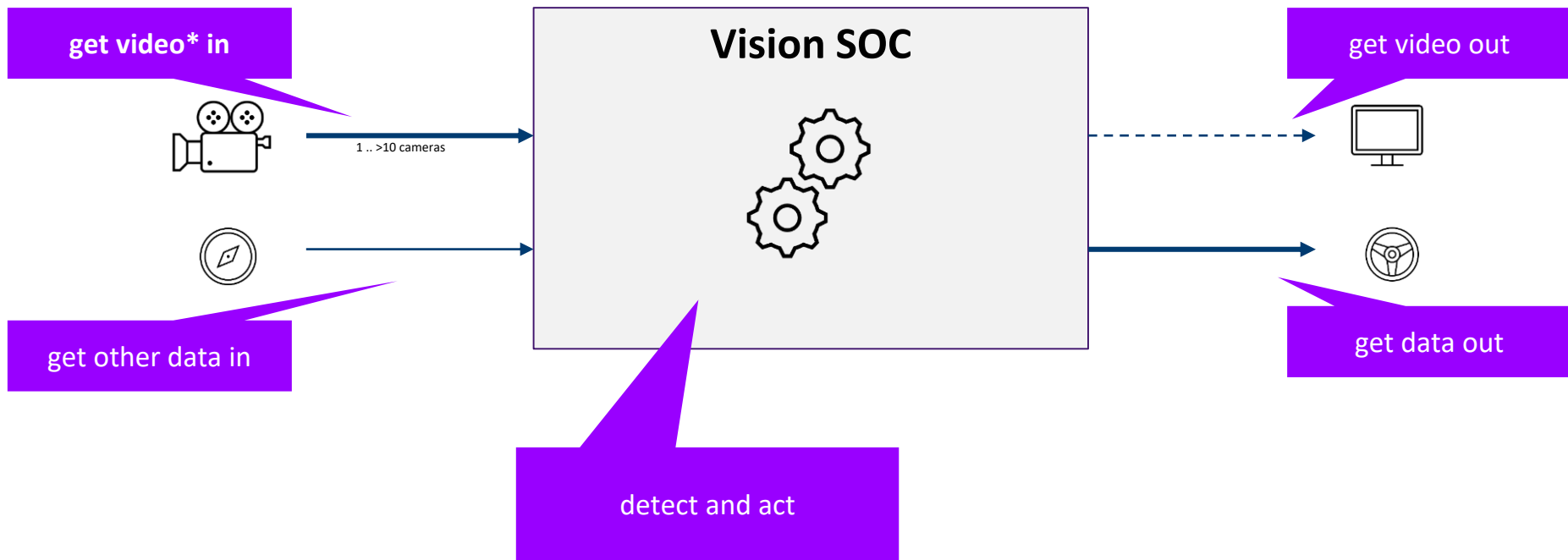


Typical ADAS SOC layout



What do we have to do in (vision) ADAS?

* similar for radar, lidar, ultrasonic



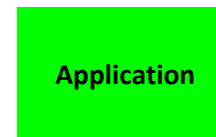
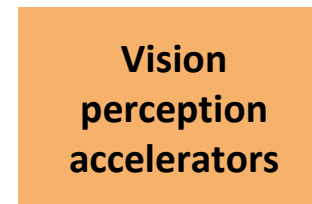
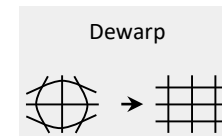
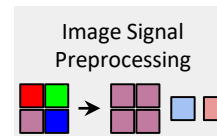
What are typical tasks on an ADAS (vision) SOC?

- Adjust video signal
- Find and track relevant objects in the image

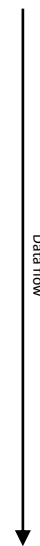


Curbstones
Lanes
Vehicles
Traffic signs
...

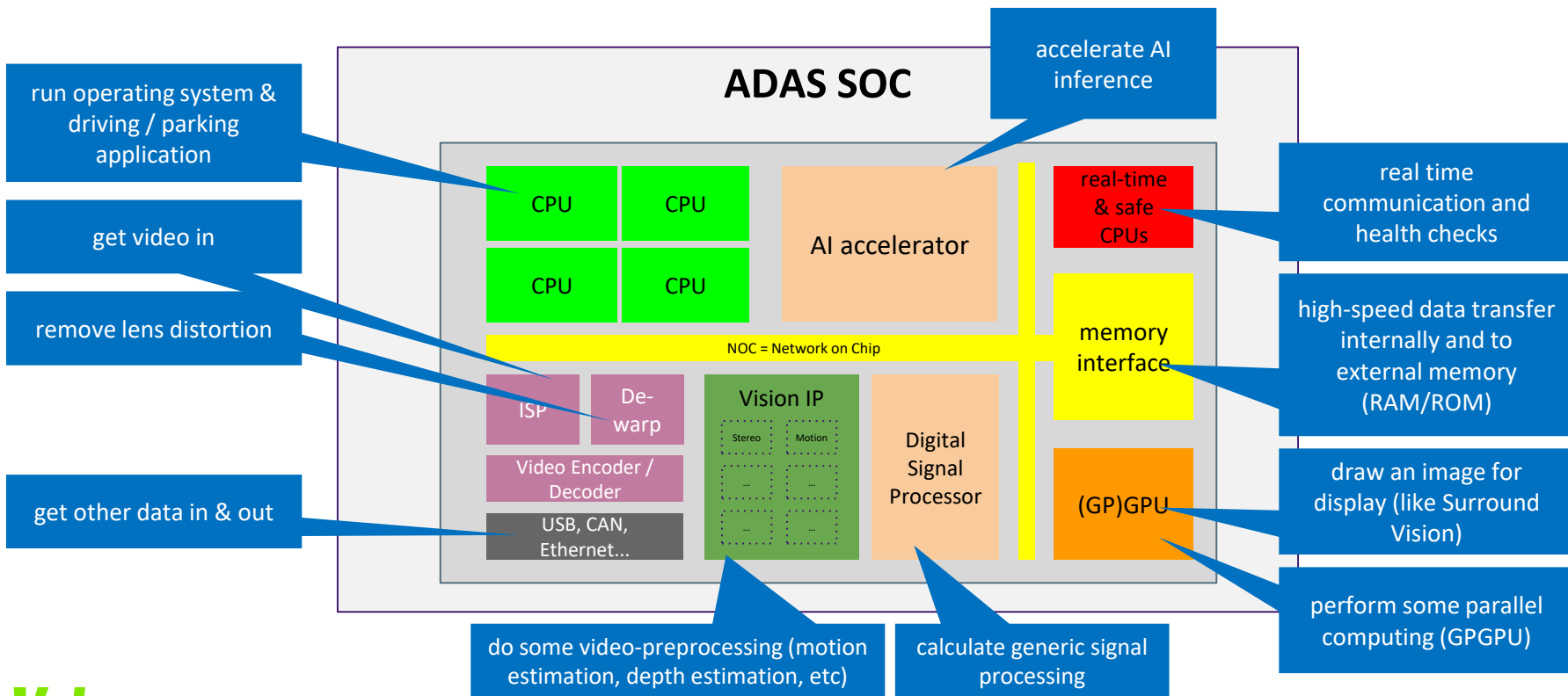
- Find a suitable driving / parking corridor
- Activate steering and braking
- Monitor the whole system



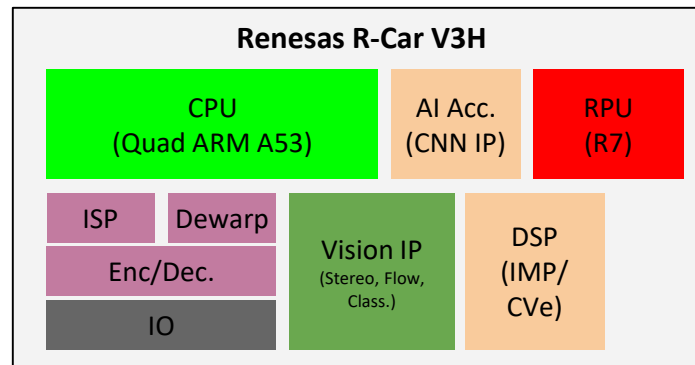
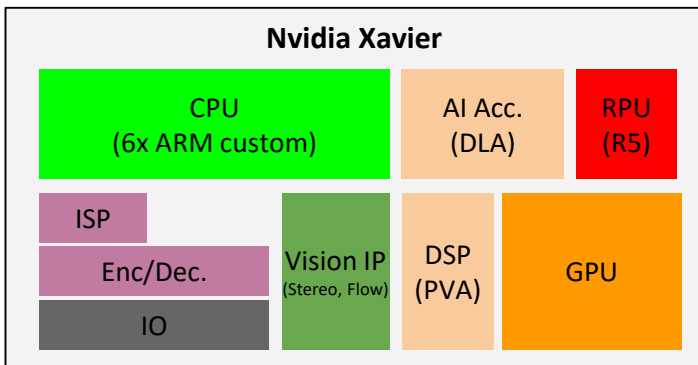
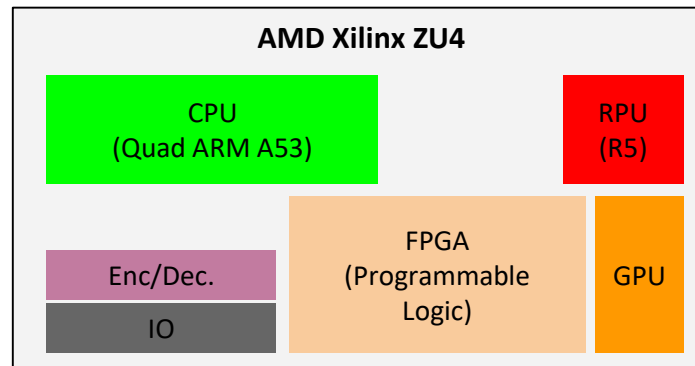
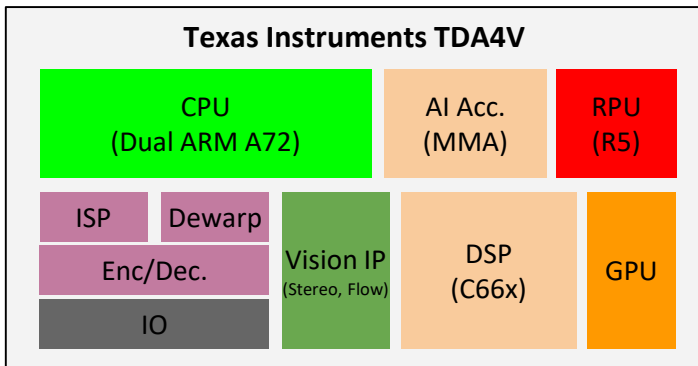
Data flow



Inside an ADAS (vision) SOC

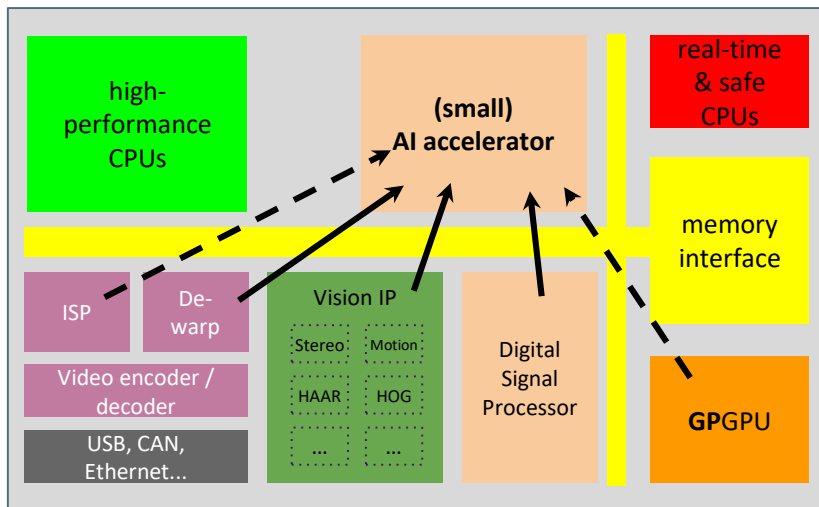


Example ADAS SOCs of previous/current generation



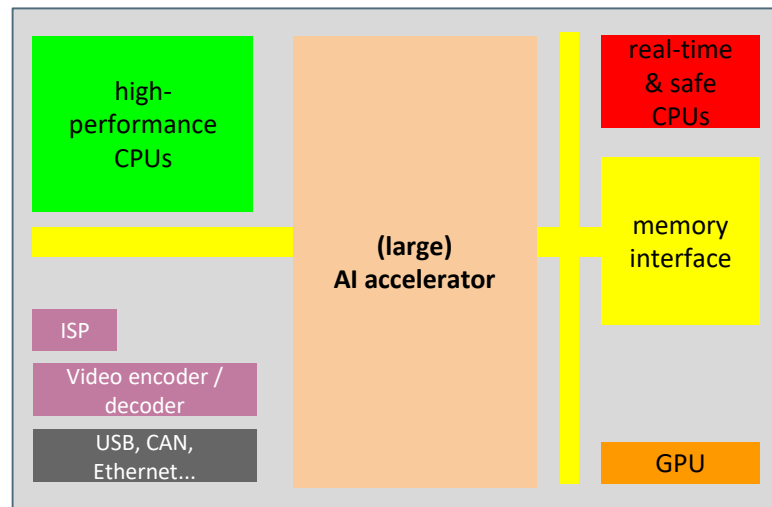
The hardware side: AI replacing other accelerators

Previous generation



→ Many dedicated small accelerators

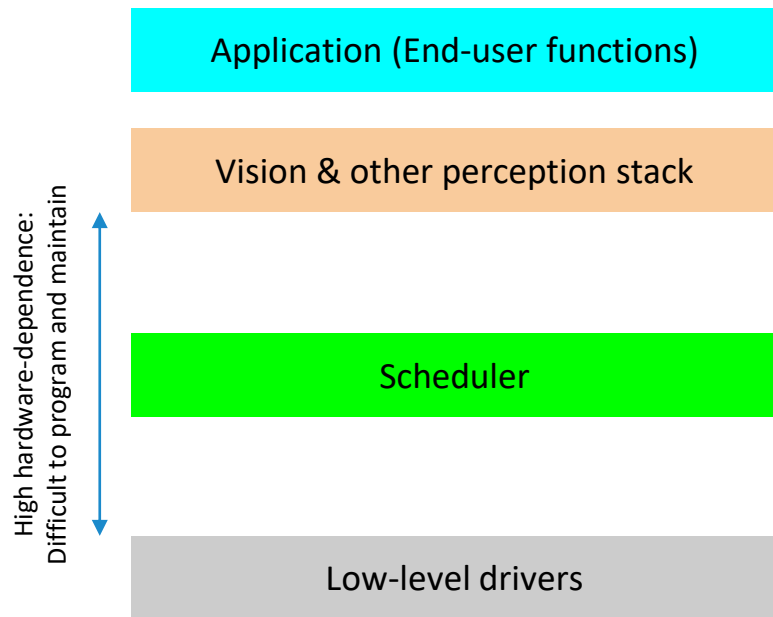
Next generation



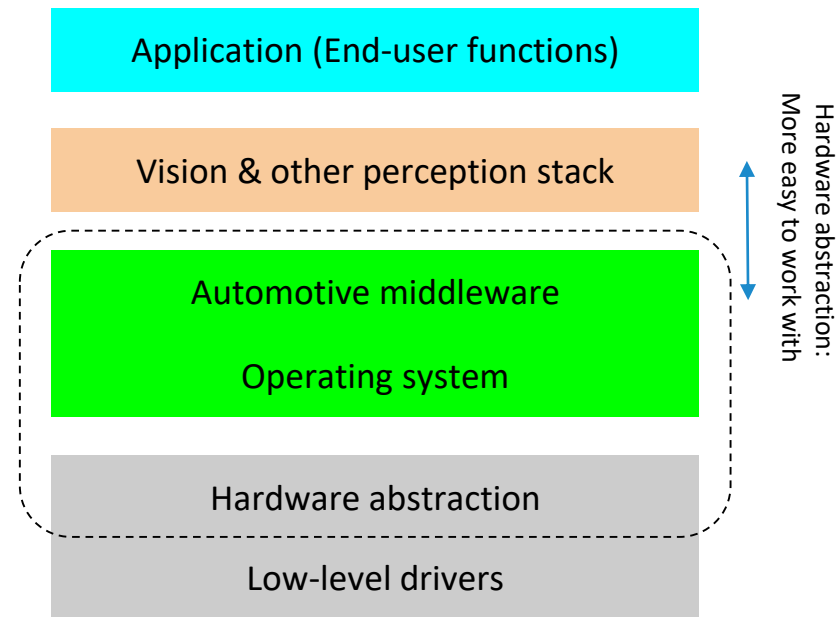
→ Fewer, unified accelerators

The software side: Introduction of new layers

Previous generation

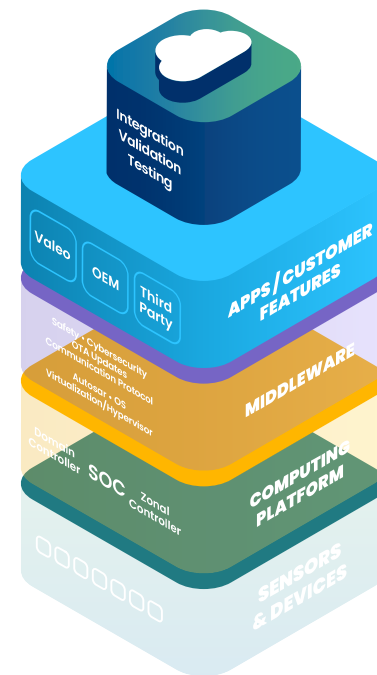


Next generation



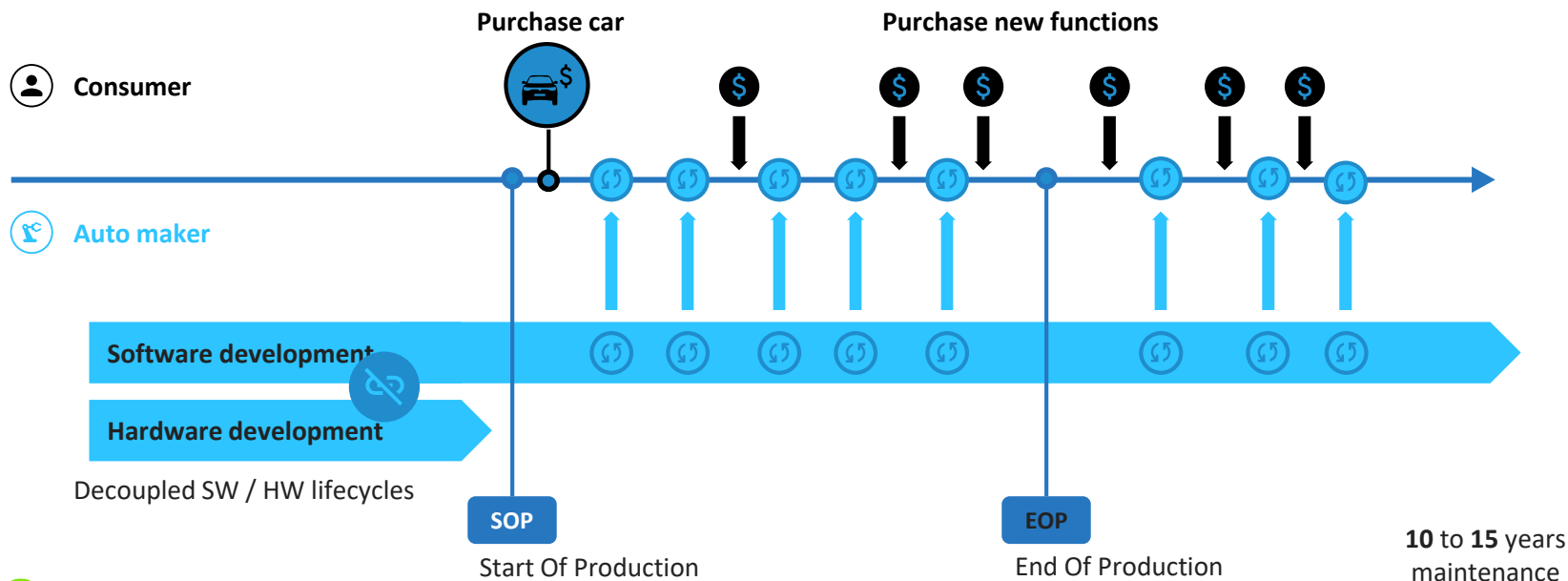
Middle and upper layer abstraction

- Automotive middleware acts like a translator between the car's hardware and its software
 - Auto maker's solutions: MB.OS, BMW OS, ASIMO OS, Tesla OS...
 - Tier 1's solutions: Valeo vOS, Bosch AOS...
- The underlying operating system is often QNX
- Some of these rely on AUTOSAR (Adaptive or Classic)
- They include mechanisms to distribute code over several CPUs and SOCs, to balance the load and to update SW



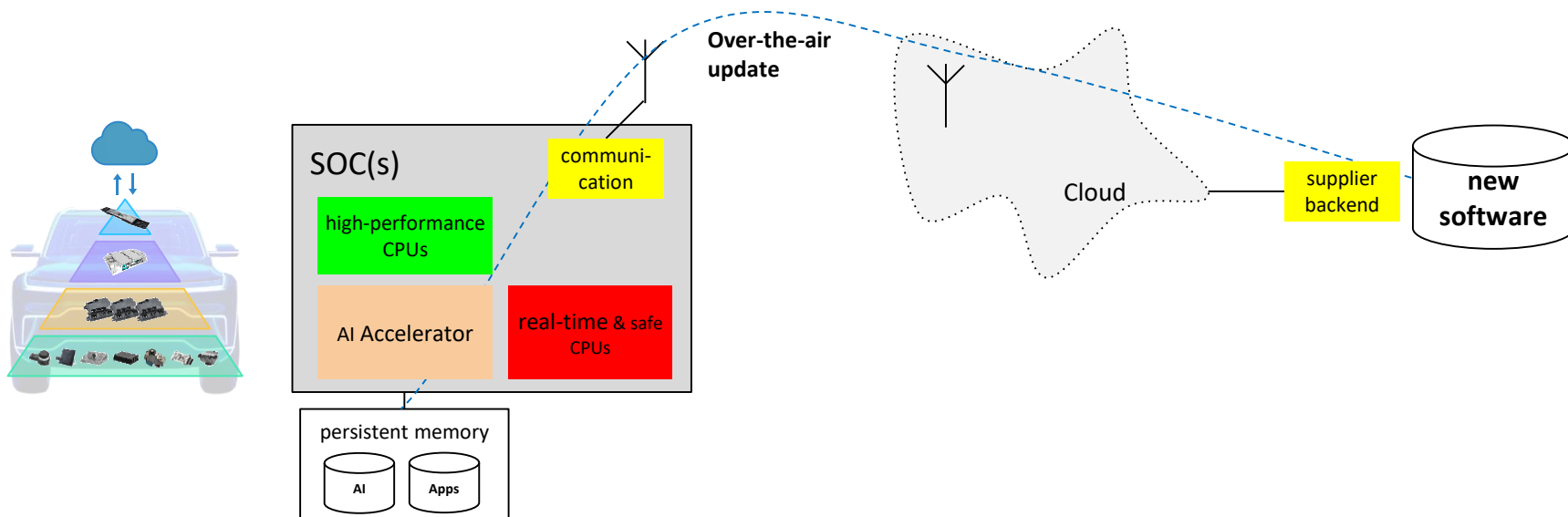
Towards the Software Defined Vehicle (SDV)

- A SDV is a “an ecosystem that continuously provides new value and experiences to users by updating features through software” (source PWC)

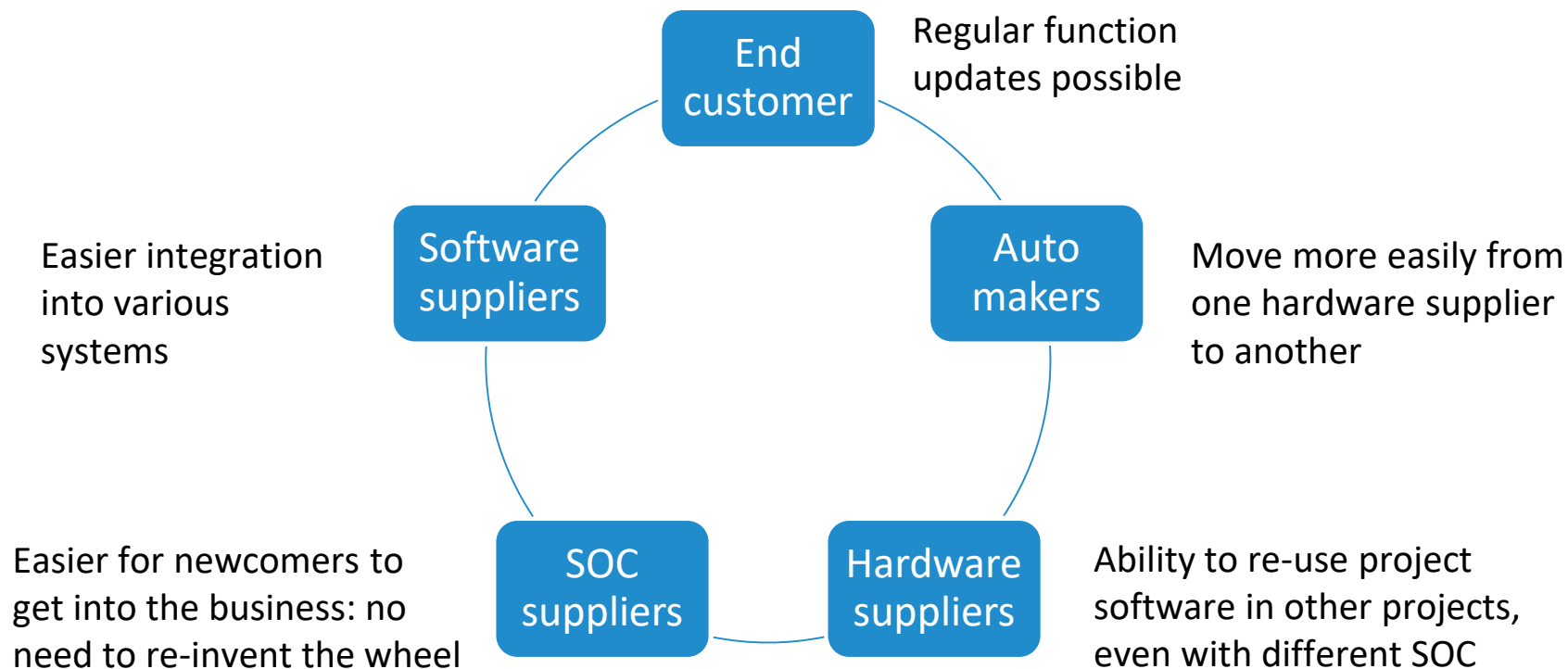


Towards the Software Defined Vehicle

- Key new vehicle requirements: **updatable, connected, secure**

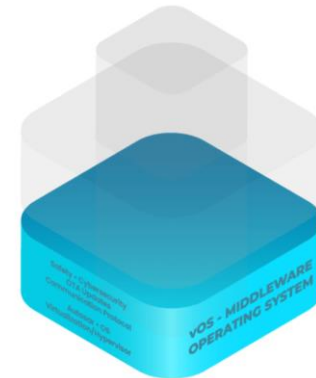


Advantages of new programming models for SDV



Recap – Towards HW-Agnostic ADAS for SDV

- Software-defined vehicles require preparation
 - Choose the right middleware (preferably HW independent)
 - Abstract your software from hardware-dependencies, move away from specific accelerators to AI engines
 - Use open, standardized solutions where possible
 - Move away from low-level programming
 - Use independent, open frameworks



OpenVX™

 ONNX ...

“OpenVX and the OpenVX logo are trademarks of the Khronos Group Inc.”

- Edge AI and Vision Alliance
 - <https://www.edge-ai-vision.com/resources/applications/automotive/>
- Valeo BRAIN division
 - <https://www.valeo.com/en/brain-division/>
- SAE levels of driving automation
 - https://www.sae.org/binaries/content/assets/cm/content/blog/sae-j3016-visual-chart_5.3.21.pdf