AUTOSAR™

Impact of the Zone Architecture on the in Vehicle SW Distribution

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28 June 2021

AHK meets AUTOSAR: Automotive Software Development

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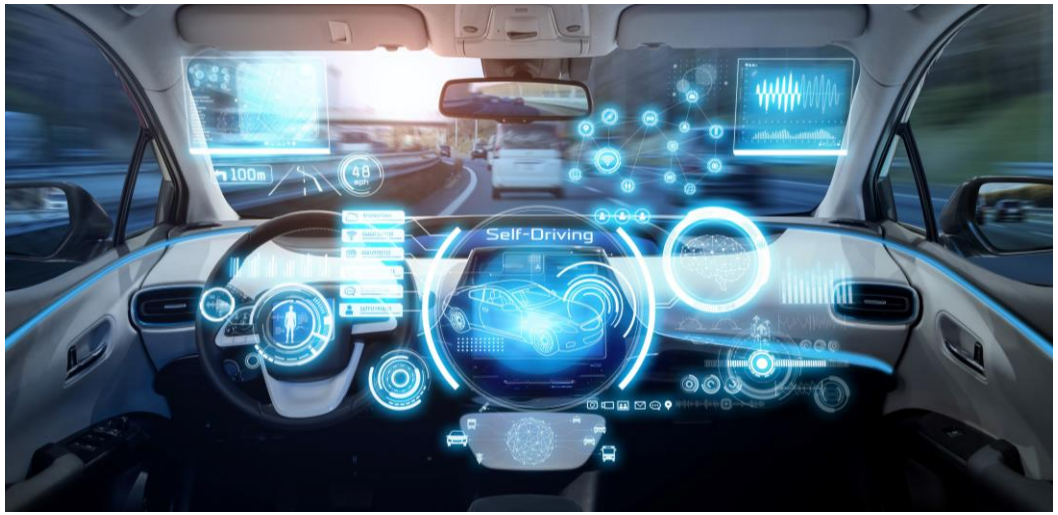
BMW Group · BOSCH · Continental · DAIMLER · Ford · GM · PSA GROUPE · TOYOTA · VOLKSWAGEN AKTIENGESELLSCHAFT

Agenda

- Current challenges and evolution of the E/E-Architecture to Zone Architecture
- Analogy „Human“ and „Zone Architecture“
- Example SW Architecture: Brake
- How can AUTOSAR support such a change?
- Conclusion

Mobility Challenges

Selected Main Drivers



Highly Automated Driving with Dependability

- Reliability
- Availability
- Maintainability
- Safety
- Security

CAR2X, Internet of Things, Cloud-Based Services

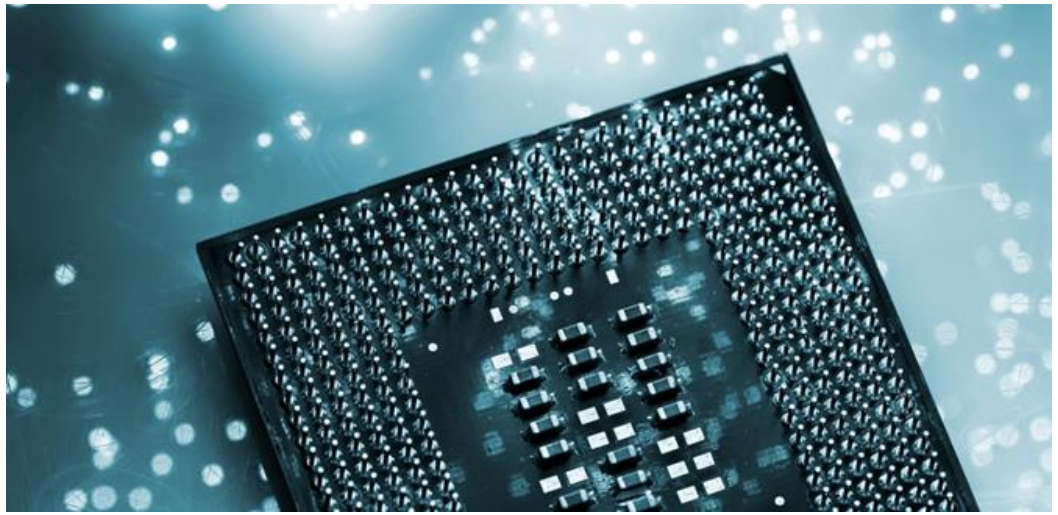
- Security
- QoS
- Over the Air (OTA) Update/Upgrade

Mobility Challenges

Selected Main Drivers

Increasing Data Rates and Volume

- Automotive Ethernet
- 5G



New Automotive Processor Technologies

Centralized multi-core processors

Driving Changes in E/E Architectures

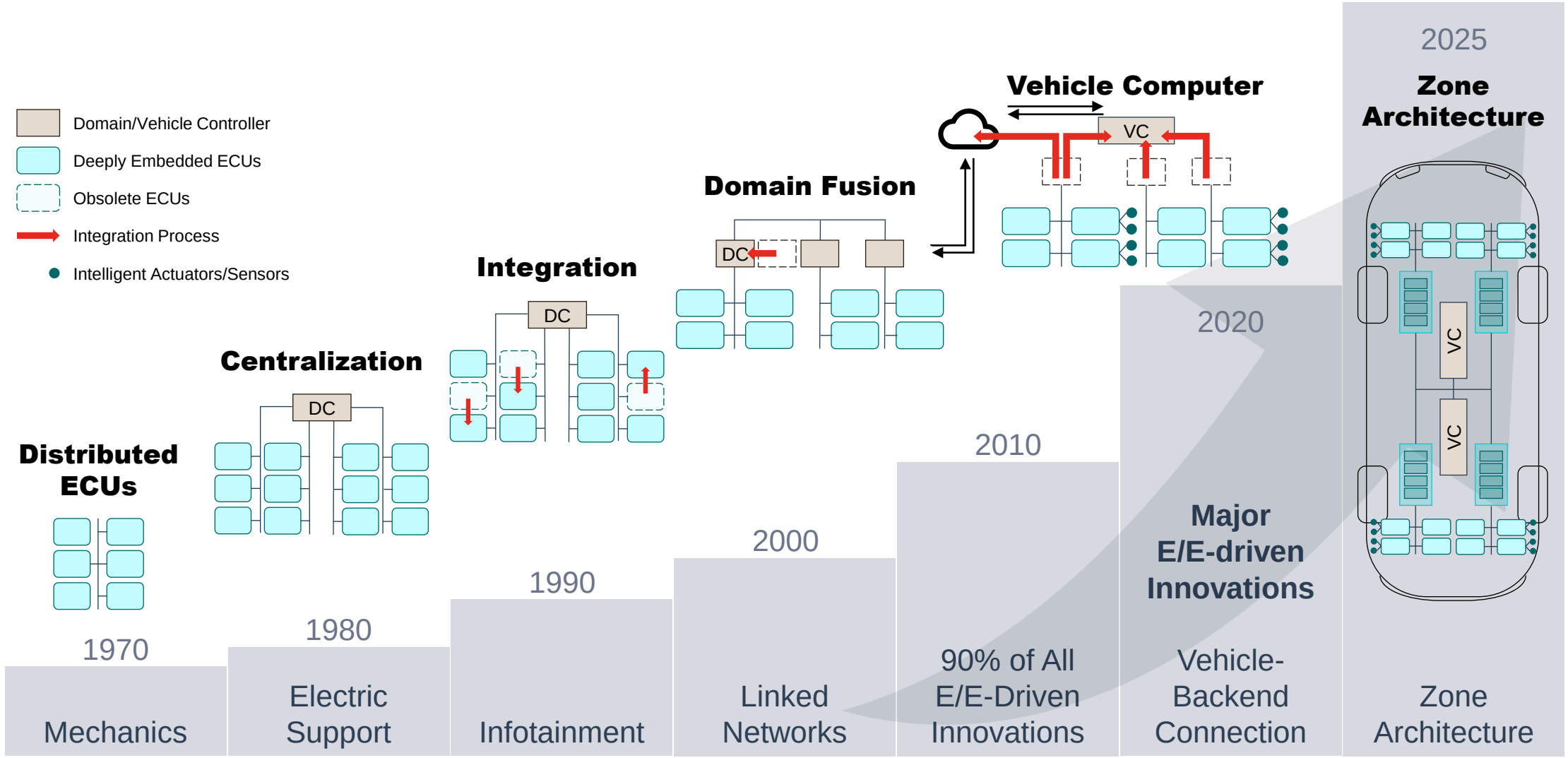
New types of in-vehicle-computers are required to fulfill the needs of

- **performance**,
- **flexibility** and
- **connectivity.**

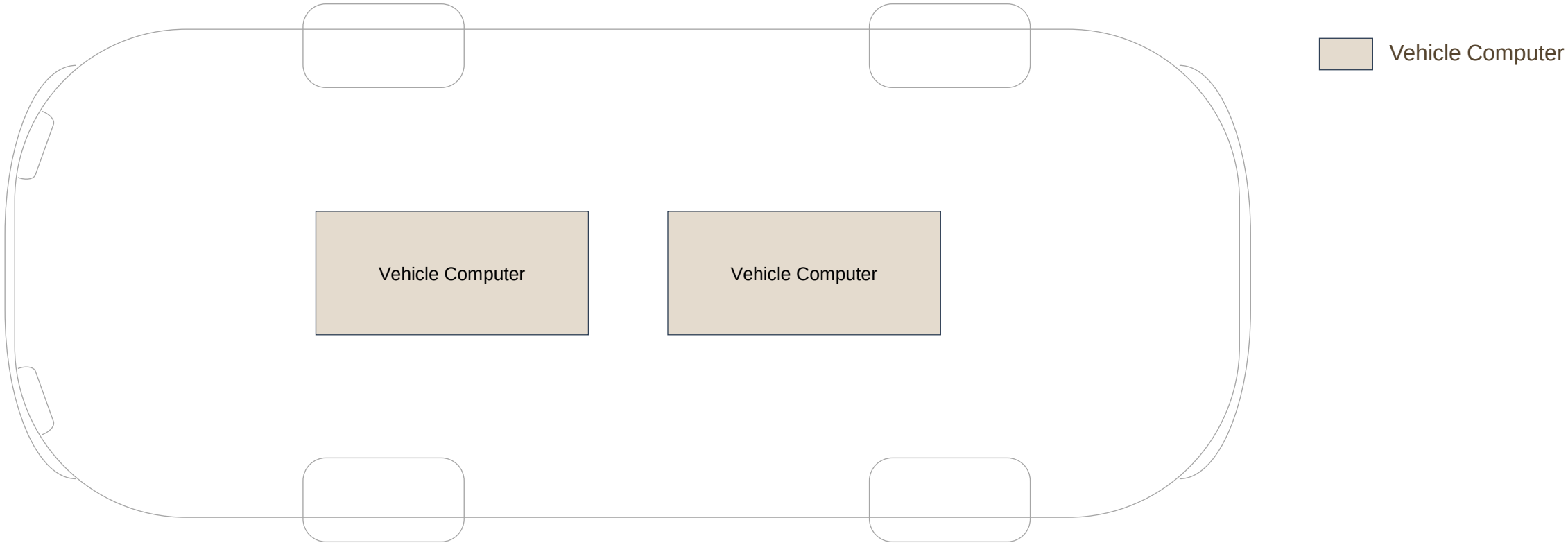
A Must is

- **backwards compatibility** with existing solutions and
- the fulfillment of increasing requirements for **safety** and **security**.

Driving Changes in E/E Architectures



Zone Architecture



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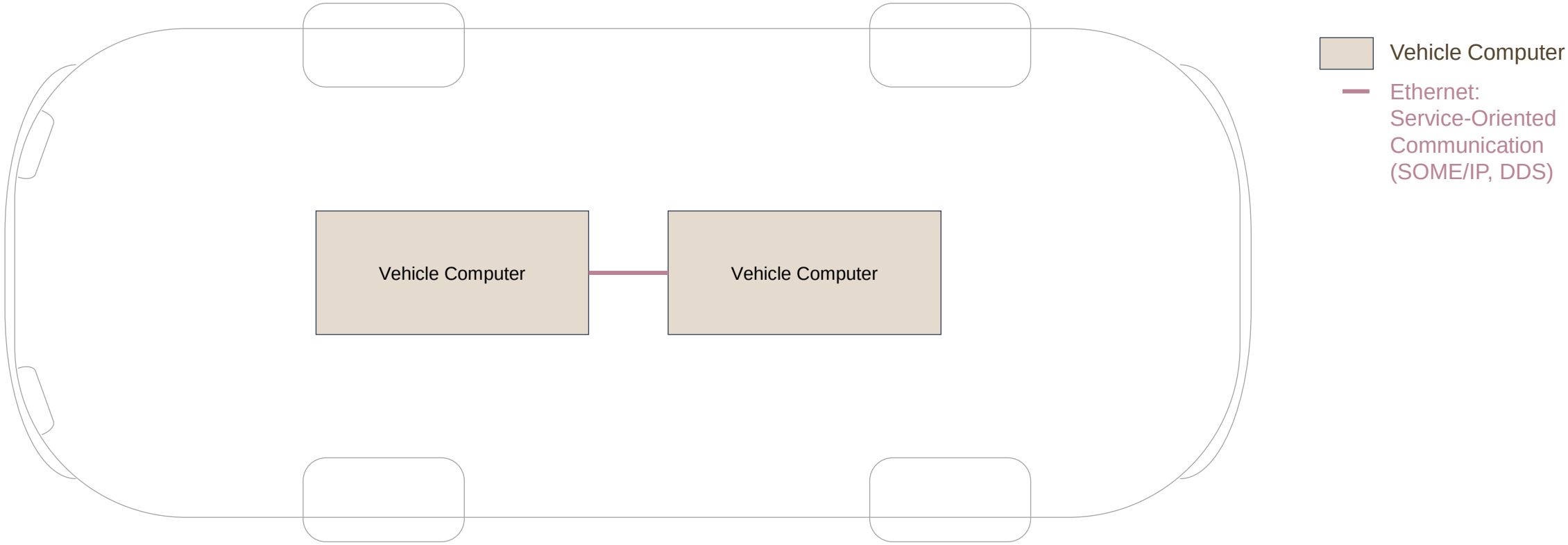

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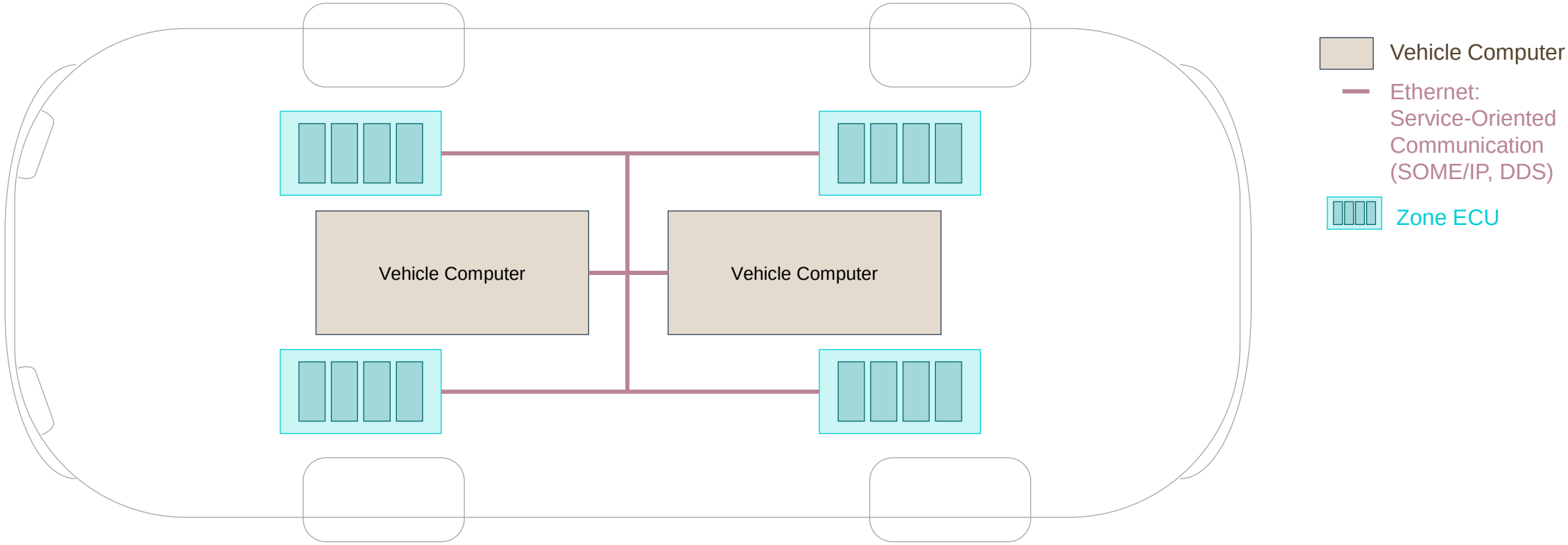

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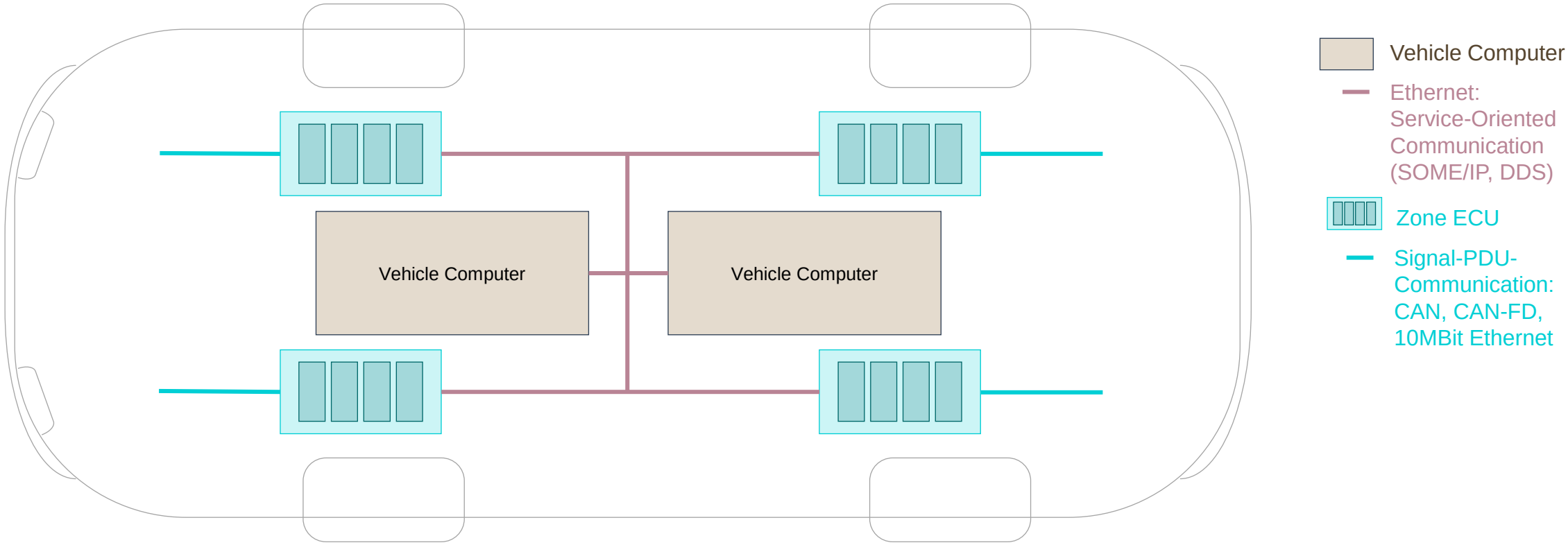
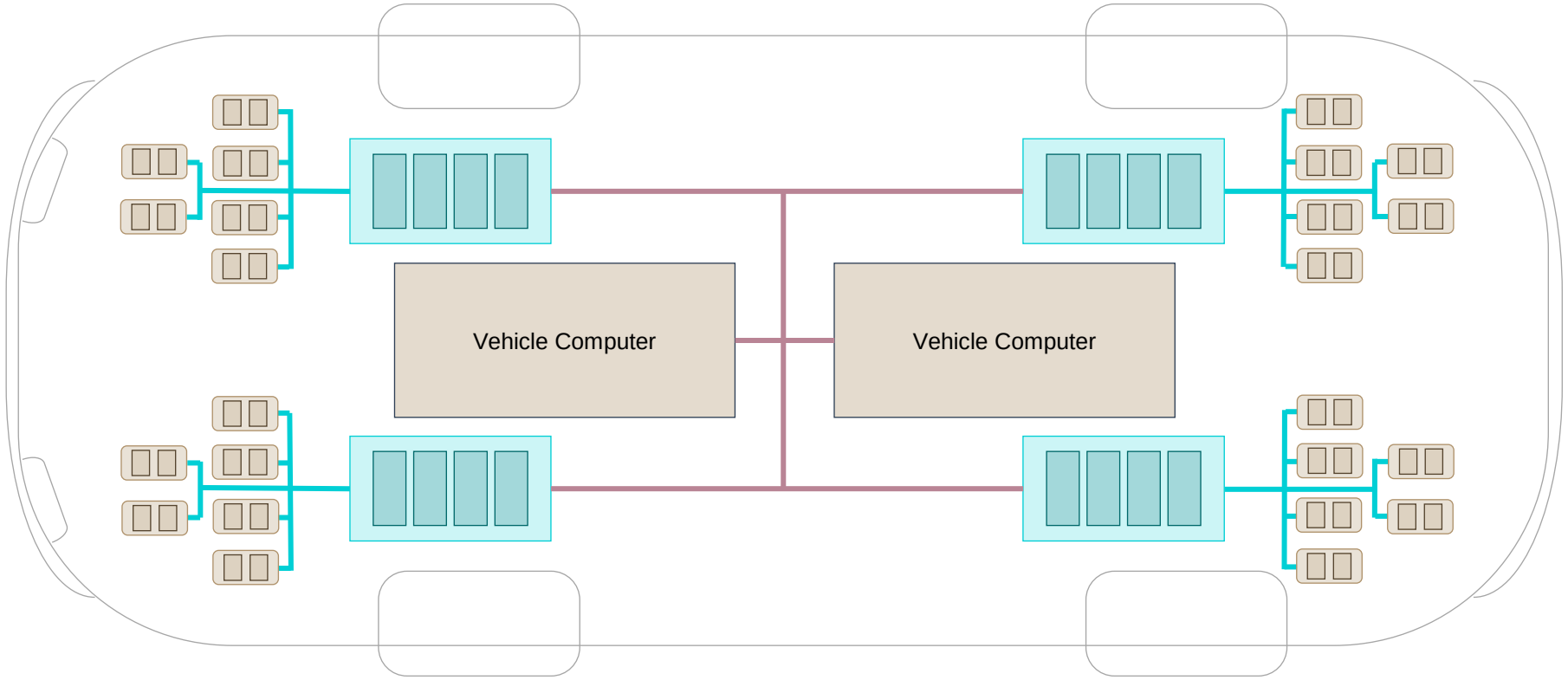


Zone Architecture



Vehicle Computer

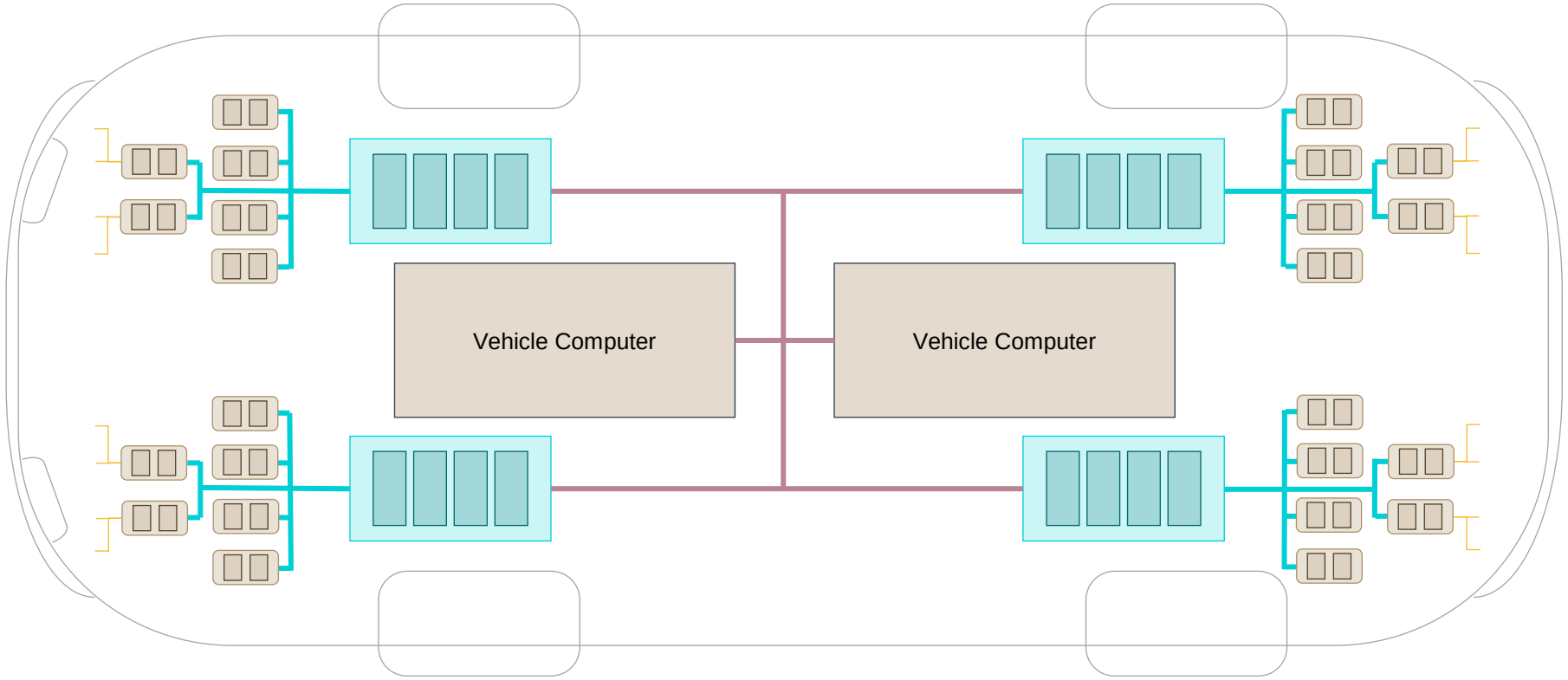
Ethernet: Service-Oriented Communication (SOME/IP, DDS)

Zone ECU

Signal-PDU-Communication: CAN, CAN-FD, 10MBit Ethernet

Actuator/Sensor ECU

Zone Architecture



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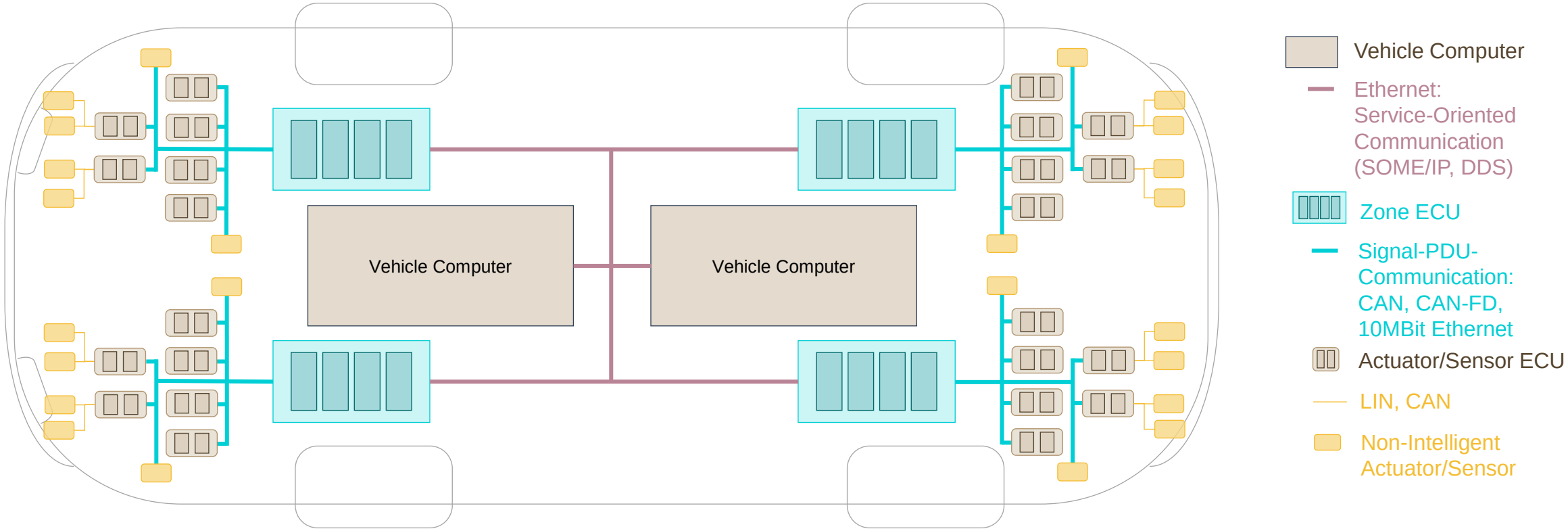
LIN, CAN

Zone Architecture



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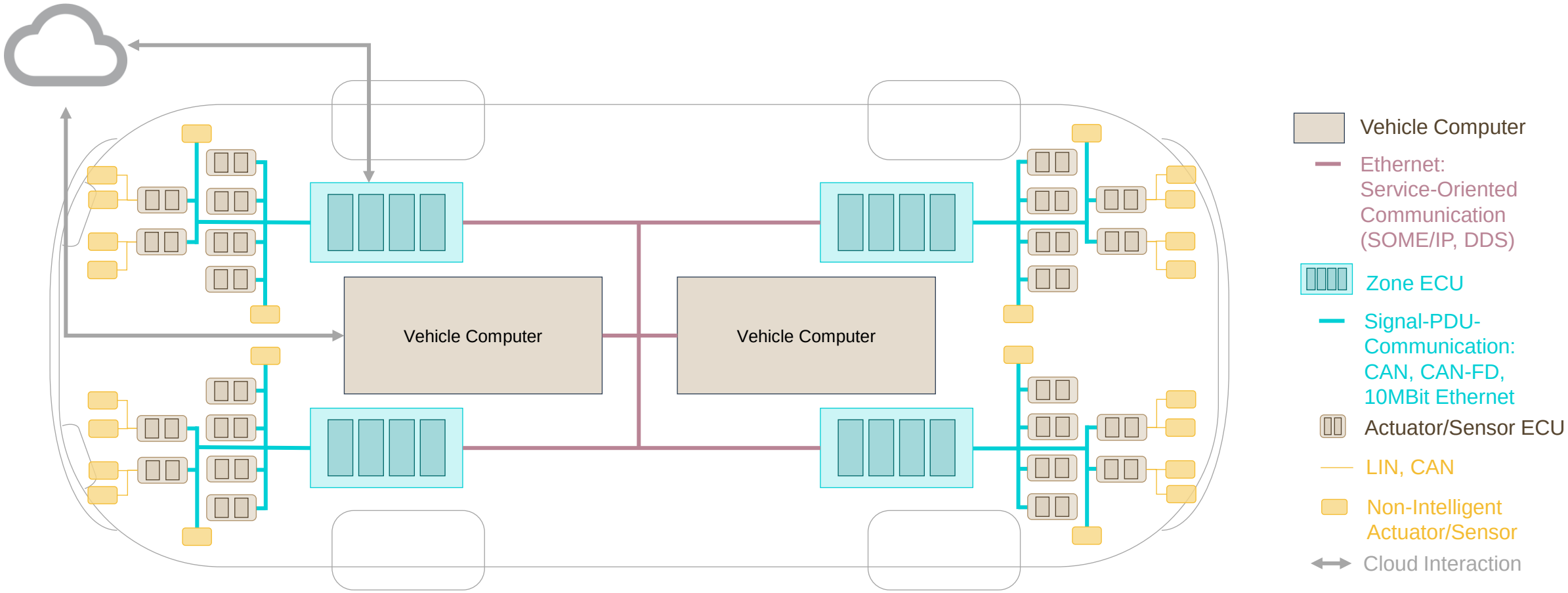
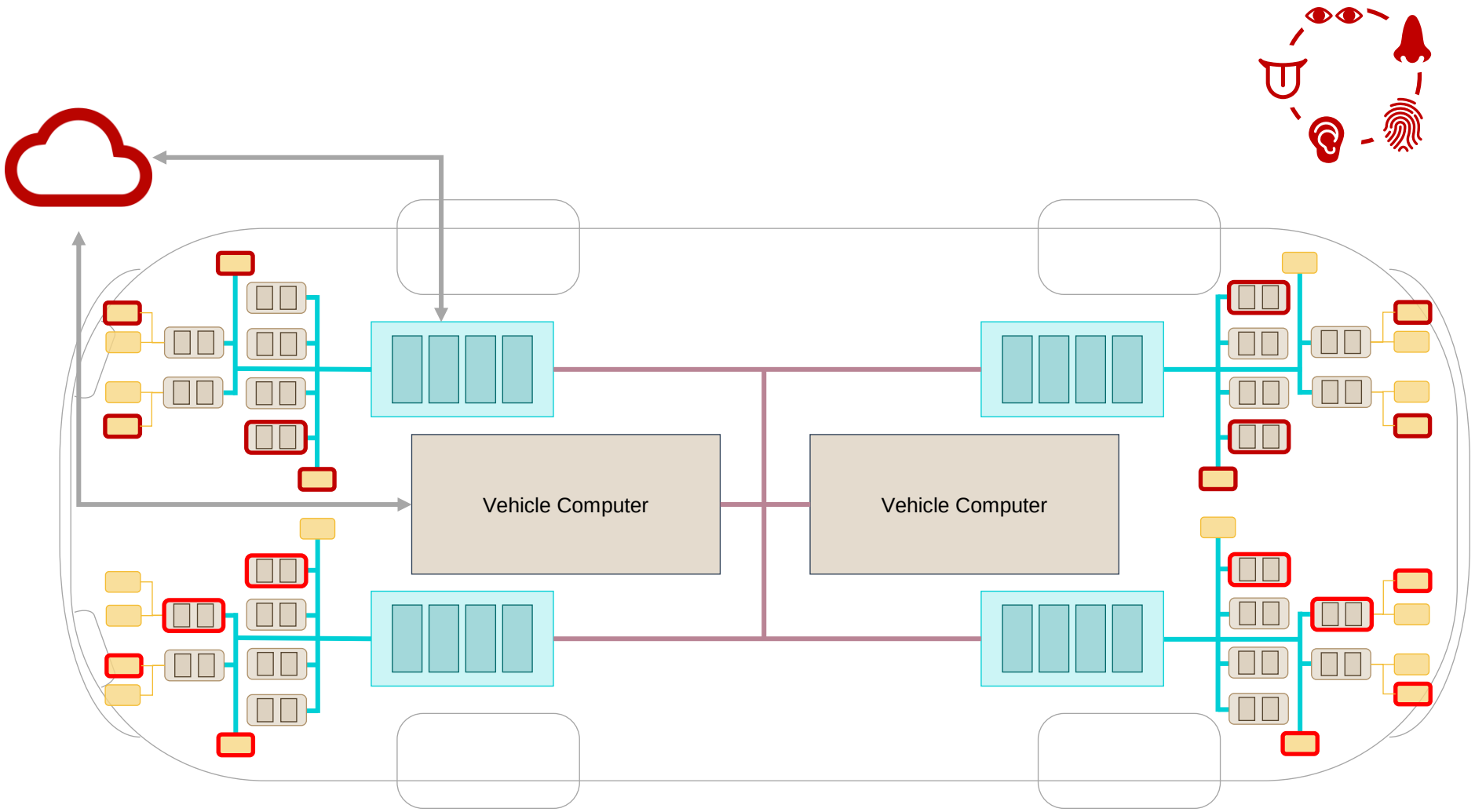


Analogy Human - Zone Architecture

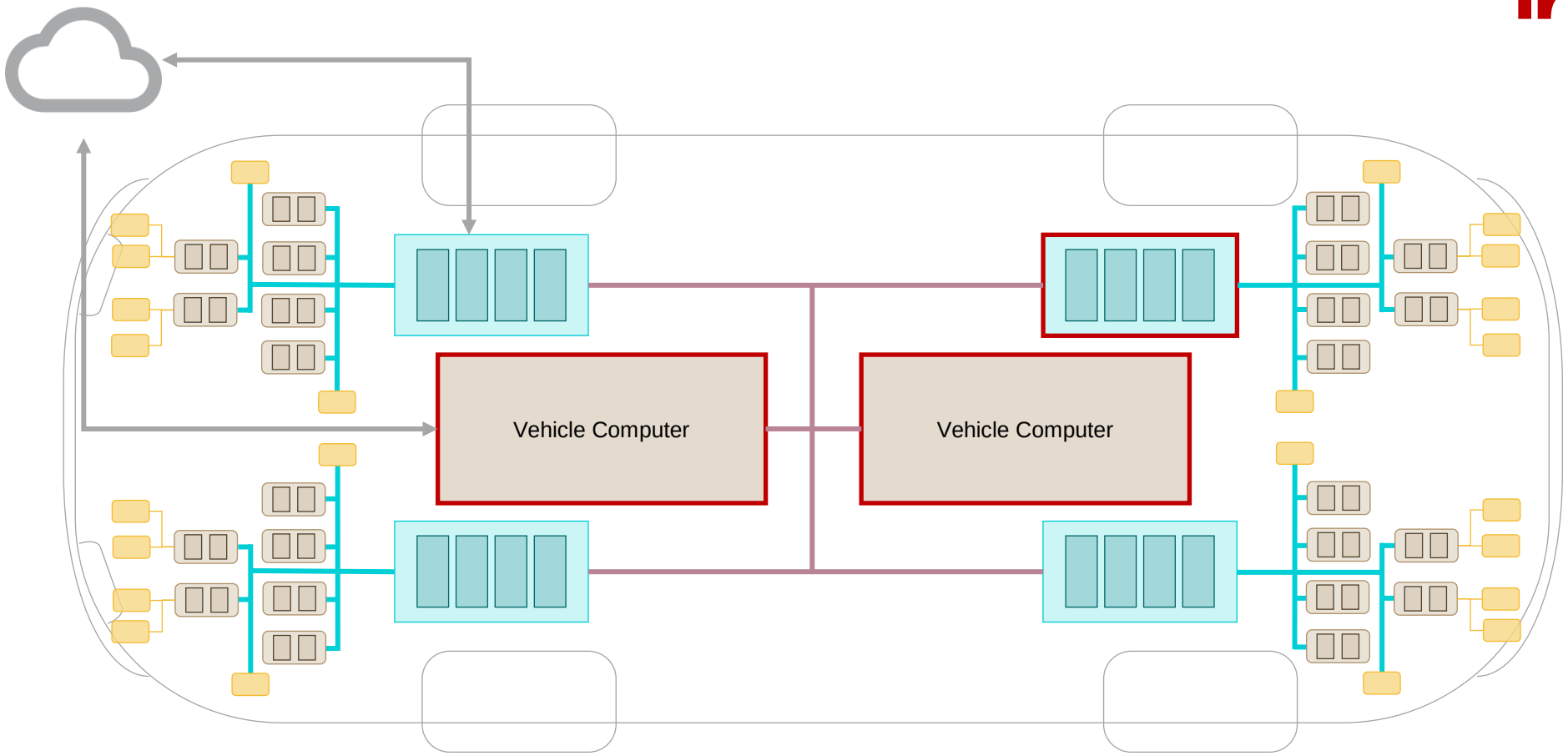


The eyes, ears, nose, tongue and skin are the sensors in the vehicle e.g. :

- Camera
- Lidar
- Radar
- Ultrasonic sensor
- Tire pressure sensor
- Pedals
- Buttons
- HMI
- Tankflap
- …

⇒ Input to the system „car“ analog to the “human“ senses

Analogy Human - Zone Architecture

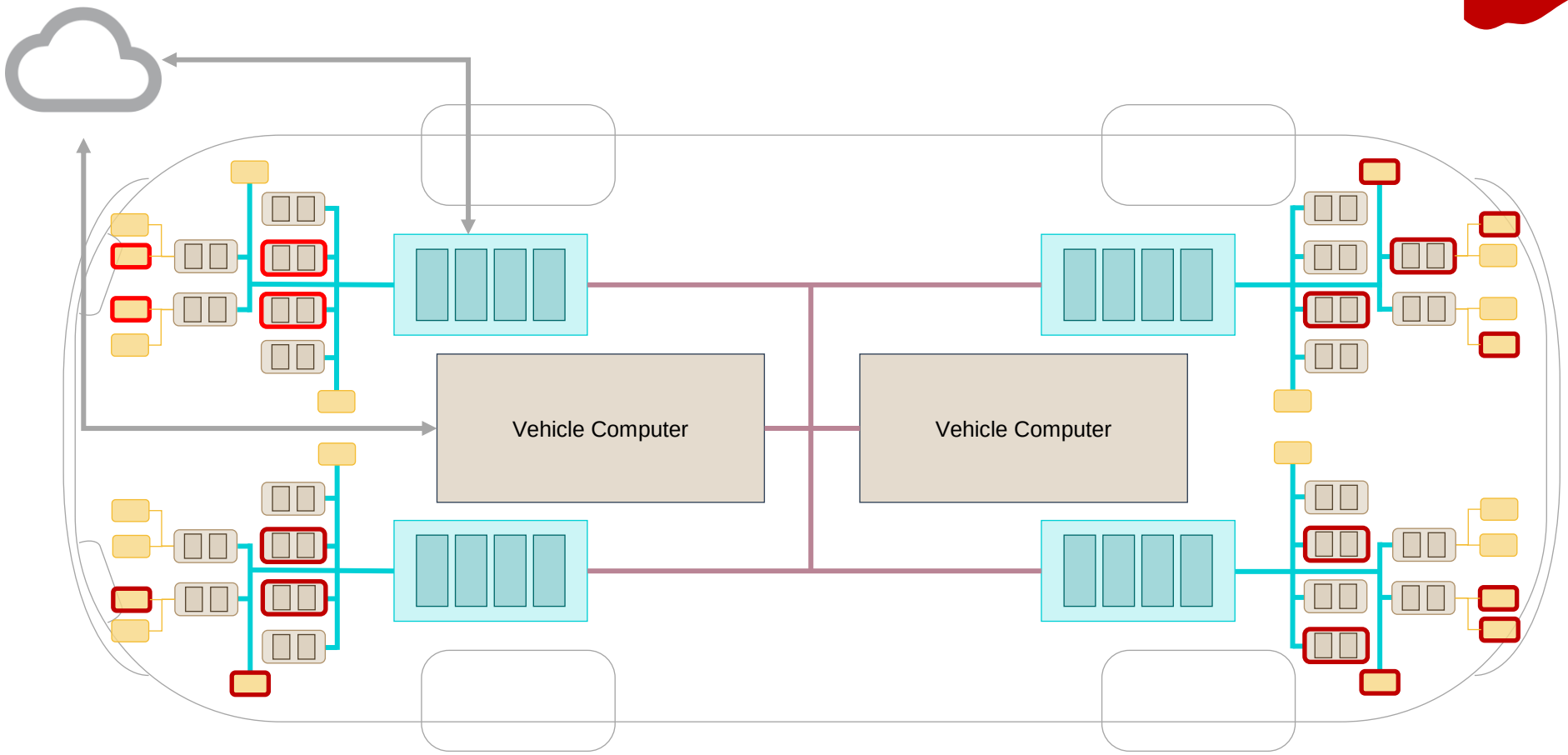


The brain in the vehicle:

- Vehicle Computers
- Partially Zone ECUs

⇒ Cognitive level of the system „car“ analog to the “human“ brain

Analogy Human - Zone Architecture

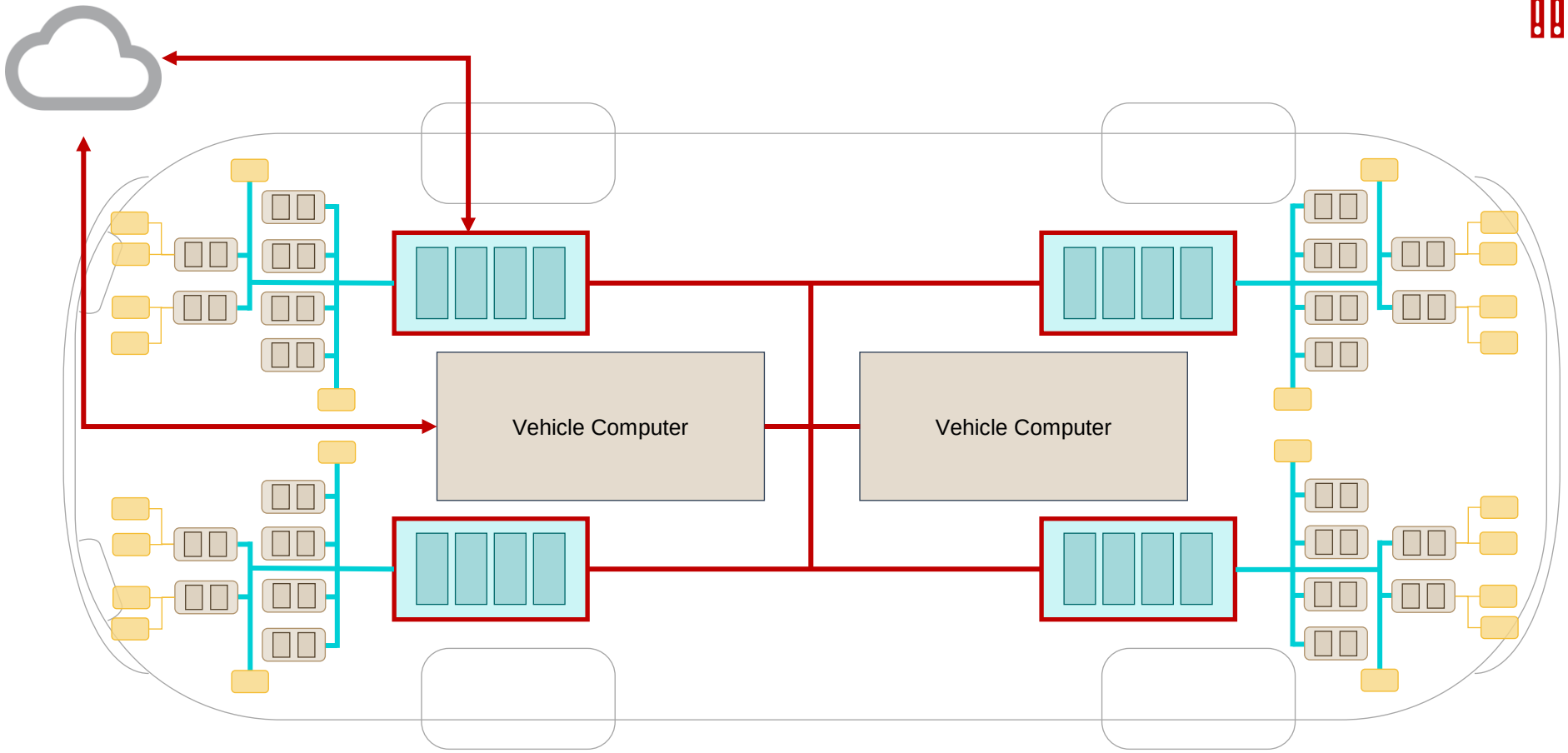


The actuators in the vehicle:

- Steering Angle
- Deceleration (Brake)
- Acceleration (Engine)
- Airbag
- Lamps/Sounds
- Light

⇒ Execution level of the system „car“ analog to the “human“ muscles (including reflexed)

Analogy Human - Zone Architecture

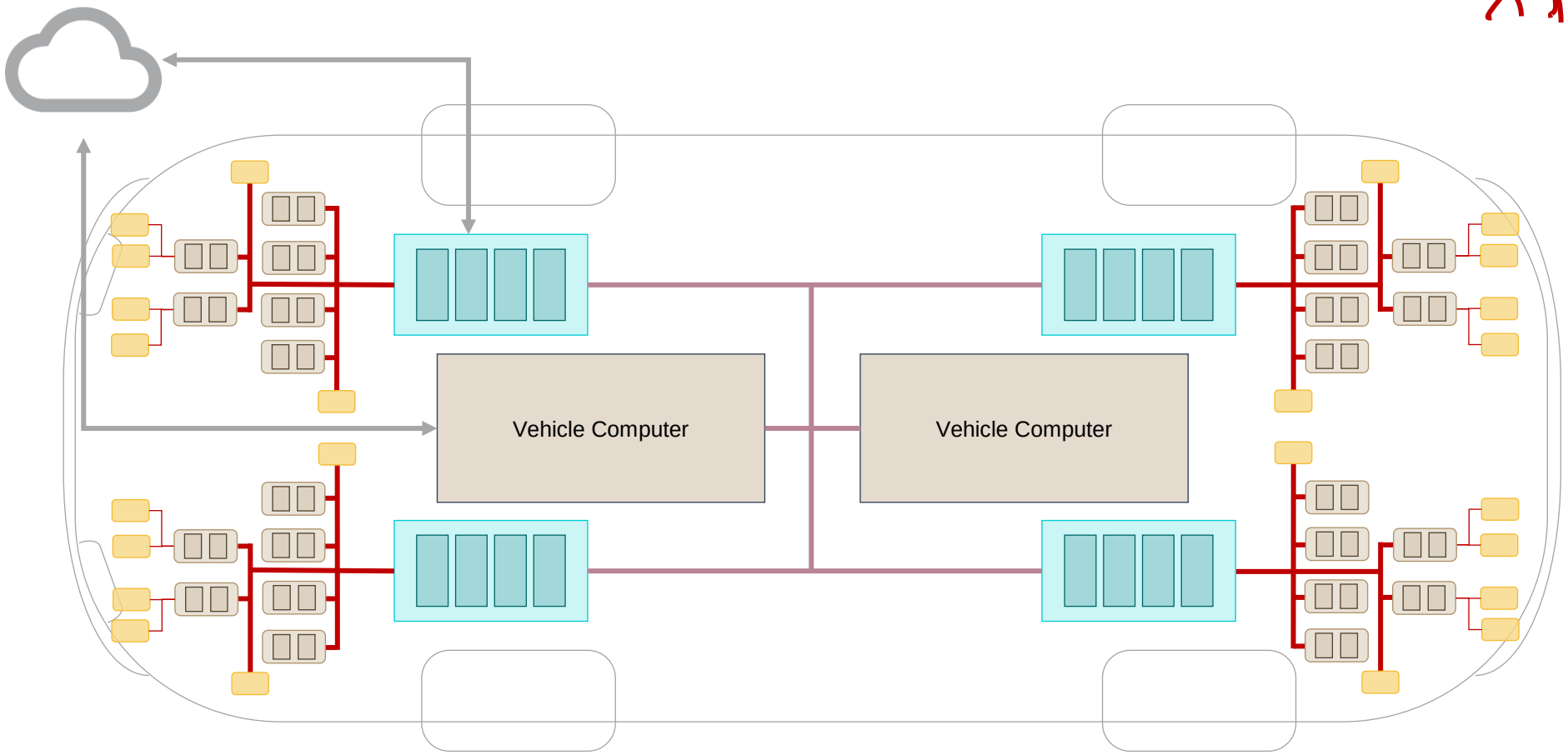


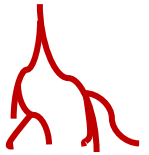
The service Oriented communication:

- Abstraction of all Sensors and Actuators in a service domain
- Translation of the Service to Signal Domain

⇒ Service Oriented Communication in the „car“ analog to the “human“ spine

Analogy Human - Zone Architecture





The signal/pdu based communication:

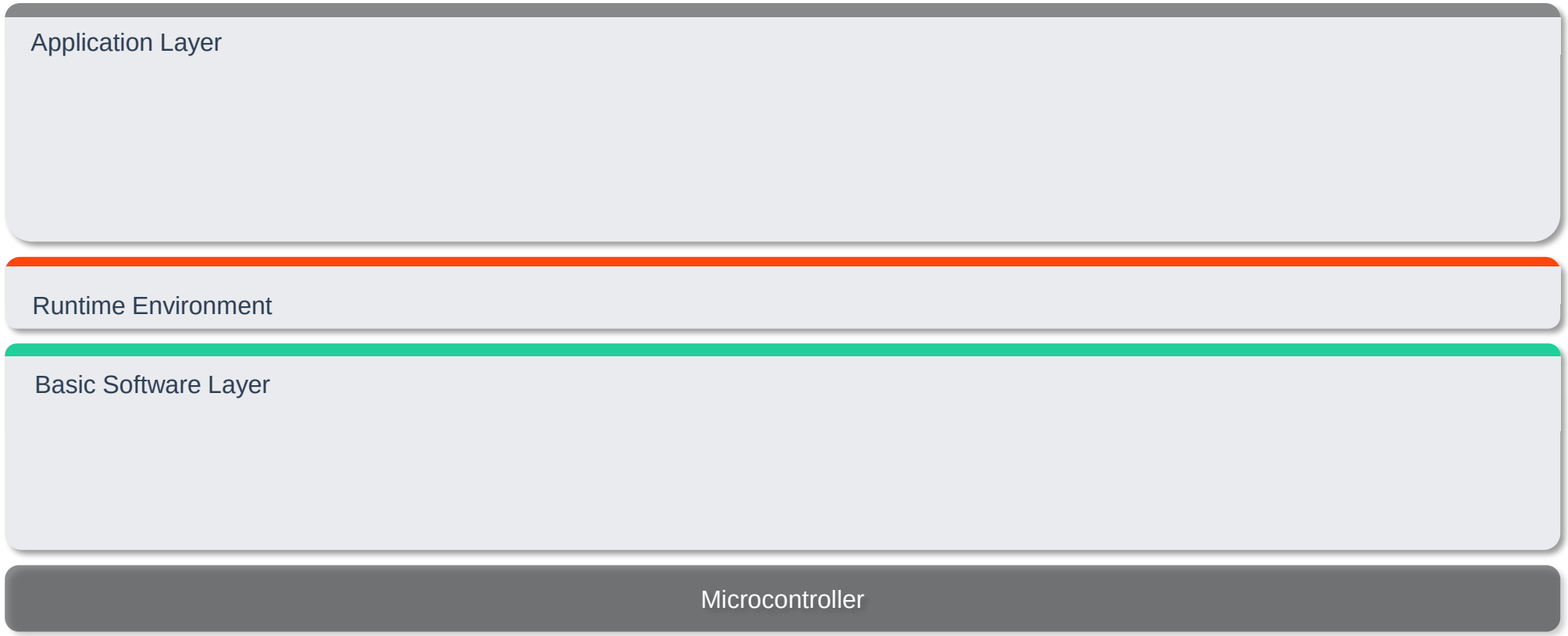
- Details on sensors and actuators

⇒ Signal/PDU based communication in the „car“ analog to the “human“ nerves

Overview Analogy Human – Zone Architecure

 Senses	 Brain	 Muscles and reflexes	 Spine	 Nerves
Sensor ECUs Non-Intelligent Sensors	Vehicle Computer Partially Zone ECUs	Actuator ECUs Non-Intelligent Actuators	Service Oriented Communication via highspeed Backbone Zone ECUs	Signal/PDU based communication via medium/low speed bus systems

Example SW Architecture - Brake



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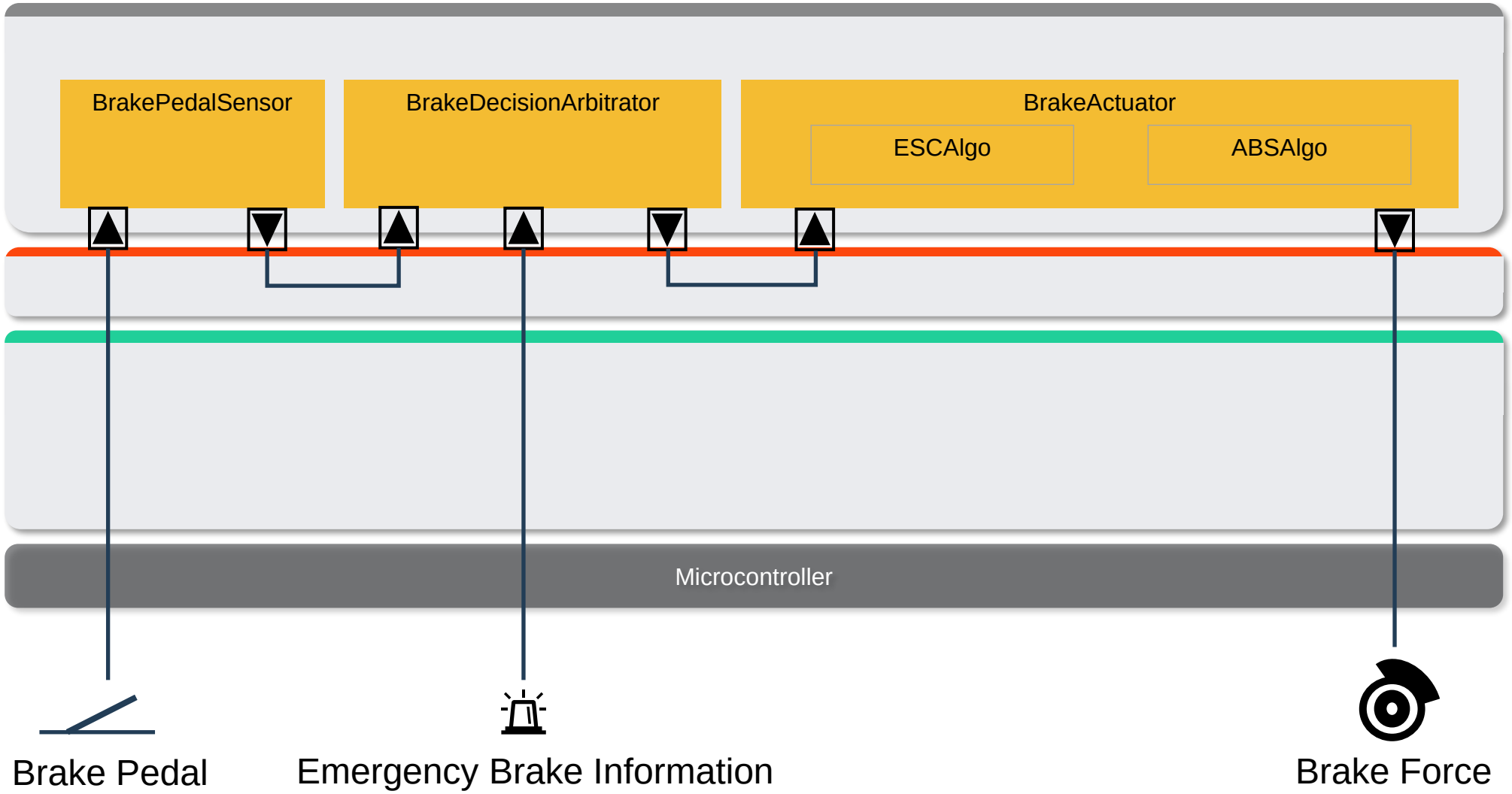

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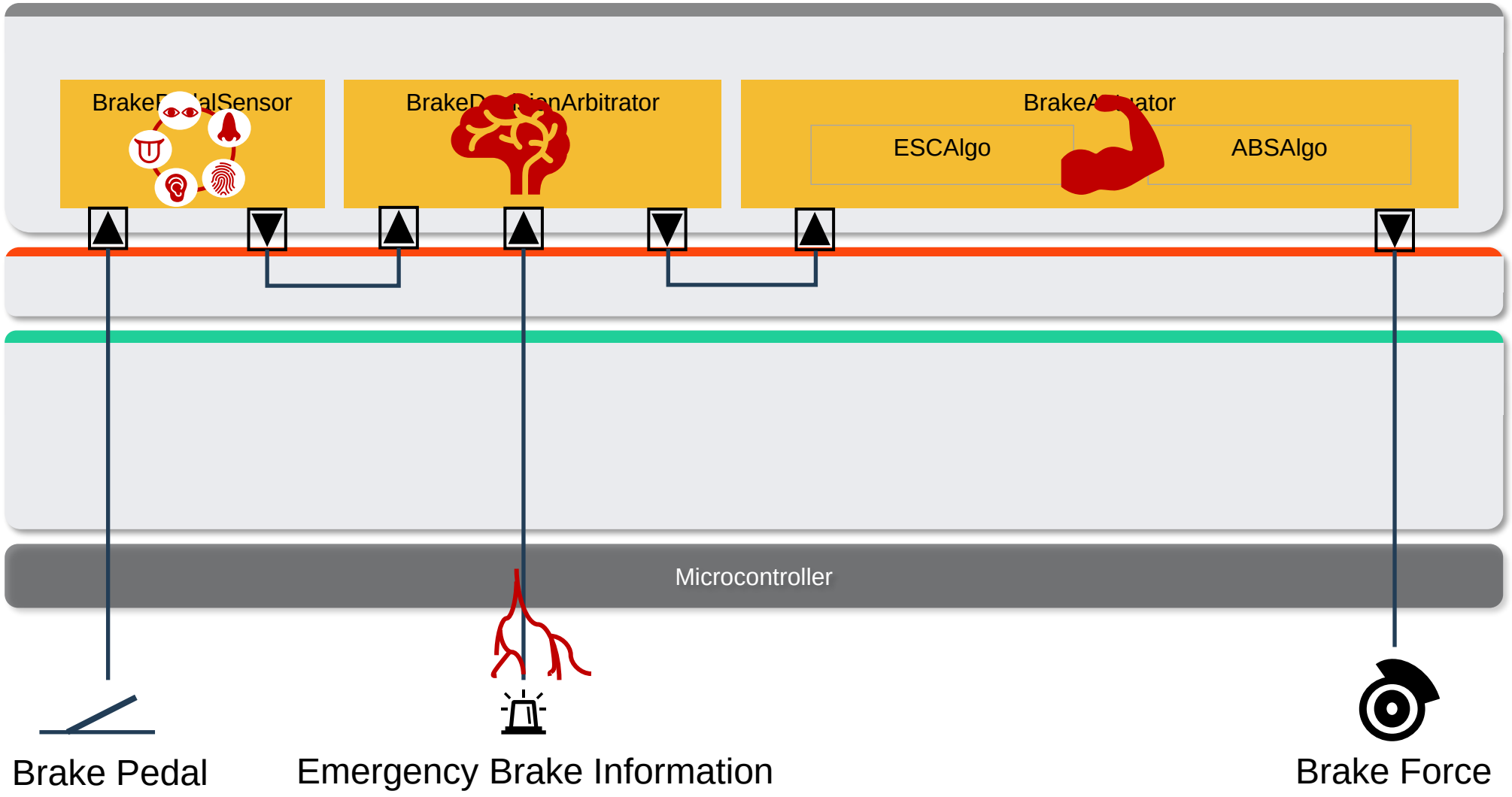
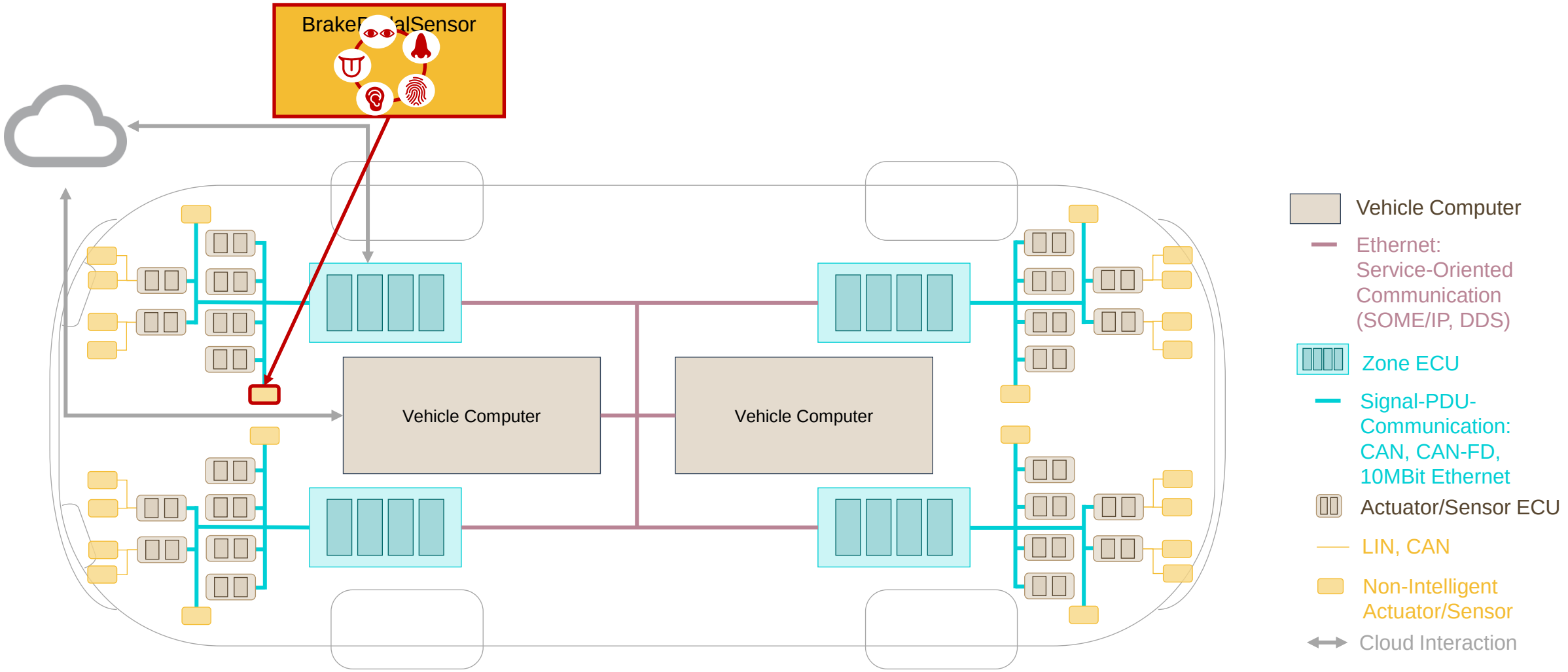


Zone Architecture View - New Brake Function



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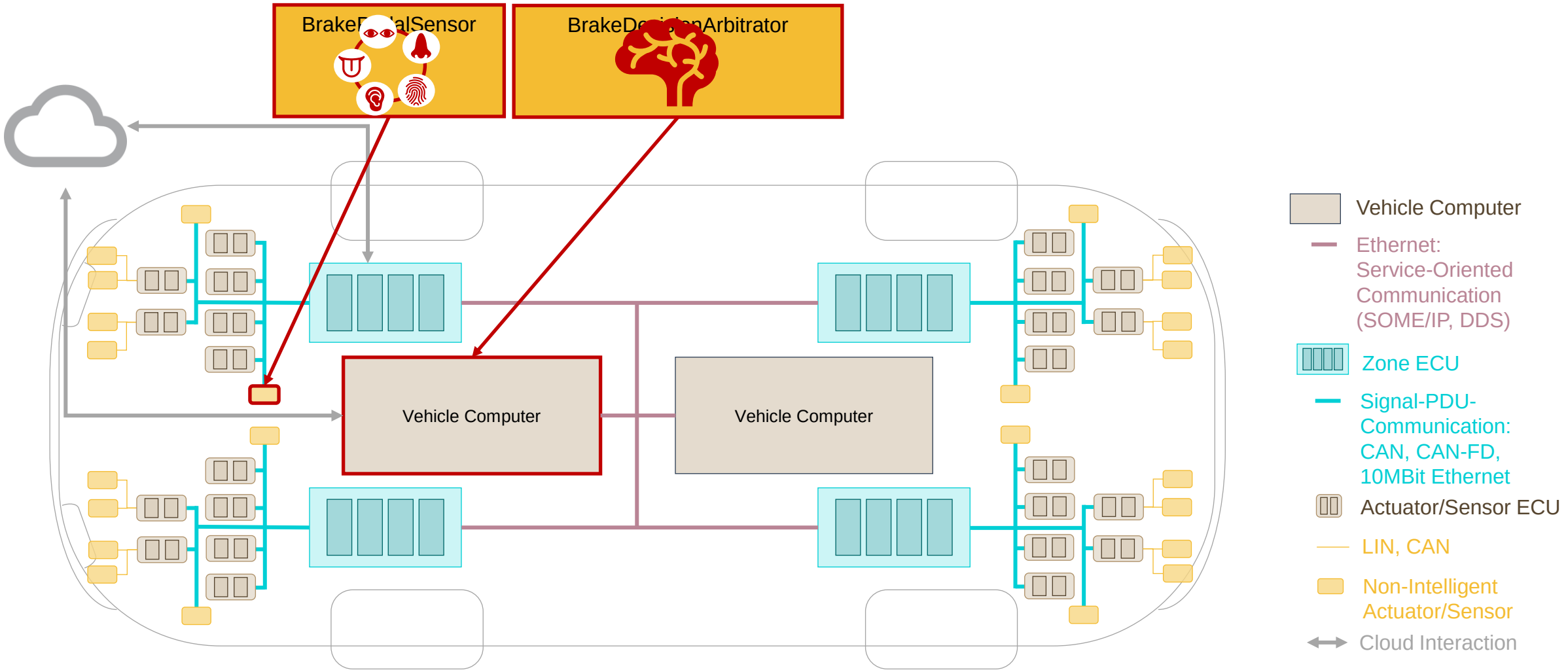

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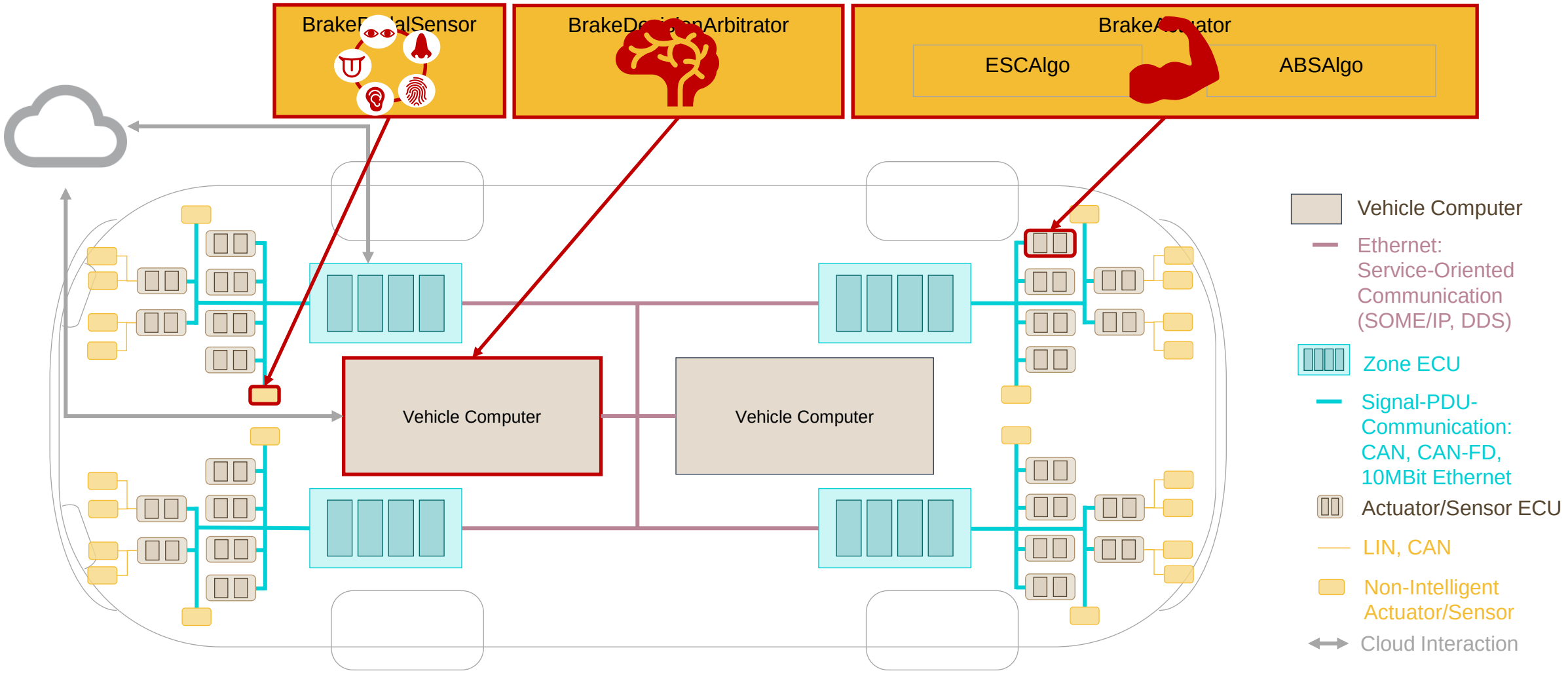

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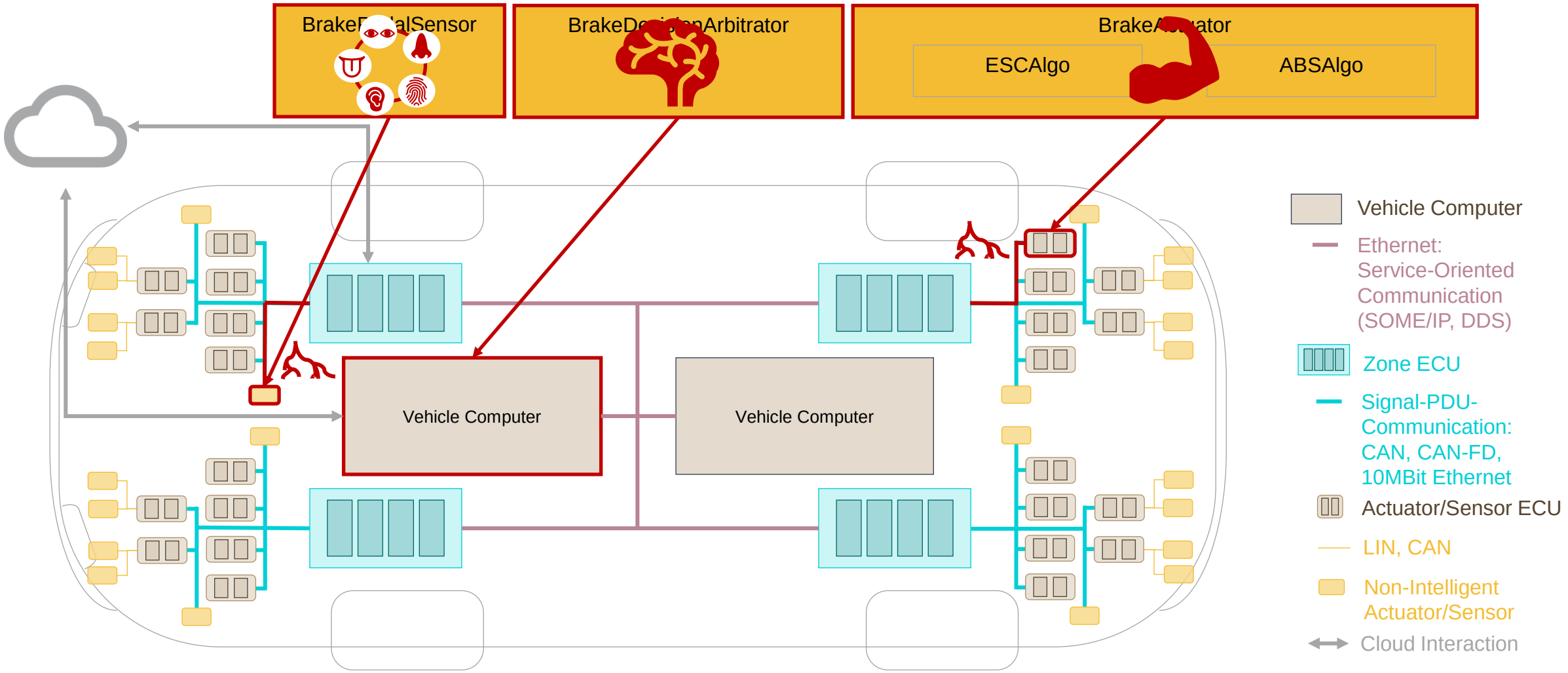

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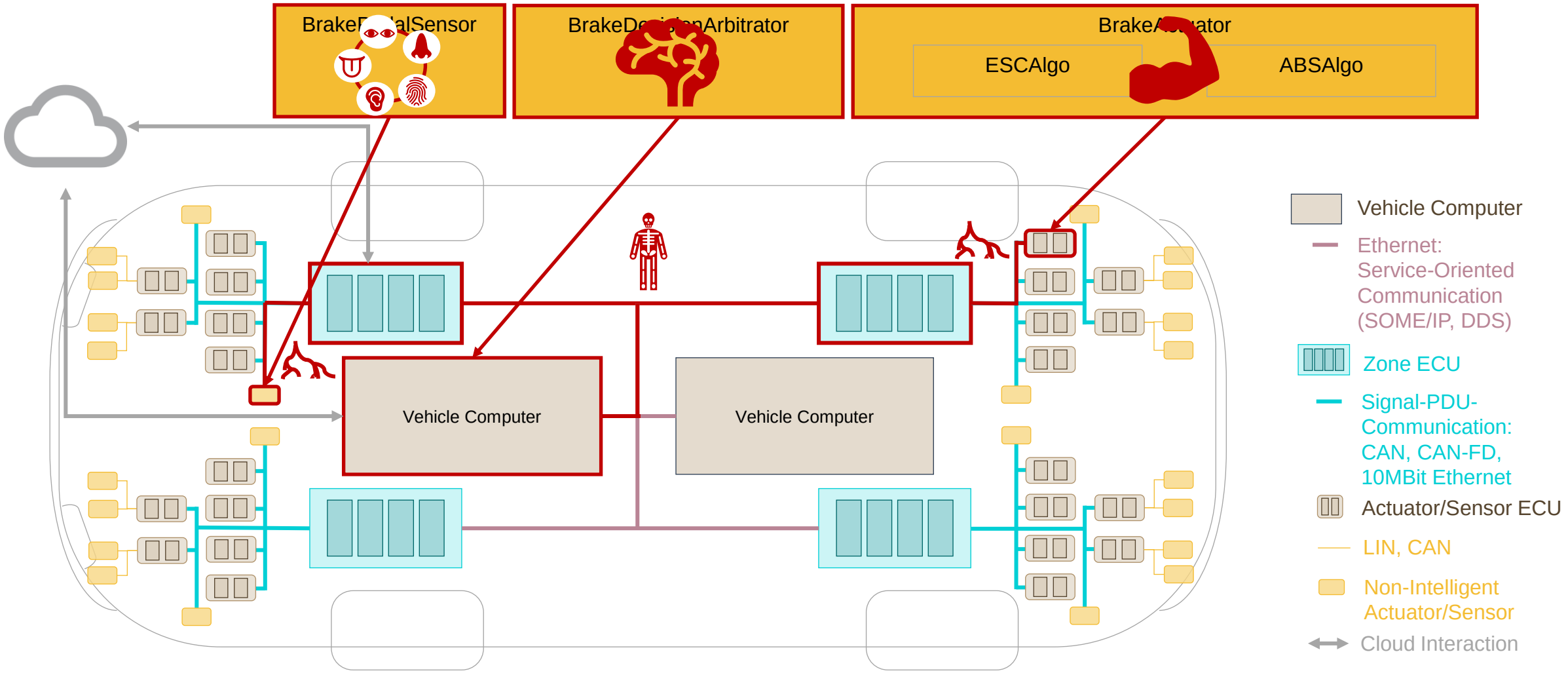
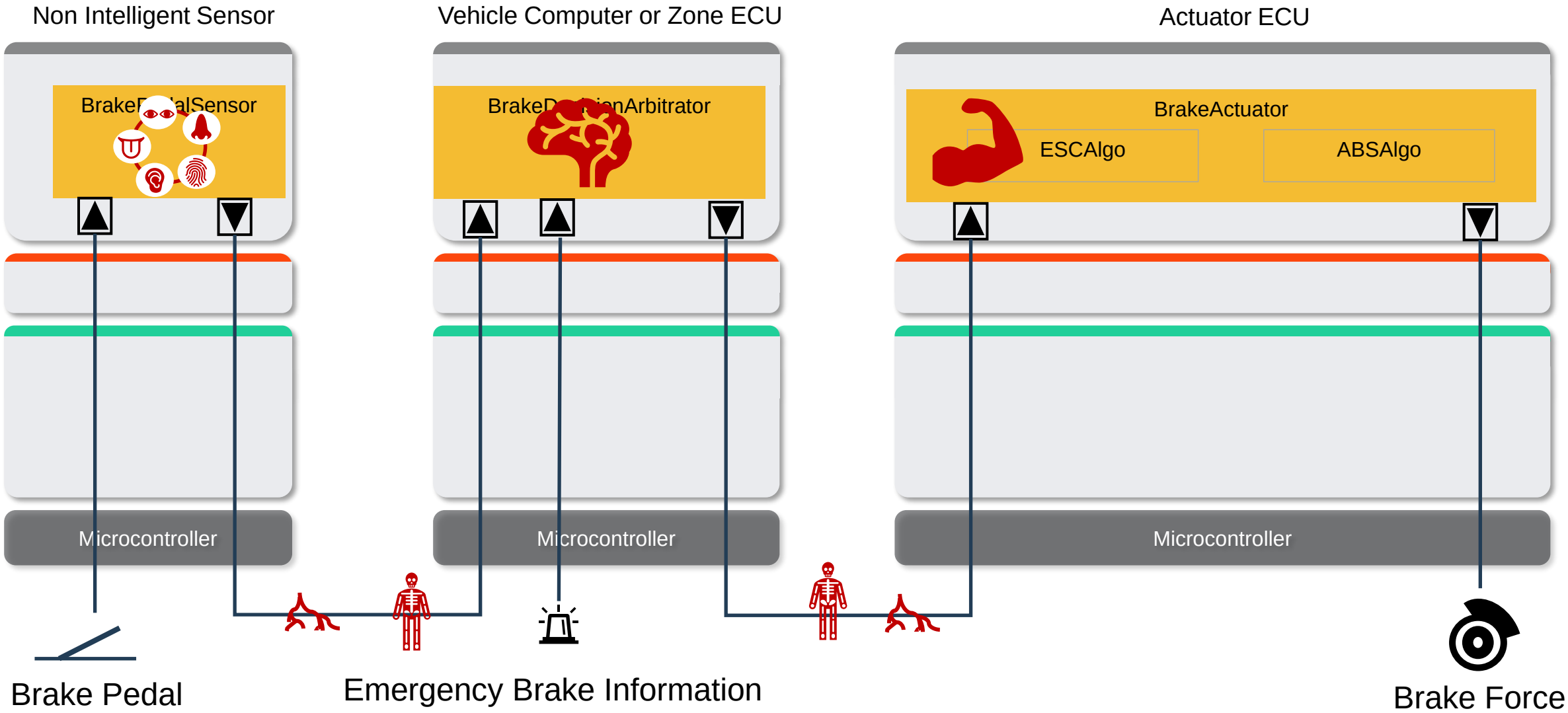
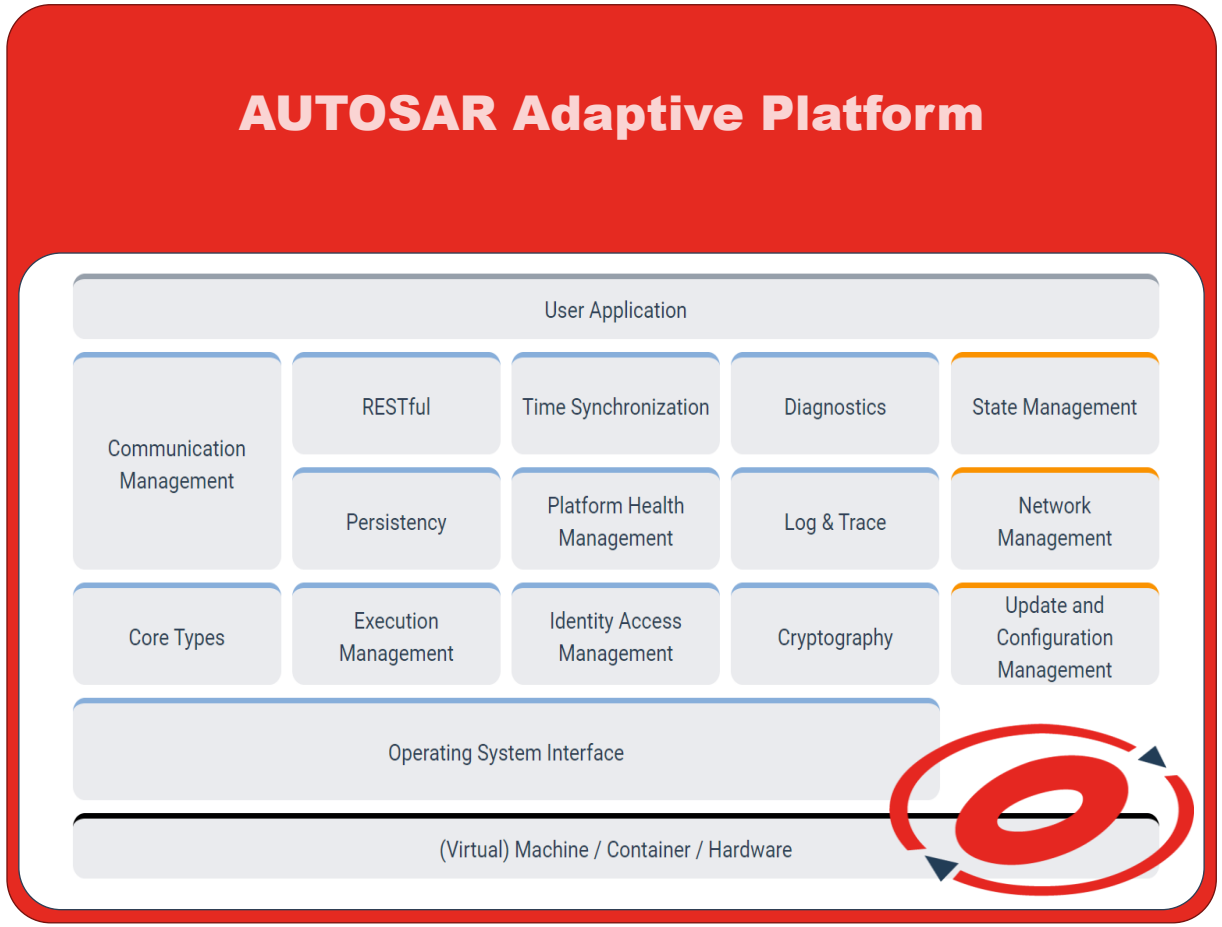
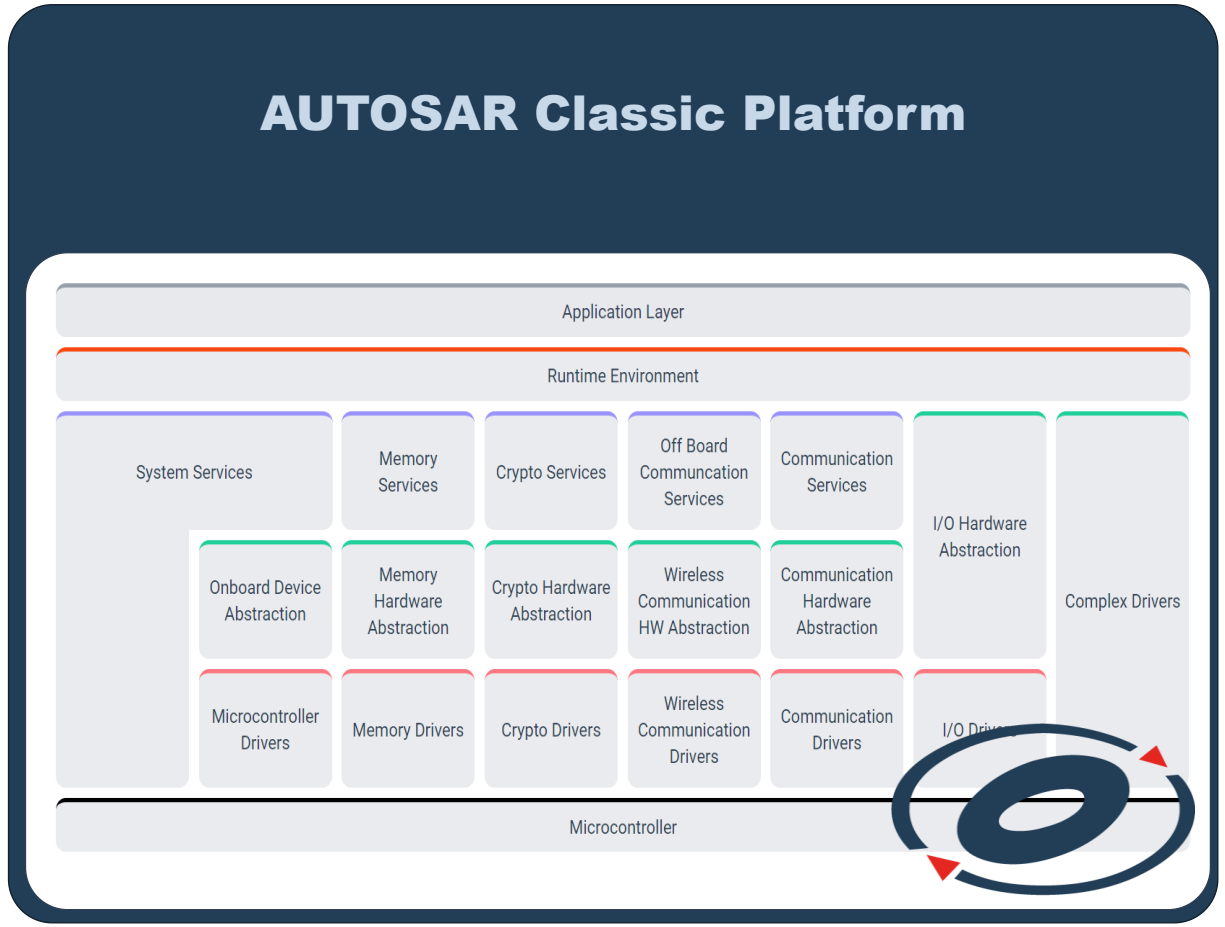


SW View - New Brake Function



AUTOSAR Platforms



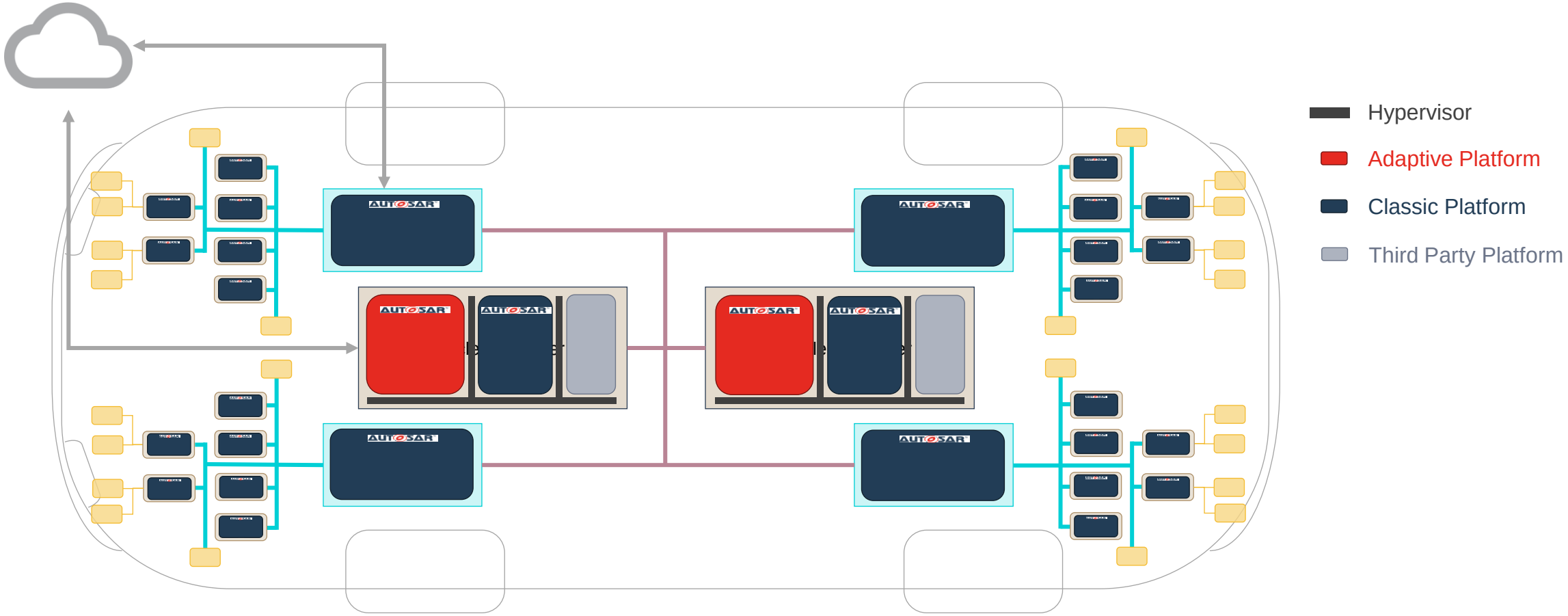


AUTOSAR Adaptive and Classic Platform

What Are the Differences?

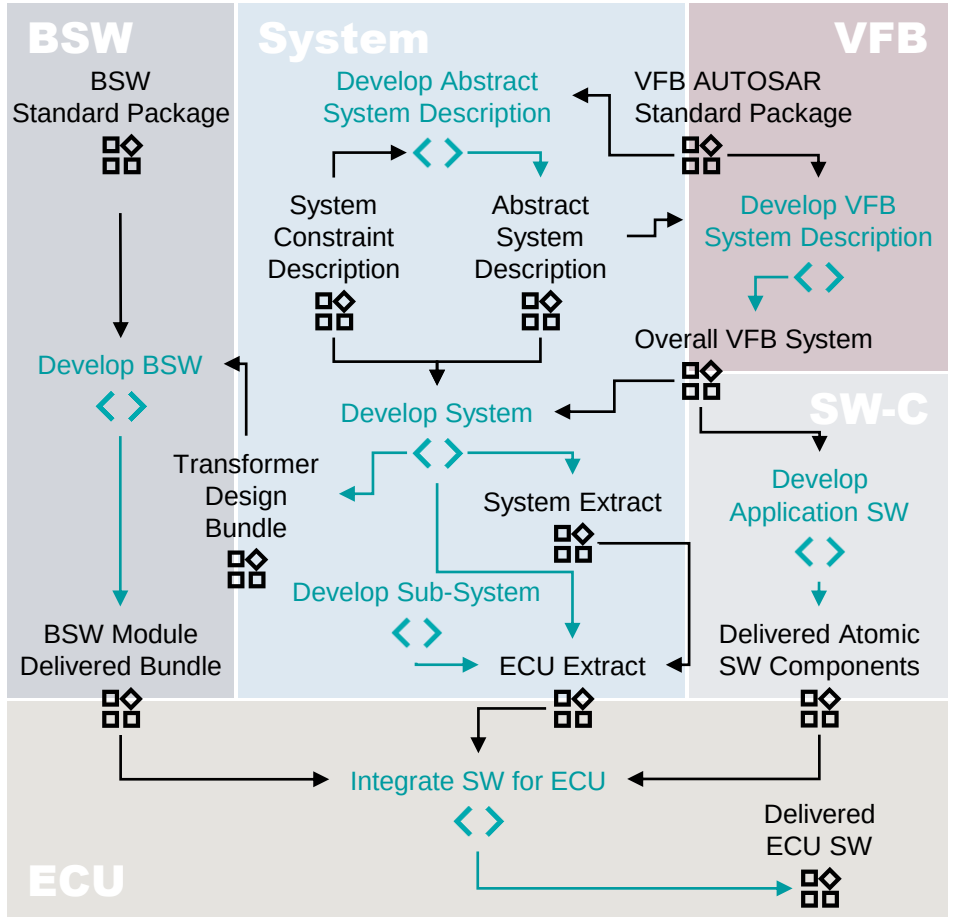
	Adaptive	Classic
Real Time Requirements	**Mid**, in the range of milli-seconds	**High**, in the range of micro-seconds
Safety Criticality	**High**, at least ASIL-B	**High**, up to ASIL-D
Computing Power	**High**, > 20.000 DMIPs	**Low**, ~ 1000 DMIPs

Zone Architecture Supported by AUTOSAR



AUTOSAR Methodology

Main Overview



- Develop the system description acording to the E/E architecture concept
- Develop the Virtual Function Bus to describe the abstract functionality
- Develop or buy COTS AUTOSAR Basic Software
- Develop application HW independent
- Integrate the different Workproducts to ECU

Conclusion

- AUTOSAR can support the Software transition necessary for harvesting the full power of a zone architecture
- A good (AUTOSAR) structured and modeled application is key to a smooth transition to zone architecture
- AUTOSAR will be extended in the future to:
  - further enhance interoperability with offboard systems
  - provide a more abstract Virtual Function Bus (VFB++)
  - Implement any E/E architecture related innovations to cover the market need
- Want to exploit AUTOSAR or contribute to its further development? Join as a partner via admin@autosar.org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