

Apollo Enterprise

Valet Parking with RTI DDS

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Baidu Intelligent Vehicle Business Unit

apollo

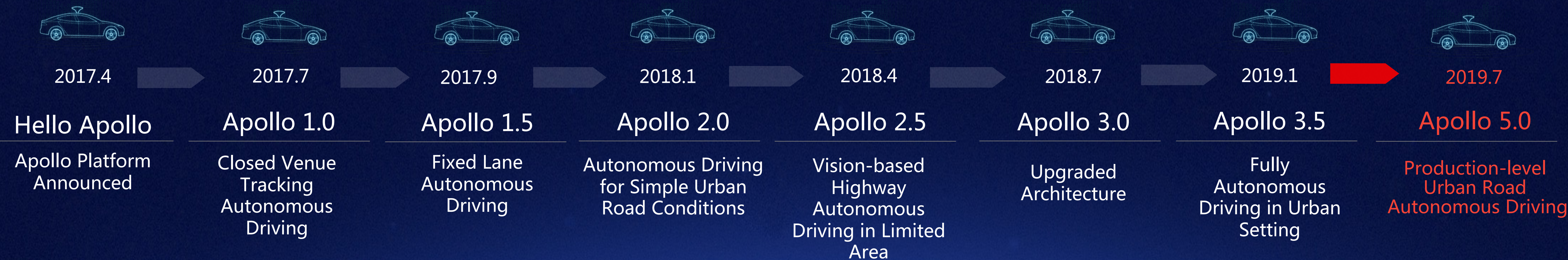
**Open
Capability**

**Shared
Resources**

**Accelerated
Innovation**

**Sustained
Mutual Benefit**

Apollo is Accelerating Innovation for Autonomous Driving



15,000 +
Developers

150+
Partners

390,000 +
Lines of code

Apollo Robotaxi × 一汽红旗 FAW

Apollo Robotaxi in Changsha City

Passenger Control in the Seat



45 Robotaxi with License



Nearby Detection



Real time Detection & Display



Starting with Clearance



Cross Road Strategy



With Apollo the Possibilities are Limitless

“The only thing that limits Apollo is a developer’s creativity”



Last mile
delivery:
Neolix



Last mile
delivery:
HNA
Technology



Passenger
Vehicle:
Hyundai



Public
Transit:
King Long



Farming
Automation:
Thor Tech



Port
Logistics:
Main Line
Technology



Cleaning
Automation:
COWA
Technology

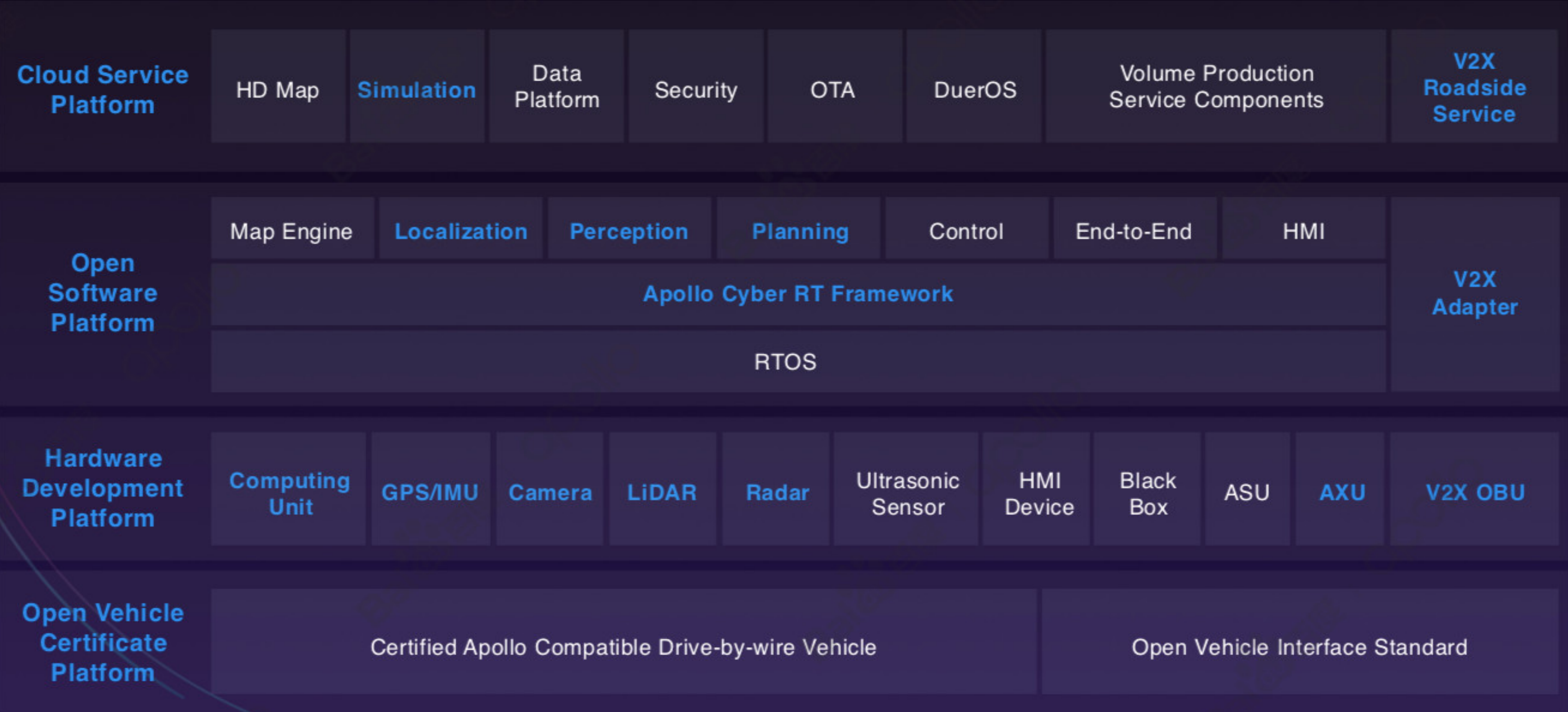


Well-being
Initiative:
Golden
Ridge

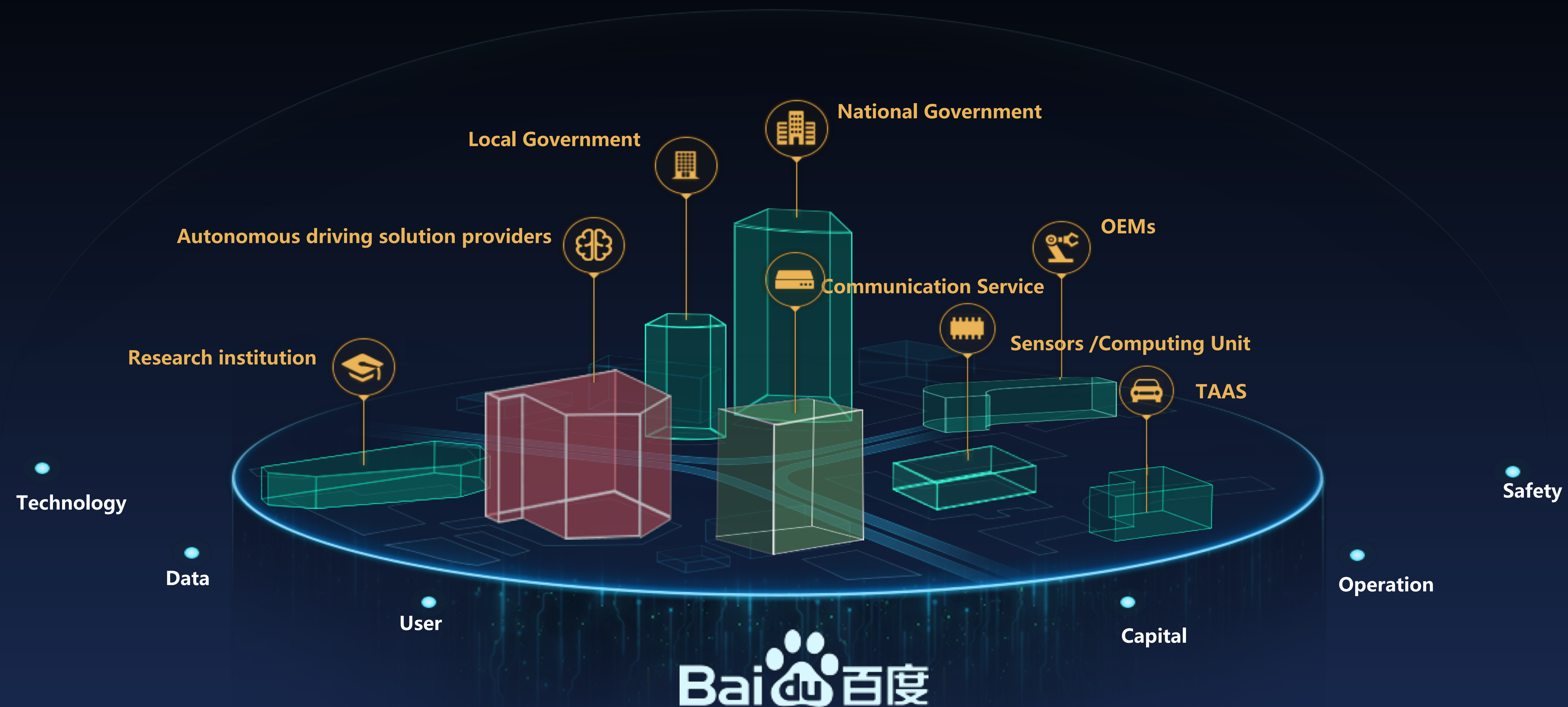


Intercity
Logistics:
CiDi

Apollo 5.0 Architecture




Apollo Closely Cooperates with the Government , OEM , TAAS etc. to Build the New Ecology of Intelligent Driving and Transportation



Apollo Enterprise

Provides OEMs, Tiers and Taas* with
mass-produced, customized and safe solutions
of autonomous driving and internet of vehicles
to accelerate the autonomous, connected and shared trends.



Apollo Enterprise



Apollo Enterprise DuerOS for Apollo

面向量产的完整人工智能车联网系统解决方案：包含小度车载AI能力

Apollo Enterprise Highway Autonomous Driving

Apollo Enterprise Autonomous Valet Parking

Apollo Enterprise Autonomous Driving Minibus

最适应中国国情的安全、经济、舒适的量产自动驾驶解决方案



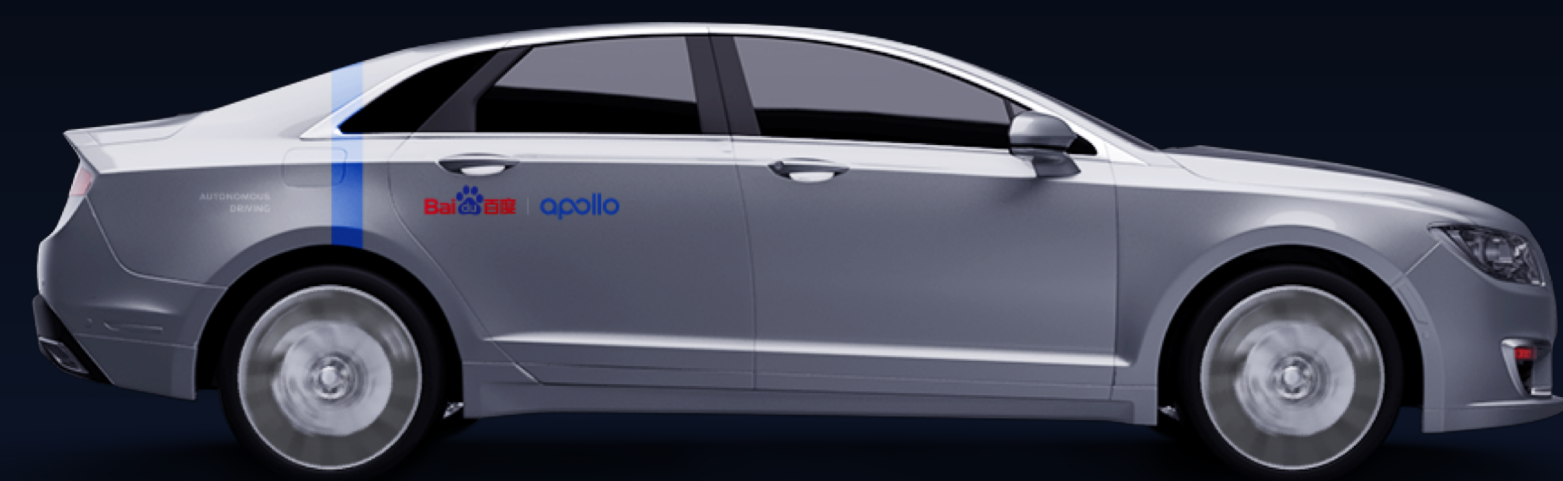
Apollo Enterprise Intelligent Map

基于多源数据生态、动态更新的高精数据服务：包含车机地图，ADAS地图和高精地图



合作伙伴 Partners





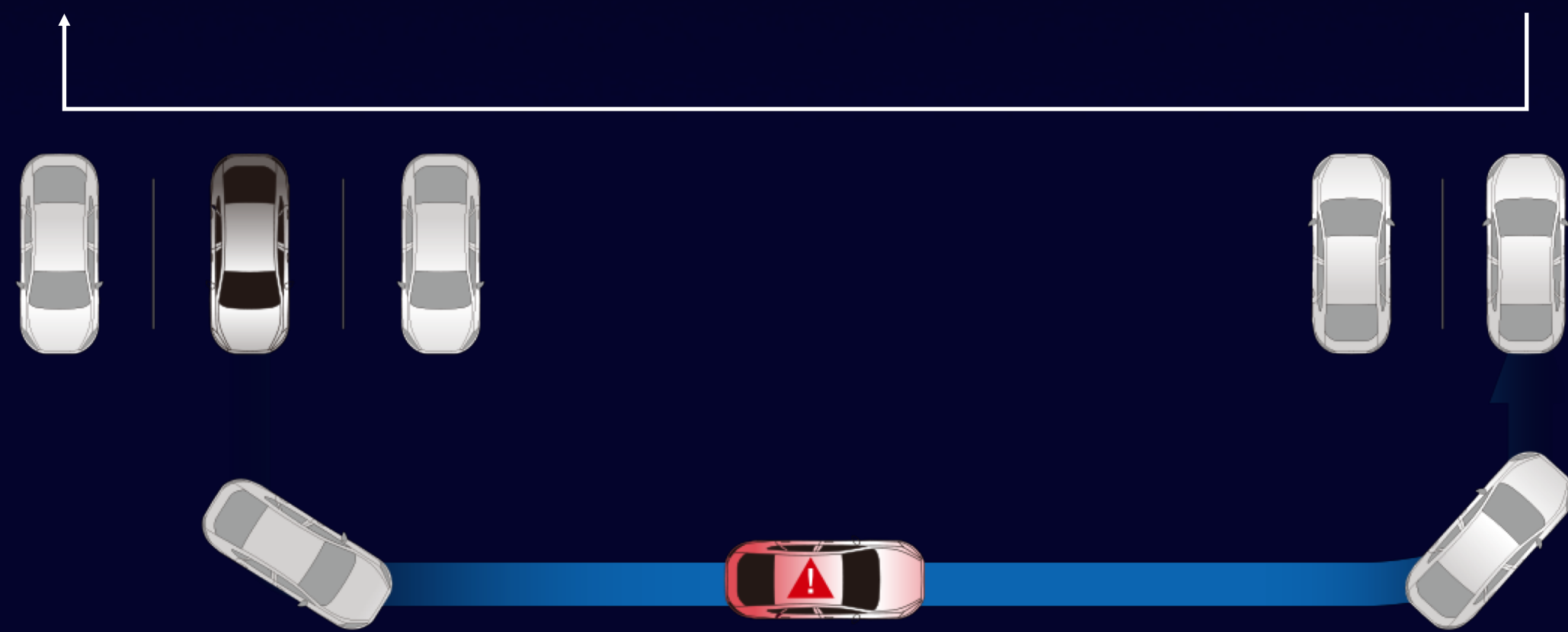
Apollo Autonomous Valet Parking

Complete the last mile driving

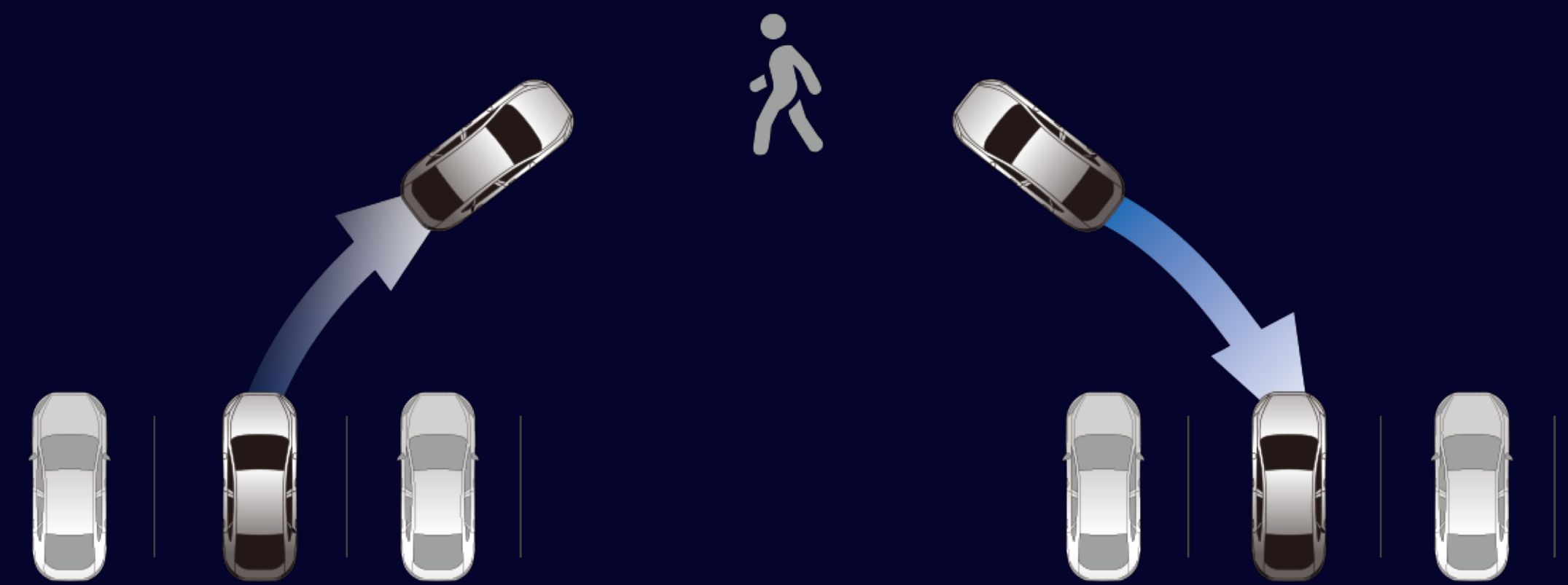
Apollo Enterprise for Autonomous Valet Parking

Fleet Management: Dispatch / Auto-Charging

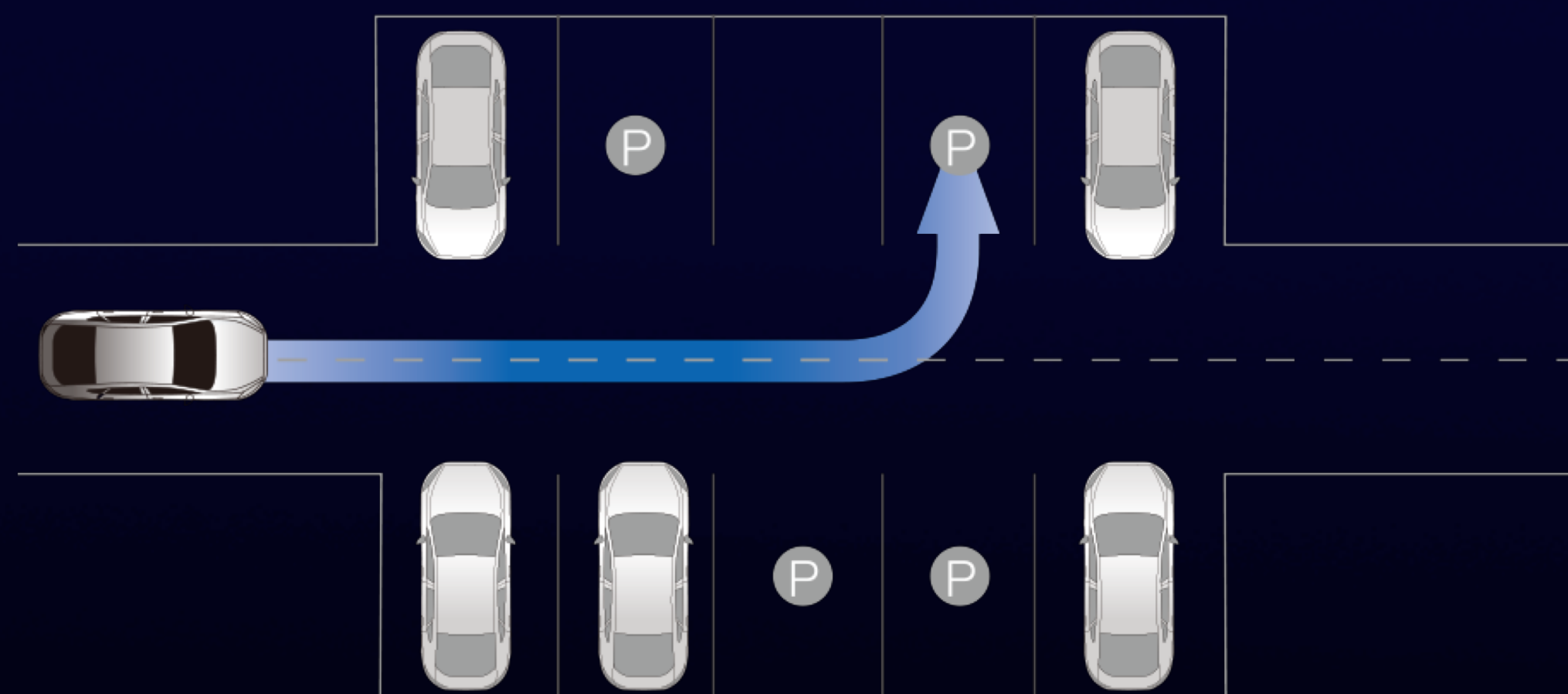
Parking Spot A ← Dispatch → Parking Spot B



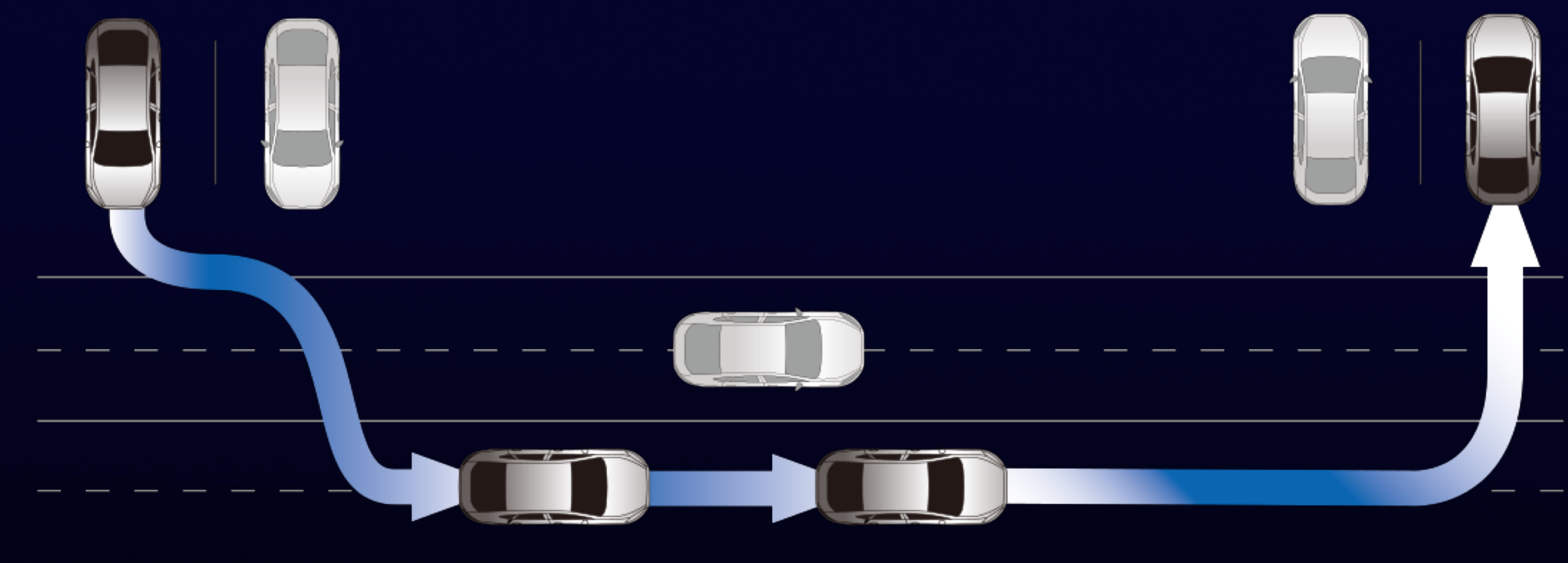
Auto Summon / Return



Autonomous Valet Parking



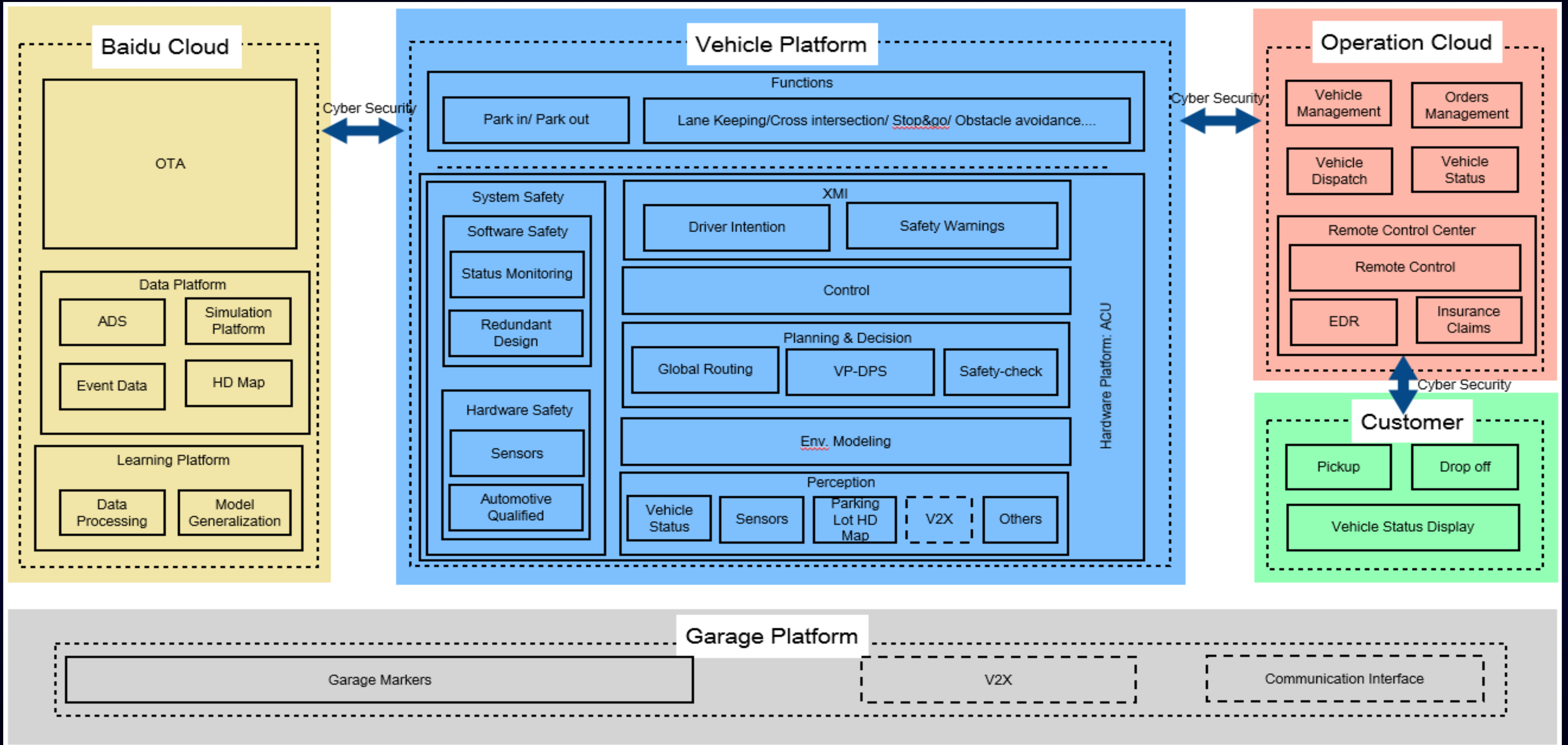
Low-Speed L4



Autonomous Valet Parking



Autonomous Valet Parking Architecture

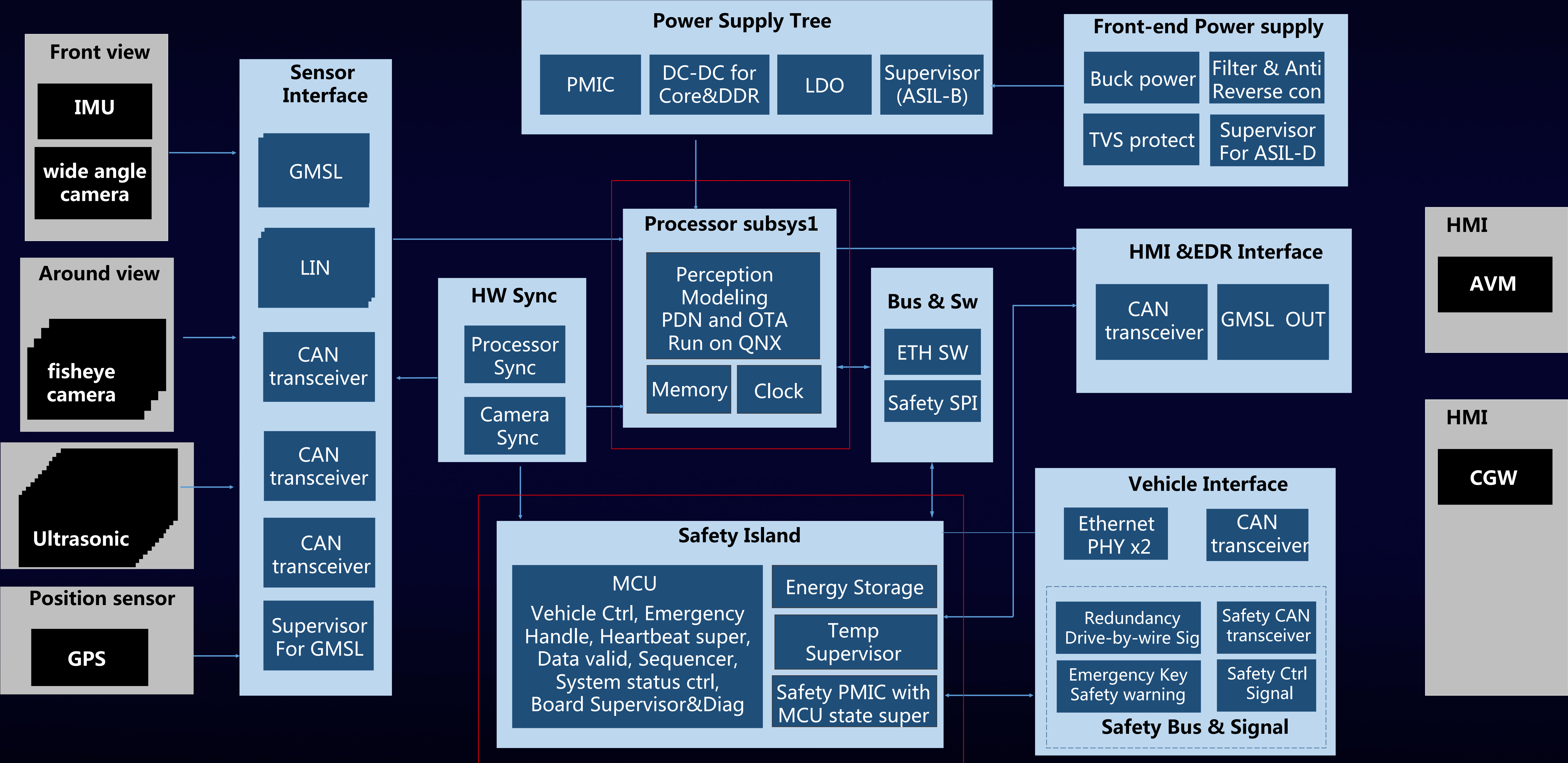


Valet Parking Domain Controller – Apollo Computing Unit

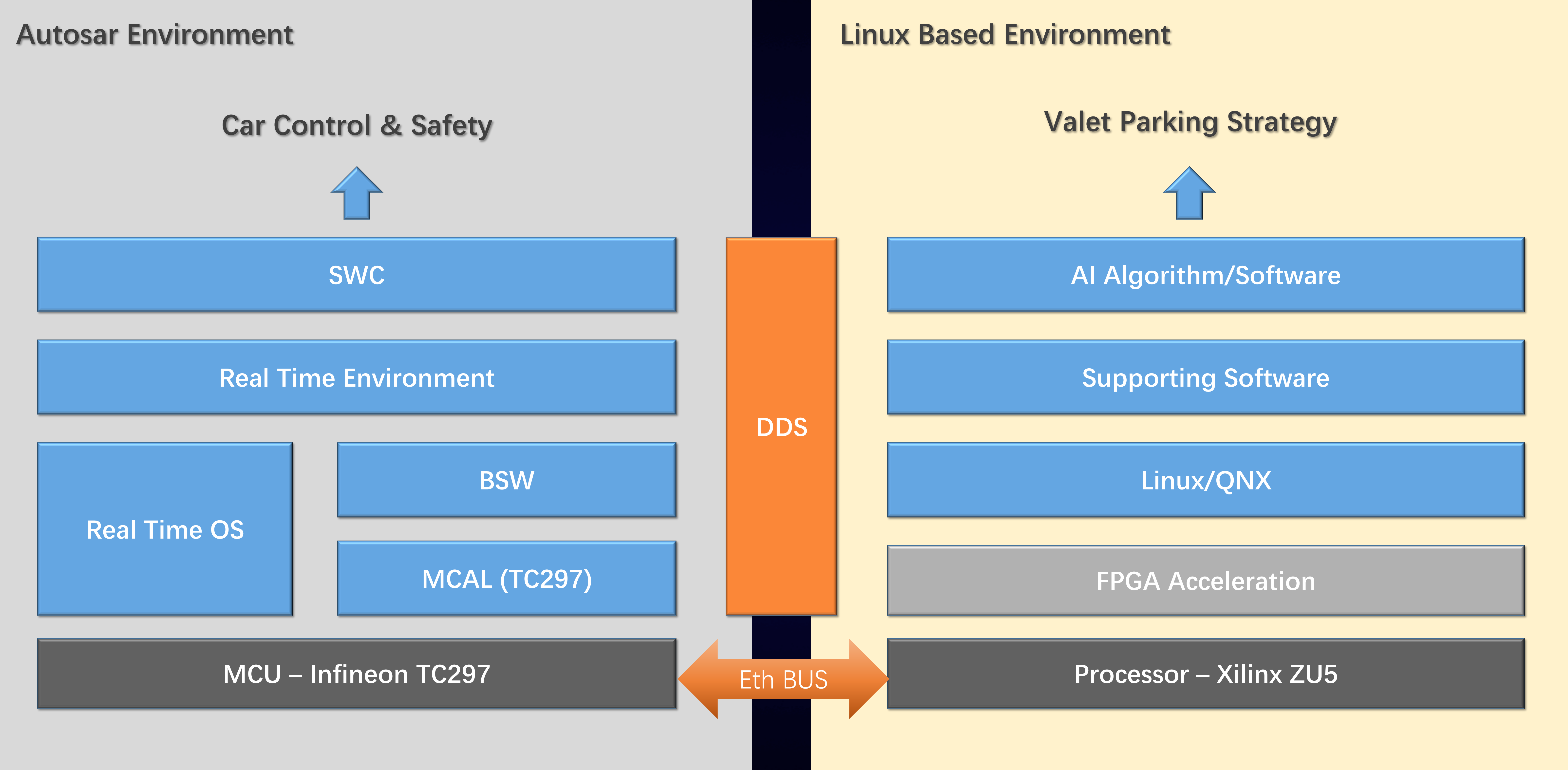
The first computing unit dedicated to Valet Parking (compatible APA or L2 ADAS)

- ✓ Designed with Xilinx ZU5 (FPGA) , AI capability reaches 1.5TOPS, safer, lower cost, lower power consumption
- ✓ Leverage and support Paddle framework (First opensource AI deep learning framework)
- ✓ Support 8 cameras, 6 mmWave radars, 16 ultrasonic radars, even Lidars
- ✓ Temperature between -40°C~85°C, leading other Autonomous driving solutions
- ✓ Meet ASIL-D functional safety , special hardware safety island design
- ✓ Based on IATF16949 design and flow requirement, 100% auto grade devices, pass comprehensive auto environment
- ✓ Integrated Autosar software, operating system(QNX) from top vendors
- ✓ Based on PPAP supply chain and production management

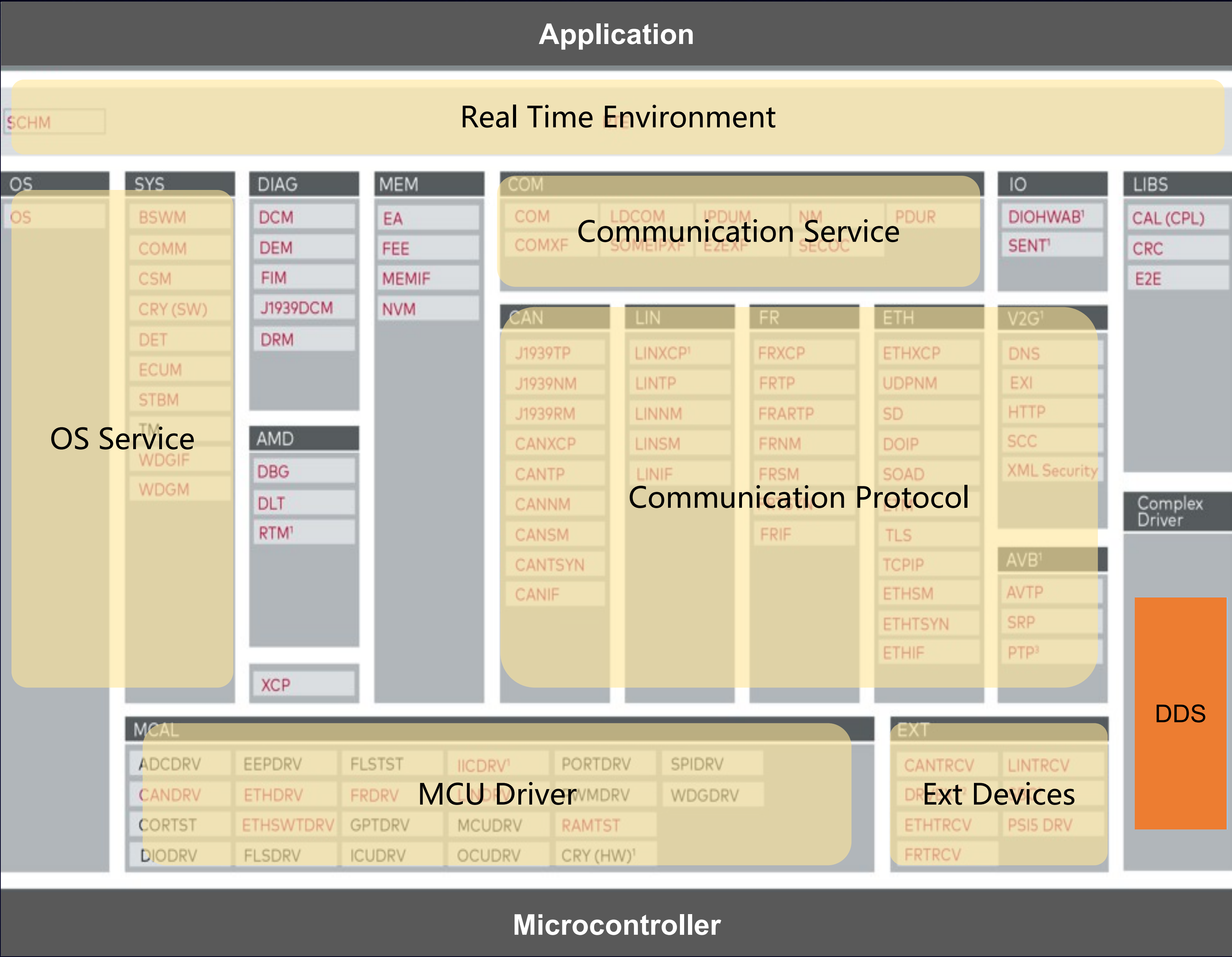
Block Diagram - Apollo Computing Unit



Basic Software Architecture - Apollo Computing Unit

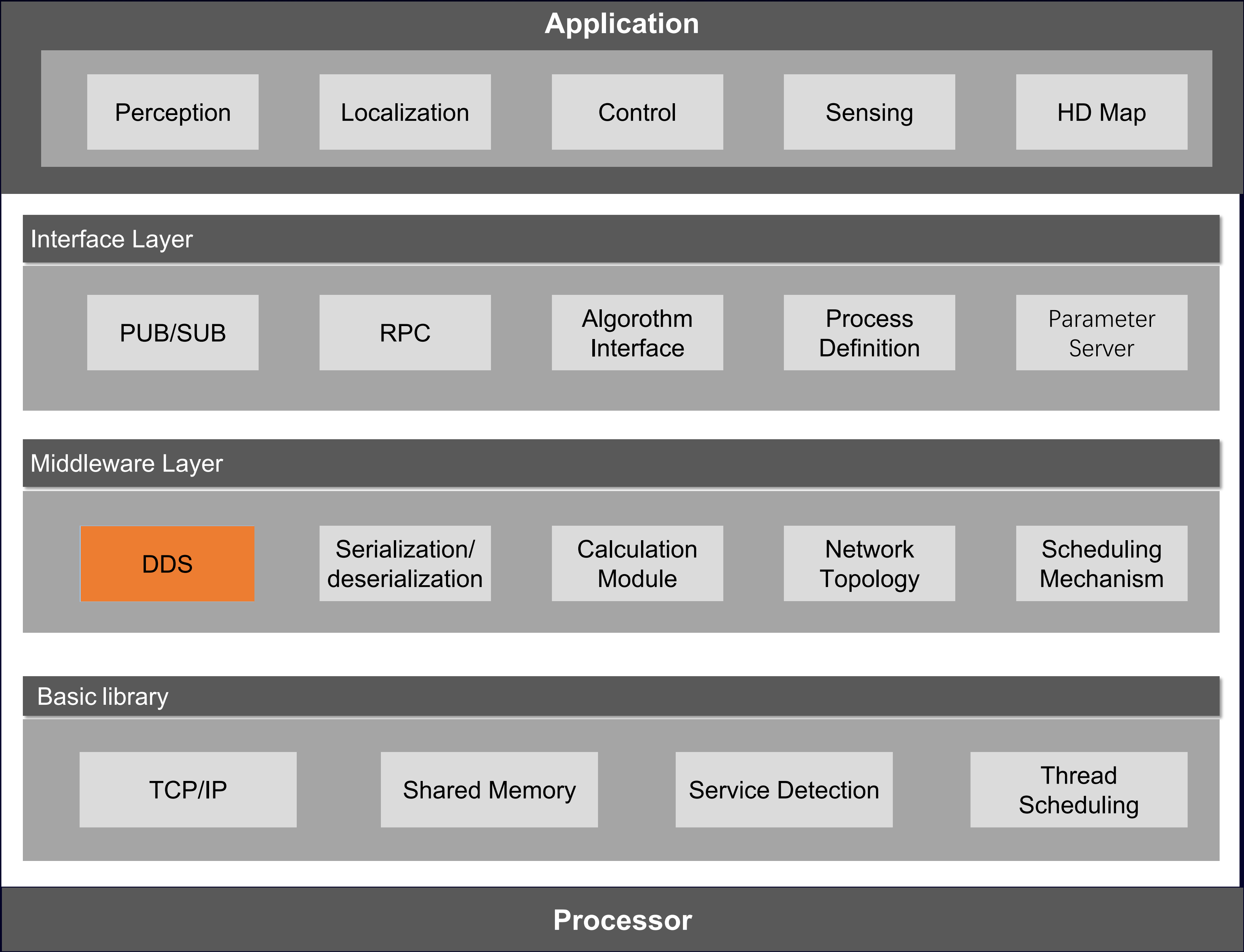


First Step of DDS in Apollo Computing Unit



MQTT Disadvantages:

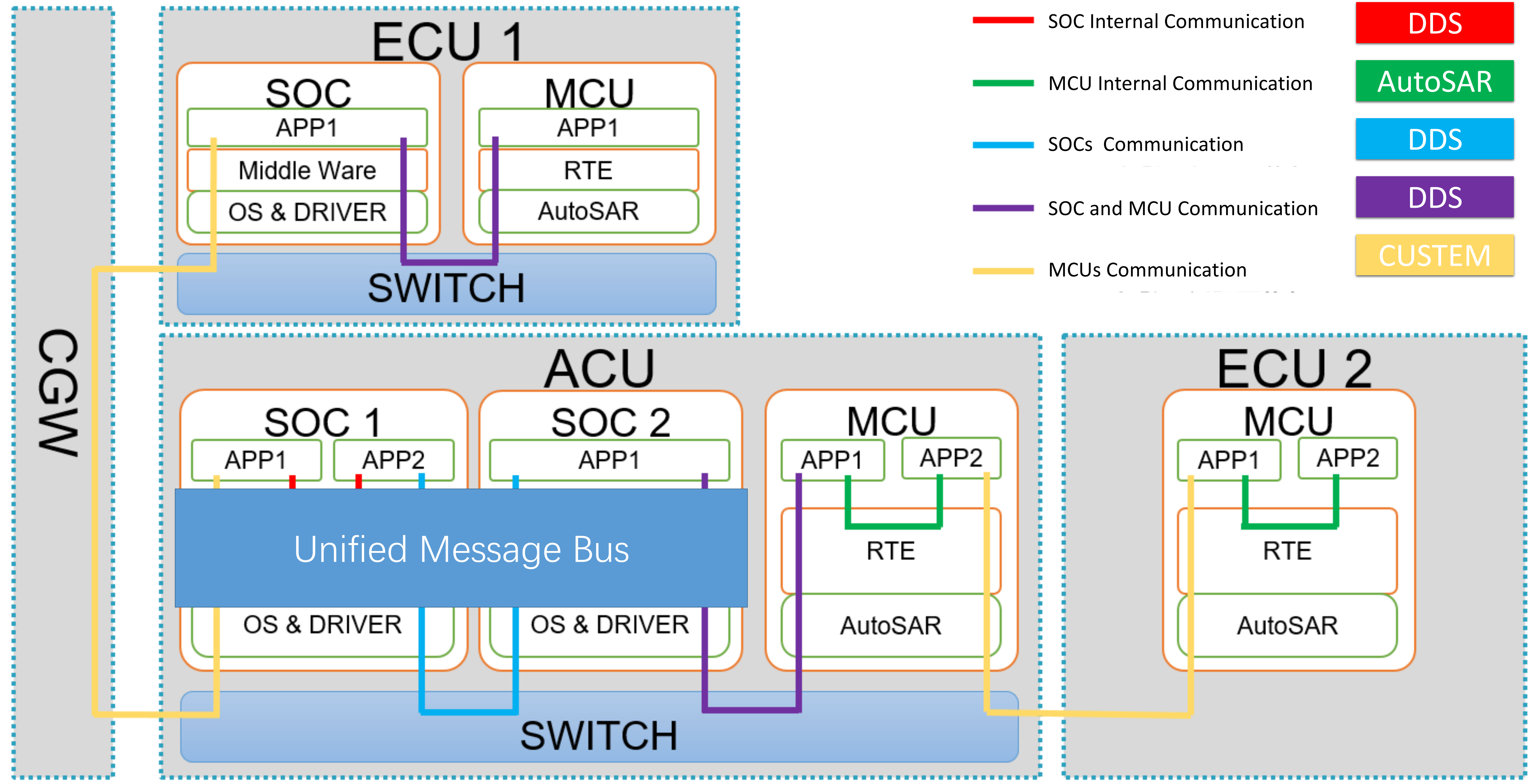
- 1. Only use TCP, not meet restrict real time requirement, Nagle causes certain delay and jitter
- 2. Not meet QoS(at most once, at least once, exactly once) combined with Hardware
- 3. Risk of Single point failure from centralized solution



DDS Advantages:

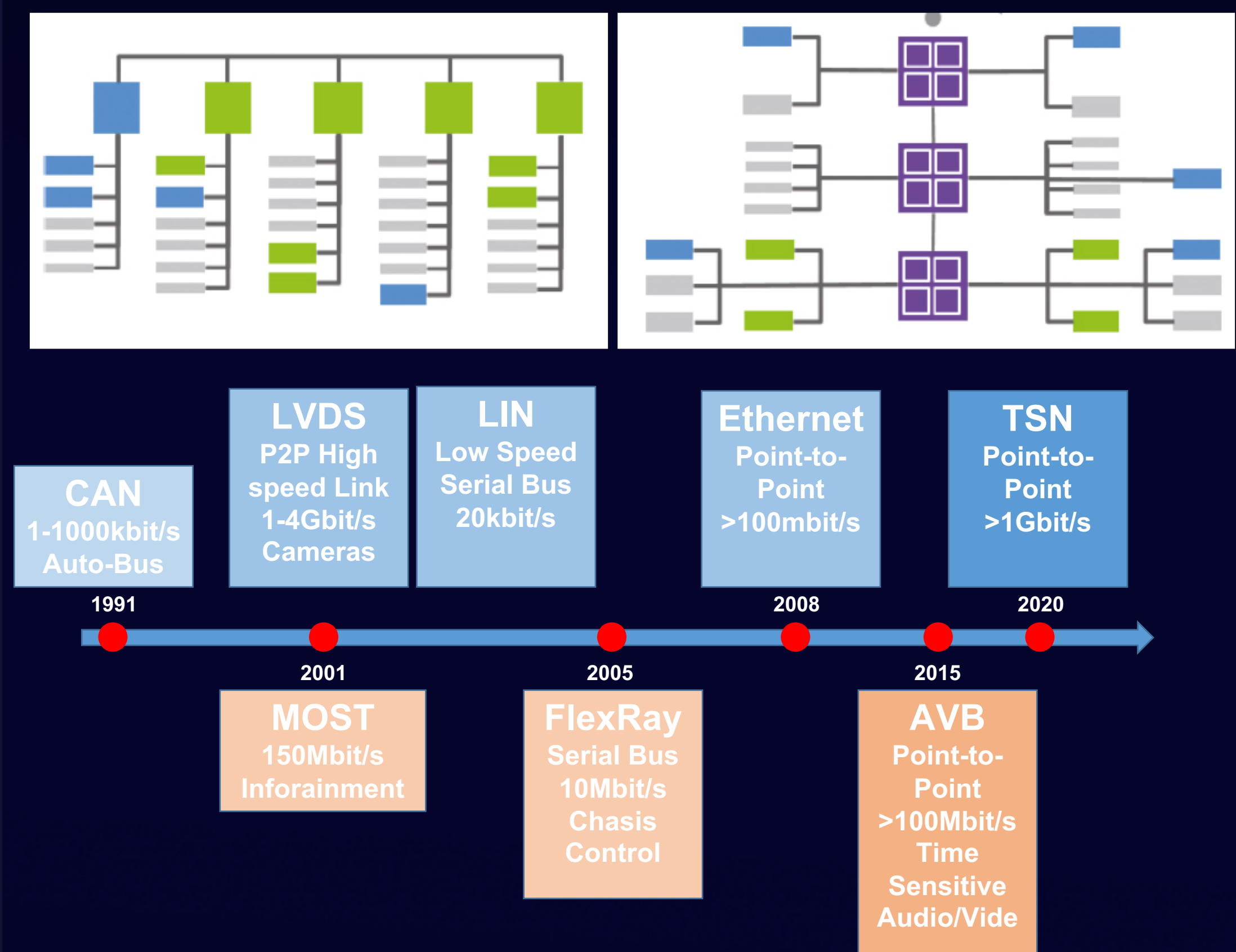
- 1. TCP+UDP guarantee the utilization of bandwidth
- 2. Multi QoS strategies
- 3. Distribute dispatch
- 4. Safety and Stabile with RTI DDS

First Step of DDS in Apollo Computing Unit



DDS has potential in Autonomous driving

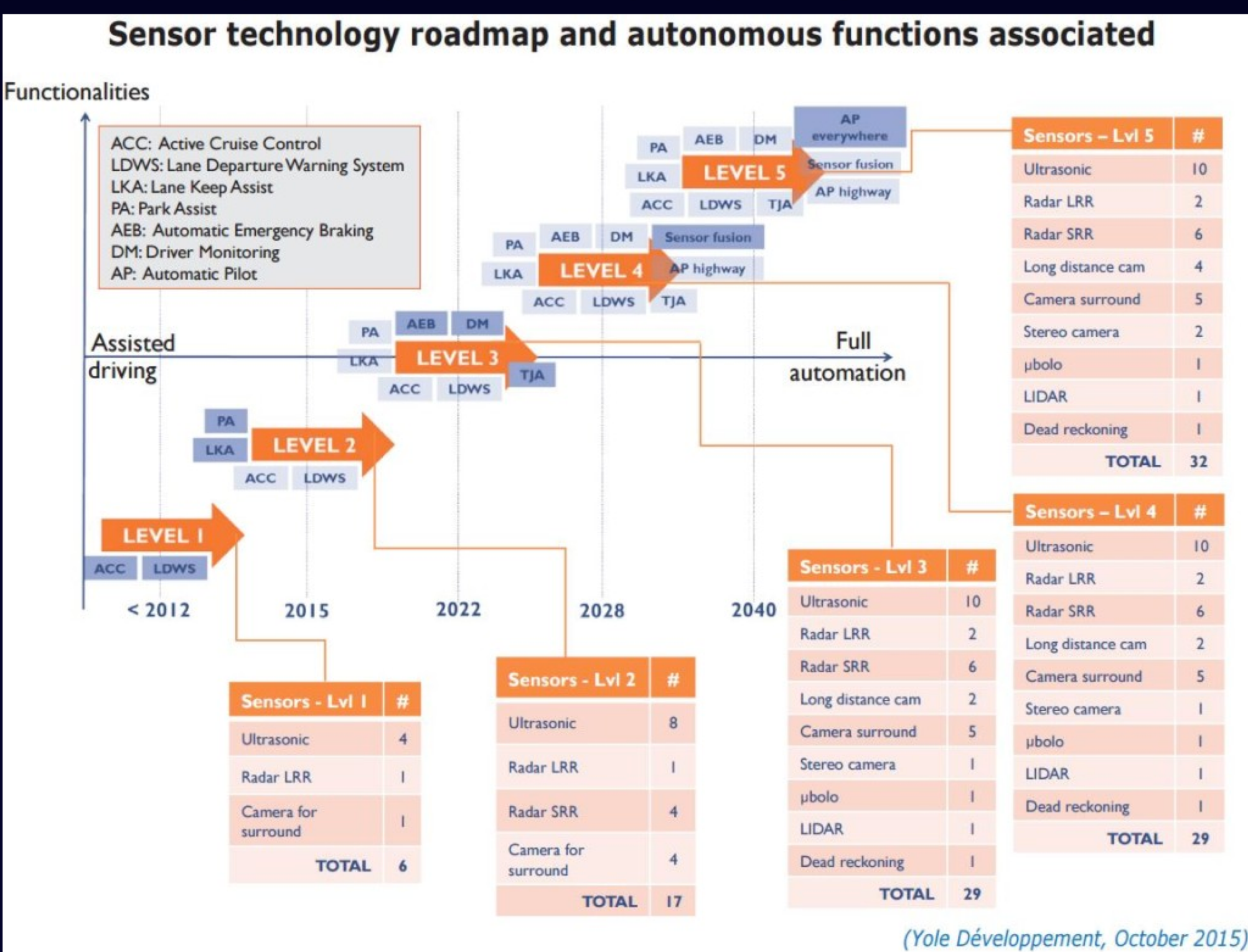
E/E Architecture Evolution



Vehicle E/E Architecture

- Centralized Domain Controller
- Ethernet Based connections
- Auto BUS from CAN to TSN
- Data transfer require higher Speed

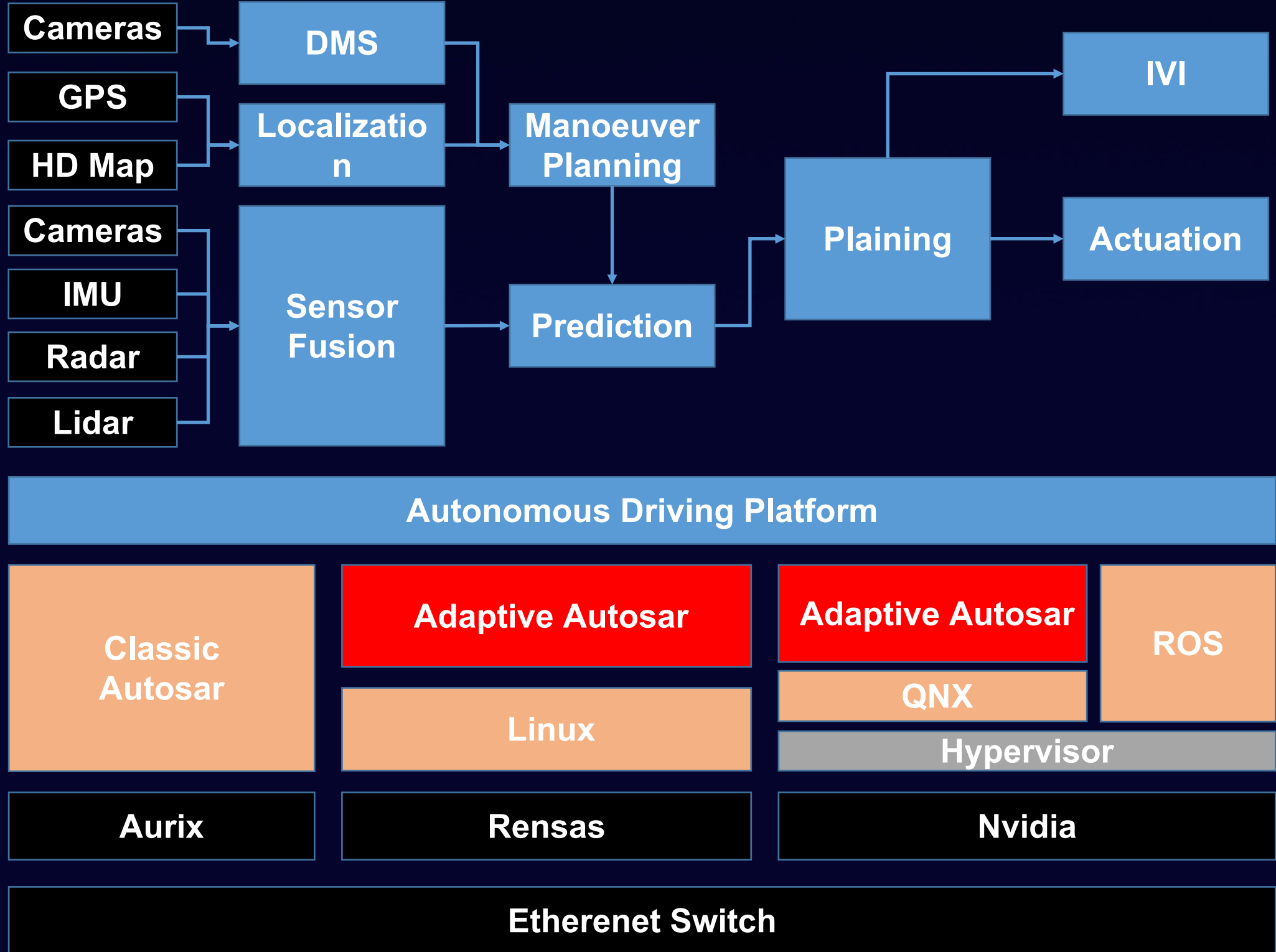
Sensors Evolution



Sensors in Autonomous Driving

- Multi types and quantity of sensors
- Ethernet Connections, Camera
- Smart Sensors with SoC intergration

Software Evolution



Software in Autonomous Driving

- Applications with multi functions
- Adaptive Autosar becomes new trend
- Unique protocol over operating systems



Data distribution will be a serious topic to discuss

DDS vs Other Protocols

DDS with 22+ QoS , Real time, With TCP/UDP

	DDS	REST	Some/IP	AMQP	MQTT	CoAP
Abstraction	Pub/Sub	Req/Rep	Pub/Sub	Pub/Sub	Pub/Sub	Req/Rep
Architecture	Global Data Space	Client-Server	Client-Server	P2P/Brokered	Brokered	Client-Server
QoS	22+	NONE	NONE	3	3	2
Interoperability	Yes	Yes	No	Yes	Partial	Yes
Hard Real-time	Yes	No	No	No	No	No
Transports	TCP/UDP	TCP	TCP	TCP	TCP	UDP
Dynamic Discovery	Yes	No	No	No	No	Yes

Why RTI DDS

- >1400 successful customer projects, including mission and safety critical applications
- >15 years designing architectures for autonomous systems



- UDP+QoS
- Distributed Design to Avoid Single Point Failure
- RTI DDS can be well integrated with TSN to meet the features of next generation automobile communication technology

- Best-in-Industry developer tools e.g. recorder, replay, logger, monitor, etc.
- Safety Certification; path to ISO 26262 ASIL-D
- Security; Standards based, fine-grained security

Thank you!