Driving into the Future:
Advancement of Automotive Storage Technology

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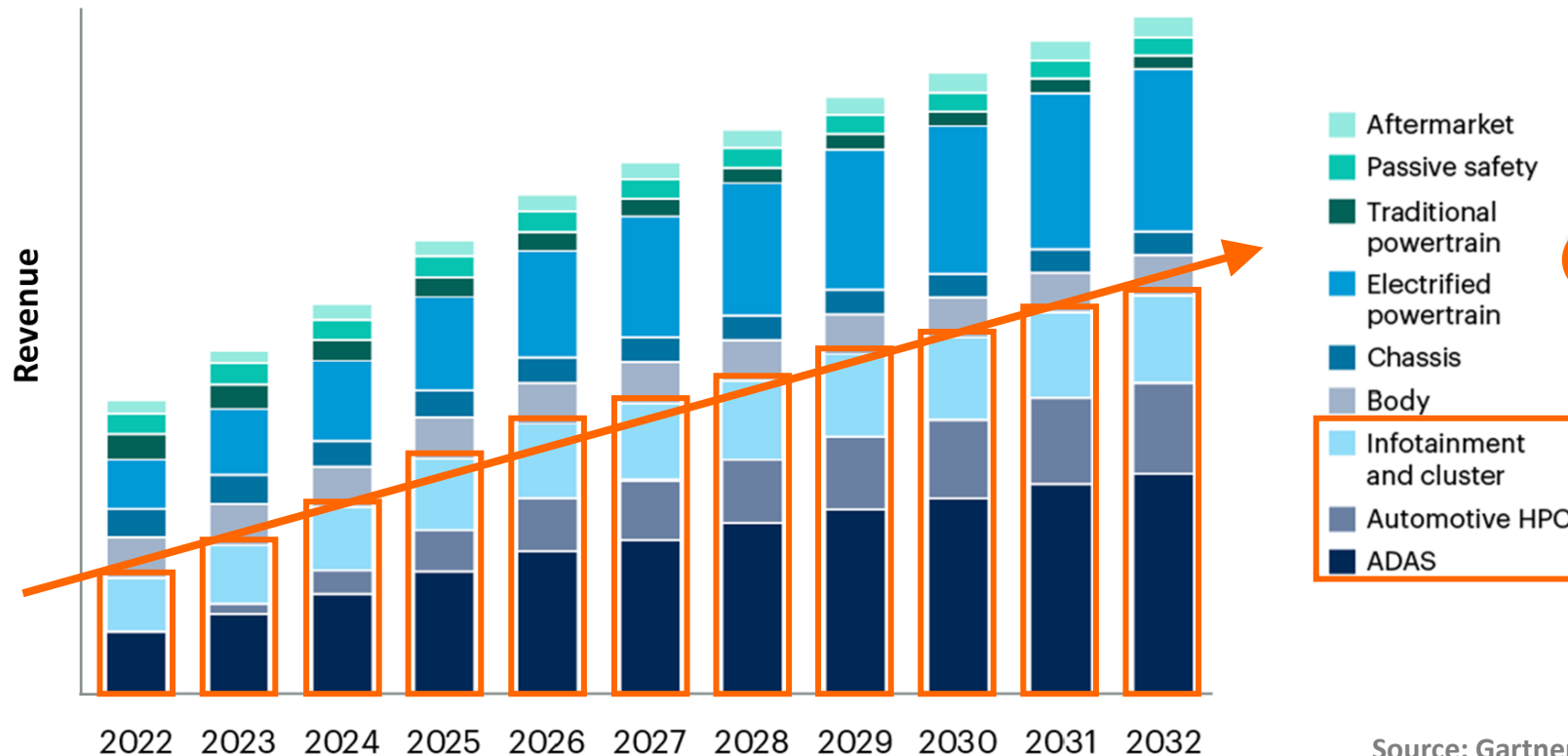
Agenda

- Automotive Semiconductor Market Trend

- Demands for Automotive Storage

- Automotive Storage Technology Trend

- Eco-System of Autonomous Vehicle

- E/E Architecture Evolution and Storage Solution

- Automotive Safety and Security

- Summary: Storages for Autonomous Vehicles

Automotive Semiconductor Market Trend

- There are several automotive application segments. Among the segments, **ADAS**, **HPC (High-Performance Computing)**, **infotainment and cluster** will significantly contribute to semiconductor revenue growth.

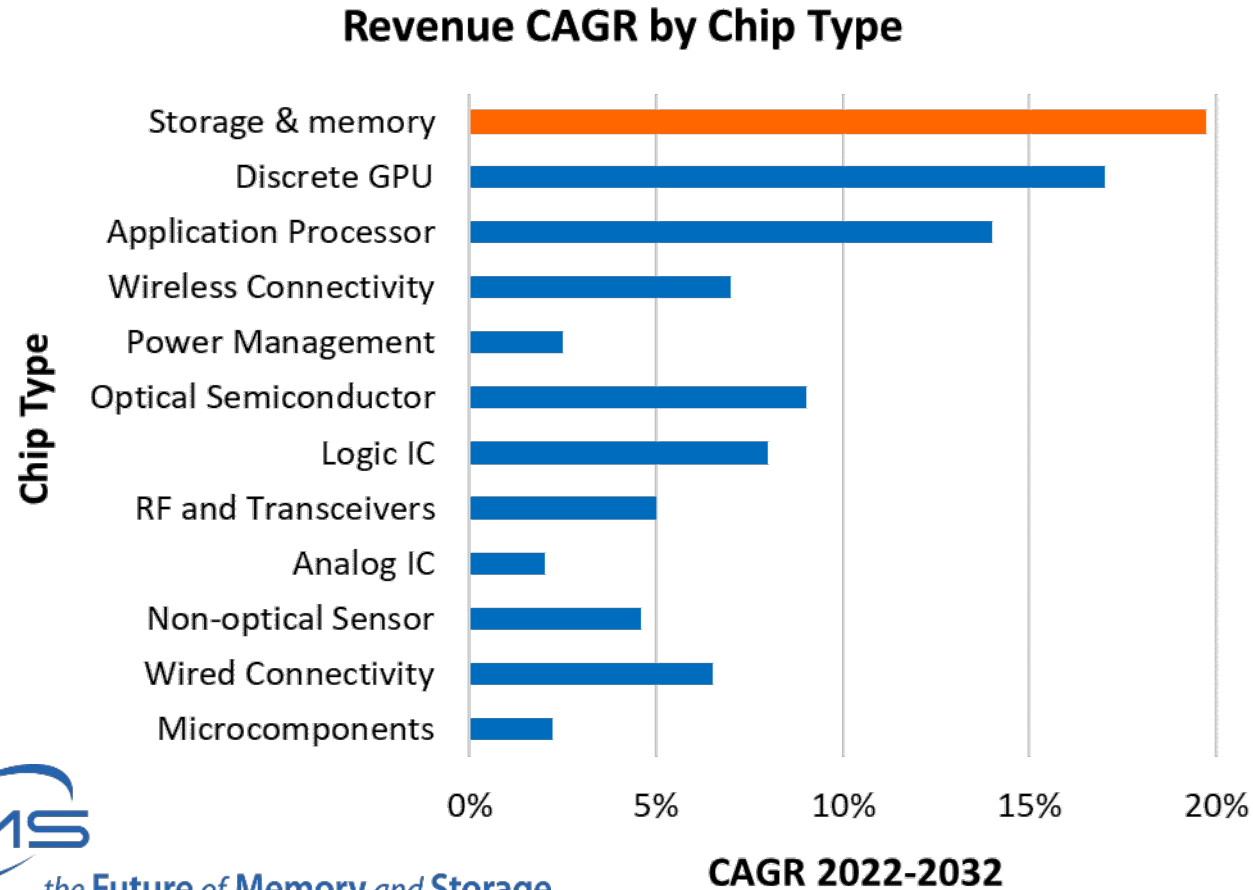## Automotive Semiconductor Forecast by Application

Storage & memory are the largest-proportion semiconductors in these applications

Legend:
- Aftermarket
- Passive safety
- Traditional powertrain
- Electrified powertrain
- Chassis
- Body
- Infotainment and cluster
- Automotive HPC
- ADAS

Years: 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032

Source: Gartner

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Demands for Automotive Storage

- **Automotive storage market will grow at the highest rate** among all chip types due to the large need from high-level autonomous driving systems, high-performance computers, infotainment and cluster.

Revenue CAGR by Chip Type

Chip Types (top to bottom):
- Storage & memory
- Discrete GPU
- Application Processor
- Wireless Connectivity
- Power Management
- Optical Semiconductor
- Logic IC
- RF and Transceivers
- Analog IC
- Non-optical Sensor
- Wired Connectivity
- Microcomponents

X-axis: CAGR 2022-2032 (0%, 5%, 10%, 15%, 20%)

Storage & memory are getting more important in future vehicles

Source: Gartner

the Future of Memory and Storage

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Demands for Automotive Storage (Cont.)

- **The data generated/obtained by vehicles will be increasing tremendously.** This requires automotive storages to equip with the technologies and capabilities to handle the big data.

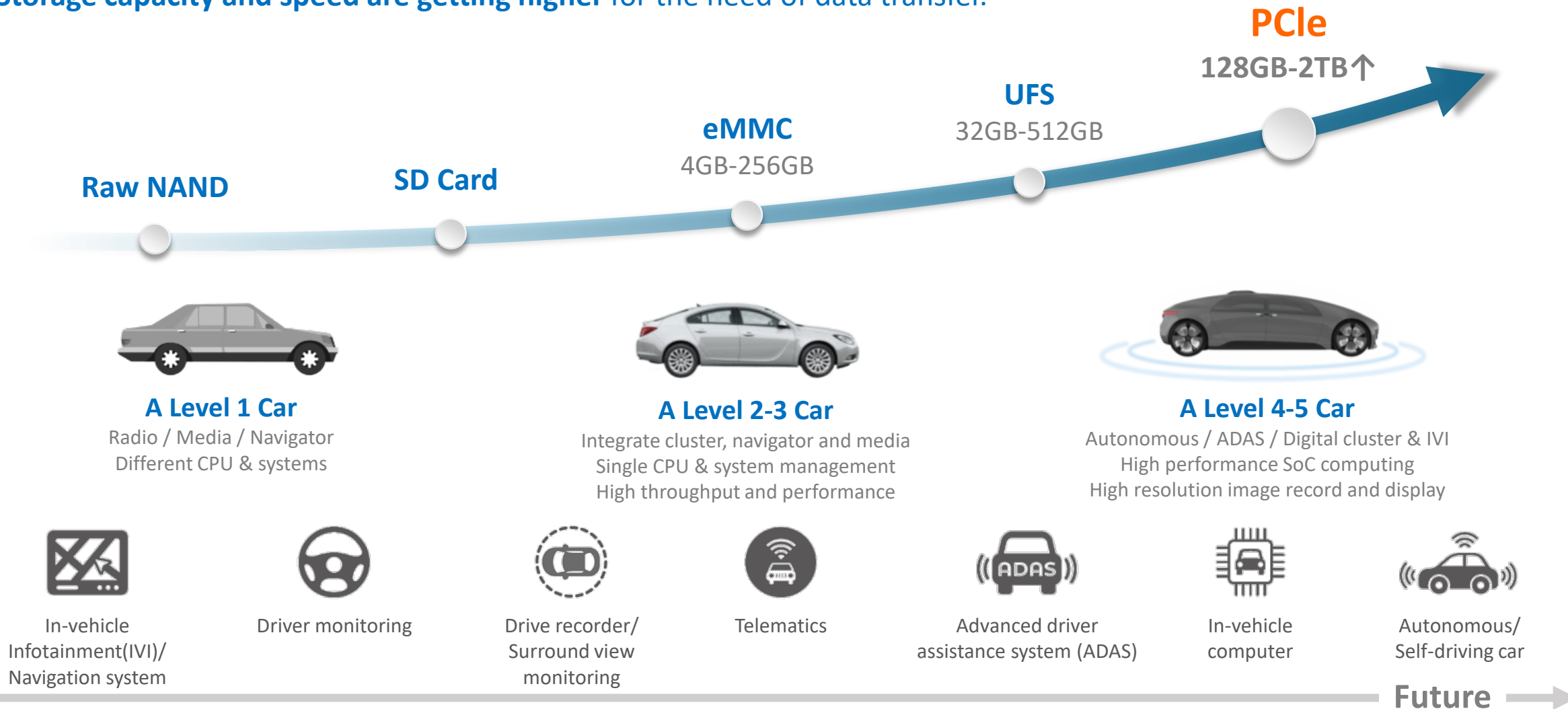**Automotive Big Data Generated (Peta Byte)**
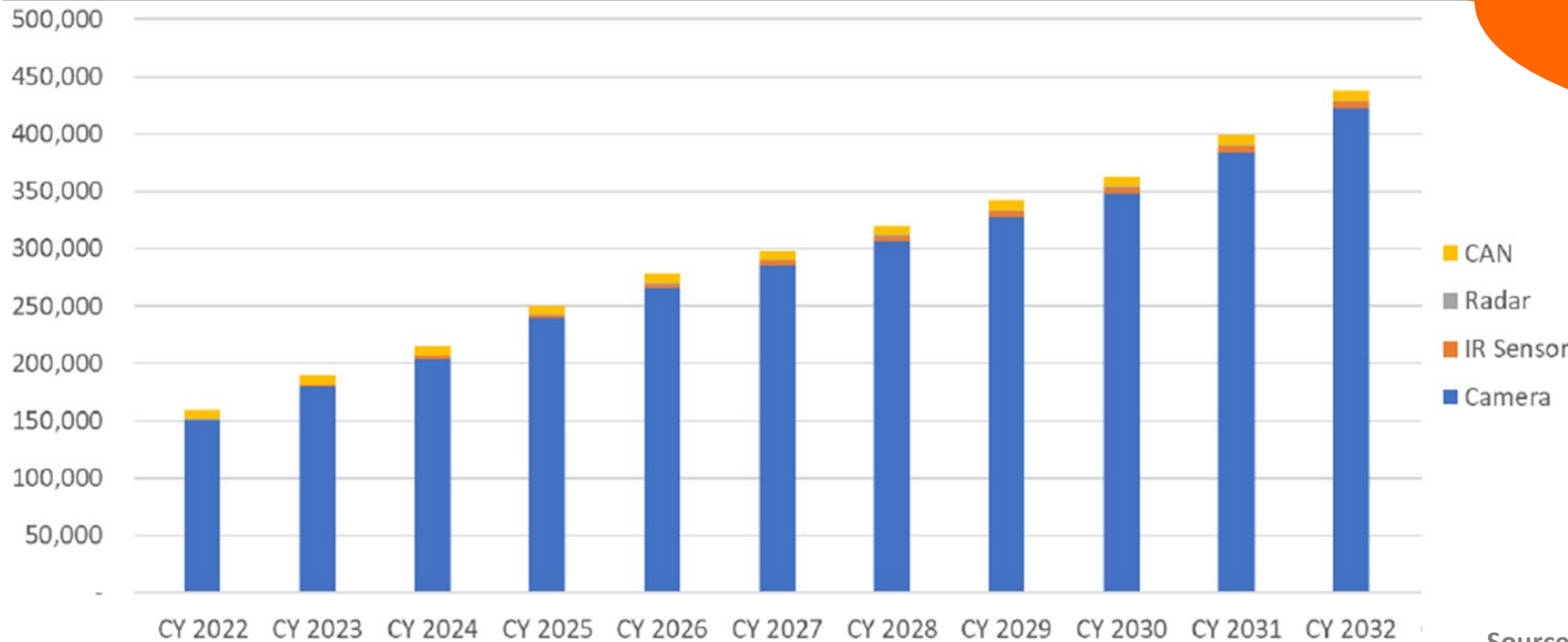
Storage is fundamental for the big data handling and transfer

Source: Gartner

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Automotive Storage Technology Trend

- **Storage capacity and speed are getting higher** for the need of data transfer.

PCle
128GB-2TB↑

UFS
32GB-512GB

eMMC
4GB-256GB

SD Card

Raw NAND

A Level 1 Car
Radio / Media / Navigator
Different CPU & systems

A Level 2-3 Car
Integrate cluster, navigator and media
Single CPU & system management
High throughput and performance

A Level 4-5 Car
Autonomous / ADAS / Digital cluster & IVI
High performance SoC computing
High resolution image record and display

In-vehicle Infotainment(IVI)/ Navigation system

Driver monitoring

Drive recorder/ Surround view monitoring

Telematics

Advanced driver assistance system (ADAS)

In-vehicle computer

Autonomous/ Self-driving car

Future

Eco-System of Autonomous Vehicle

- Autonomous vehicles require responsive, safe and secure solutions including the storages.

Data from cloud

**Sensing → Detection → Analysis → Reaction**
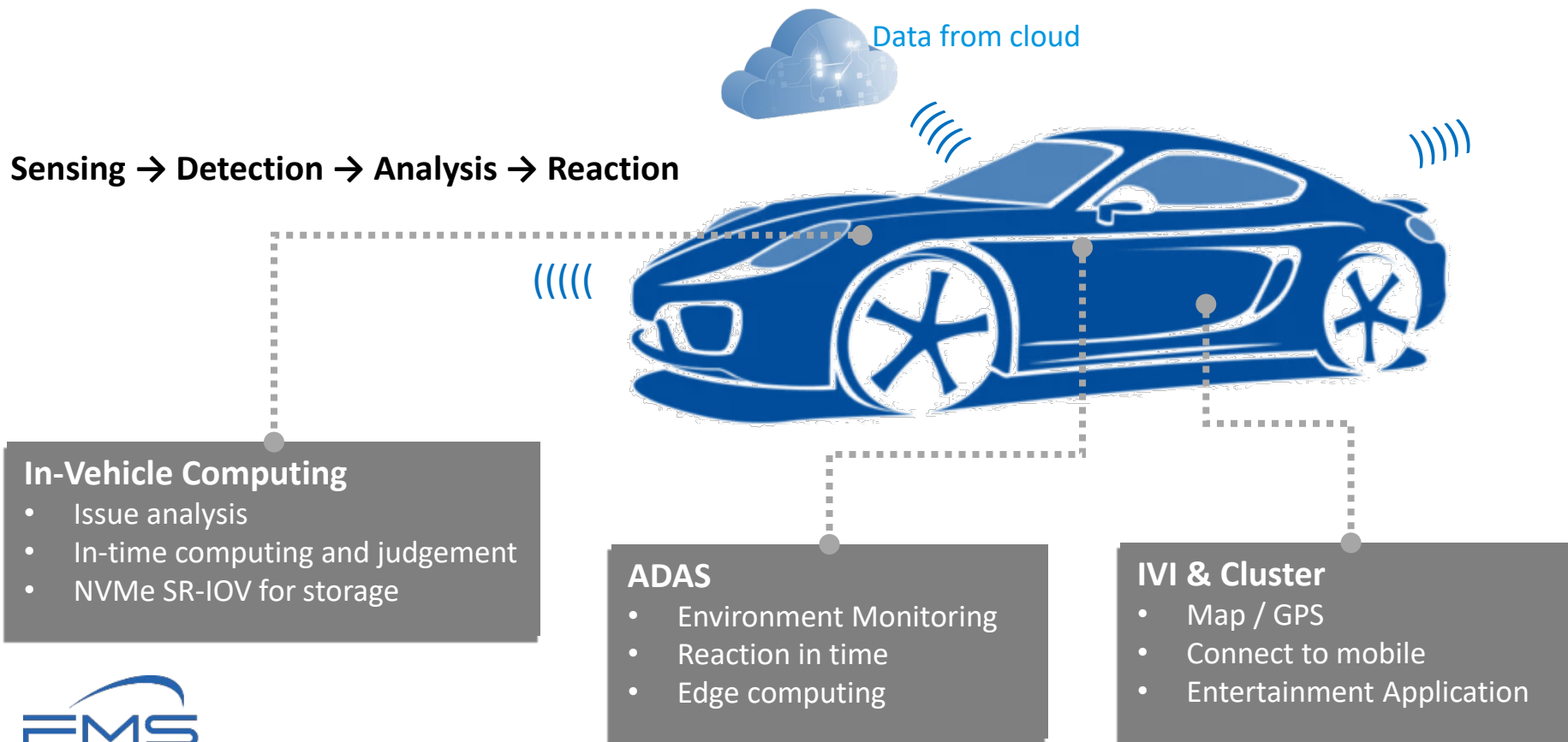
Storage needs
- Performance
- Data error correction
- Data security
- Dual-ports and SR-IOV

Automotive standards
- AEC-Q100
- ISO 26262 Functional Safety
- ISO 21434 Cyber Security
- ASPICE

In-Vehicle Computing
- Issue analysis
- In-time computing and judgement
- NVMe SR-IOV for storage

ADAS
- Environment Monitoring
- Reaction in time
- Edge computing

IVI & Cluster
- Map / GPS
- Connect to mobile
- Entertainment Application

E/E Architecture Evolution and Storage Solution

- Automotive E/E architecture is migrating from distributed to centralized architecture with which software-defined vehicle goes. The centralized architecure is composed of HPC, several domains and storages.
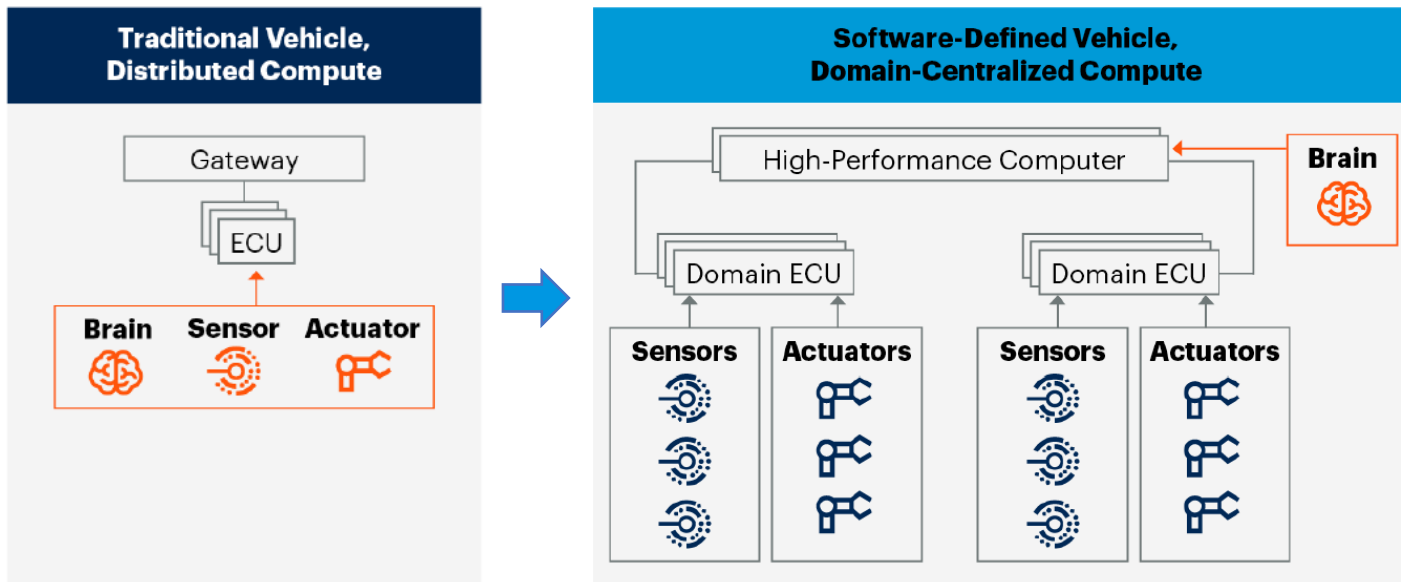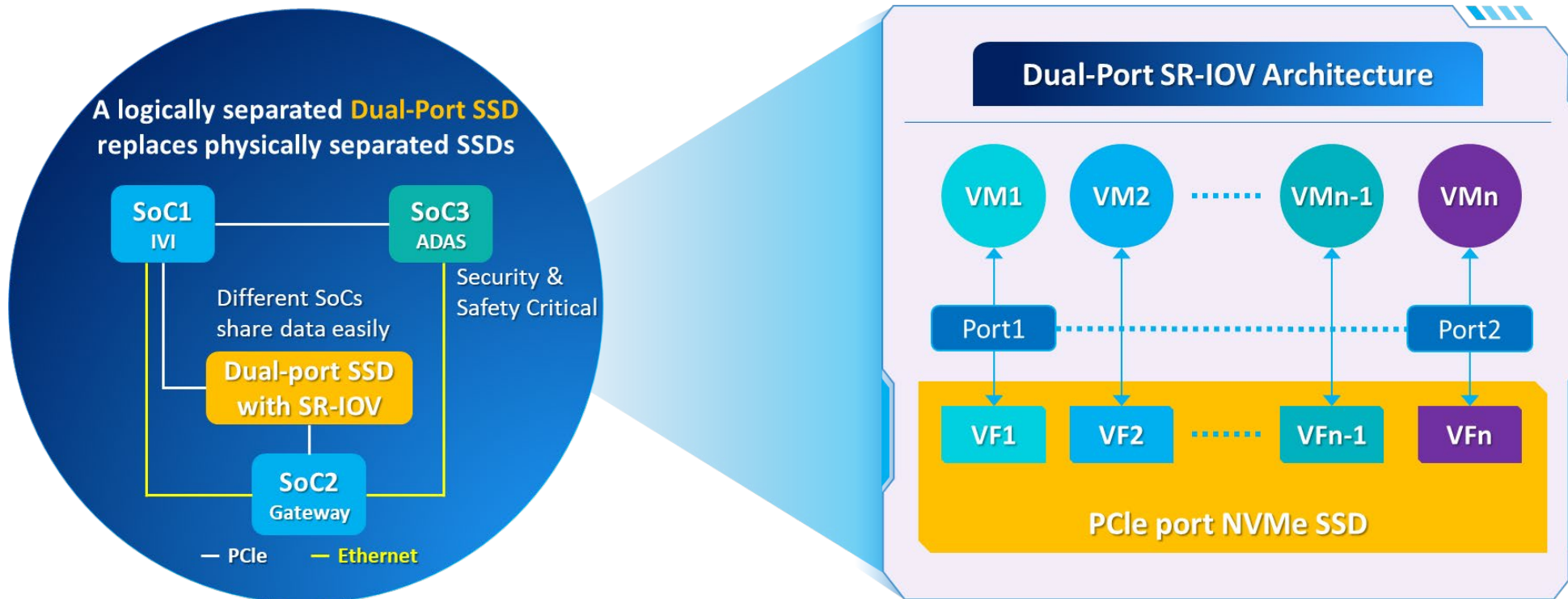

Source: Gartner

Vehicle Quantity Proportion by E/E Architecture
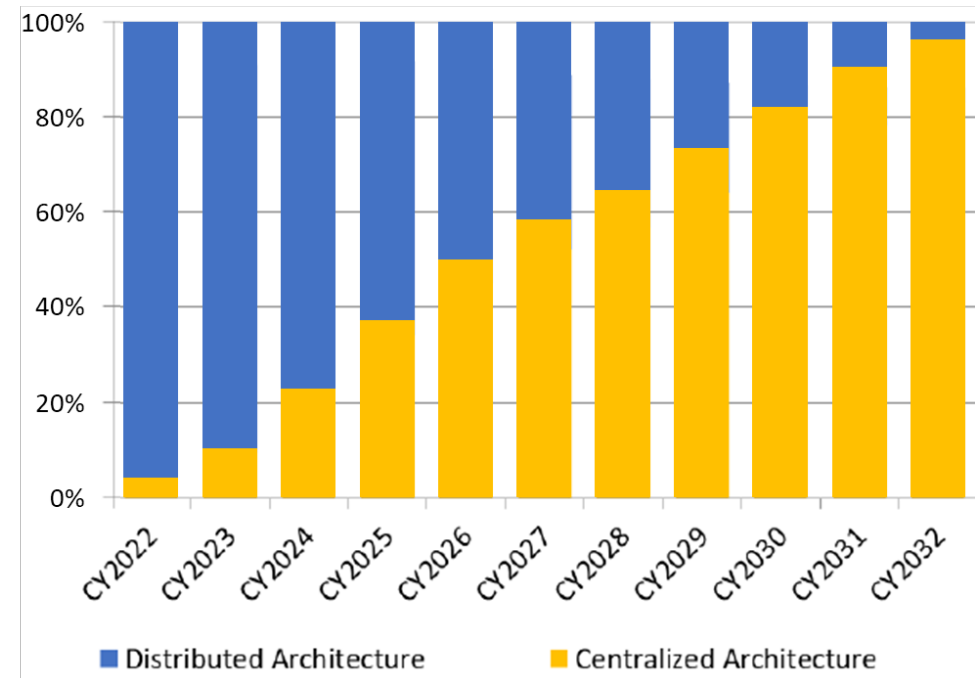
E/E Architecture Evolution and Storage Solution (Cont.)

- Different domains are connected to share information within the vehicle, and applications have their own software systems.
- A **dual-port PCIe SSD with SR-IOV** is highly suitable and a cost-effective storage solution for the architecture.

Automotive Safety and Security

- Vehicles will be autonomous and connected, and software controls everything in a vehicle. This brings vulnerability to cyber attacks and hacks. And any malfunction of electrical or electronic systems may cause huge hazard.

Functional Safety - ISO 26262

Defend against hazards caused by random component failures. If a component were to fail, there are safeguards in place for safe continuation and termination of the vehicle's path.

Cyber Security - ISO 21434

Defend against negligent and willful attacks. Safeguard the sensitive information from hackers, cybercriminals, and other malicious actors.

FMS the Future of Memory and Storage

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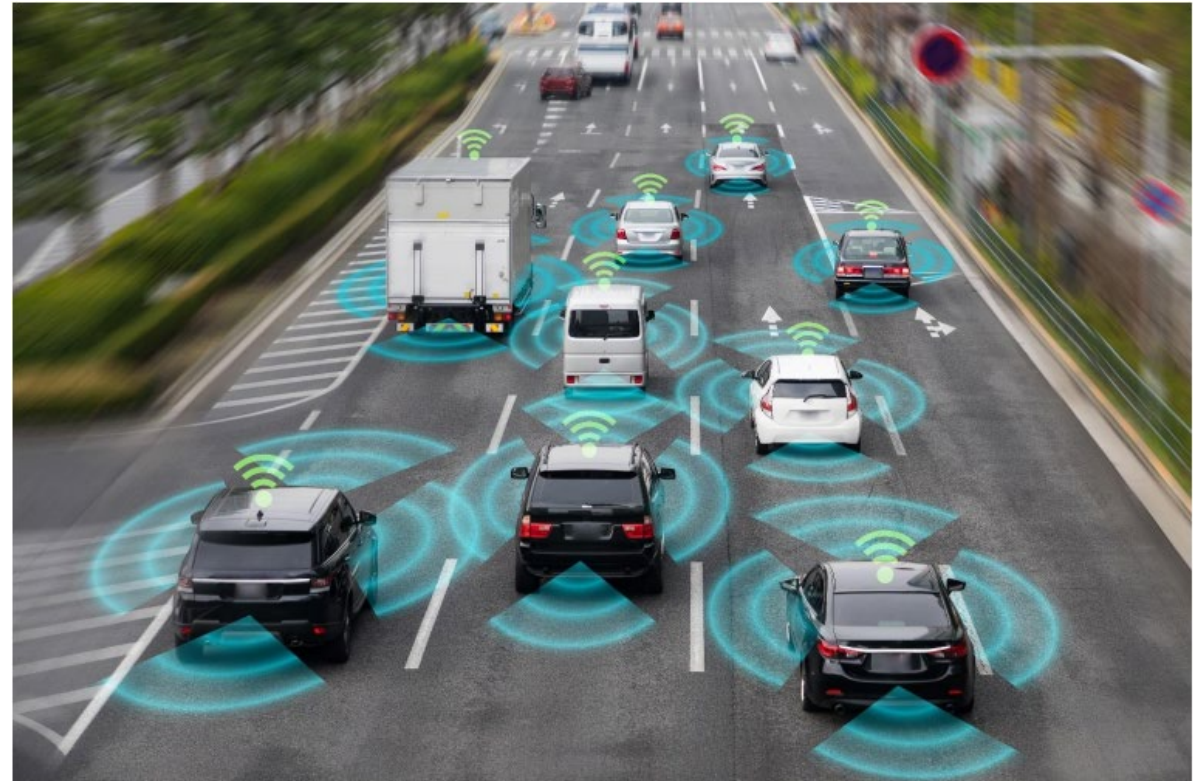
Summary: Storages for Autonomous Vehicles

Autonomous vehicles will continue to drive innovation in storage technology to meet speed and data requirements.

Dual-Port and **SR-IOV** are cost-effective ways to implement centralized system in autonomous vehicles.

Silicon Motion's automotive storages **provide the solutions to support various applications.**

Functional Safety and **Cyber Security** are key elements of autonomous and connected vehicles.

Autonomous driving requires **reliable** protection of data and integrity of devices.