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SNIA-at-a-Glance

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Ethernet, Fibre Channel, InfiniBand®

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Virtualized, HCI, Software-defined Storage

Storage Protocols (block, file, object)

Securing Data

Technologies We Cover
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Agenda

- Automotive Storage Trends
- Special Requirements for Autonomous Vehicles
- Where Automotive Data is Typically Stored
- Special Use Cases
- Networking & Compute Changes and Challenges
What is Driving Growth in Automotive Storage?

In-Vehicle-Infotainment (IVI)

Advanced Driver Assistance System (ADAS)/Autonomous Driving

Connected Car
Automotive Storage Market Outlook

Vehicle Production

- Covid19 Pandemic
- Chip Shortage

Storage per Vehicle (GB)

- NAND CAGR 31%

Auto Storage Market Size ($M)

※ Note: All the information is subject to change without notice.

* Source: SEC & IHS
Storage Trends

Auto. Storage I/F Trend

Density & Interface by Application

* Source: SEC

eMMC – Embedded Multi-Media Card
UFS – Universal Flash Storage
Storage In the Car – Vehicle Operations

- In-vehicle Infotainment
- Modern Vehicles run on Software and Data
  - Engine/motor operations
  - User interfaces, Assisted/autonomous driving
  - Navigation, location tracking, remote diagnostics,
- OTA Communications
  - Software updates
  - Tracking/telemetry for vehicle maker and/or owner
“Black Box” Storage In the Car

- Record parameters right before or during incidents
  - Speed, accelerator/brake use, steering inputs
  - G-forces, airbag deployment,
  - External video, radar, lidar inputs

- Determine cause/fault for accidents
  - Accident report, investigation, insurance/liability
  - Help design safer cars/software for future

- Must be immutable and durable
  - Record large burst of data in real-time
  - Survive impact, fire, tampering attempts
Collecting Data From the Cars

- Manufacturers Store Telemetry
  - Customer behavior, marketing/sales
  - Predictive maintenance
  - Improving current software, future products

- Employer Data Collection for the job
  - Dashcams, safety video (bus/taxi/truck cam)
  - Driver evaluations and training
  - OTA or periodic connected uploads

- Must be sharable, long-term storage
  - May be object-oriented, replicated, on-prem or cloud
  - Survive impact, fire, tampering attempts
Vehicle Design Storage

- Vehicle design is increasingly complex
- More Storage for design/testing
  - Mechanical design
  - Software/chip design
  - Virtual testing/simulations
  - Regulatory/compliance
  - Assisted/autonomous driving training/design/testing
Special Storage Requirements for Autonomous Vehicles

1. Code
   1. Storage for inference; high-definition maps
      1. OTA

2. Data (logging)
   1. Performance - Sustained Write
      1. Resolution of sensor suite
      2. Amount of compression
   2. Endurance
      1. TBW/DWPD
      3. Life-time vehicle operation

1. Qual
   1. AEC-Q100
   2. ISO26262 - Functional Safety
Computational Storage in Vehicles

Use Cases:
- HD Map Updates
- Object Recognition & Tracking
- Distributed AI/ML Model Training
Special Use Case – Intelligent Traffic Management

**Use Case 1: Adaptive Traffic Control**

- Driving-tests.org

**Use Case 2: Sensor Extension**

- The Dallas Morning News

Road Side Unit (RSU)
Vehicle Networking and Compute Challenges

**Today**

- **Domain Architecture**
  - Vehicle functions separated into specific functions or domains – ADAS, IVI, etc.
  - Central gateway connects to the different domains enabling data communication among the ECUs
  - Each domain contains separate storage – eMMC, UFS or PCIe3

**Next Generation: Centralized**

- **Consolidation of domains into Centralized compute platform**
  - Zonal Architecture: Partitioning/Local Pre-processing/Prioritizing
  - SW defined architecture: Variation of chip integration & Data traffic/flow
  - Central CPU, Virtualization/Hypervisor, Network
  - High speed busses (PCIe5, 10Gb Ethernet, MIPI)
  - Storage: High Density/Bandwidth requirement
Summary

- Automotive storage growing 31% annually
- Driven by In-vehicle Infotainment (IVI) and advanced driver-assistance systems (ADAS) and autonomous driving systems
- Data collected during vehicle operation driving growth off-vehicle storage
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