Architecture changes that are driving the requirement for >10Gbps network technology

Hamid Salehi, Marvell Semiconductor
September 24, 2019, Detroit, MI
2019 IEEE Ethernet & IP @ Automotive Technology Day
Path Toward Autonomy

Compute and Networking Need

- **L1**: ZERO
- **L2**: BASIC
- **L3**: CONDITIONAL
- **L4**: HIGH
- **L5**: FULL

- **<1 TFLOPS* <100Mbs**
- **1-10 TFLOPS <10Gbs**
- **100+ TFLOPS 10Gbs+**

* Tera Floating Point Operations Per Second
Number of Ports in Cars Increasing

- **1 port**: 2008, OBD
- **<10 ports**: 2013, Low Res Cameras
- **10-50 ports**: 2017-2019, Connected Car, IVI, TCU, Gateway
- **>100 ports**: 2024-2026+, ADAS & Autonomous Driving

- **100BASE-TX**
- **100BASE-T1**
- **1000BASE-T1**
- **2.5/5/10G BASE-T1**
- **10G+**

*Average Ethernet ports per vehicle
Migration to Zonal Architecture

A zonal arrangement means data from different traditional domains is connected to the same ECU, based on the location (zone) of that ECU in the vehicle.
Zonal Architecture Overview

Very High bandwidth (10G+) Symmetric Traffic

> 6 links per car

Mixed Data Type

Redundant systems
Consolidation of processing require 10G+ links

Locally distributed processing resources

Cross domain distributed processing resources

Central integration of processing resources

Communication only between systems (ECUs)

Communication between systems via Ethernet Switches

Consolidation of processing requires 10G+ bandwidth
Network Topology Breakdown

Symmetric:
- Inter-Server/Zone Connection

Asymmetric:
- Typically > 100:1
- From Sensor
- To Display

Asymmetric Data Requirement
Autonomy Needs High Bandwidth

Moving high resolution, uncompressed sensory data for L4/L5 autonomous cars requires **High Bandwidth**

- 2.5-25Gbs
- <200M
Market Trend: 100M+ >10Gbps by 2030

Source: McKinsey’s “Automotive revolution – perspective towards 2030” study, 2016 and internal estimates
Final Thoughts

As network complexity increases, domain-based approach is becoming less and less efficient, and there is shift to zonal architecture.

Shift to zonal architecture with centralized compute center require high bandwidth (>10Gbps) connection to maintain low latency and quality of service.

Optimized network architecture for L3/L4 autonomous cars require highly optimise 10Gbps+ asymmetric option (80% of the market) potentially at the cost of symmetric implementation.