Navigating the Future of Connectivity

Overview | September 2020



NAV Alliance

Networking for Autonomous Vehicles

Autonomous Vehicles: The Dawn of a New Era in Automotive



Challenge	Trust of humans in machine-driven vehicle
Requirement	Secured system with no failures of critical applications
Solution	Built in redundancy for critical components and connectivity

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The Path Towards Full Autonomy

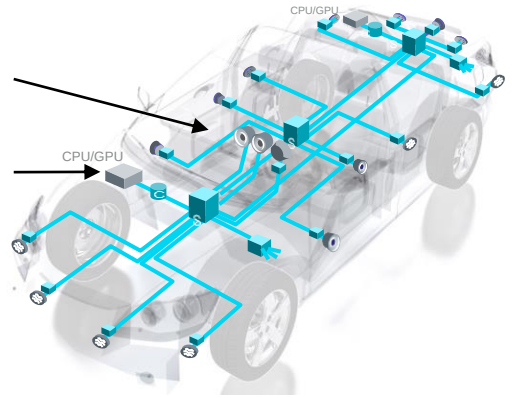
Level 4-5
Self Driving

Level 2-3
Decision Assistant

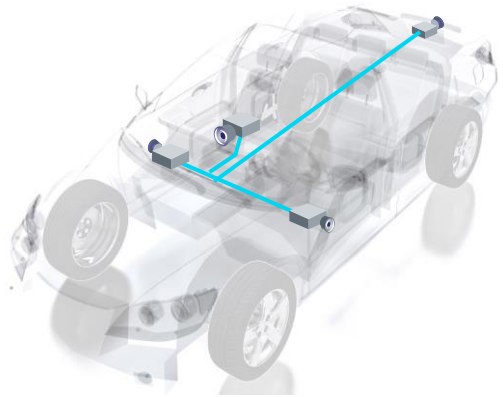
Level 1-2
Simple Aid

High-Speed, Reliable & Secure Nervous System

High-Performance Brain



Local Computing
”behind” every sensor



Centralized Computing
integrates input from all sensors (*Sensor Fusion*) similar to a human driver’s brain

	Compute Power (TFLOPS)	Networking Speed (Gbit/s)
Level 4-5 Self Driving	100+	25+
Level 2-3 Decision Assistant	10	10
Level 1-2 Simple Aid	1	1
	0.1	0.1

2010 - 2015 | 2015 - 2020 | 2020 - 2025

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Sensor Fusion & Rich Data Drive Bandwidth To Multi-Gig

Cameras

Increasing resolution from 720p to 4K and improving dynamic range = **Multi-Gigabit/s of raw bandwidth**

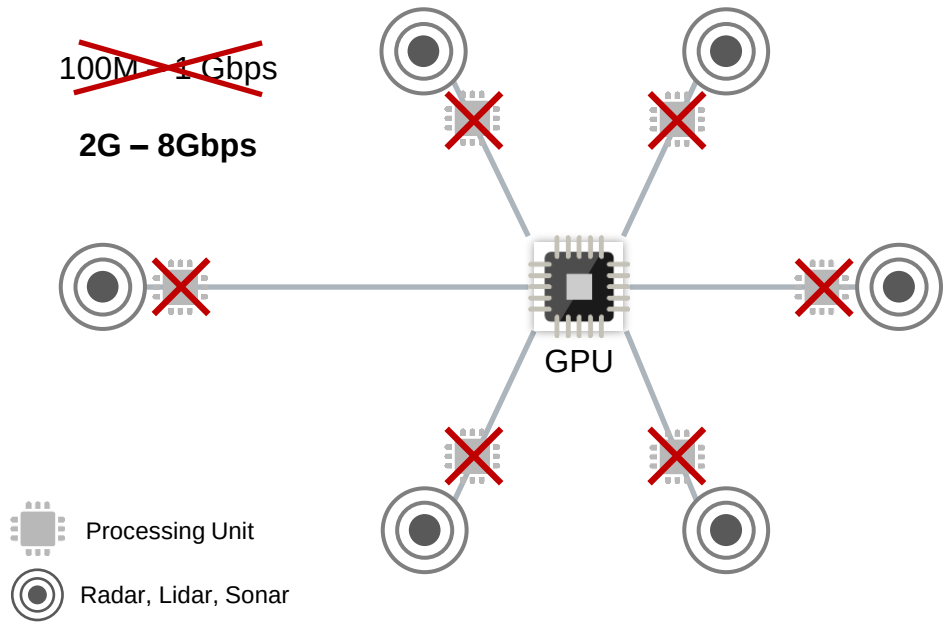
Hres	Vres	Fps	8bit	12bit	16bit	20bit	24bit
1280	720	30	0,22	0,33	0,44	0,55	0,66
1280	1080	30	0,33	0,50	0,66	0,83	1
1280	720	60	0,44	0,66	0,88	1,11	1,33
1920	1080	30	0,50	0,75	1,00	1,24	1,49
1280	1080	60	0,66	1,00	1,33	1,66	1,99
1920	1080	60	1,00	1,49	1,99	2,49	2,99
3840	2160	30	1,99	2,99	3,98	4,98	5,97
3840	2160	60	3,98	5,97	7,96	9,95	11,94

100BASE-T1	1000BASE-T1	Multi-Gig Ethernet 2,5 Gbps	Multi-Gig Ethernet 5 Gbps	Multi-Gig Ethernet 10 Gbps
No Use Case	Available	Speed grades which are currently discussed		

IEEE NGAUTO 802.3ch, February 2017

Sensor Fusion

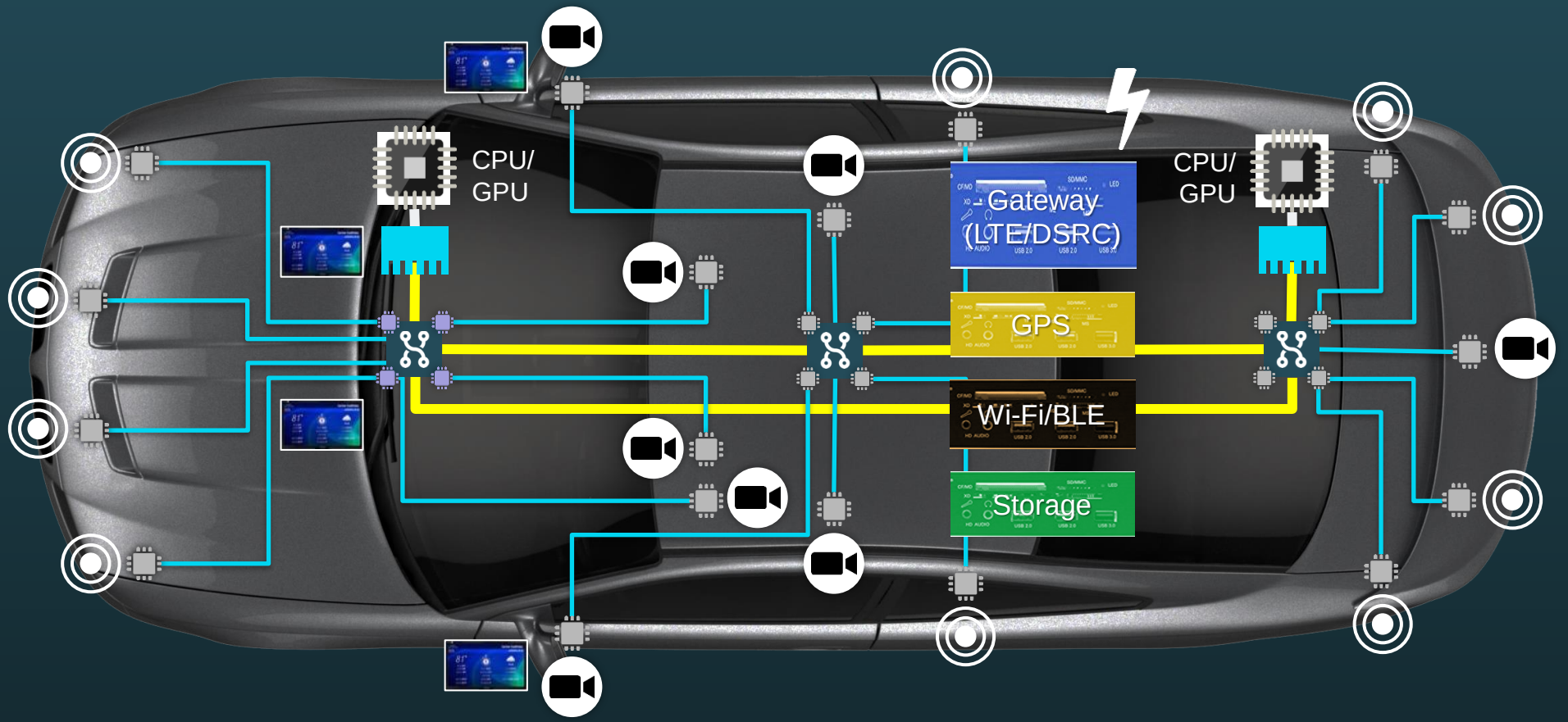
Moving processing of data from sensors to centralized GPU = **Multi-Gigabit/s data over the network**



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Connecting *IT* All Together Reliably and Securely

ADAS | Infotainment | Telematics | Storage | Gateway



Radar, Lidar, Sonar

Camera

Switch with Multiple Phys

Controller

Phys

Ethernet link – 2.5G, 5G, 10G

Ethernet link – 25G, 50G, …

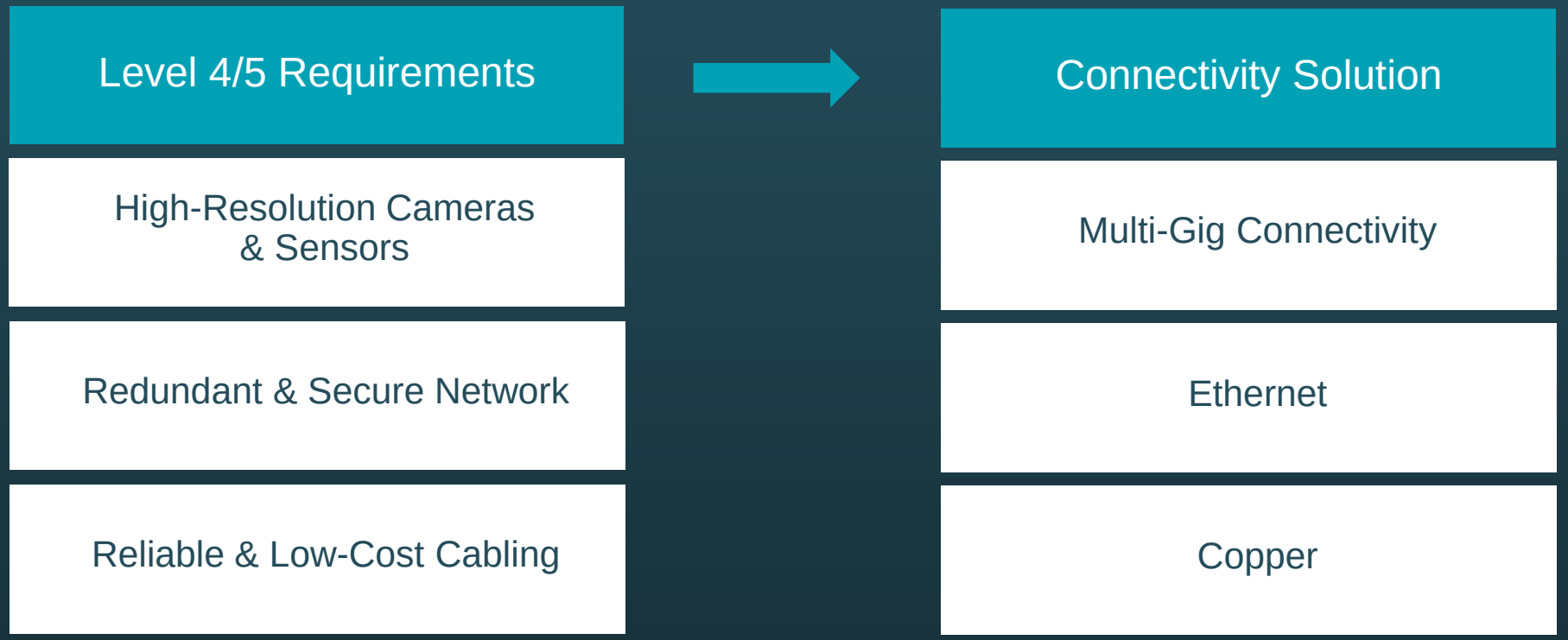
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Autonomous Vehicles Networking Additional Requirements

	Reliability	Security
Requirements	• Zero failures for functional-critical systems • Failsafe: failure doesn't jam the network • Failover: failure triggers backup device operation • System operation under harsh conditions (temperature, humidity, dust, …) • Reliable operation over long life cycle	• Prevent unauthorized remote control of the vehicle – whether physically on the vehicle or through the air • Protection from data hacking • Defend from system software harmful modifications
Solutions	• Redundancy through multiple data paths • Scalable to Multi-Gig speeds • Mature HW/SW stack	• Encryption • PHY-layer Security • Secure boot

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Industry-Wide Effort Required to Define Next-Gen Multi-Gig Technology



We call it Networking for Autonomous Vehicles : NAV

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Networking for Autonomous Vehicles

The NAV Alliance

Founded by

AQUANTIA BOSCH Continental NVIDIA VOLKSWAGEN GROUP OF AMERICA

Leading car manufacturers, system and component suppliers in the automotive market

Purpose

To provide a platform for the automotive industry to develop the next generation of in-vehicle network infrastructure for autonomous vehicles and facilitate wide deployment of networking technologies and products, ensuring interoperability, security and reliability of the network.

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Objectives

- Develop the ecosystem for next generation Multi-Gig Ethernet automotive networking
- Create procedures and specifications to insure interoperability, security and reliability of the network
- Promote best practices and solutions that adhere to the new specifications
- Establish standards body liaisons
- Build marketing activities to build awareness and educate the market place and users

TWG1/TWG2 : 25G/50G Automotive Ethernet PHY Specifications and EMC Requirements

Scope – TWG1: This project is to create Physical Layer specifications and Management Parameters for 25Gbps and 50Gbps electrical interfaces for automotive Ethernet networks.

Scope – TWG2: Specification of the EMC requirements and limits for communication channels between two Ethernet Ports (inclusive the PHY) at speeds higher than 10Gbps.

Chairman: Ramin Farjad, Marvell

TWG3 – Physical Layer System and Component Integration

Scope: This project is to specify the integration of an Automotive Multi-Gig PHY in an Automotive Electronic Control unit (ECU) or an Electronic Vehicle Computer (EVC).

Chairman: Olaf Grau, Bosch

TWG4 – Protocol Encapsulation for Ethernet

Scope: This WG defines standard encapsulation of various protocols within Ethernet frames in a backwards compatible manner. The initial target protocols for encapsulation are I2C, SPI, CSI2 and for example Radar, Lidar applications.

Chairman: Hari Parmar, Marvell

TWG5 – System Controls and Management

Scope: This WG defines how to interface the IVN (In-Vehicle Network) components and its features with respect to manageability. Therefore, it identifies recommendations associated with hardware and software-based interfaces that are supporting systems used for autonomous vehicles. The WG elaborates also on an automotive network management protocol that includes additional considerations including enhanced diagnosis, predictive maintenance, redundancy, Quality of Service, wake-up and sleep and device management.

Chairman: Helge Zinner, Continental

Thank you.

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