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Network architecture use cases for data rates beyond 10Gb/s

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Overview

This presentation discusses use cases for 802.3cy Ethernet

802.3ch should support current needs but we will need higher rates soon

Need to support both symmetric and asymmetric use cases

Ethernet Advantages for Automotive

- Standard based. Multiple vendors.
- Switching, VLAN: IEEE 802.1
- MAC Speeds: 2.5G, 5G, 10G, 25G, 50G (soon 100G)
- Security: IEEE-802.1AE MACsec plus Encryption (AES-256)
- Synchronization: IEEE-1588v2 PTP (802.1AS and Rev)
- Power over Data Line: IEEE PoDL 802.3bu (0.5W to 50W)
- Audio/Video Bridging: AVB/TSN
- Support all topologies: point-to-point, mesh, star, ring, daisy-chain

In-Vehicle-Network (IVN) for ADAS

The Path Towards Full Autonomy

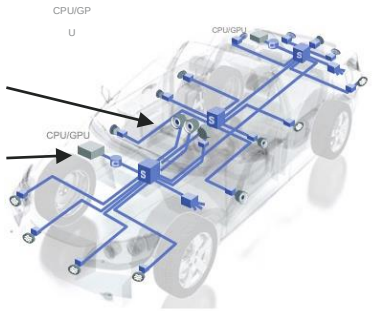
Level 4-5
Self Driving

Level 2-3
Decision Assistant

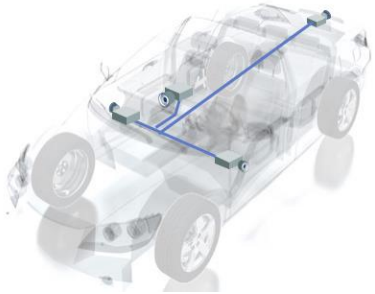
Level 1-2
Simple Aid

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

2010 - 2018 | 2019 - 2025 | 2025…

Compute Power (TFLOPS)	Networking Speed (Gbit/s)
100	25
10	10
1	1
0.1	0.1

Asymmetric Use Cases

Asymmetric: Camera Link Data Rates

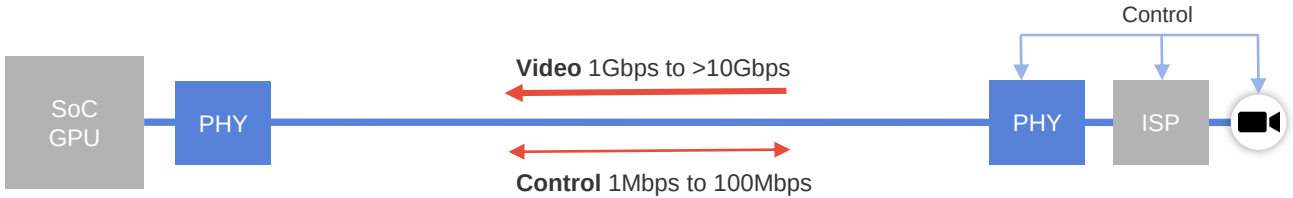
Hres	Vres	Fps	8bit	12bit	16bit	20bit	24bit
1280	720	30	0,22	0,33	0,44	0,55	0,66
1280	1080	30	0,33	0,50	0,66	0,83	1
1280	720	60	0,44	0,66	0,88	1,11	1,33
1920	1080	30	0,50	0,75	1,00	1,24	1,49
1280	1080	60	0,66	1,00	1,33	1,66	1,99
1920	1080	60	1,00	1,49	1,99	2,49	2,99
3840	2160	30	1,99	2,99	3,98	4,98	5,97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

1000BASE-T1	802.ch @ 2,5 Gbps	802.3ch @ 5 Gbps	802.3ch @ 10 Gbps	**Beyond 10G > 10Gbps**

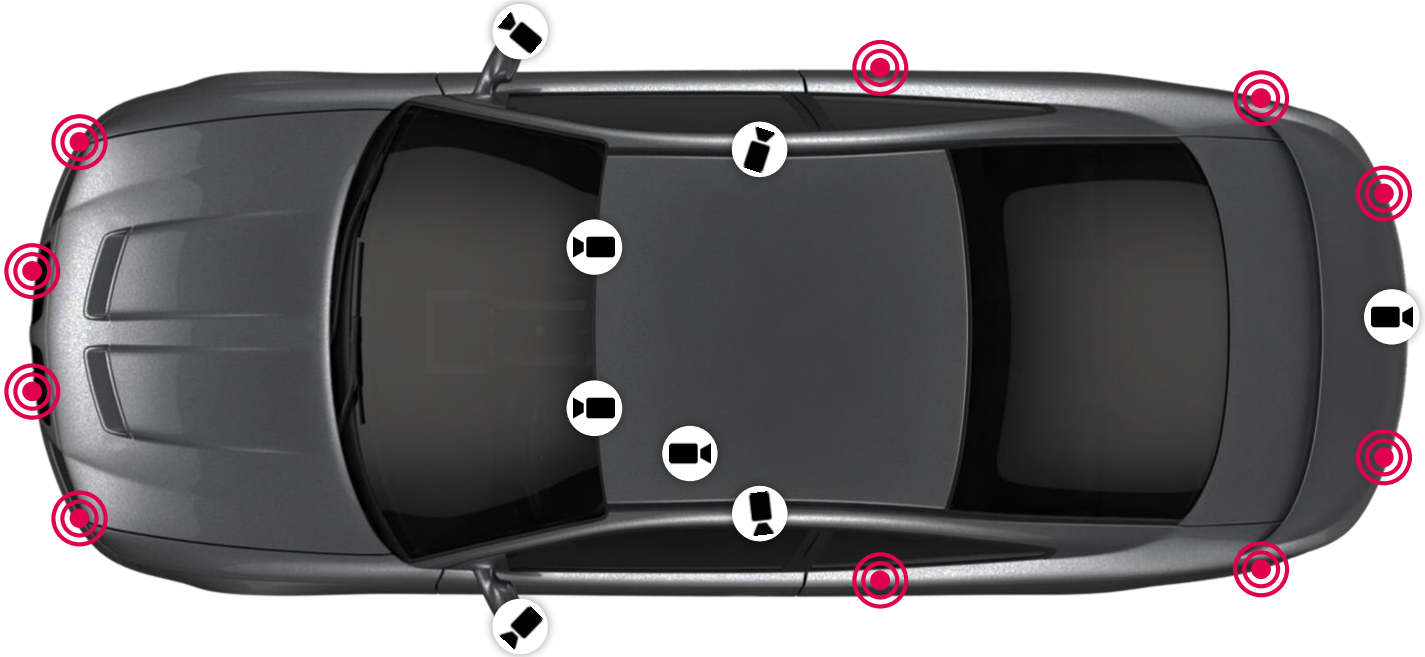
Most common video rates today can be supported by 802.3ch or 1000BASE-T1

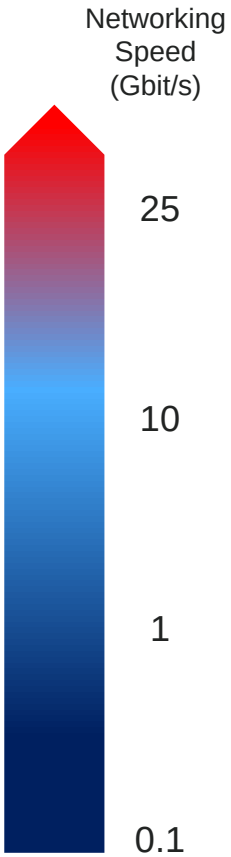
Future cameras with resolution beyond 4K or with very high frame rates will need data rates beyond 10Gb/s

Camera links inherently have asymmetric data rates

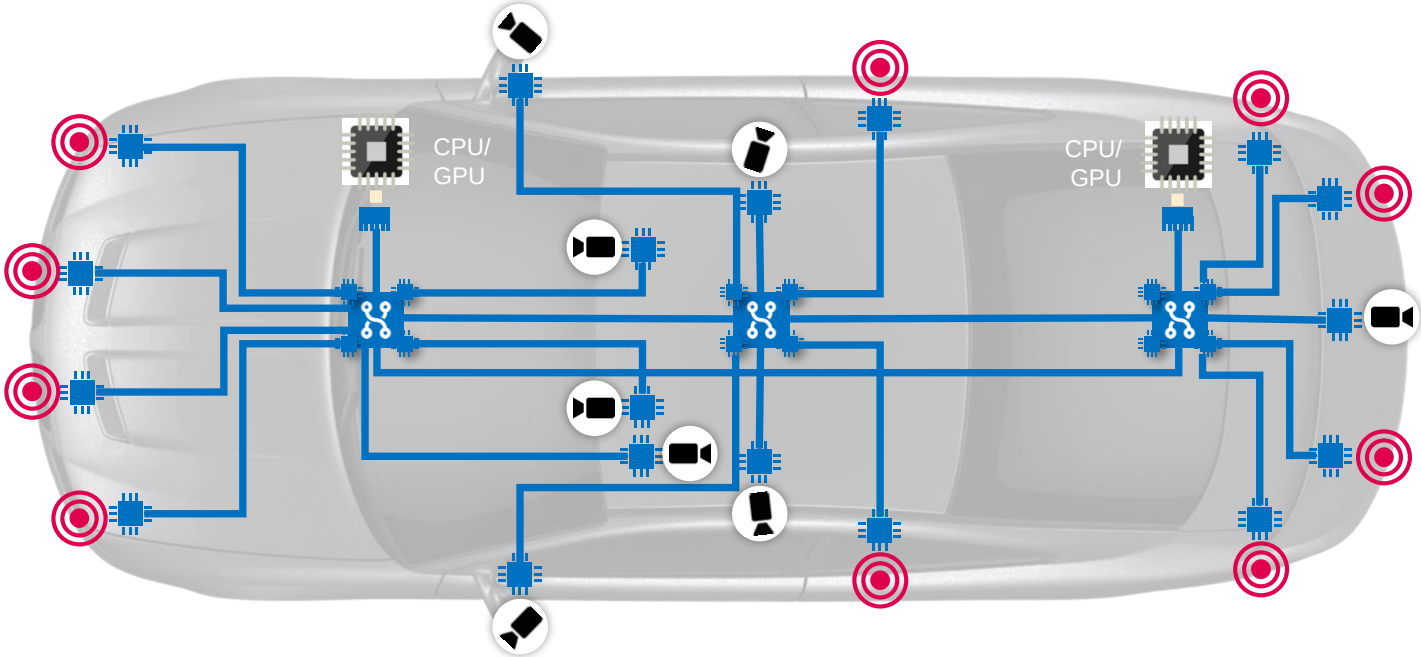


In-Vehicle-Network (IVN) for ADAS



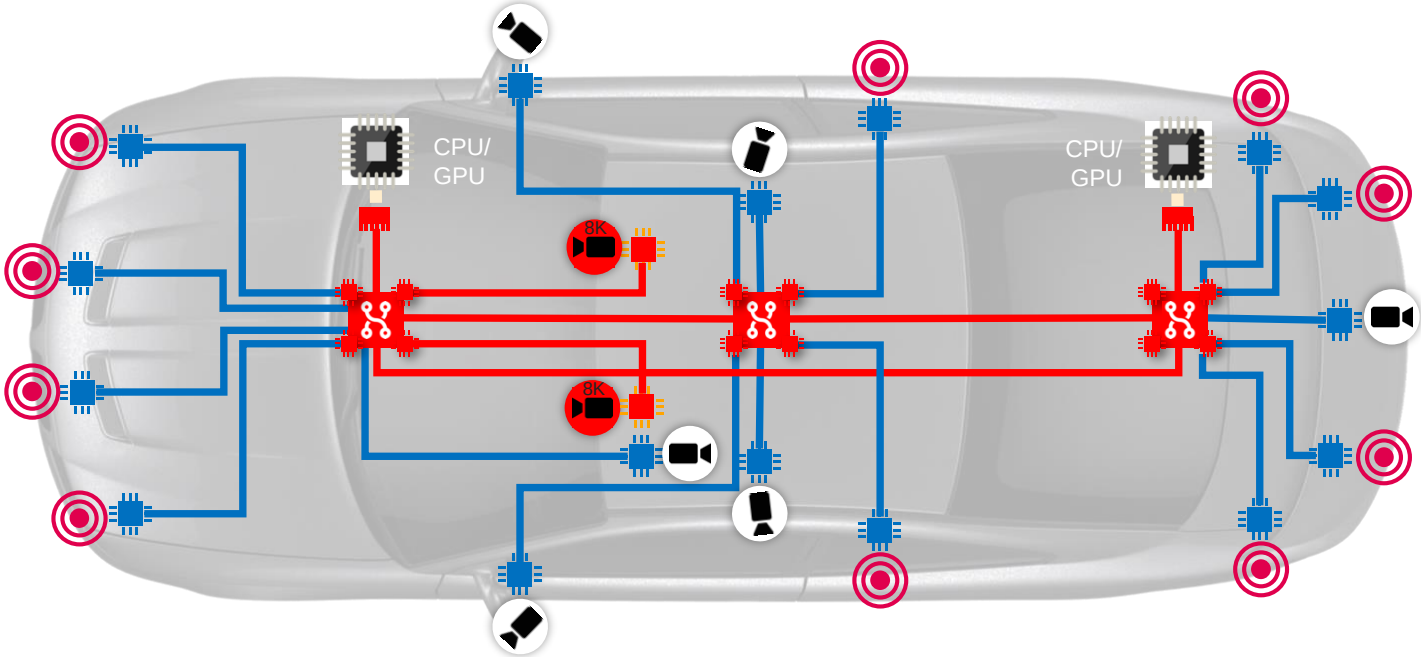


In-Vehicle-Network (IVN) for ADAS



802.3ch with 10Gbps should in some cases be sufficient for the whole car network

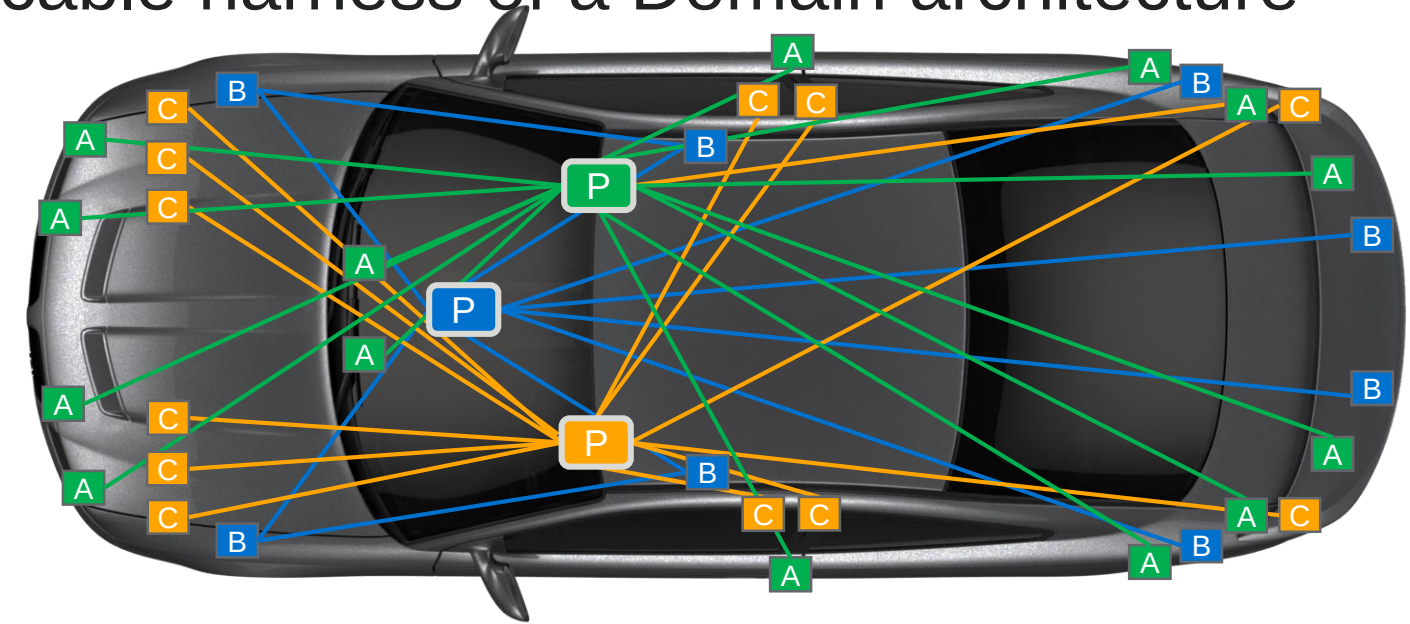
In-Vehicle-Network (IVN) for ADAS



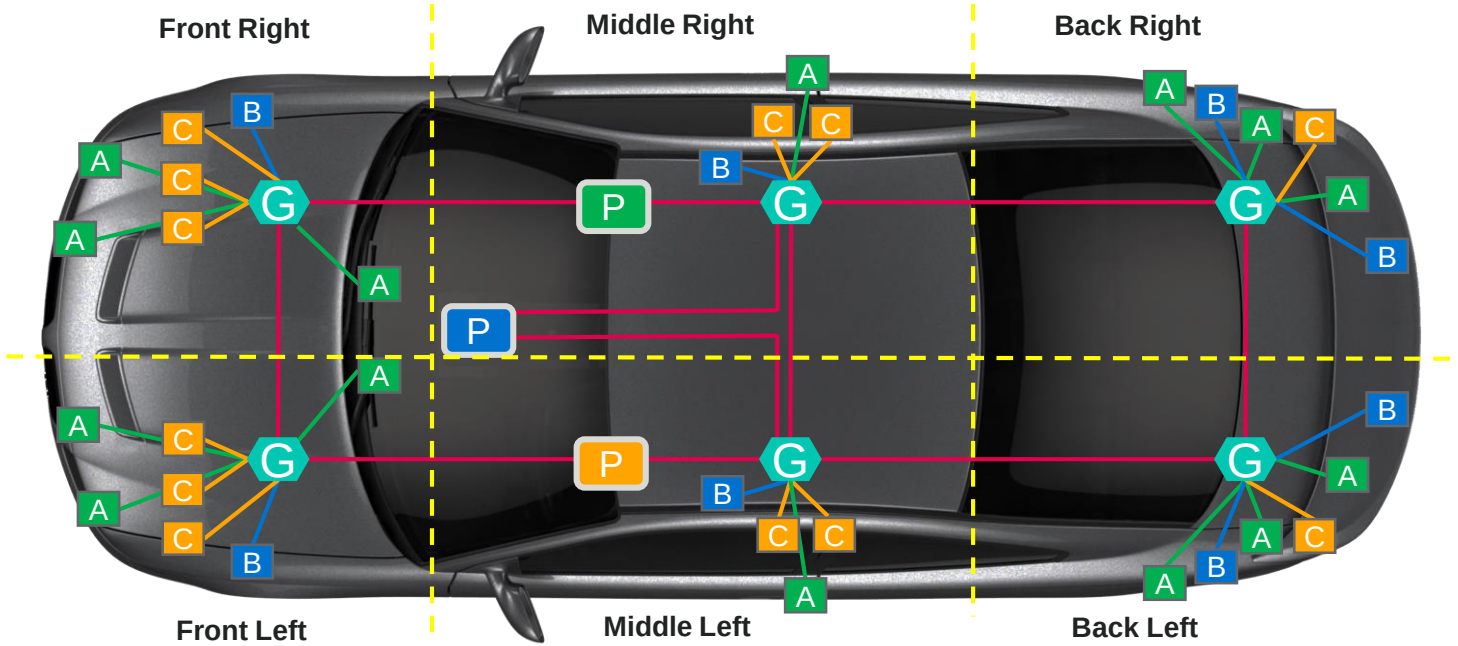
Cameras with high frame rate or resolution beyond 4K will need more than 10Gbps

Symmetric Use Cases

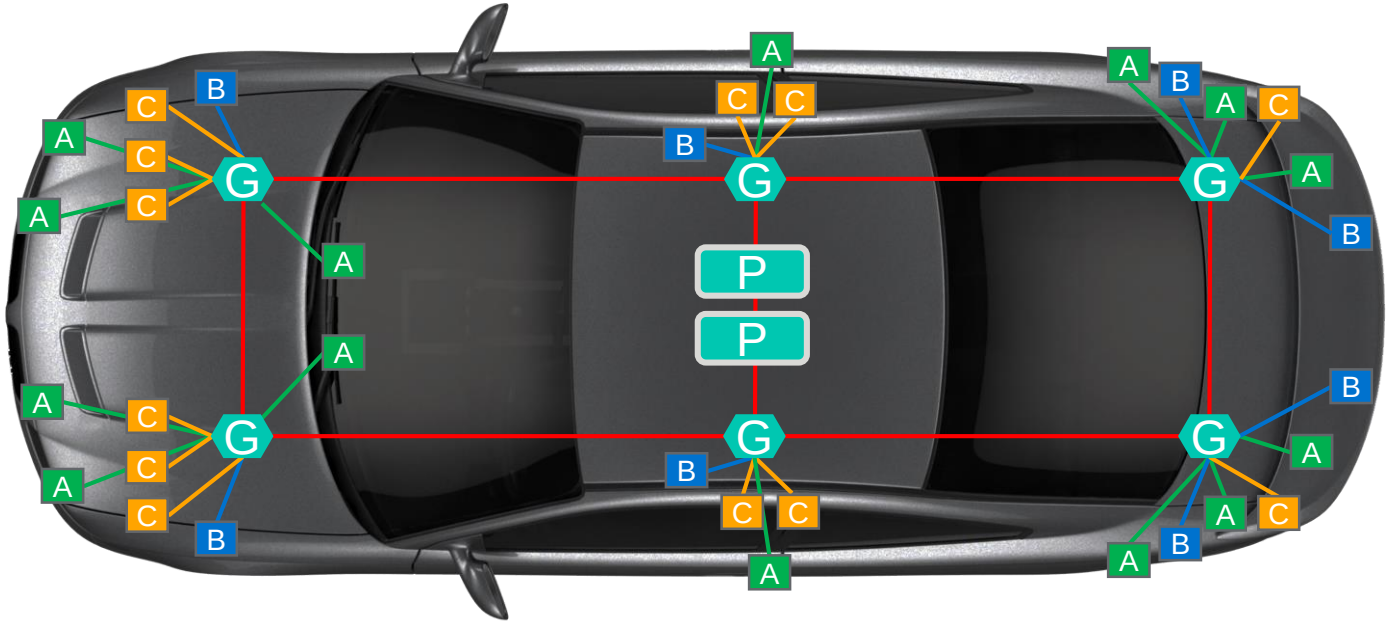
The motivation for Zonal architecture:
The cable harness of a Domain architecture



Zonal architecture IVN – Distributed domains

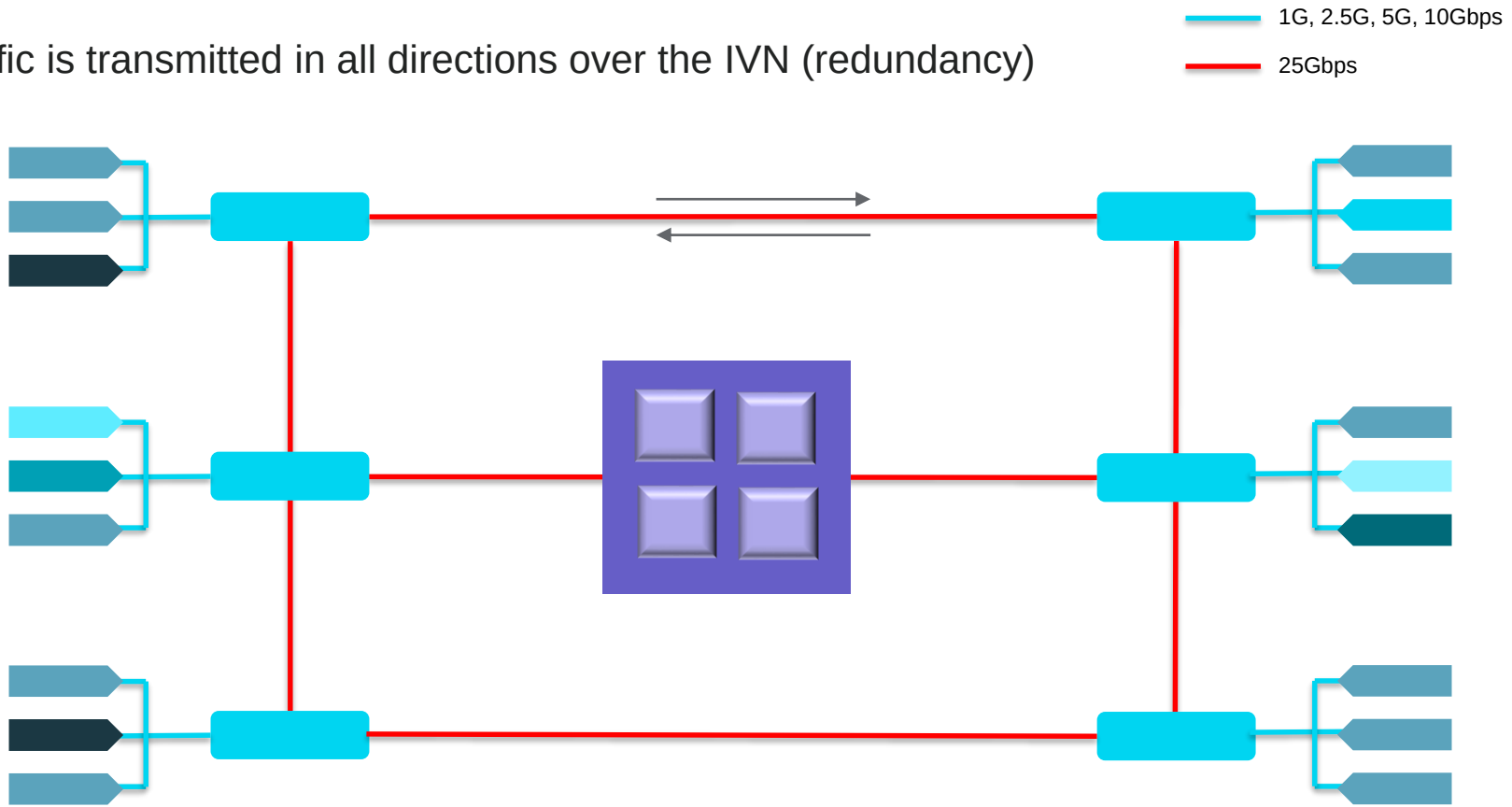


Zonal architecture IVN – Central processing

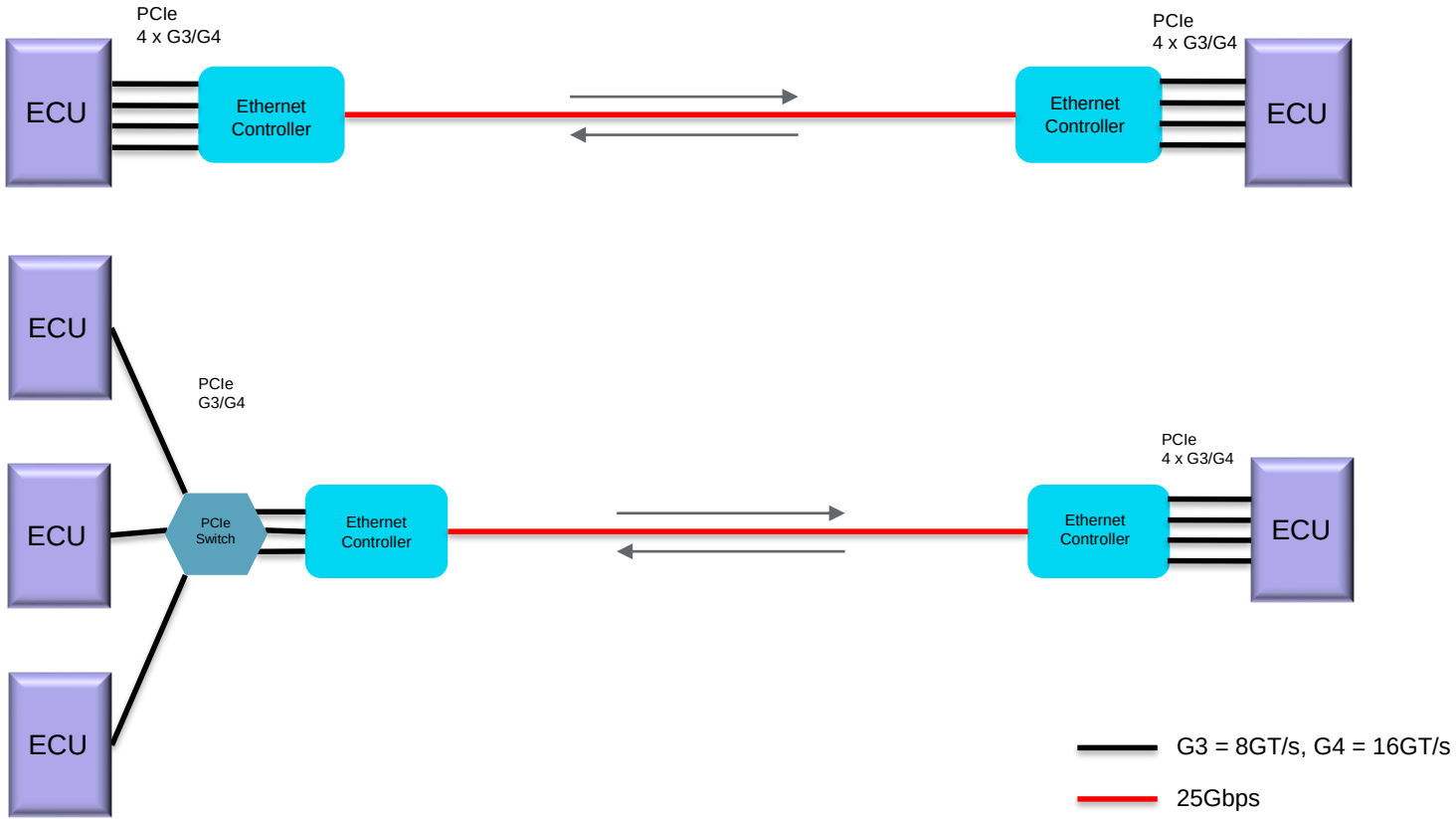


Symmetric: Zonal Architecture

Traffic is transmitted in all directions over the IVN (redundancy)

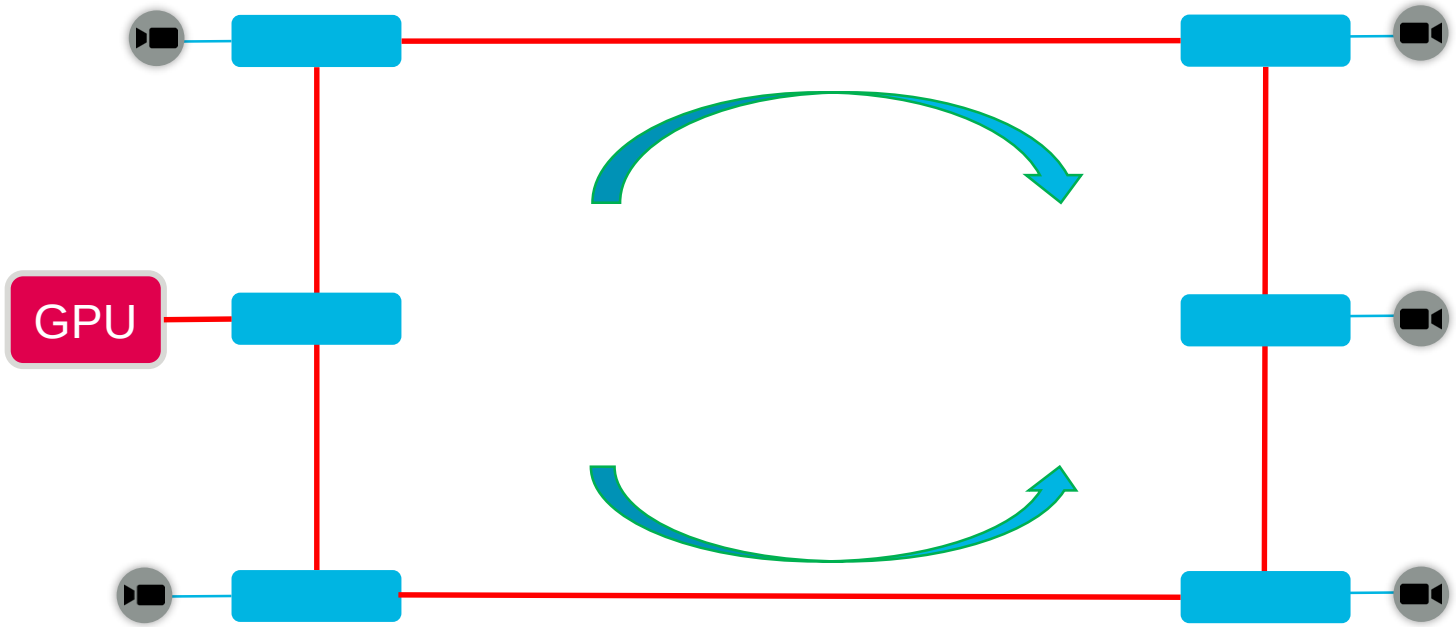


Symmetric: PCIe Tunneling Over Ethernet



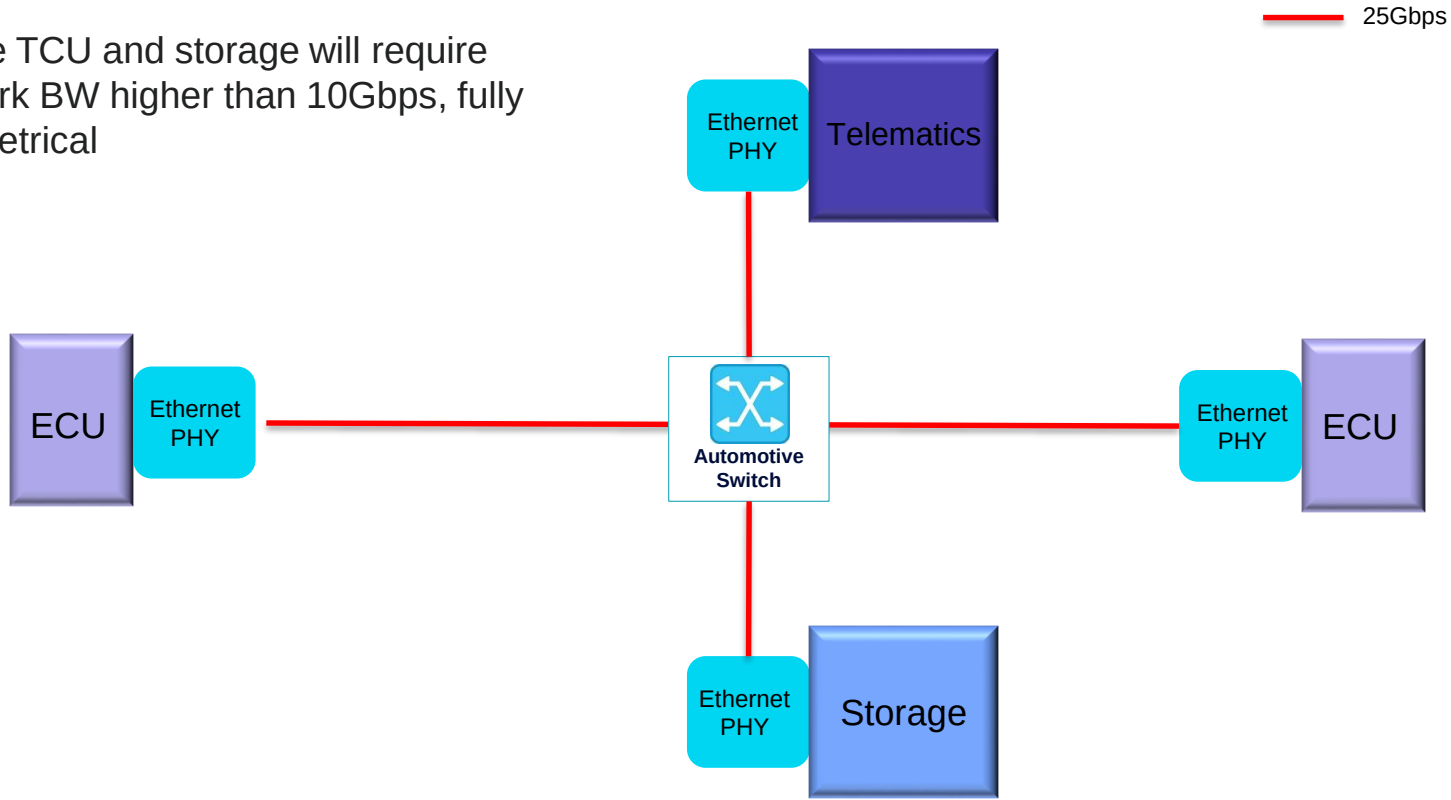
Symmetric: Ring Topology

Traffic can be transmitted in every direction in the ring (redundancy)

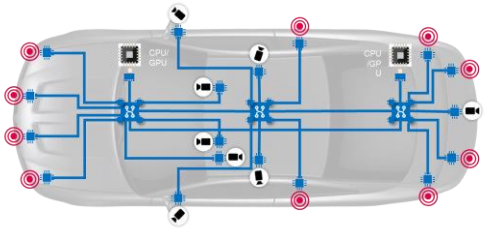


Symmetric: ECU, Storage, Telematics Over Ethernet

Future TCU and storage will require network BW higher than 10Gbps, fully symmetrical

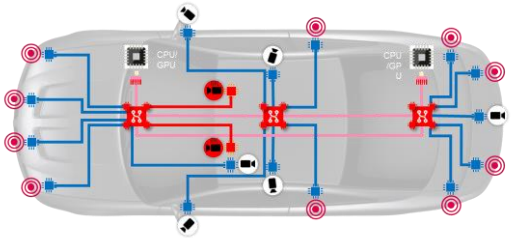


Summary



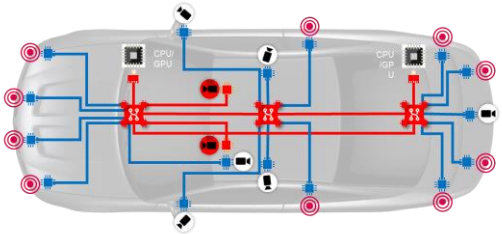
802.3ch

- Much of todays camera and sensor data can be handled by 802.3ch
- EEE makes this efficient for asymmetric data



802.3cy Asymmetric

- Some future camera systems will require data rates above 10Gbps
- Camera data traffic is asymmetric in nature



802.3cy Symmetric

- Aggregation and network backbone will need rates above 10Gbps in the future
- Backbone data traffic is symmetric in nature

Conclusion

802.3ch will be able to handle most use cases in the near future

Some camera connections may need asymmetric rates above 10G

Backbone and processor interconnections will need symmetric rates above 10G

While symmetric use cases will probably be more common for 802.3cy, it is important to also keep focus on asymmetric rates

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Thank You

Essential technology, done right™