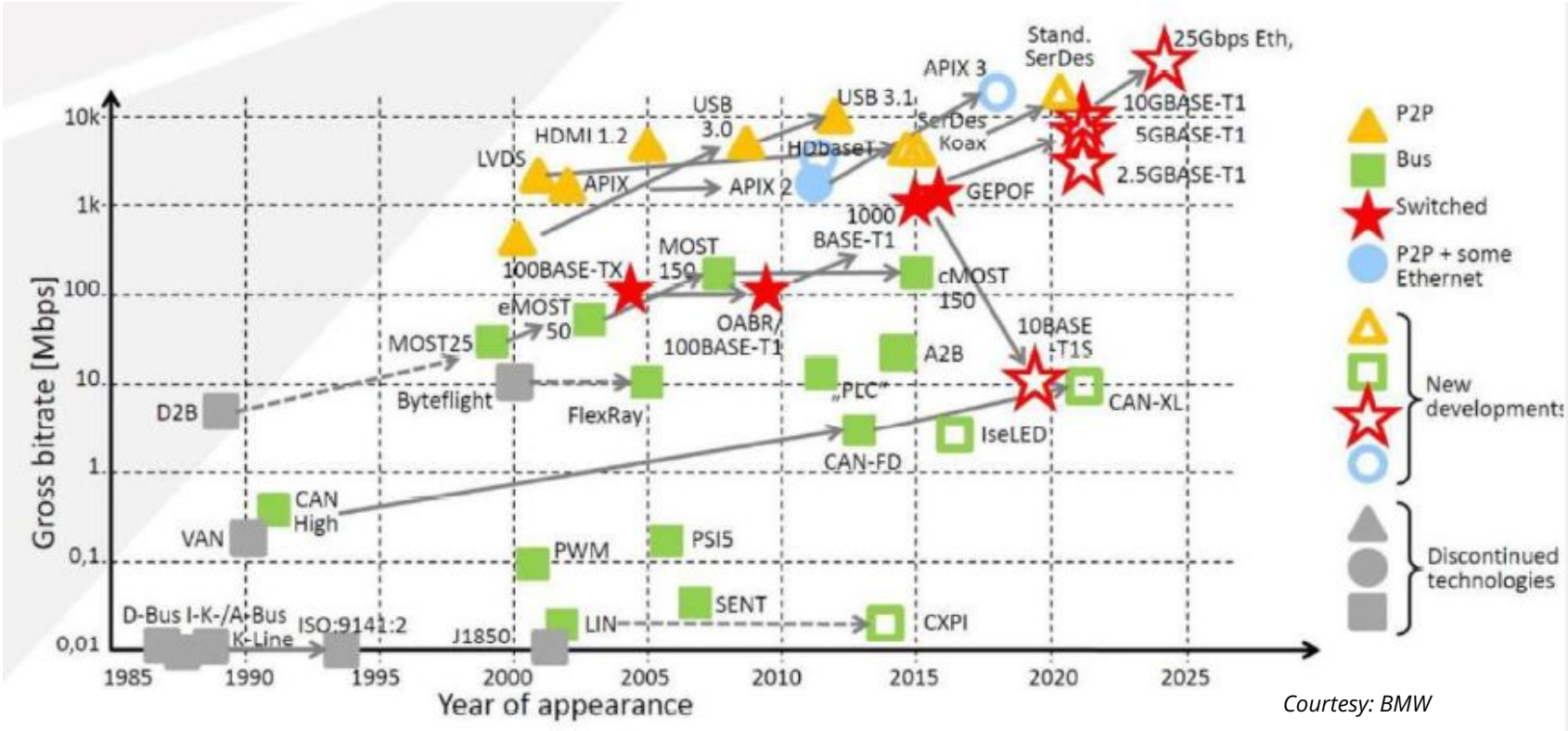
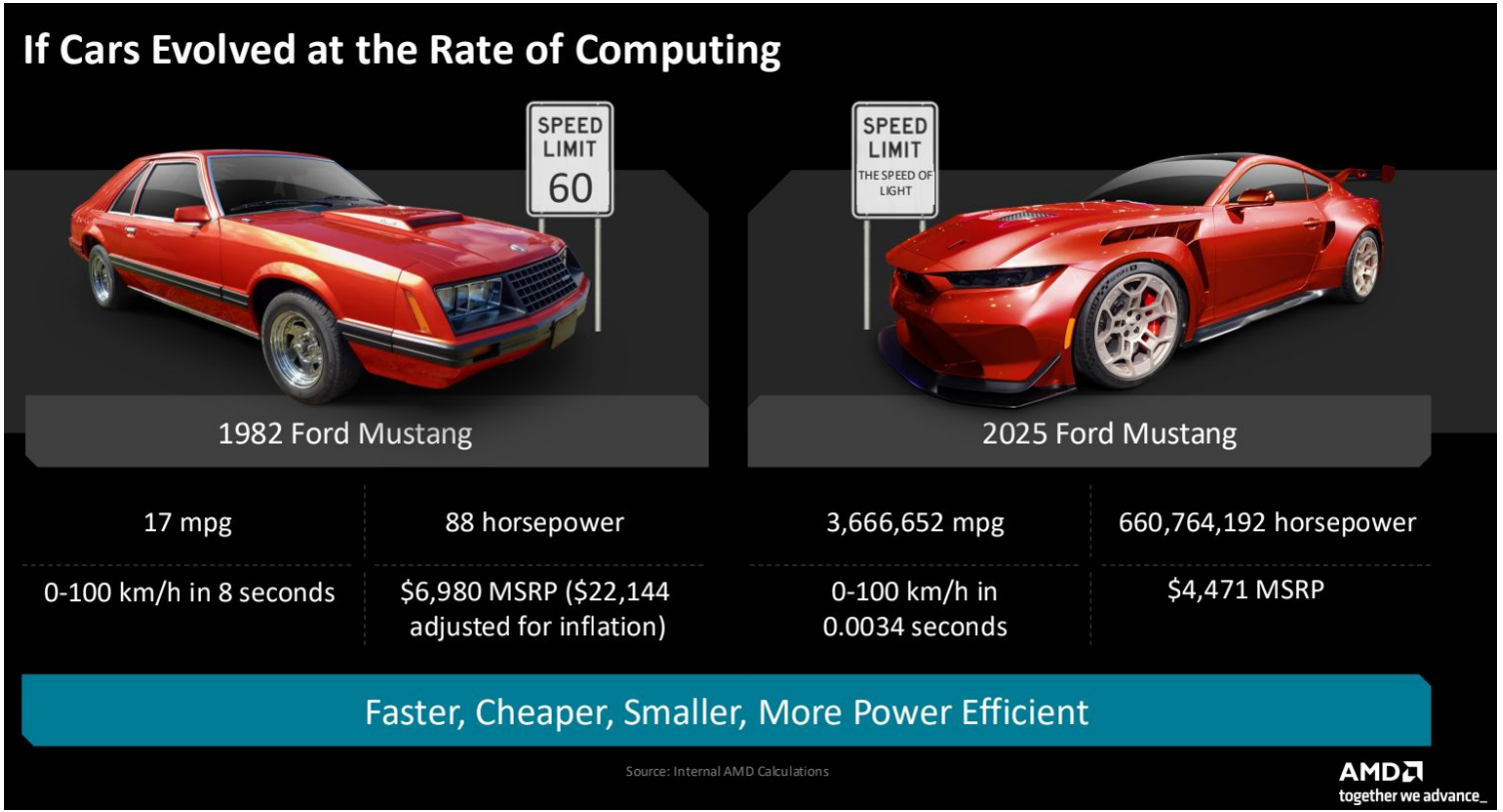
In-Vehicle Networking Needs More Bandwidth



Courtesy: BMW

Vehicles Increasingly are Defined by EE and SW

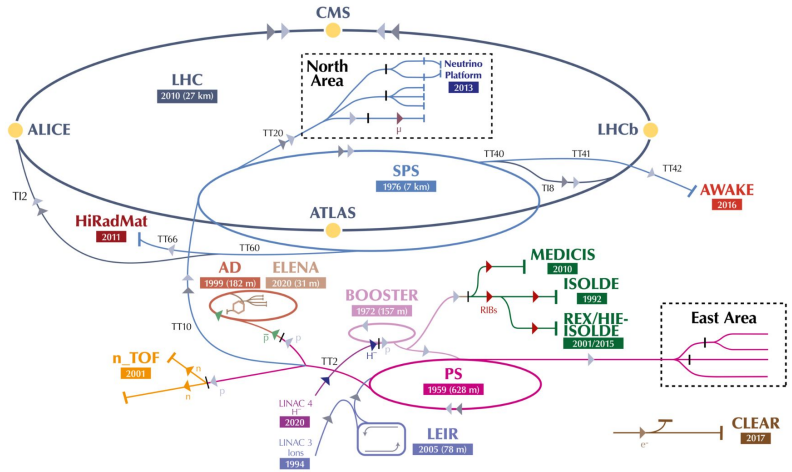


Courtesy: AMD

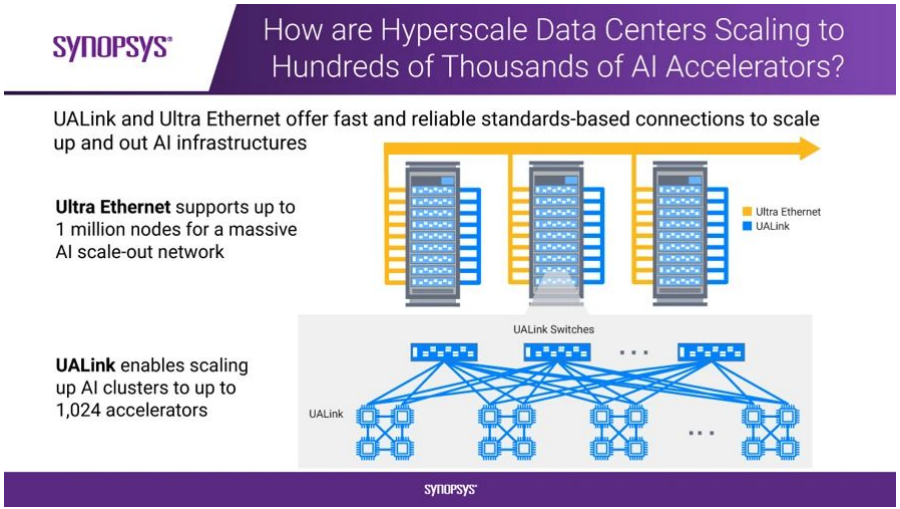
Adopt & Adapt from CERN, Datacenter, …

At Team MLE we “borrow” from many different domains and make this applicable for others.
Example is Auto/TSN where we take networking technology from CERN and from Datacenter.

CERN White Rabbit
High Accuracy Time Synchronization



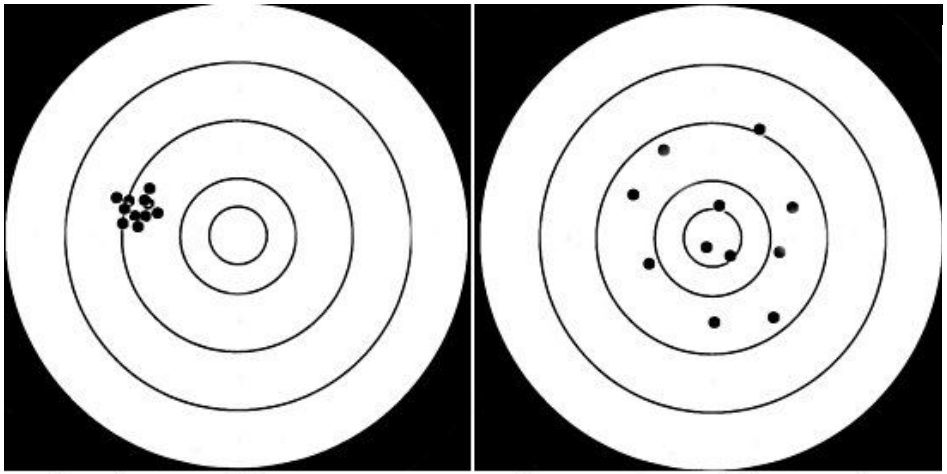
Low-Latency Datacenter Networking with Ultra Ethernet

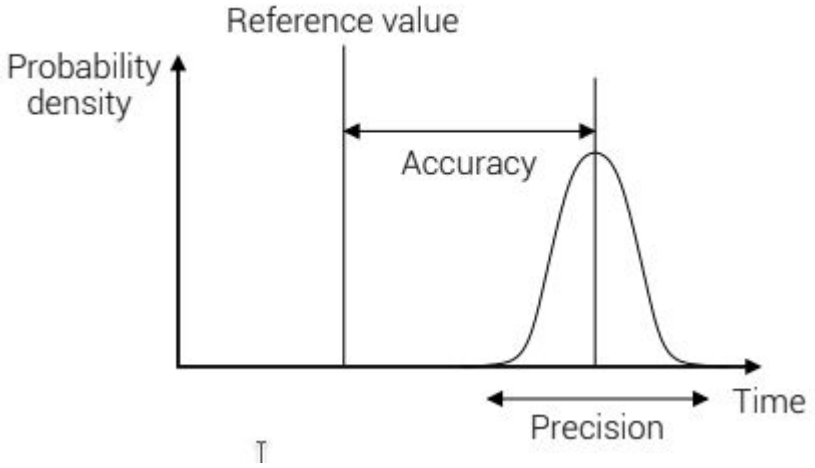


Accuracy vs Precision

White Rabbit aims for sub-nanosecond accuracy and picoseconds precision

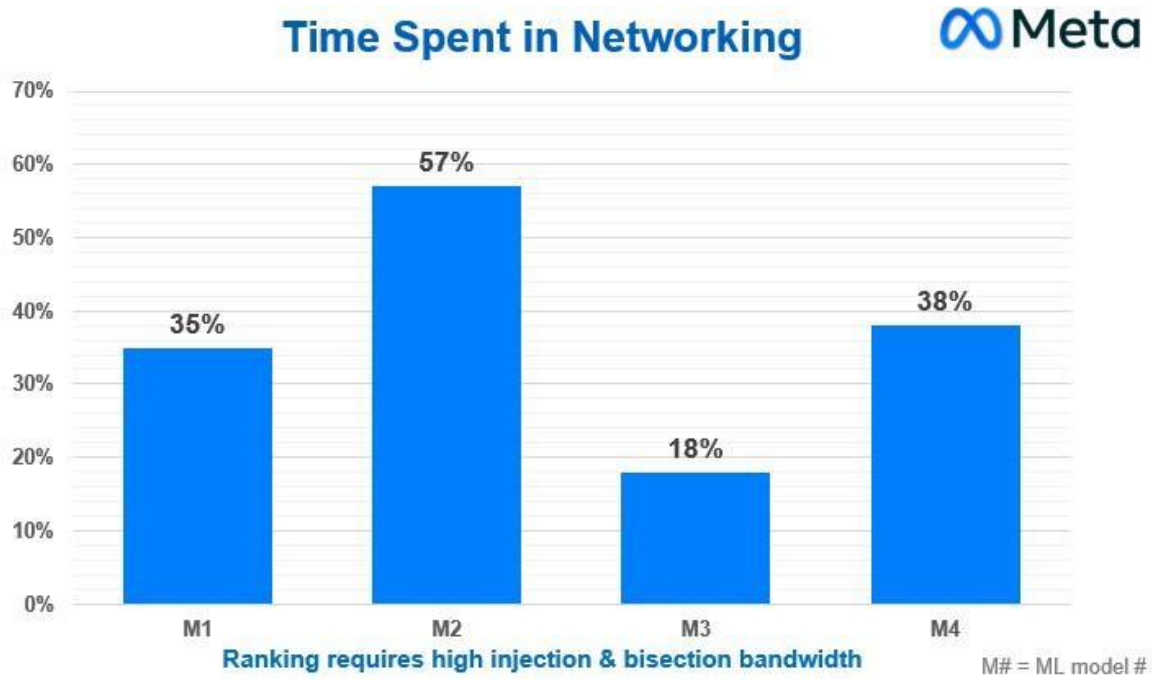
MLE “Light Rabbit”





Datacenter: Reduce Tail-End Latency

Do Not Waste Compute Cycles in $1B AI Clusters



A New Wave of Transport Layer Protocols?

Stanford University:

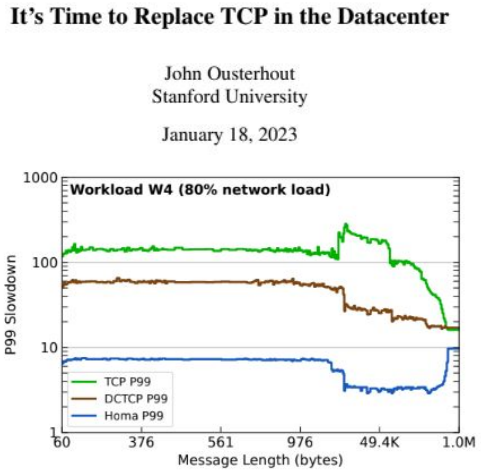
Homa

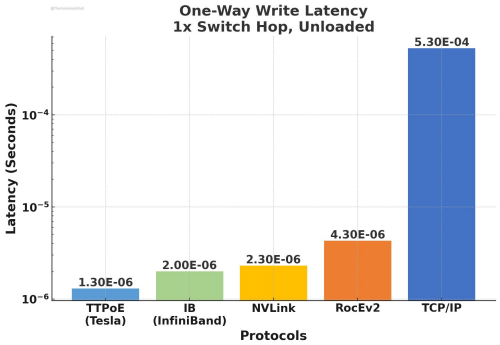
Tesla:

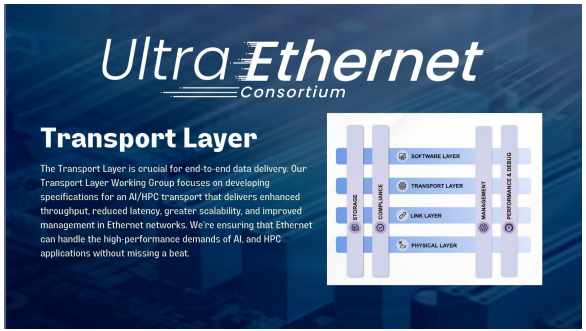
TTPoE

UltraEthernet Consortium:

UET

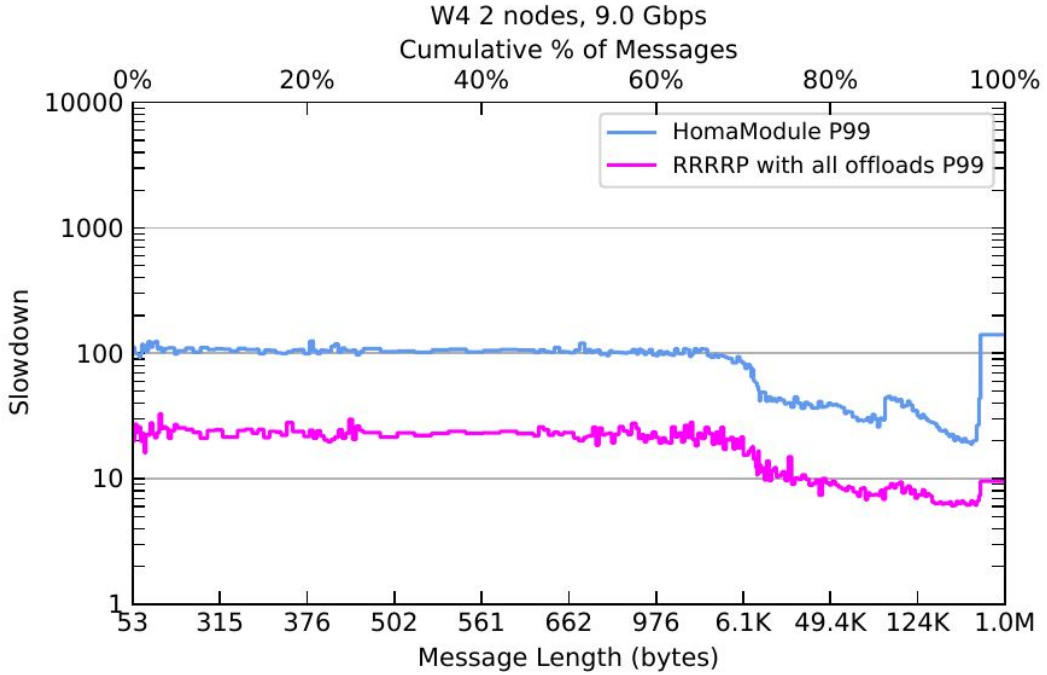






QRP - Reliable, Rapid Request-Response Protocol

- Reliable = Acknowledge receipt of Data
- Rapid = Connection-less and makes use of priorities
- Request-Response = Message based with Receiver-Diver Congestion Control
- MLE runs HOMA Protocol on Hardware Accelerator

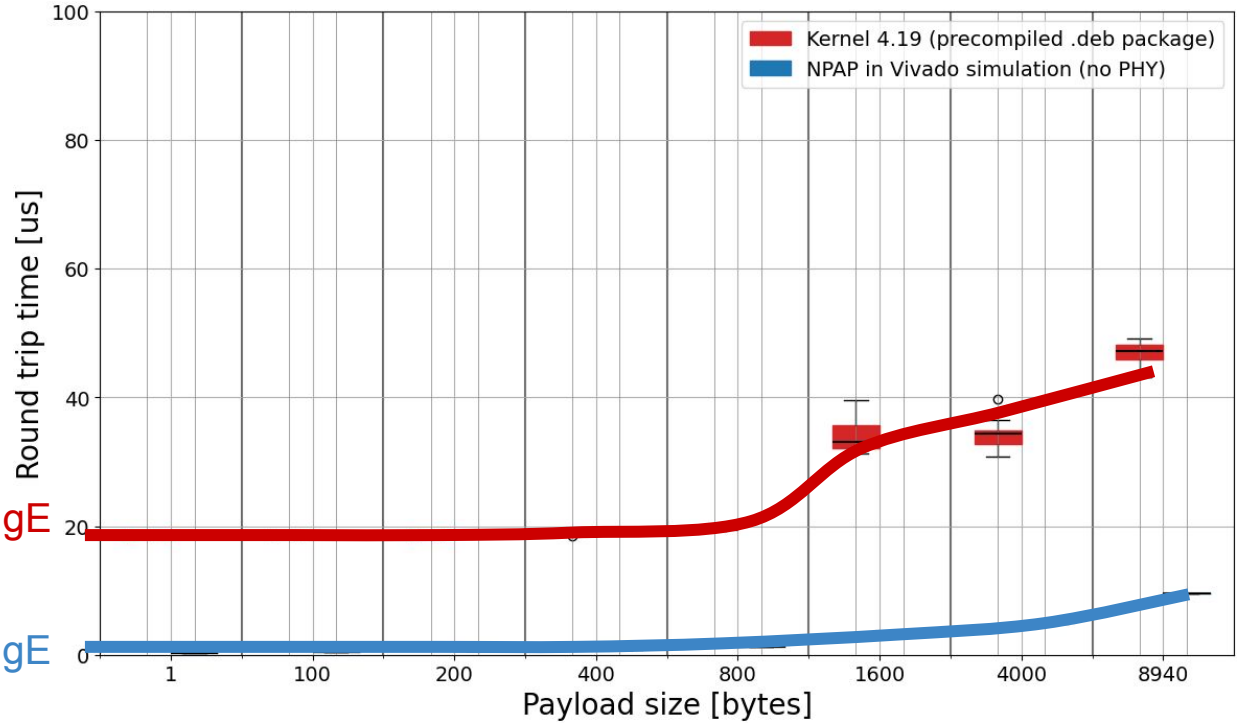


Effects of Hardware Acceleration

- Software (here Linux) means ongoing memory access, while modern memory behave non-deterministic (Caches!)
- Hardware (here FPGA) is very deterministic, stream-processing takes 10s of clock-cycles at 500 MHz

Linux-to-Linux via 10 GigE

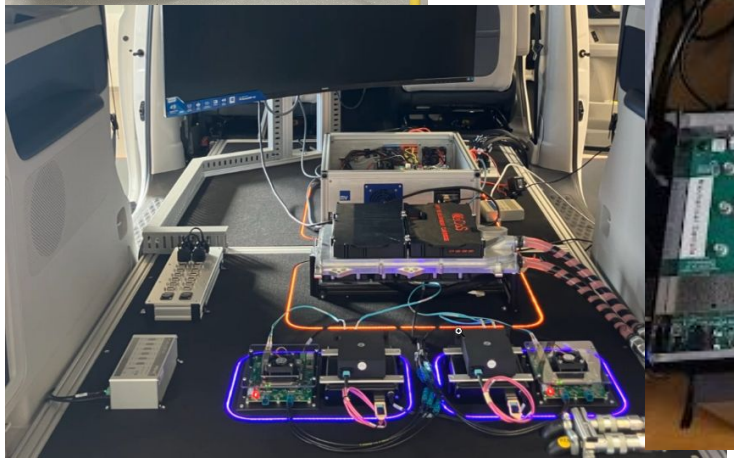
FPGA-to-FPGA via 10 GigE



Result: From Software to Silicon

Accelerating Automotive In-Vehicle Network Protocols for Zonal Architectures

Co-funded by MANNHEIM CeCaS



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