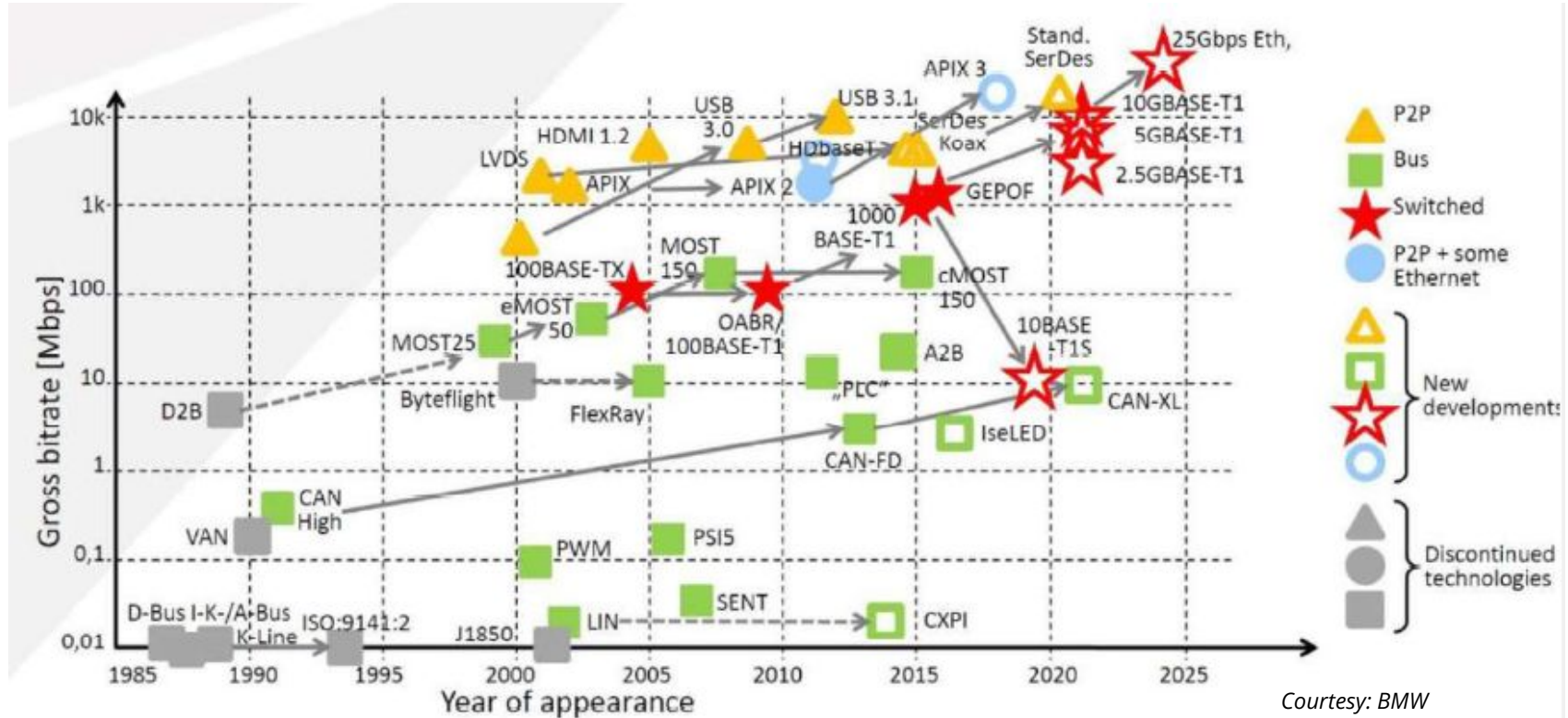


# In-Vehicle Networking Needs More Bandwidth



# Vehicles Increasingly are Defined by EE and SW

## If Cars Evolved at the Rate of Computing



1982 Ford Mustang

17 mpg

88 horsepower

0-100 km/h in 8 seconds

\$6,980 MSRP (\$22,144  
adjusted for inflation)



2025 Ford Mustang

3,666,652 mpg

660,764,192 horsepower

0-100 km/h in  
0.0034 seconds

\$4,471 MSRP

Faster, Cheaper, Smaller, More Power Efficient

Source: Internal AMD Calculations

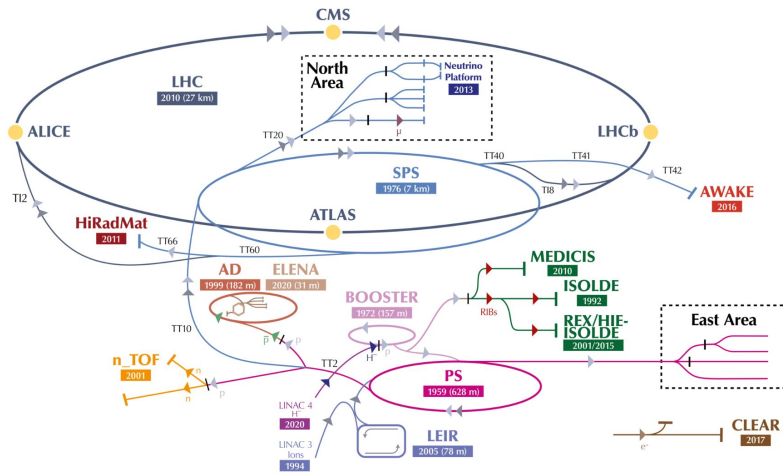
**AMD**  
together we advance.

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

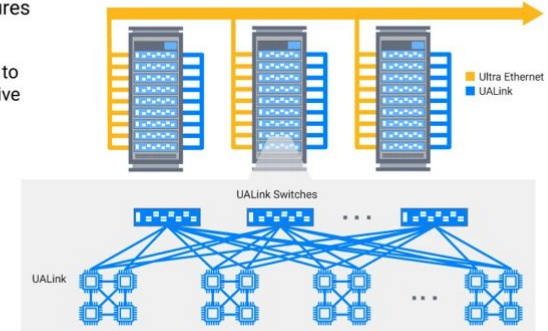
SYNOPSIS

How are Hyperscale Data Centers Scaling to  
Hundreds of Thousands of AI Accelerators?

UALink and Ultra Ethernet offer fast and reliable standards-based connections to scale  
up and out AI infrastructures

**Ultra Ethernet** supports up to  
1 million nodes for a massive  
AI scale-out network

**UALink** enables scaling  
up AI clusters to up to  
1,024 accelerators

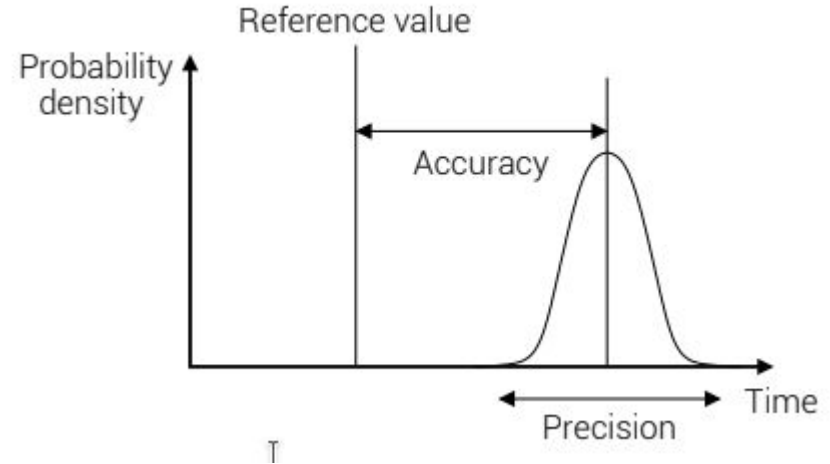
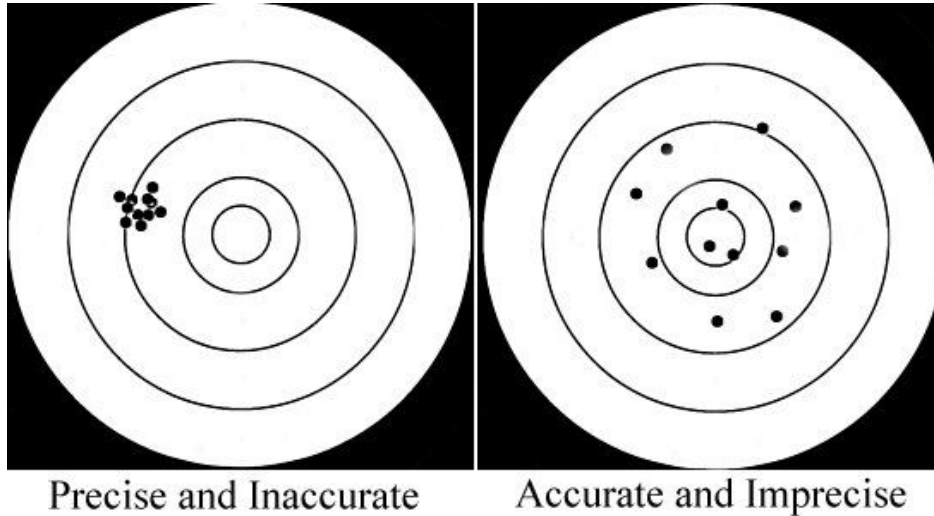


SYNOPSIS

# Accuracy vs Precision

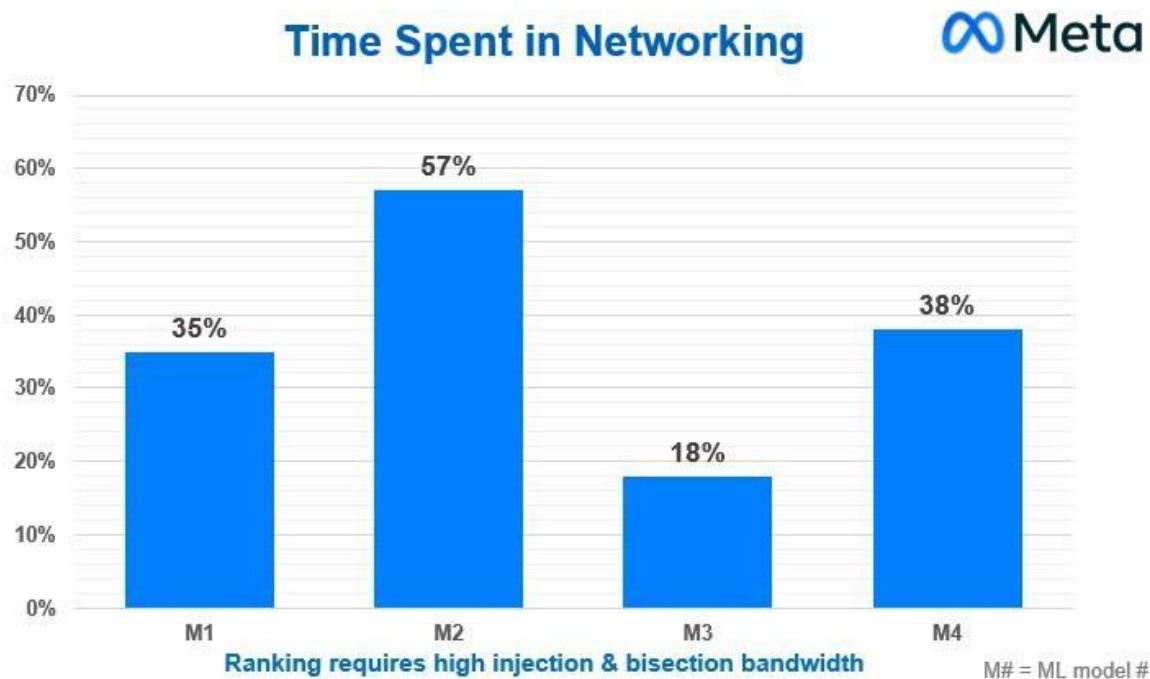
White Rabbit aims for sub-nanosecond accuracy and picoseconds precision

MLE “Light Rabbit”



# Datacenter: Reduce Tail-End Latency

Do Not Waste Compute Cycles in \$1B AI Clusters



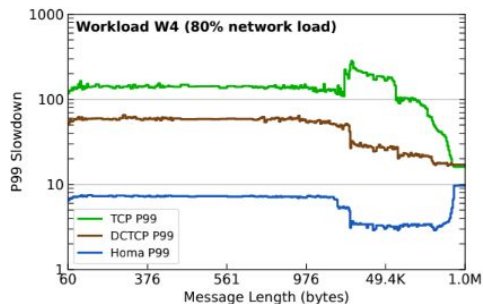
# A New Wave of Transport Layer Protocols?

Stanford University:

Homa

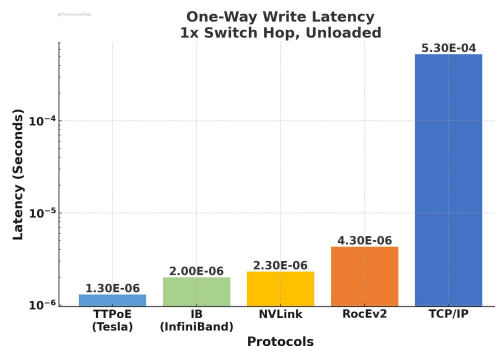
It's Time to Replace TCP in the Datacenter

John Ousterhout  
Stanford University  
January 18, 2023



Tesla:

TTPoE



UltraEthernet Consortium:

UET

**Ultra Ethernet Consortium**

### Transport Layer

The Transport Layer is crucial for end-to-end data delivery. Our Transport Layer Working Group focuses on developing specifications for an AI/HPC transport that delivers enhanced throughput, reduced latency, greater scalability, and improved management in Ethernet networks. We're ensuring that Ethernet can handle the high-performance demands of AI and HPC applications without missing a beat.

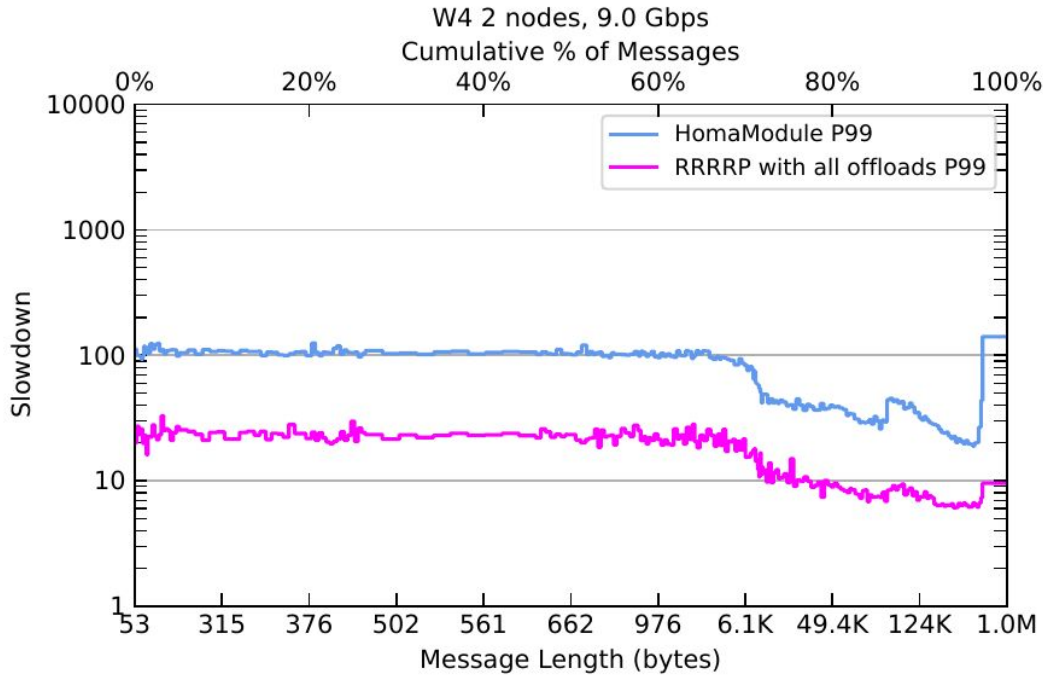
Diagram illustrating the Ultra Ethernet architecture layers:

- SOFTWARE LAYER
- TRANSPORT LAYER
- LINK LAYER
- PHYSICAL LAYER

Associated components: MANAGEMENT, PERFORMANCE & DEBUG

# QRP - Reliable, Rapid Request-Response Protocol

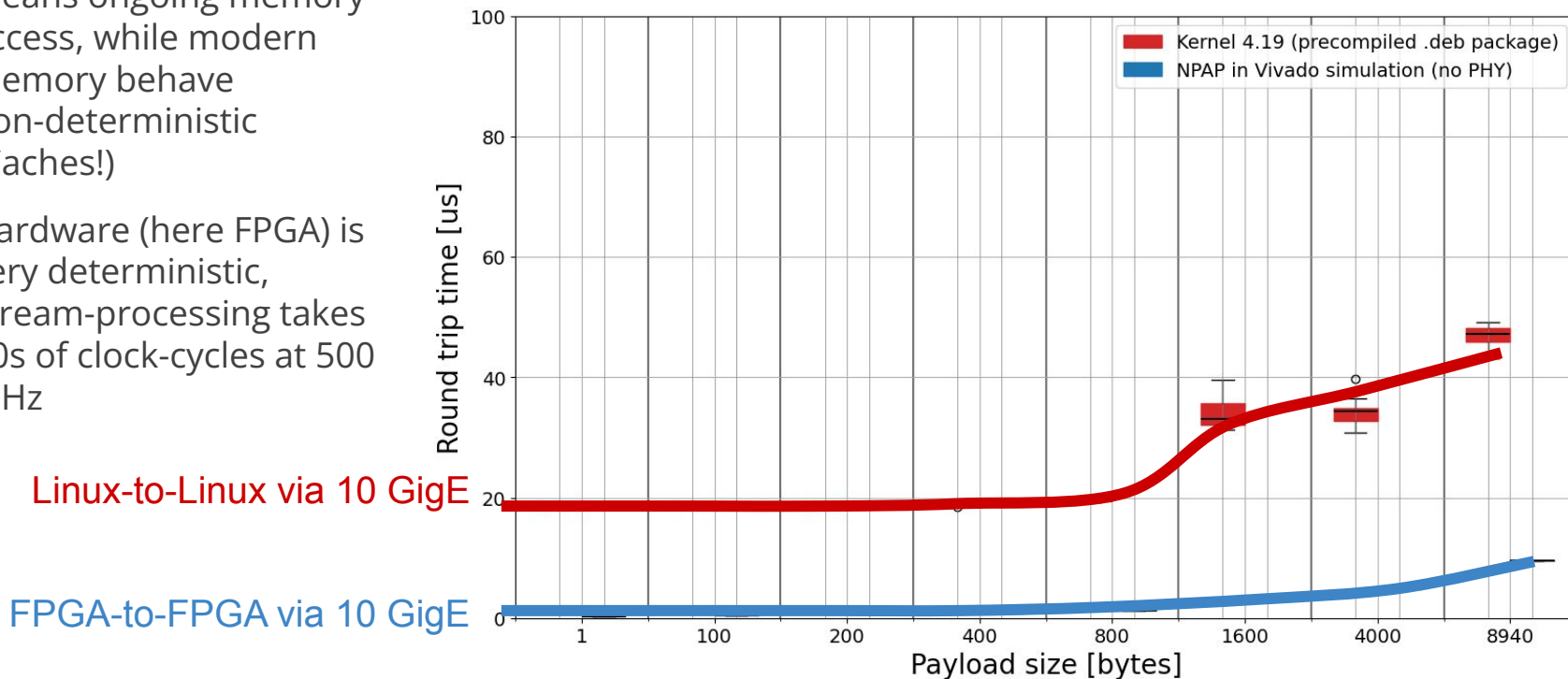
- Reliable = Acknowledge receipt of Data
- Rapid = Connection-less and makes use of priorities
- Request-Response = Message based with Receiver-Diver Congestion Control
- MLE runs HOMA Protocol on Hardware Accelerator





# 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





# Result: From Software to Silicon

Accelerating Automotive In-Vehicle Network Protocols for Zonal Architectures

Co-funded by MANNHEIM CeCaS



# Contact Infos



Endric Schubert, Ph.D.  
CTO & Co-Founder  
[endric@MLEcorp.com](mailto:endric@MLEcorp.com)  
+1 (408) 320-6139  
+49 (151) 2332-0516

Missing Link Electronics, Inc.  
2880 Zanker Rd, Suite 203  
San Jose, CA 95134, USA

Universität Ulm  
Institut für Mikroelektronik  
Albert-Einstein-Allee 43  
89081 Ulm, Germany