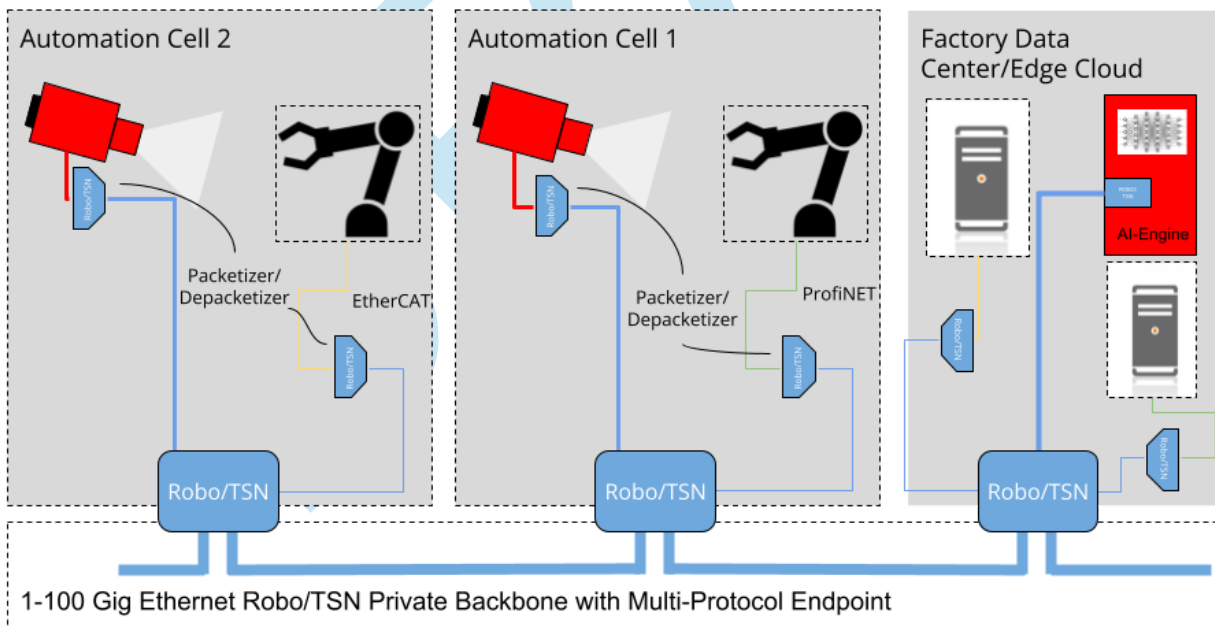


Artificial Intelligence algorithms and machine vision with high-resolutions and fast frame-rates continue to drive towards higher bandwidth demands in real-time industrial networks.

Under the working title “Robo/TSN”, MLE and partners have developed open standards technology for multi-Gigabit TSN (Time Sensitive Networking). Solutions include endpoints, switched endpoints and SmartNICs to enhance existing infrastructure to 100 Gbps. Use cases are:

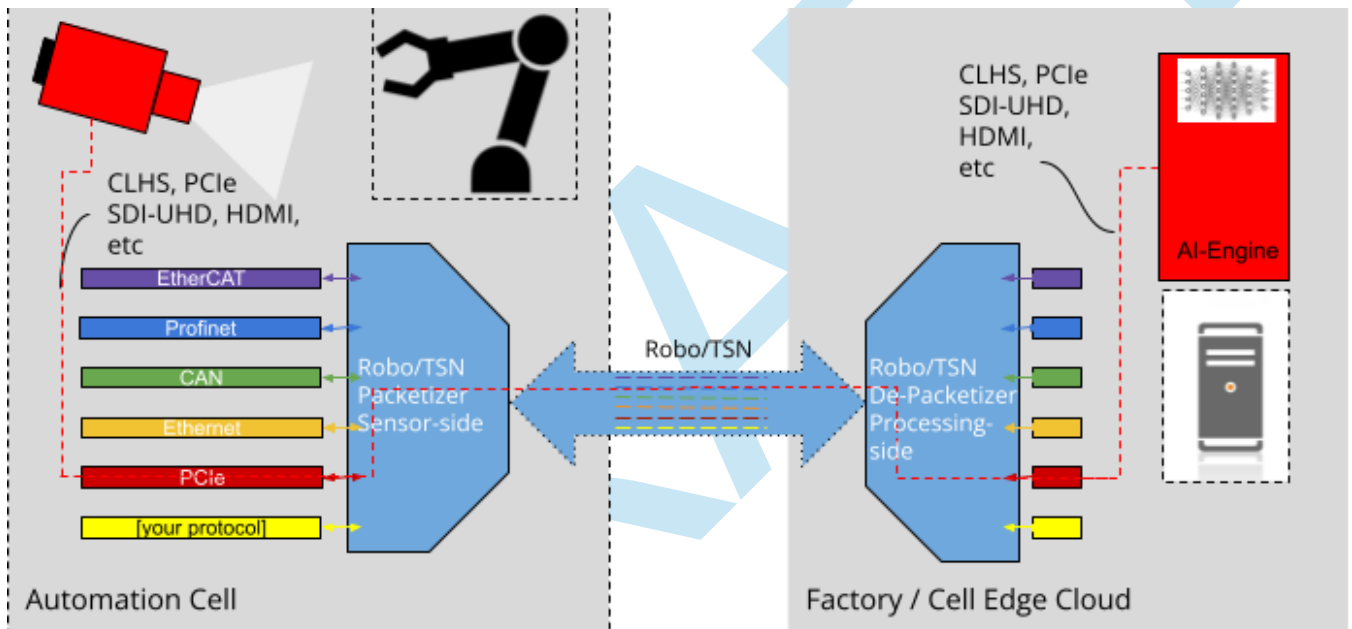
- Connect high speed sensors in the field with AI engines in edge cloud data centers.
- Tunnel multiple protocols such as PCIe, MIPI CSI-2, GMSL, field buses like Ethercat or Profinet via virtual connections over high-speed TSN.
- Transparent connection of sensors and actuators from automation cells to AI engines and/or virtualized/software PLCs in edge cloud data centers via high-speed TSN.
- Tunnel field bus protocols from the automation cell through the TSN backbone to your edge cloud/ data center and integrate e.g. an AI engine as a field Bus slave providing control data to the Field Devices.
- Offload computing and controlling/ PLC tasks to edge cloud/ data center infrastructure with all advantages like virtualization, containerization, redundancy, backup organization etc. and without any compromises concerning real-time and high-speed requirements.
- Use all advantages imaginable by having a high speed time sensitive network through the whole production plant.



MLE offers TSN for Industrial Multi-Gigabit Ethernet!

AI and videos need high data rates and are breaking industrial networking. In industrial environments and control technology, real time requirements are common practice. Since camera technology, image recognition or AI become more and more usual, hard real time requirements combine with extremely high data rates. SoA Sensors provide up to 25 Gbps data which has to be transferred, processed and evaluated real time with reliable low latency.

MLE's backbone-oriented approach allows it to tunnel modern multi-Gig sensor data (GigEVision, PCIe, MIPI CSI-2, GMSL, ...) as well as industrial protocols like Ethercat or Profinet. Robo/TSN builds on patented and patent pending technology from MLE (US Patent Nos. 9,209,828 10,708,199 10,848,442 11,356,388 11,695,708, other Patents Pending).



Application Example: Bridging of PCI Express connection through High Speed Ethernet TSN via ROBO/TSN Packetizer/ Depacketizer Devices

Features and Benefits

Bridging/ Tunneling of several protocols like PCIe, Ethercat, Profinet, Ethernet, CAN, etc.

Scalable from 1 to 100 Gbps

Precision time synchronization with IEEE TSN or IEEE 1588 v2 (CERN White Rabbit)

Hardware accelerated deterministic transport with Ultra Low Latency (RTT < 600 ns)

Reliable transports via TCP/IP and/or Quad-RP/IP

Optional security features MACsec, IPSec, TLS

Real-time Compliance

Time Sync IEEE 802.1AS (IEEE 1588 profile)

- Bounded Low Latency

IEEE 802.1Qav Credit Based Traffic Shaper

IEEE 802.1Qbu / 802.3br Preemption

IEEE 802.1Qbv Scheduled Traffic

IEEE 802.1Qcr Async Traffic Shaping

- Reliability: IEEE 802.1Qca Path Control,

IEEE 802.1CB Frame Replication & Elim.

- Dedicated Resources & API

IEEE 802.1Qat Stream Reservation

IEEE 802.1Qcc TSN Config

IEEE 802.1CS Link-Local Reservation

Missing Link Electronics (MLE)

We are experts in Data-in-Motion systems with high-speed I/O connectivity and acceleration of data communication protocols as they are, for example, used in industrial control, networking, storage and audio/video processing. We have been opening up FPGA technology for high-speed analog applications, and have been driving the integration and optimization of Open Source Linux and Android software stacks on modern heterogeneous processing architectures. This is complemented by our expertise in Functional Safety and Security / Trusted Execution (OP-TEE).



Deliverables and Options

Pre-configured SmartNIC PCIe-Card, ready-to-run

Linux device drivers (GPL sources)

Application-specific expert design service

Appliance implementation

License for ASIC/ FPGA Full System Stack

Contact Information

Robo/TSN is available under MLE's Early Access Program to end-users and development partners

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