

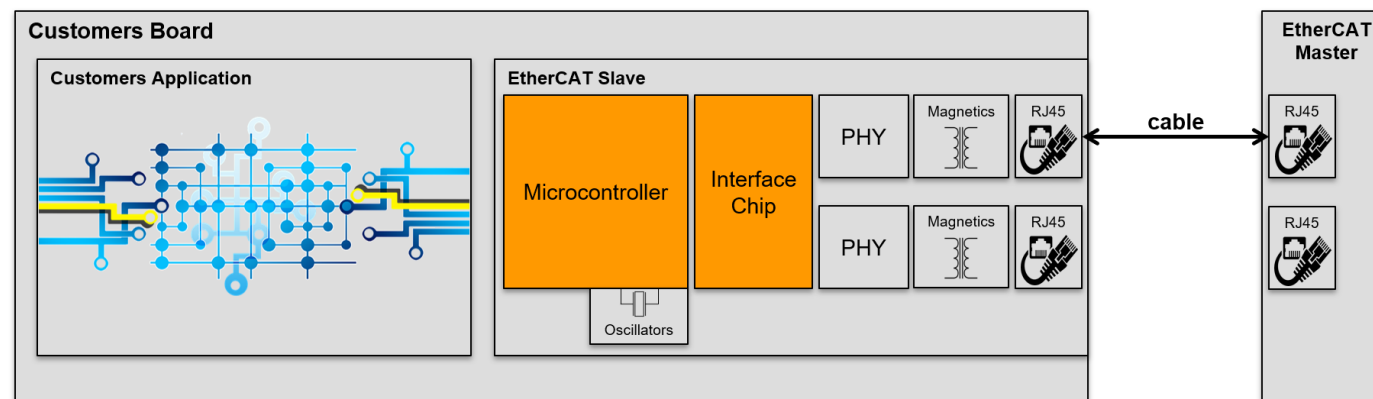
# Industrial Communication

## Agenda


1. Industrial Communication Introduction
2. RUTRONIK Arduino Shield: RutAdaptBoard-HMS
3. Time-Sensitive Networking (TSN)
  - Toshiba TC9562
  - Intel I225
4. Further Information about TSN

# Industrial Communication Introduction

## Discrete – EtherCAT – Coverage



### 1. Choose the coverage you need

Master	Slave	PEC
PCI-1203 	XMC4300 	C40 
	XMC4800 	B40 
	M40 	
		Magnetics
		Cables
		Oscillators
		Connectors

### 2. Select the tool





## RutAdaptBoard-HMS

### Features:

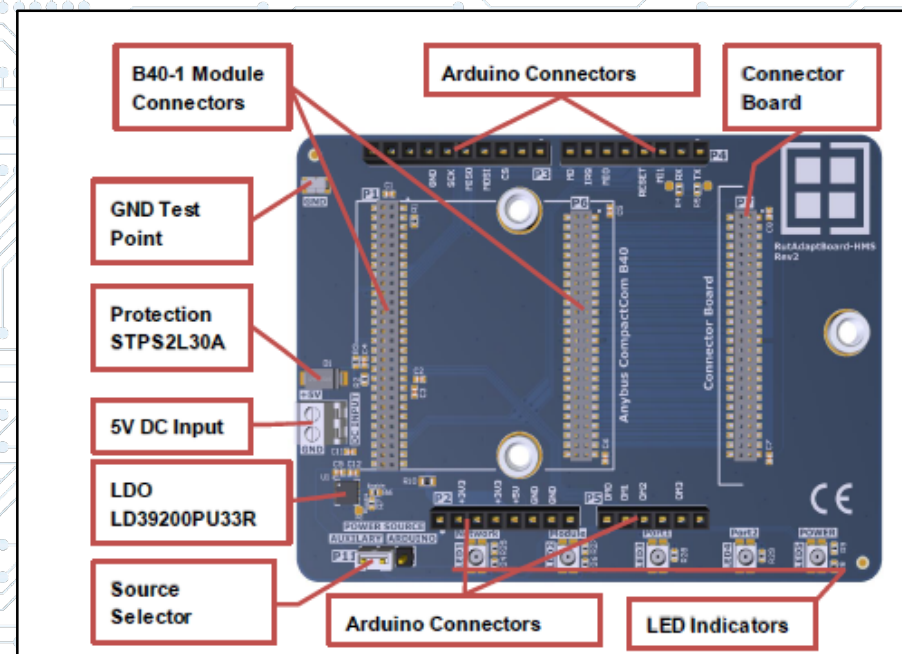
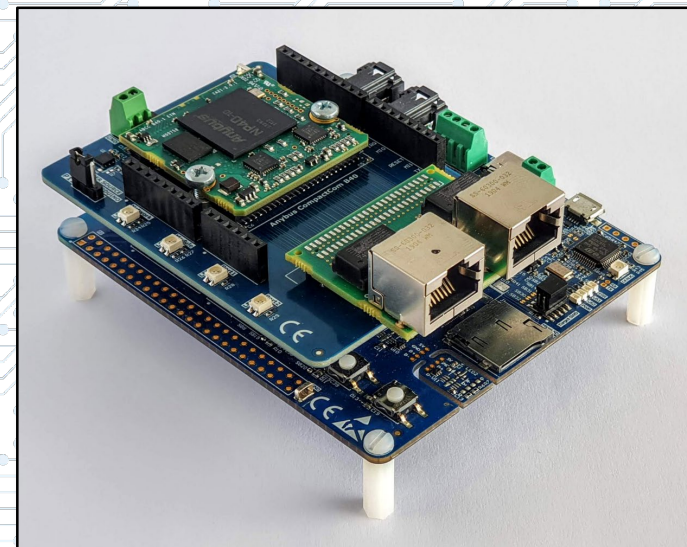
- Arduino Connectors
- Connection for HMS Anybus Brick „B40“
- Connection for HMS „Connector Board“
- Full integration of all Industrial Ethernet / Fieldbus protocols, which are supported by HMS
- Software support for STM32L5 as host-MCU available

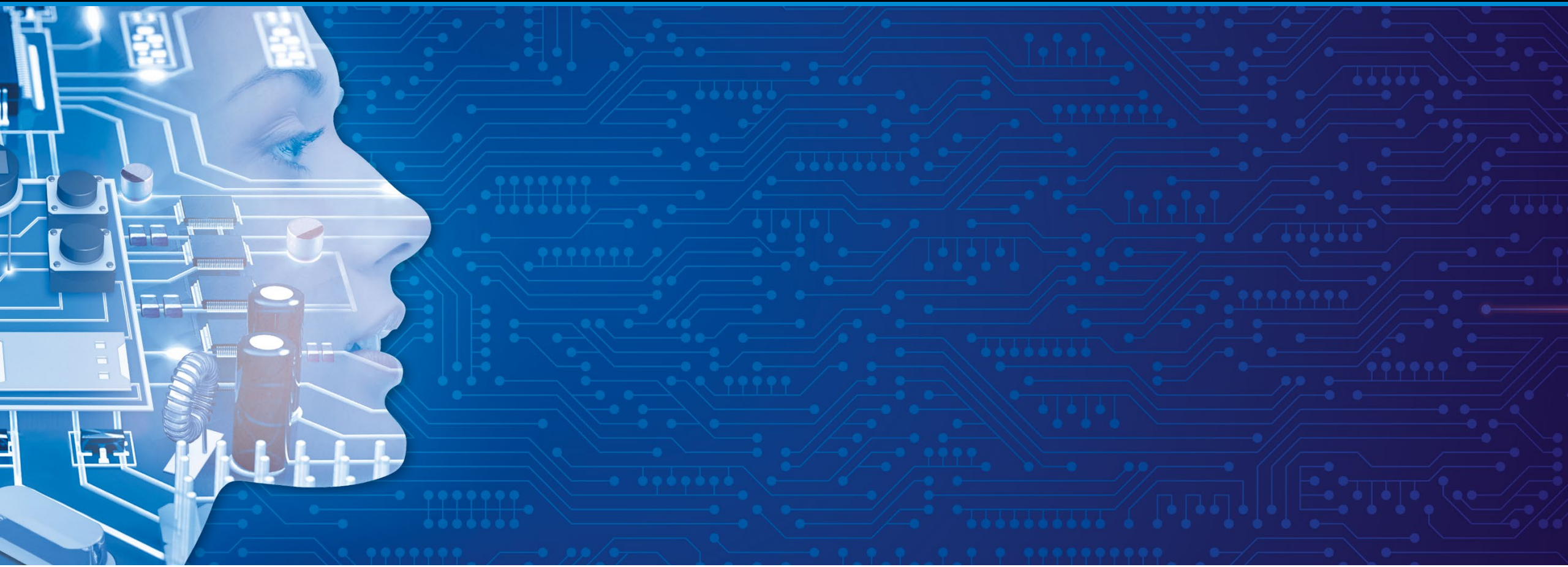


**B40**



**Connector Board**





# TSN – Time-Sensitive Networking

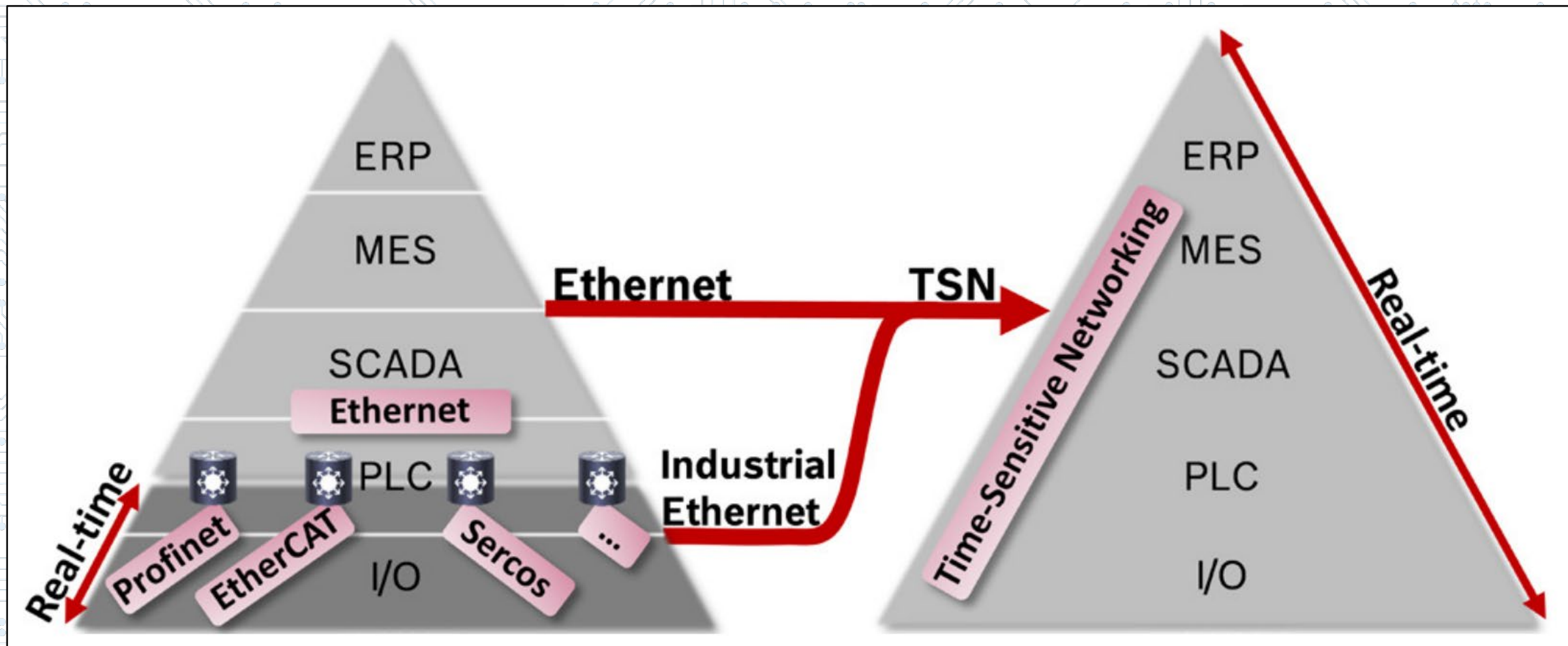


## TSN Introduction

**TSN (Time-sensitive networking) is an attempt to standardize different protocols in the field of industrial Ethernet. Previous systems can be upgraded**

- The trend is moving further and further away from conventional fieldbuses towards Industrial Ethernet
- Ethernet is increasingly used in the lower layers of the network pyramid
- TSN will replace in long term a wide range of Industrial Ethernet protocols and Fieldbus Systems
- In order to implement TSN, real-time capability must be guaranteed. Several IEEE standards has been defined to achieve this goal

## TSN Introduction – Network Pyramide



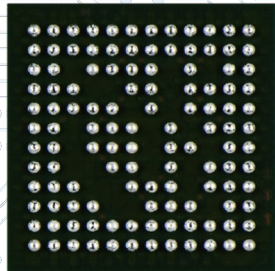


## Available Rutronik Solutions:

### Toshiba TC9562

**TOSHIBA**

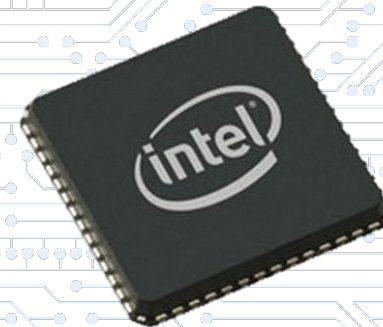
- ARM Cortex-M3 Core (187MHz)
- Off-loading host SoC (e.g. gPTP or IP acceleration)
- PCIe Gen2 (5Gt/s) – Host interface
- HW Support for Ethernet AVB/TSN
- Flexible PHY interface



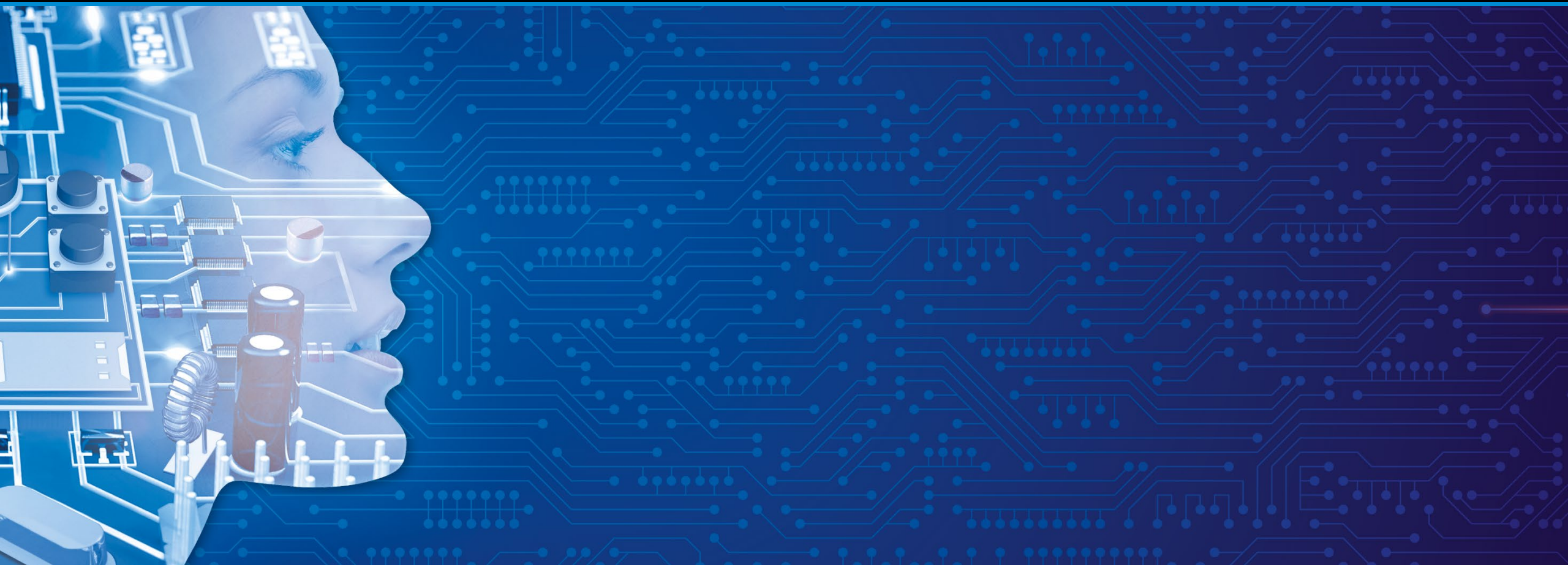
### Intel I225

**intel**

- PCI Express 3.1 (5GT/s) x1 host interface
- MDI (Copper) standard IEEE 802.3 Ethernet interface up to 2.5Gb/s<sup>1</sup>
- Time Sensitive Networking (TSN) capability support
- Innovative power management features
- Support for Intel® Active Management Technology on systems enabled with Intel vPro® technology







Toshiba TC9562

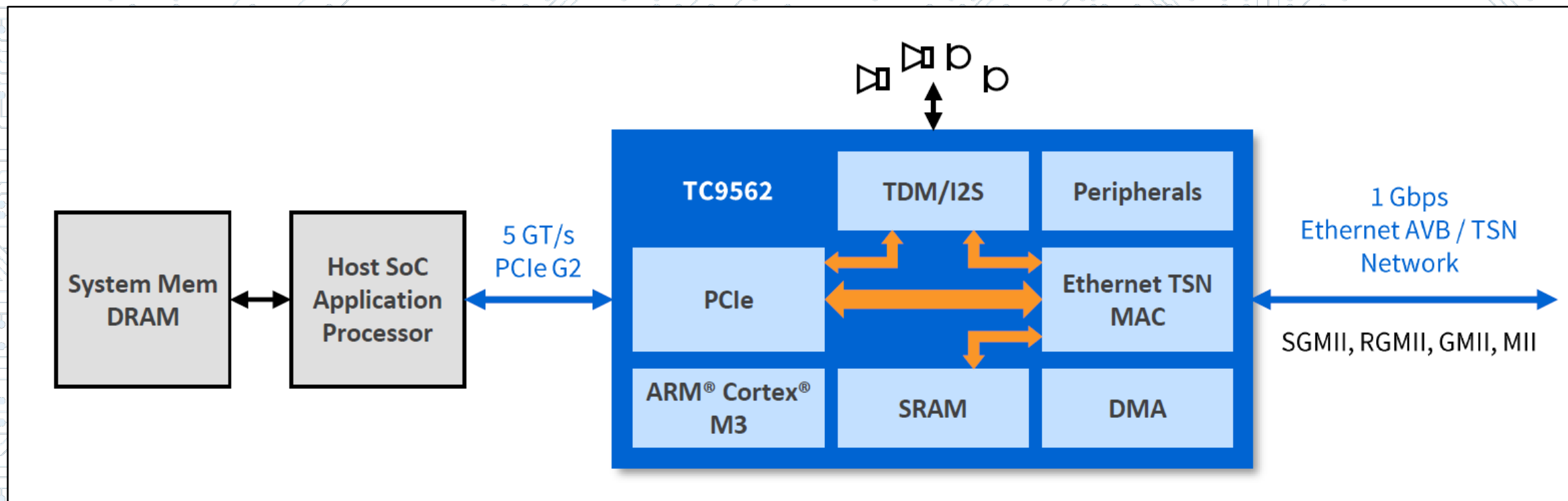
**TOSHIBA**

## Toshiba TC9562 – Overview

**TOSHIBA**

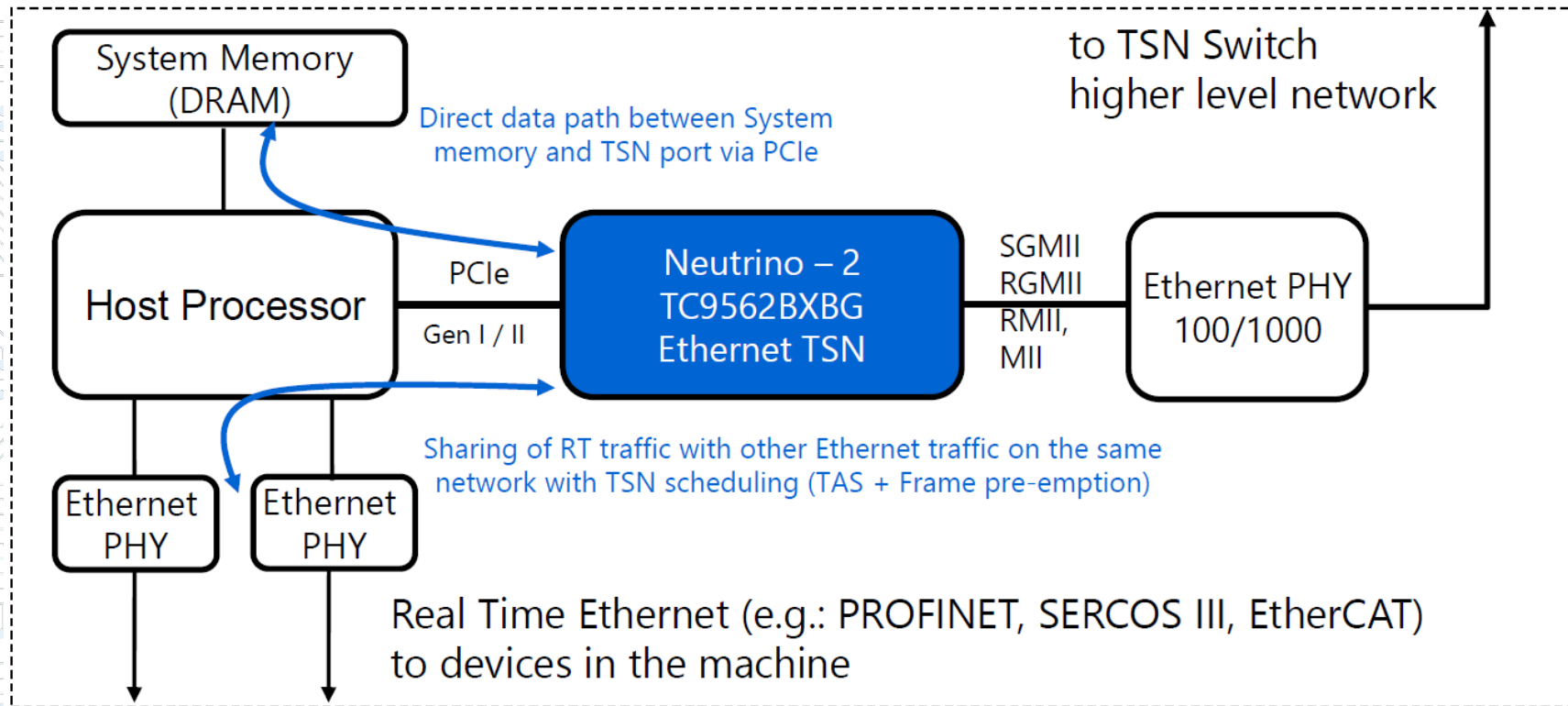
### Applications:

- PLCs, Motion Controllers
- Industrial PCs
- Brownfield device adaptation to TSN network



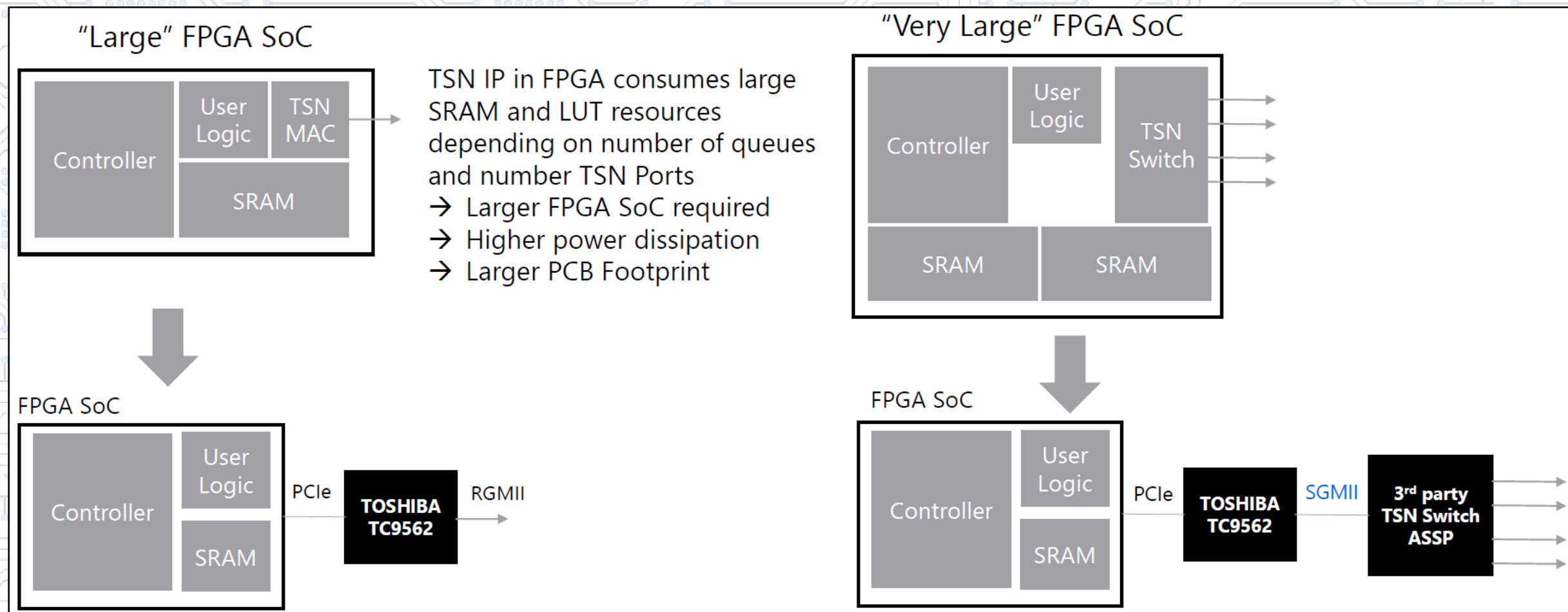


# Toshiba TC9562 – TSN Network Interface Enabler

**TOSHIBA**

- Time Synchronization
  - IEEE802.1AS
- Traffic shapers
  - TAS: IEEE802.1Qbv
    - 6 Queues
  - CBS: IEEE802.1Qav
- Frame pre-emption
  - IEEE802.1Qbu
  - IEEE802.3Qbr
- Flexible PHY interface
  - Enables SPE\* T1 PHYs

# Toshiba TC9562 – Competitive Solution vs. FPGA SoC

**TOSHIBA**



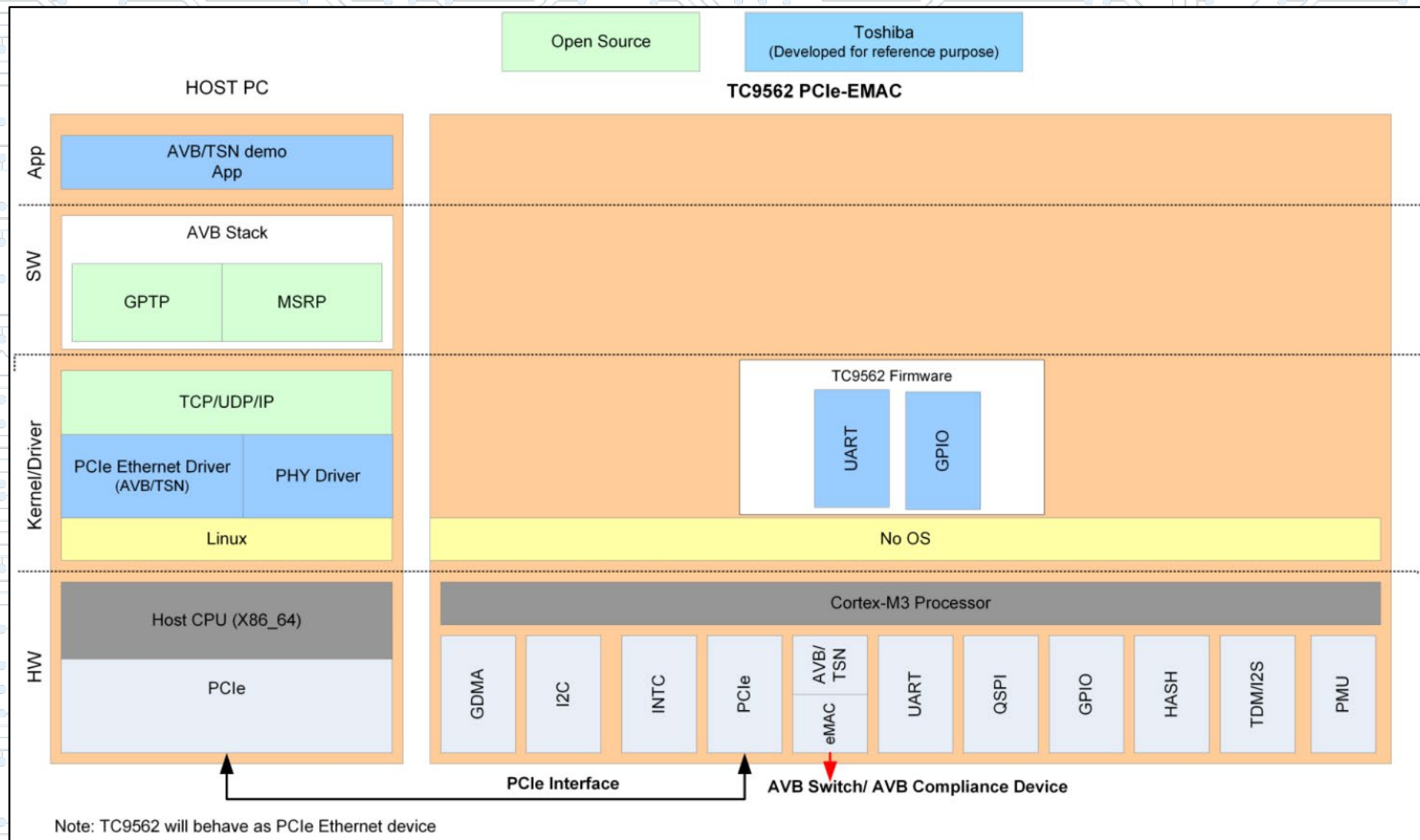
## Toshiba TC9562 – Neutrino Development Environment

**TOSHIBA**

- **PCIe Reference board**
- **SW Package available**
  - Drivers for Linux kernel 4.19
  - PCIe and eMAC drivers (including TSN HW Acceleration)
  - NTN Firmware + Flash loader + Utilities / debug tools
  - Bridge mode Sample application
  - Sample PHY drivers
- **Neutrino Developer Zone**
  - Access portal to documentation and SW download
  - Requires user registration
  - Local application engineering support



# Toshiba TC9562 – SW Architecture

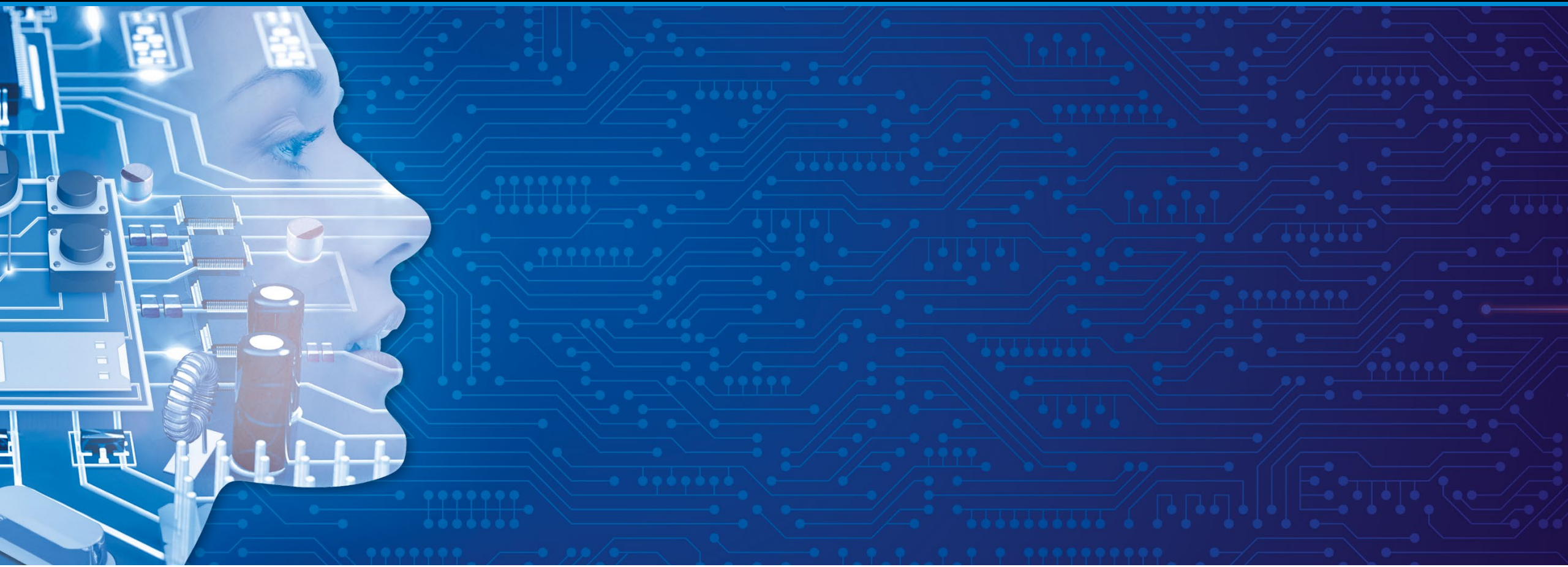
**TOSHIBA**



## Toshiba TC9562 – Neutrino2 MAC Features

**TOSHIBA**

- **Interfaces: SGMII/RGMII/RMII/MII**
- **Speed: 10/100/1000Mbps**
- **Maximum of 1500-byte MAC client data portion supported for Tx and Rx**
- **Supports Full duplex**
- **Supports 16 perfect address filters – individually selectable to match either source address or destination address**
- **Supports 64 bit hash filter**
- **Supports 16 bit VLAN hash table for VLAN filter**
- **Supports Magic packet detection for Wake-up event generation**
- **Supports wake up event generation based on specific pattern of the incoming packet.**
- **Supports TCP segmentation offload**
- **6 queues for Tx – Tx FIFO : 14,336Bytes (shared by 6 Tx queues)**
- **4 queues for Rx – Rx FIFO : 10,240Bytes (shared by 4 Rx queues)**
- **Flow control supported only when configured in non AVB/TSN mode only**
- **6 Tx and 6 Rx channel DMA controller that may be used to transfer data over PCIe/SRAM**
- **Supports 2 trigger inputs to capture current gPTP timestamp (function shared with GPIO pins)**
- **Supports 2 outputs to output pulse train based on gPTP timestamp (function shared with GPIO pins)**
- **Supports interrupt moderation**
- **Supported Standards**
  - IEEE 802.1AS – gPTP and Synchronization – AP Software assisted
  - IEEE 802.1Qav
  - IEEE 1722 packets
  - IEEE 802.3az-2010 for Energy Efficient Ethernet (EEE)
  - IEEE 802.1Qbv-2015 (Enhancements to scheduling traffic: TSN)
  - IEEE 802.3br-2016 (Interspersing Express Traffic: TSN)
  - IEEE 802.1Qbu-2016 (Frame preemption: TSN)



Intel I225

intel®



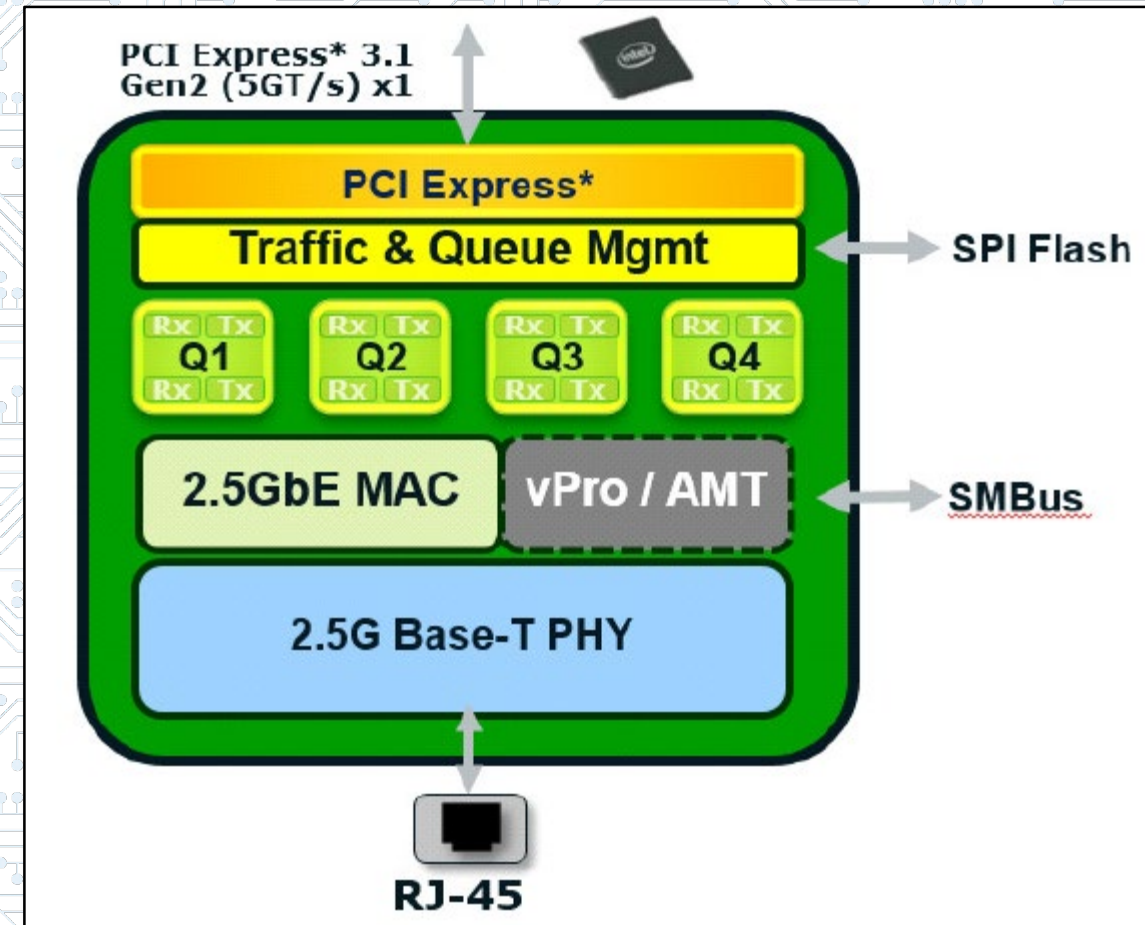
## Intel I225 – Features & Block Diagramm

### Features:

- Support for 10M / 100M / 1000M / 2.5G speeds
- 7x7mm, QFN package, 28nm process
- Supported on IoTG roadmap, 15 year life, EMB / INDU use
  - LM Sku@ 2.5G (0-70C)
  - IT Sku@ 2.5G (-40 -70C), @ 1G (-40 -85C)

### Advanced Capabilities:

- Enhanced AVB/TSN capabilities, and PCIe PTM (Linux only)
- Support for AMT / Intel® vPro™ Technology
- Onboard Host & Dock
- Intel Stable Image Platform Program (SIPP) support
- New MDI lane swap design support



# Intel I225 - Applications



## THINGS OF THE IIoT

## OPERATIONAL TECHNOLOGY (OT)

## INFORMATION TECHNOLOGY (IT)

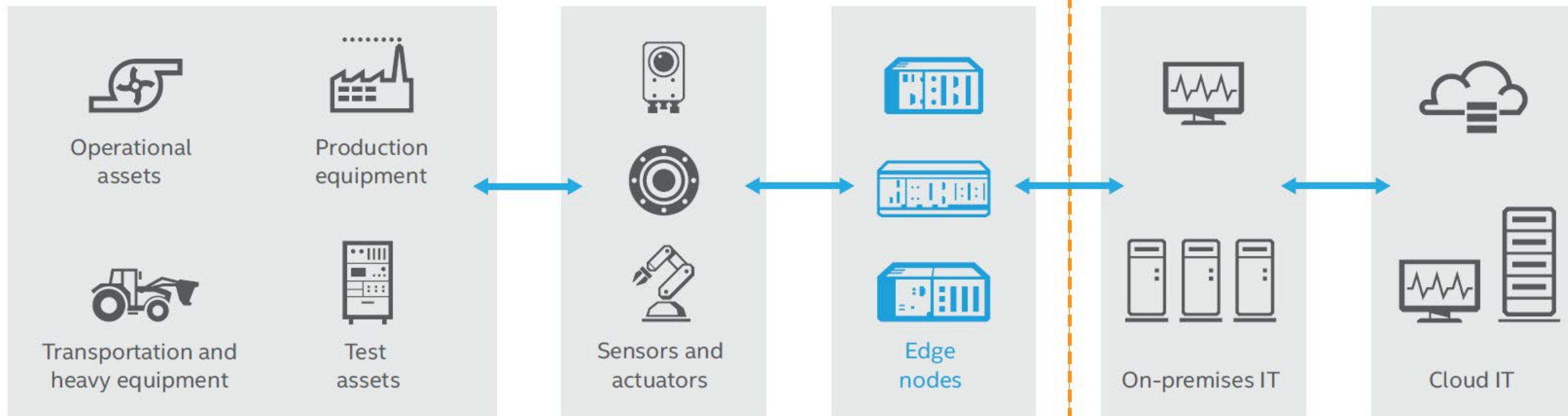
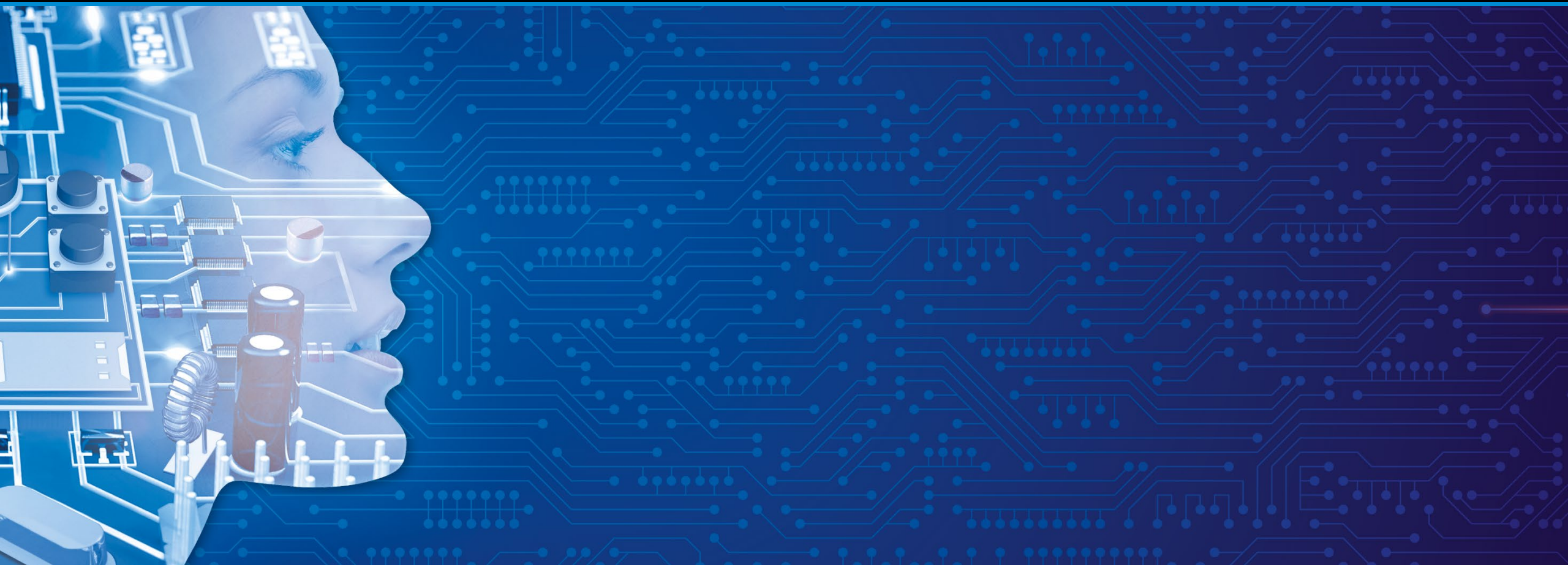


Image courtesy of National Instruments

**THE EDGE**

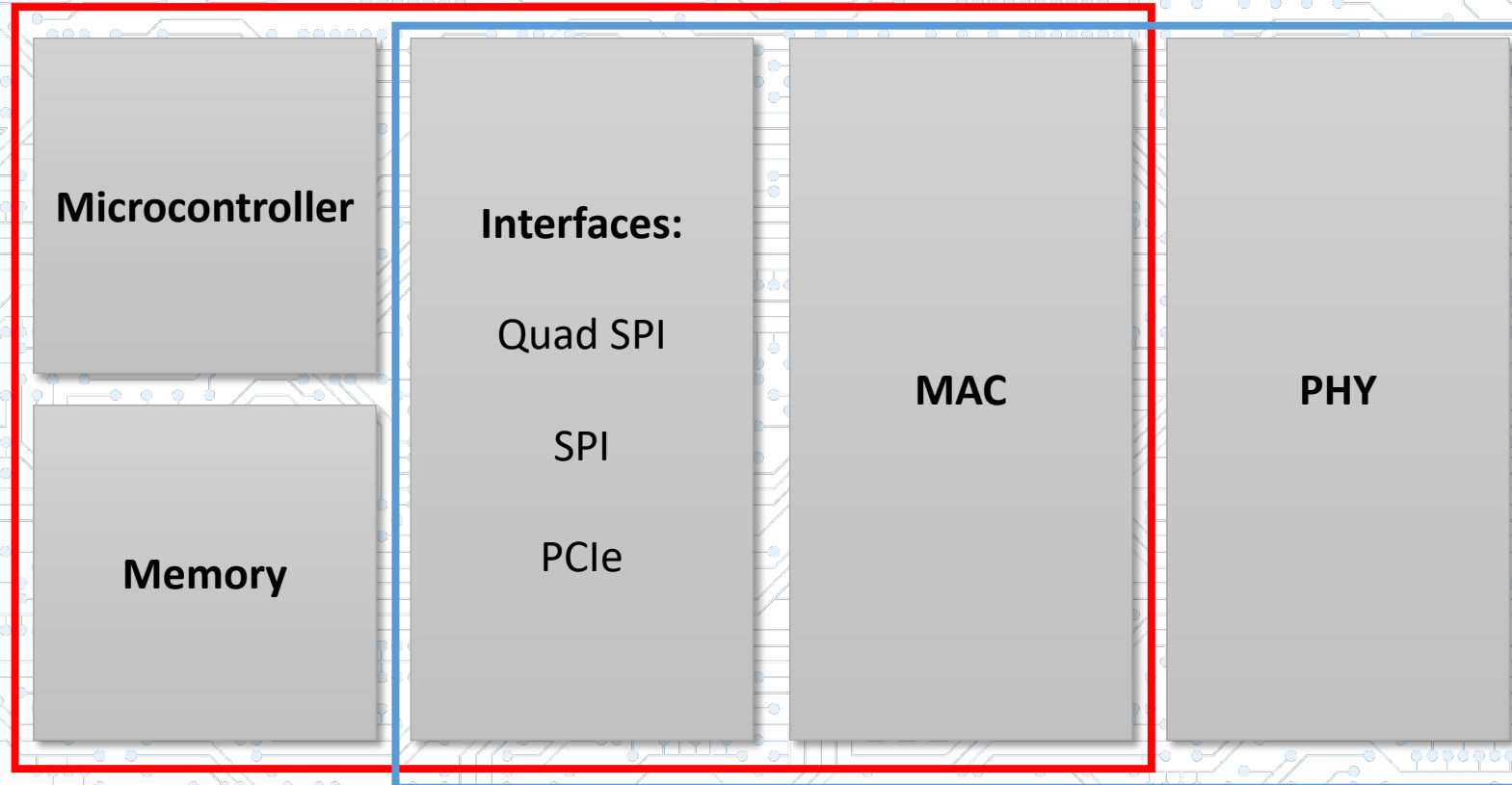




# Block Diagramm

## Block Diagramm for both solutions

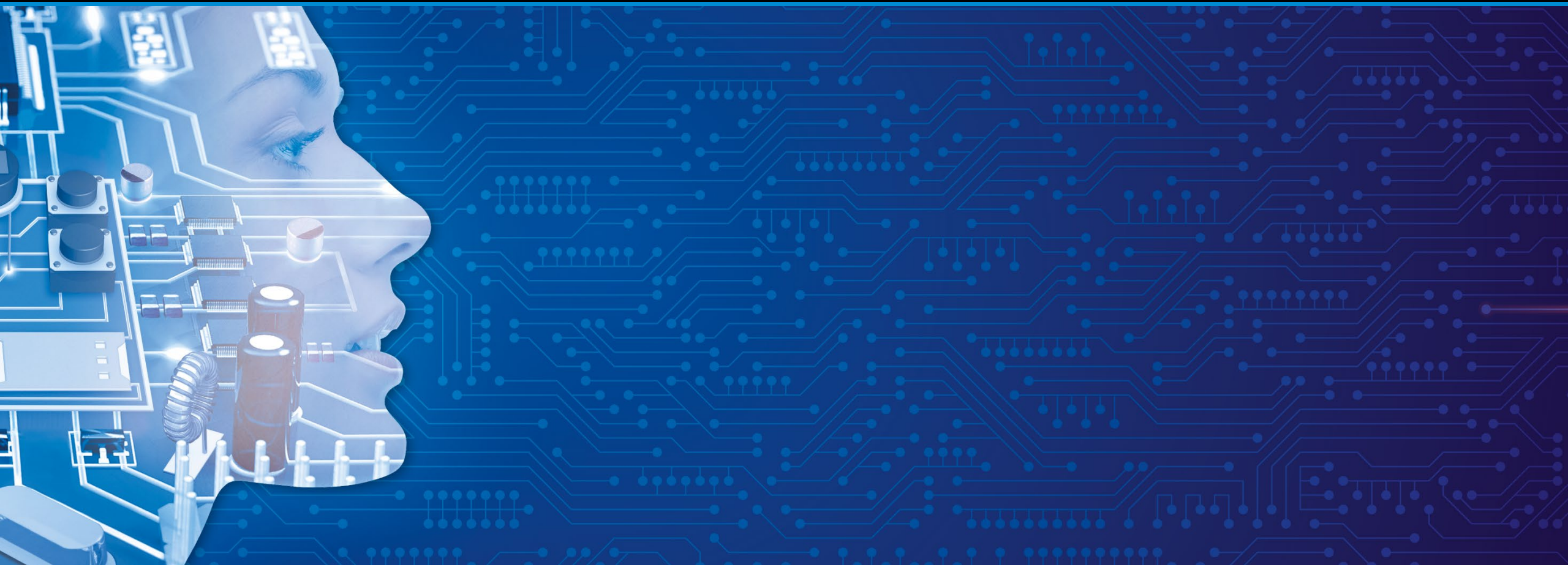
**TOSHIBA** **intel**



 **TOSHIBA - TC9562**

 **INTEL - I225**





# Further Information about Time-Sensitive Networking (TSN)

## Rutroniker 2020 – TSN Article



Time Sensitive Networking (TSN)

### A basis for Industry 4.0

*The Fourth Industrial Revolution is defined by how information is fed into or acquired from production processes.*

*Real-time support plays a critical role in this. Time Sensitive Networking (TSN) provides standardized methods for providing such support.*

By WALTER HAGNER,  
PRODUCT SALES MANAGER DIGITAL, AND  
DAVID WERTHWEIN, PRODUCT MANAGER  
DIGITAL, BOTH AT RUTRONIK

industrial production, tools, equipment and machinery needs to be adapted perfectly to one another to prevent damage to the work-piece or machinery. This requires real-time data communication, which means that all devices involved must have an identical time base and it must be guaranteed that responses are received by the recipient within the specified time. Technologies with Industrial Ethernet support such as Ethercat or Profinet guarantee such response times. As each bus system is optimized for certain applications, several standards have become established.

In non-industrial environments at the upper levels of the automation pyramid, on the other

hand, Ethernet is broadly established due to its robustness and reliability. But Ethernet cannot meet the real-time requirements of industrial processes.

For implementation in an Industry 4.0 context, it is necessary to merge the two network environments to create seamless, autonomous systems. This is where the idea of "Time-Sensitive Networking" or TSN comes into play. It runs concurrently with conventional communication technologies and enables real-time communication even in heterogeneous environments – in other words, where different bus systems and Ethernet are in use.

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- [RUTRONIKER 2020 – German](#)
- [RUTRONIKER 2020 – English](#)



# Technical TSN online training with the experts from TOSHIBA




Committed to excellence


**RUTRONIK**  
 ELECTRONICS WORLDWIDE



**Training for Toshiba TSN with TC9562**  
 November 17<sup>th</sup>, 2020 | online training | Webex

**TOSHIBA**



## Agenda

Time	Tuesday, 17 <sup>th</sup> November 2020
09:00 - 10:30	Training for Toshiba TSN (Time Sensitive Networking) with TC9562

Toshiba Webinar with Time Sensitive Networking with TC9562

Toshiba provides advanced Ethernet Capability for automotive & Industrial applications. It enables deterministic real-time performance up to 1Gbps Ethernet Transfer rates and supports Time Sensitive Networking (TSN) protocol.

The TOSHIBA TSN Training is structured around the following:

- . Features of TOSHIBA Time Sensitive Networking
- . Advantages of TOHSIBA Time Sensitive Networking
- . Benefits of TOSHIBA Time Sensitive Networking
- . Application of TOSHIBA Time Sensitive Networking

Besides if any customers wants to have an individual Meeting with TOSHIBA, the following Timeslot will be available.

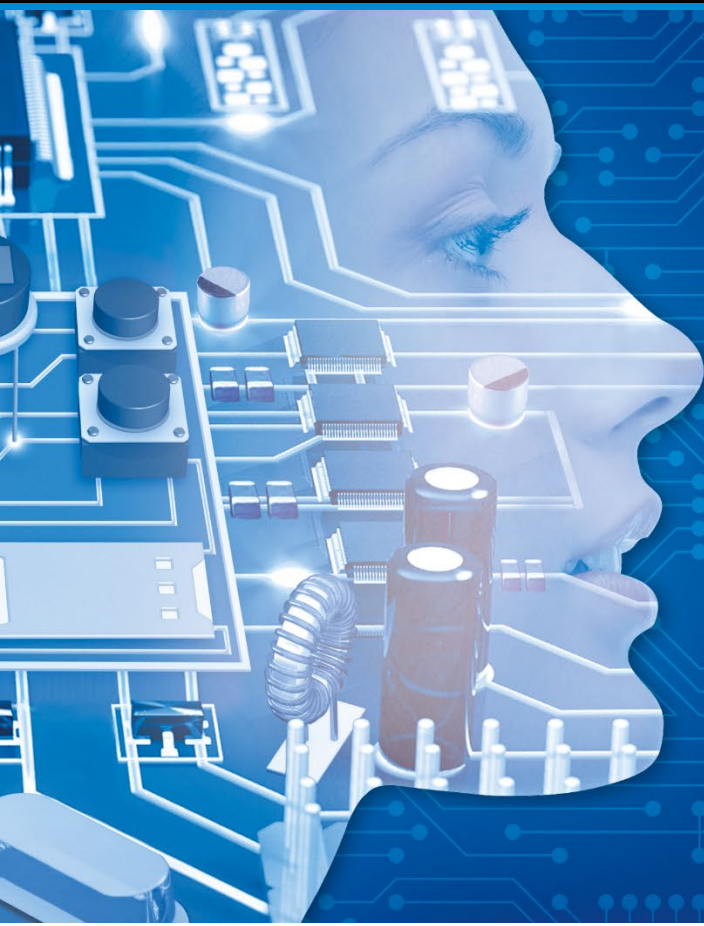
Please inform your Sales or FAEs, we will organize another Meeting for you.

	18 <sup>th</sup> November	19 <sup>th</sup> November	20 <sup>th</sup> November
09:00 - 10:00			
10:00 - 11:00			

We would like to expressly point out that this invitation is not, and under no circumstances, to be construed as an attempt to influence your business or official actions or as an attempt to make you breach your legal duties which must be observed in connection with an existing or future business relationship with our company by performing or abstaining from performing an act.

Register:

[www.rutronik.com/TSN\\_Toshiba\\_Training](http://www.rutronik.com/TSN_Toshiba_Training)



Thank you for your attention!

**Walter Hagner**

Product Sales Manager Digital

**David Werthwein**

Product Manager Digital