Webinar TSN Time Sensitive Networking

Products

Application references

NearFi Technology
Designed by Phoenix Contact

PROFIBUS

TRUSTED WIRELESS

Technologies

PoE

HART

5G

"PAVE THE WAY FOR FUTURE BUSINESS"
by addressing relevant trends

SPE & APL

5G

TSN

OPC UA

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INSPIRING INNOVATIONS

“PAVE THE WAY FOR FUTURE BUSINESS”

by addressing relevant trends

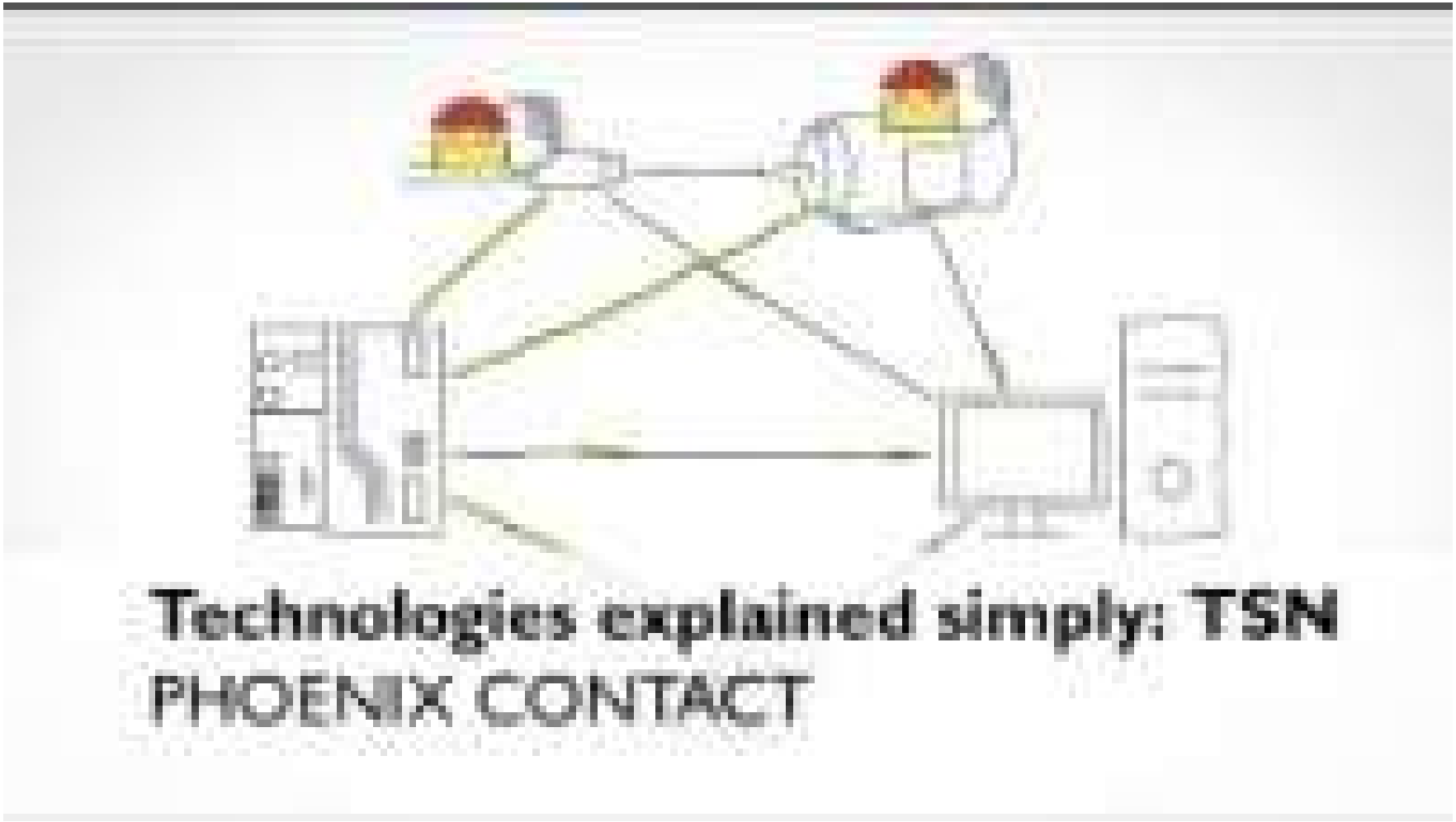
SPE & APL

5G

TSN

OPC UA

TSN



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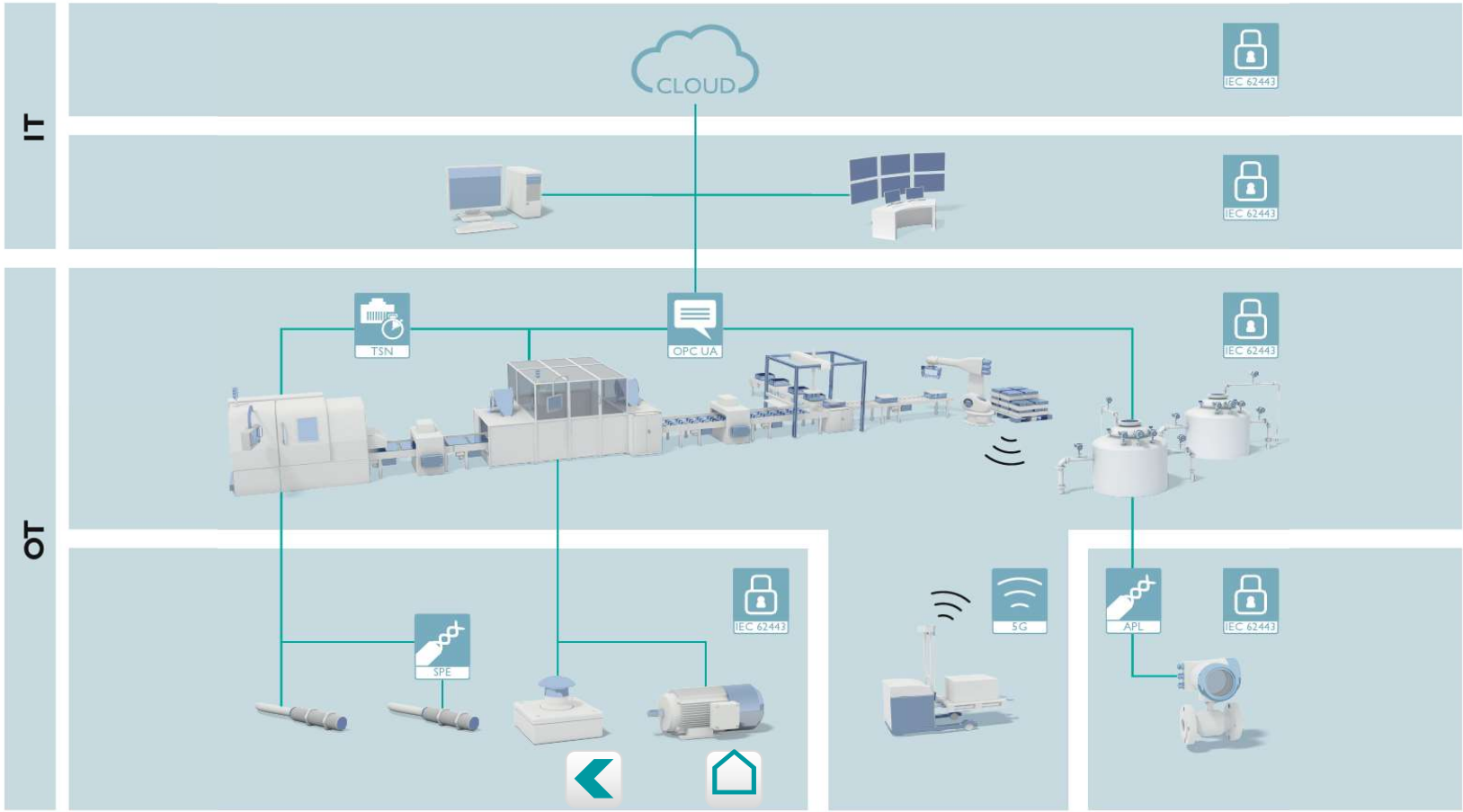
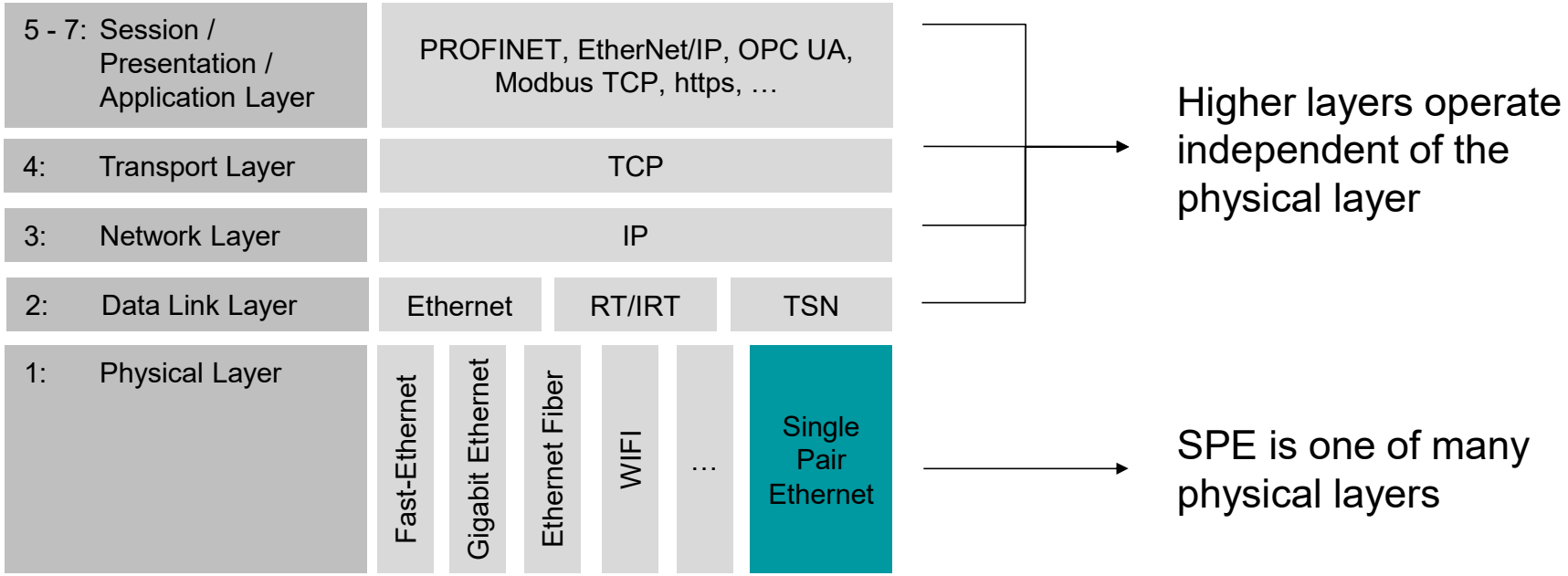
SEAMLESS COMMUNICATION FROM THE SENSOR TO THE CLOUD



SPE – JUST ANOTHER PHYSICAL LAYER



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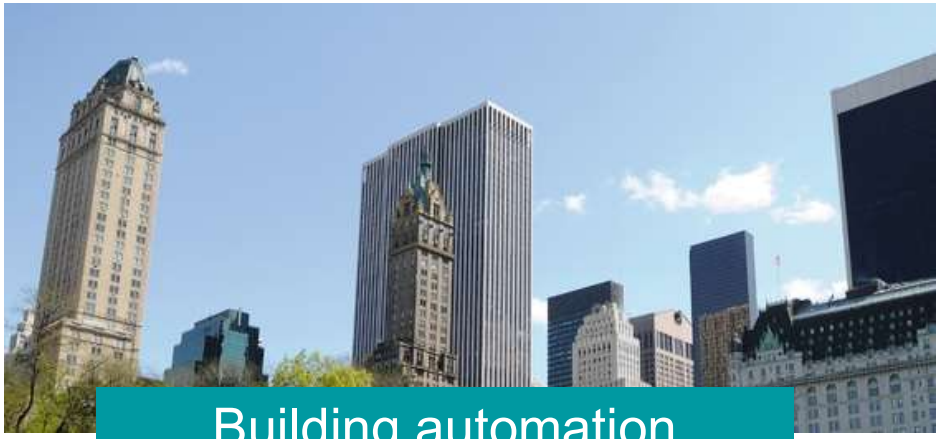
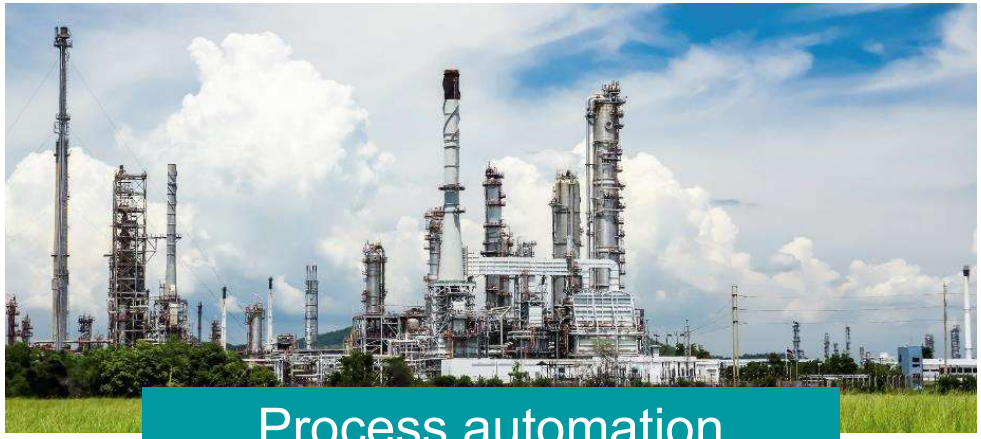
Factory automation

Automotive



Building automation



Process automation

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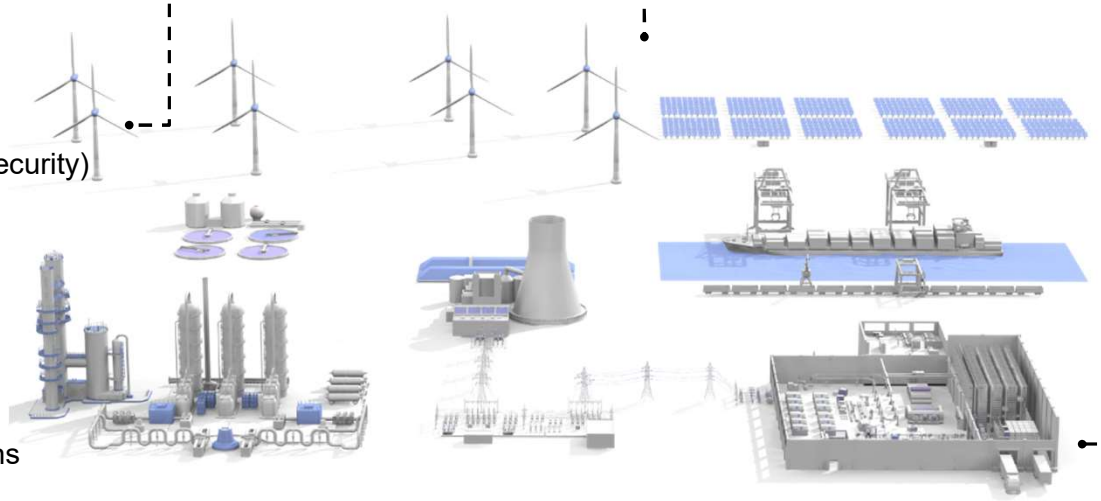
APPLICATIONS IN AUTOMATION?

Infrastructure

- ✓ Monitoring in Water/ Wastewater networks
- ✓ Monitoring and Control in distributed traffic networks
- ✓ Traffic signaling
- ✓ Video Surveillance (public security)

Process-automation

- ✓ Preemptive maintenance
- ✓ Asset tracking
- ✓ Monitoring plant conditions
- ✓ Product monitoring
- ✓ Augmented reality
- ✓ Plant Asset management
- ✓ Remote service
- ✓ Fire & Gas Alarms



Energy

- ✓ Monitoring and switching in distributed energy grids

Factory-automation

- ✓ Remote service
- ✓ Electric monorail conveyers
- ✓ AGVs & Shuttles
- ✓ Robots & Cranes
- ✓ Handlings-Machines
- ✓ Packaging machines
- ✓ Moving/rotating Machine parts

✓ **Local Communication** ✓ **Global Communication**

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Time Sensitive Networking –

The standard for real-time Ethernet

Mechanisms for **controlling and prioritizing data streams** in Ethernet networks to ensure real-time capability.

How does it work?

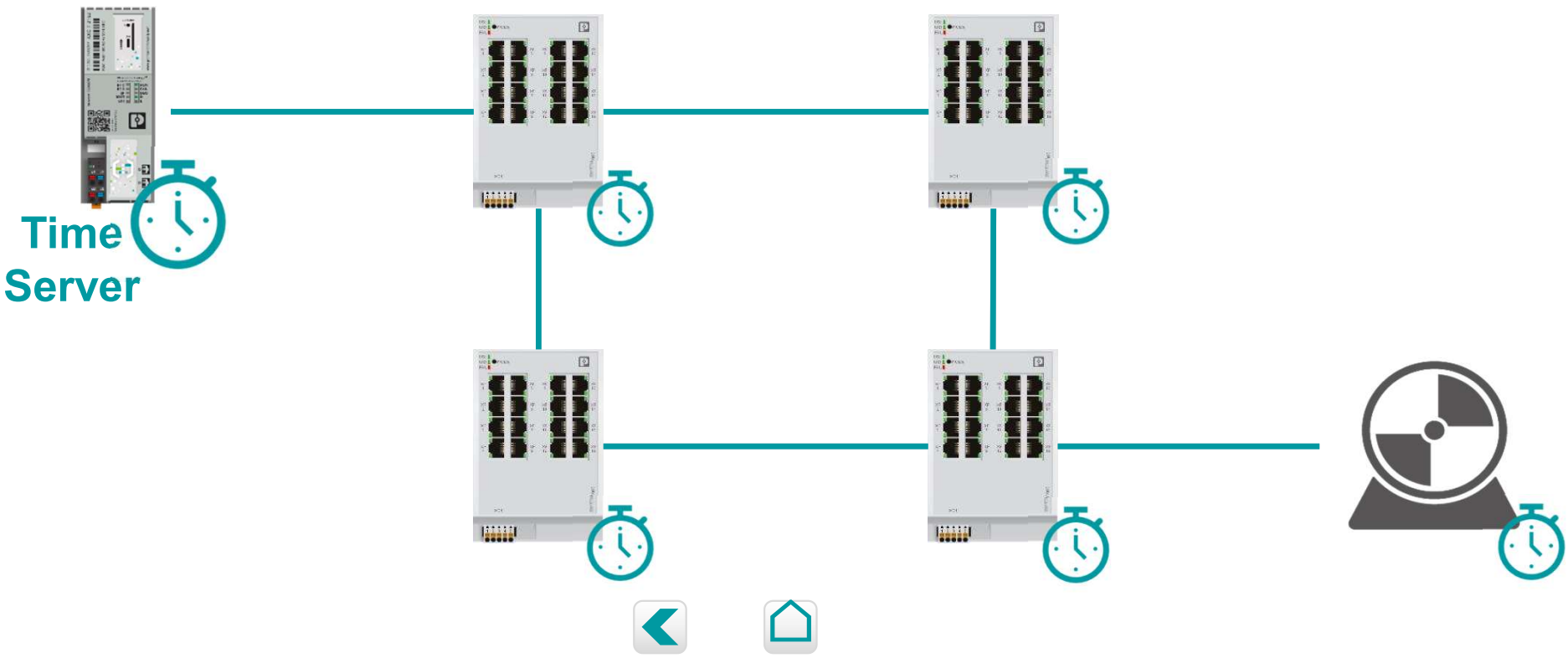
Network convergence

Time synchronization

Selection of communication paths, reservations and fault tolerance

Scheduling and Traffic Shaping

PRECISE TIME SYNCHRONIZATION



TIMESERVER NTP

The FL TIMESERVER is receiving very

accurate

time and **geo-location information**
via GNSS (GPS, Galileo, GLONASS) and
provides the
time and date information
via NTP protocol
in Ethernet networks to time clients.

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FL TIMESERVER NTP

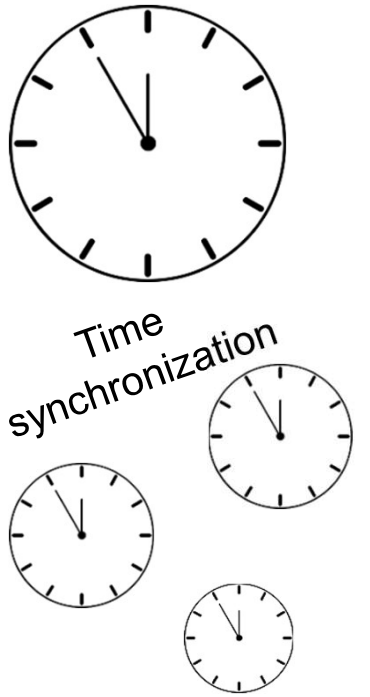
Time synchronisation

In Ethernet networks it is very important that all devices have an accurate, synchronous system time. This way, all decentral activities in the network can be documented with exact timing.
Example:

- Logfiles in network devices
- Camera images (image / time alignment)
- Telecontrol protocols IEC 60870-5-104, DNP3 ... have a time stamp

Only if all devices display the same exact time, a sequence of events can be displayed.

The FL TIMESERVER NTP provides the time to the network via NTP



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FL TIMESERVER NTP

Geo-location information

The FL TIMESERVER NTP provides accurate geo-location information (GPS coordinates).
The information can be used to determine the exact location.

Example:

- GPS positioning of e.g. containers, vehicles, buildings...

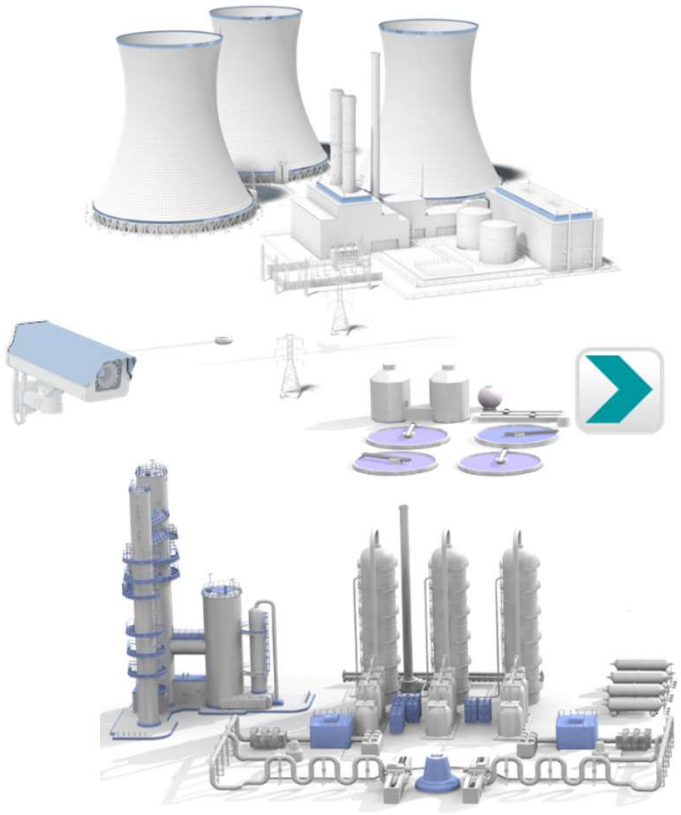
Precise position determination via web-based management, SNMP, NMEA or JSON streaming.

geo-location information

FL TIMESERVER NTP

Applications & target groups

- Energy automation
- Infrastructure
- Water- / Wastewater
- Process & Pipeline
- Camera & Surveillance



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FL TIMESERVER NTP

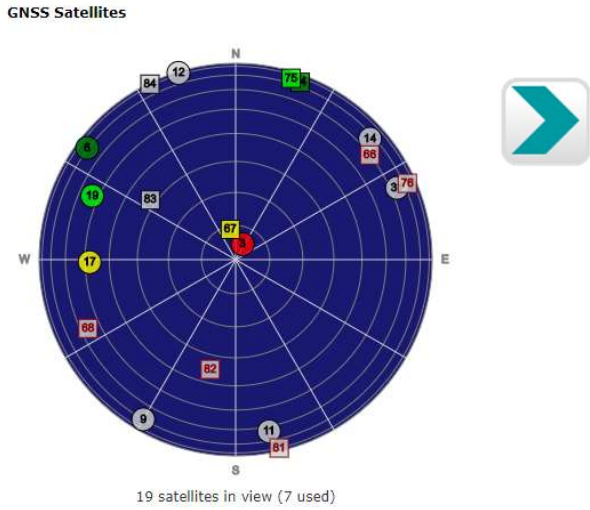
Customer benefit

- Synchronization of Ethernet devices in one network with the same time
- Precise localization (geo-localization information)
- No Internet access necessary for more security

FL TIMESERVER NTP

Satellite

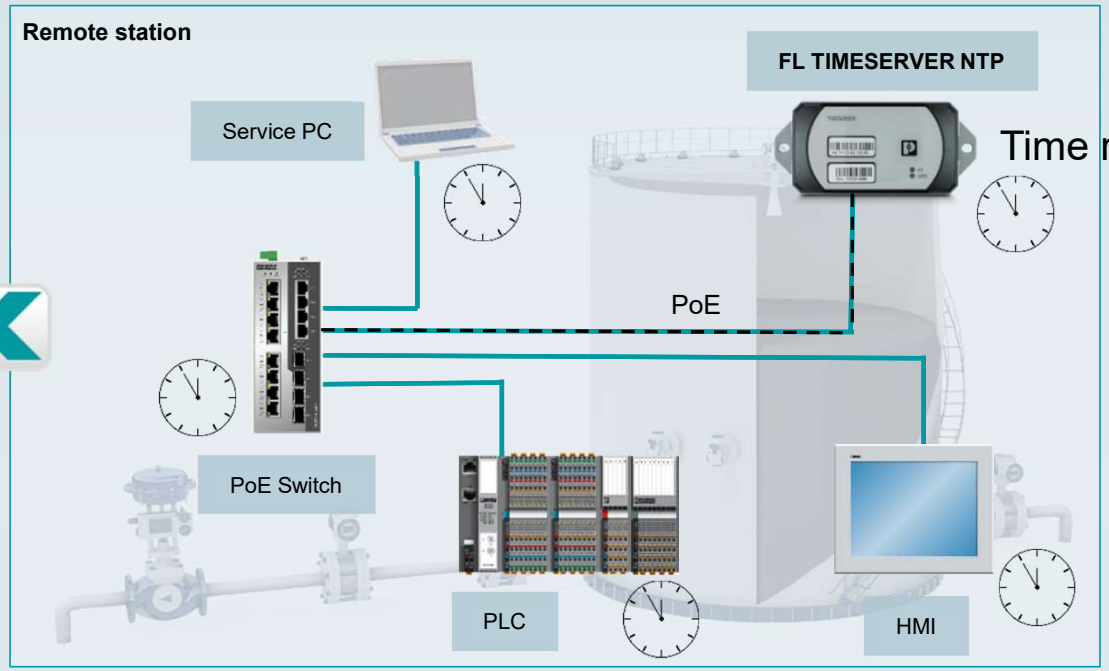
- High availability thanks to a range of different satellite systems
- GNSS (Global Navigation Satellite System) for various satellite such as:
  - GPS (USA)
  - GLONASS (Russian Federation)
  - Galileo (EU)
- Automatic switching between the satellites with integrated antenna



FL TIMESERVER NTP

Time synchronisation

GPS, Galileo
and GLONASS



- Accurate time synchronization of Ethernet devices in a network via NTP protocol
- No Internet access necessary for more security

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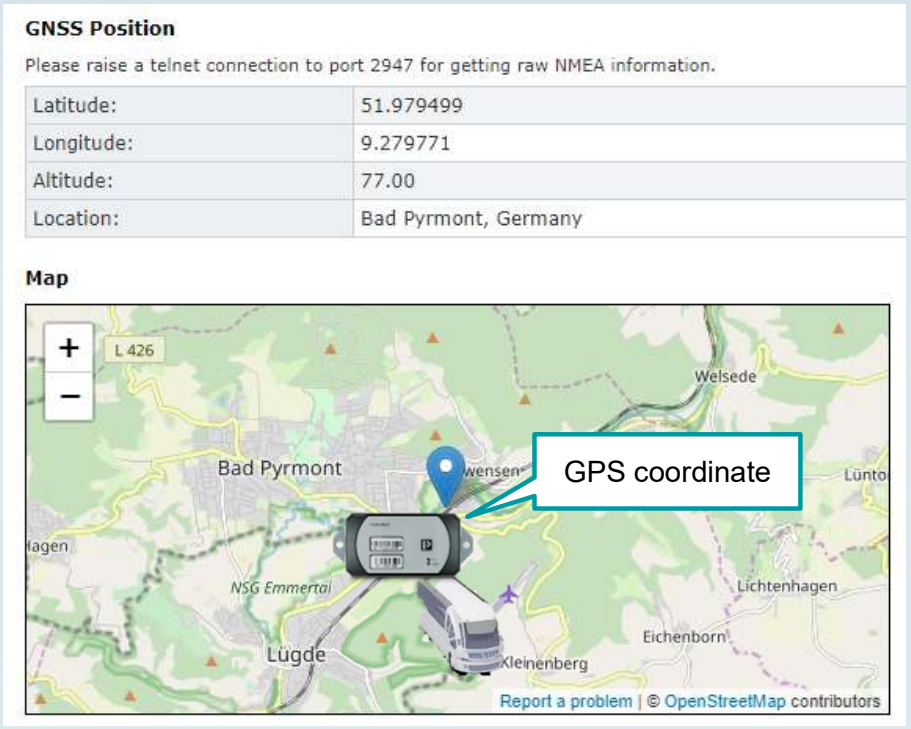
FL TIMESERVER NTP

Geo-location information



- Precise position determination via web-based management, SNMP, NMEA or JSON streaming

FL TIMESERVER NTP

Features

- IP67/68 outdoor housing with integrated antenna
- Extended temperature - 40 … + 70°C
- GNSS receiver for GPS, Galileo and GLONASS
- Diagnostic LEDs for power supply and satellite-fix (disengageable)

FL TIMESERVER NTP

Features

- NTP time server for Ethernet networks
- Gigabit Ethernet with **Power over Ethernet** supply
- Alternative external 10 … 30 V DC supply

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FL TIMESERVER NTP

Mounting

Fast and easy connection
thanks to single-hole mounting

Product overview

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FL TIMESERVER NTP

Mounting

Fast and easy connection
thanks to single-hole mounting
Quick fastening with nut

Power supply (Alternatively)
10 to 30 V DC

Gigabit Ethernet with
Power over Ethernet (PoE) supply

Product overview

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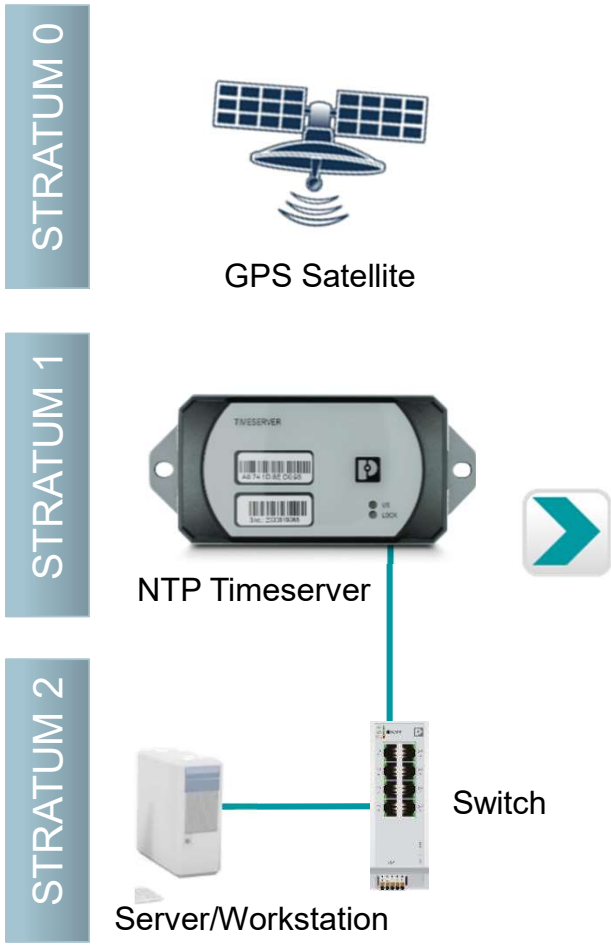
FL TIMESERVER NTP

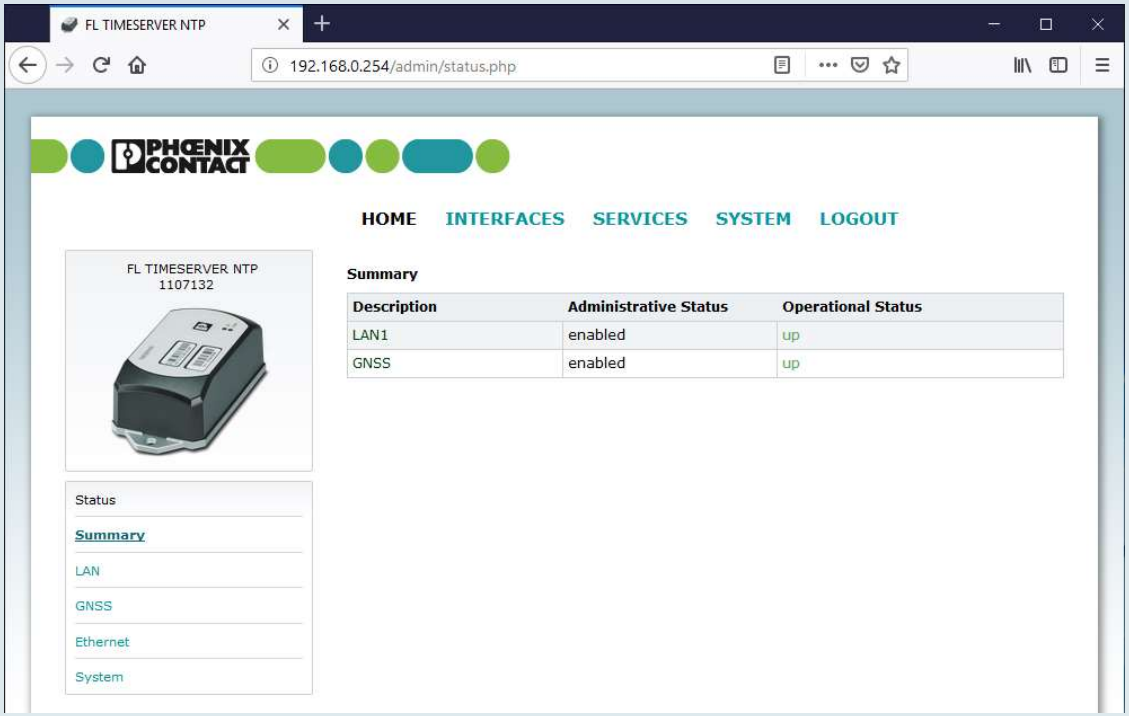
NTP Server

- Network Time Protocol (NTP) is a standard Internet Protocol (IP) for synchronizing the time of computer clocks over a network
- As a server, it makes its own time available to other NTP clients in the network.
- NTP uses a hierarchical architecture
  - Each level in the hierarchy is known as a stratum.
  - Stratum 0: are hardware reference clocks (atomic or GNSS)
  - Stratum 1: NTP servers have a direct connection to a hardware clock



FL TIMESERVER NTP

Start-up / Configuration



Web Based Management for Configuration and Diagnostic

Default IP parameters
IP address: 192.168.0.254
Subnet mask 255.255.255.0

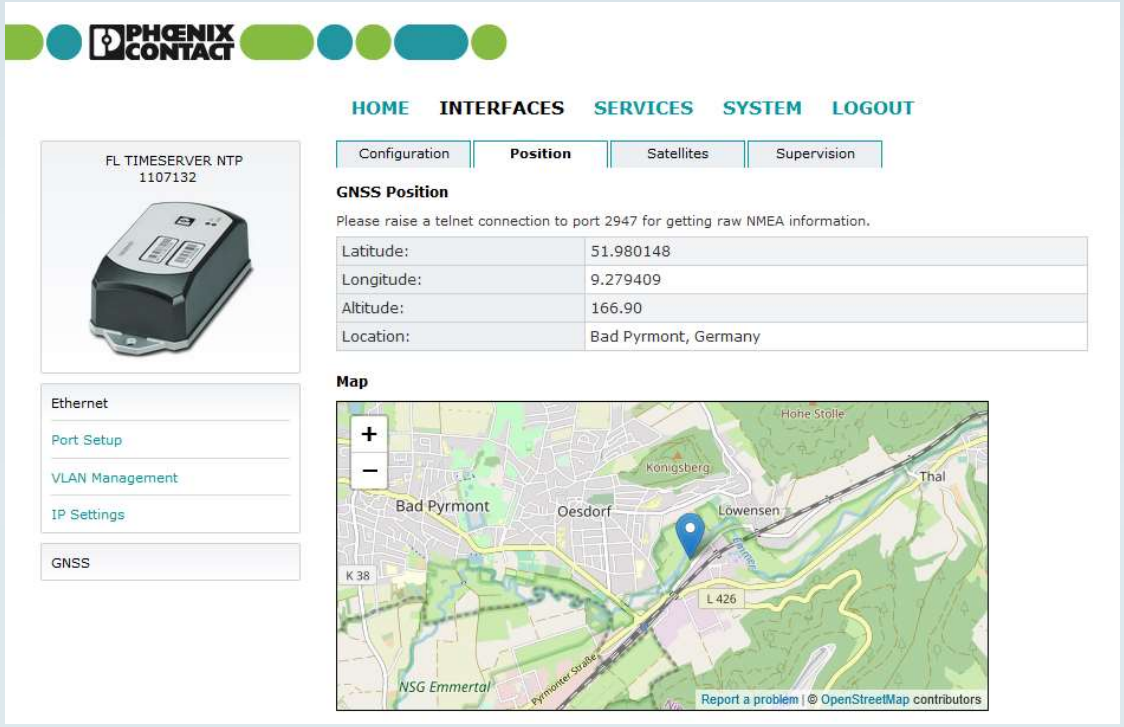
Welcome Screen with Overview about LAN and GNSS status

Product overview

INSPIRING INNOVATIONS

FL TIMESERVER NTP

Start-up / Configuration



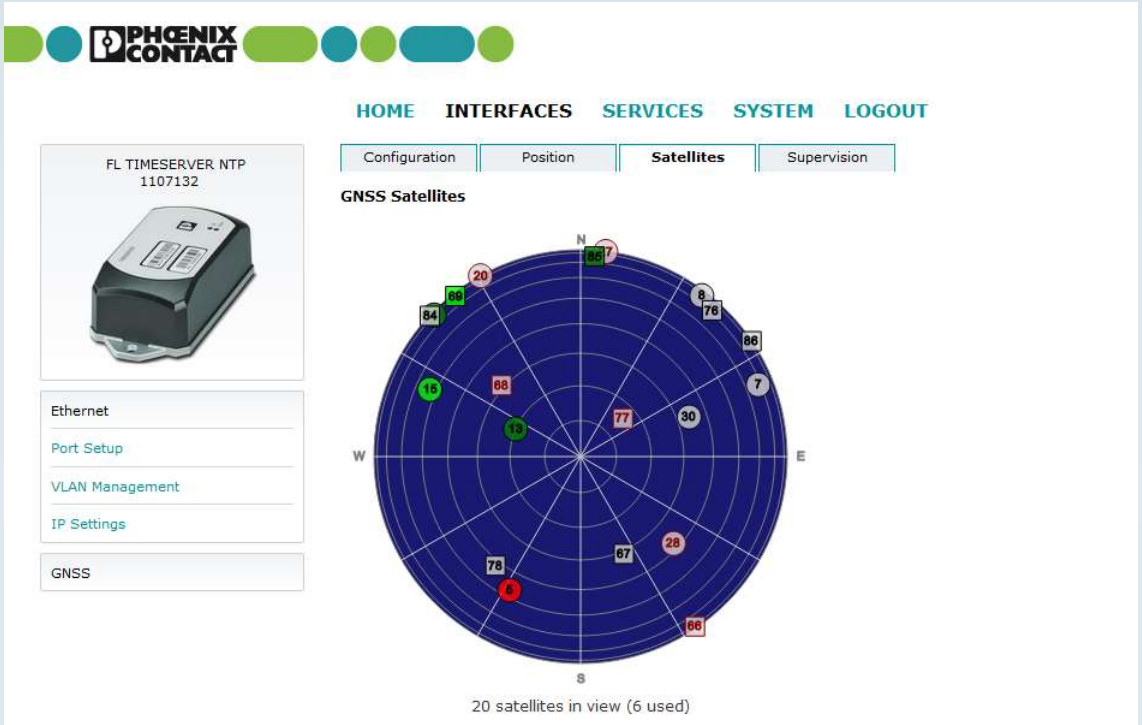
Web Based Management for Configuration and Diagnostic

Geo position is displayed comfortable via Open Street Map (Internet access needed)

Without Internet access only Latitude, Longitude and Altitude is displayed.

FL TIMESERVER NTP

Start-up / Configuration



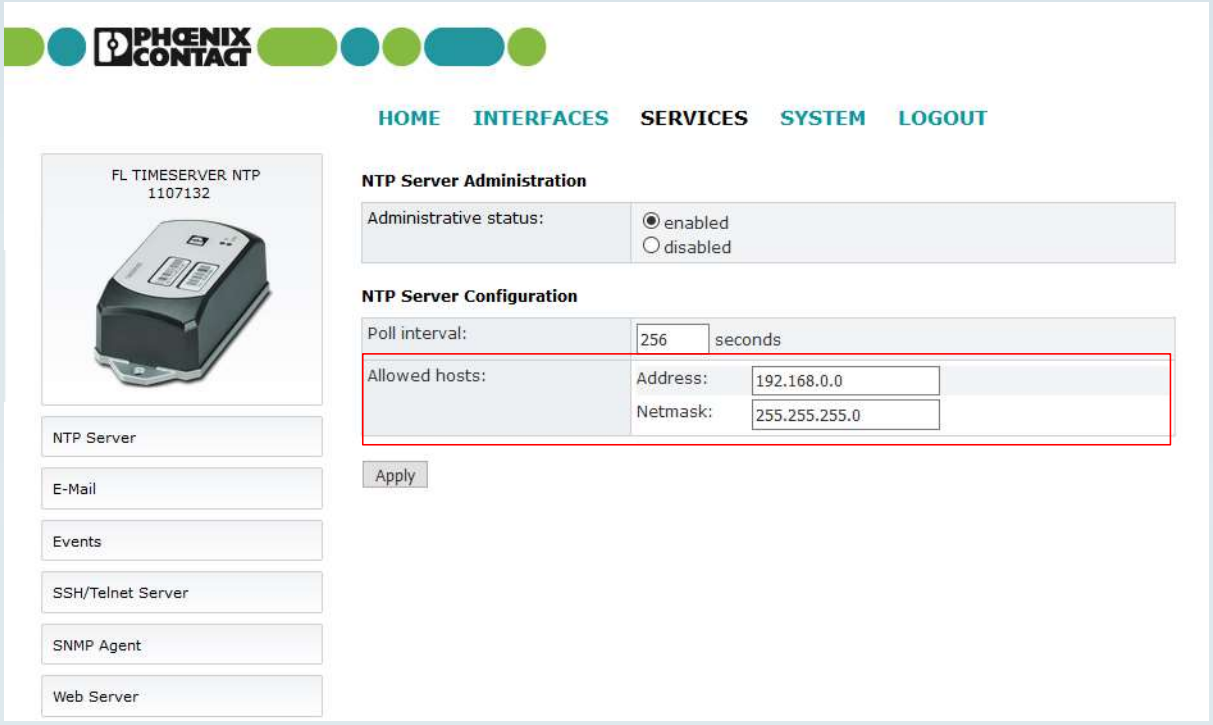
Web Based Management for Configuration and Diagnostic

Easy and comfortable overview about the available GNSS satellites

INSPIRING INNOVATIONS

FL TIMESERVER NTP

Start-up / Configuration



Web Based Management for Configuration and Diagnostic

For requesting the time via NTP, it is important to set up the „Allowed hosts“ and „Netmask“ of NTP Clients in the network!

FL TIMESERVER NTP

Start-up / Configuration

Web Based Management for Configuration and Diagnostic

For requesting the geo-position the NMEA0183 and JSON protocol can used on TCP port 2947

```
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$GNGLL,5158.77597,N,00916.78496,E,152719.00,A,A*76
```

Product overview

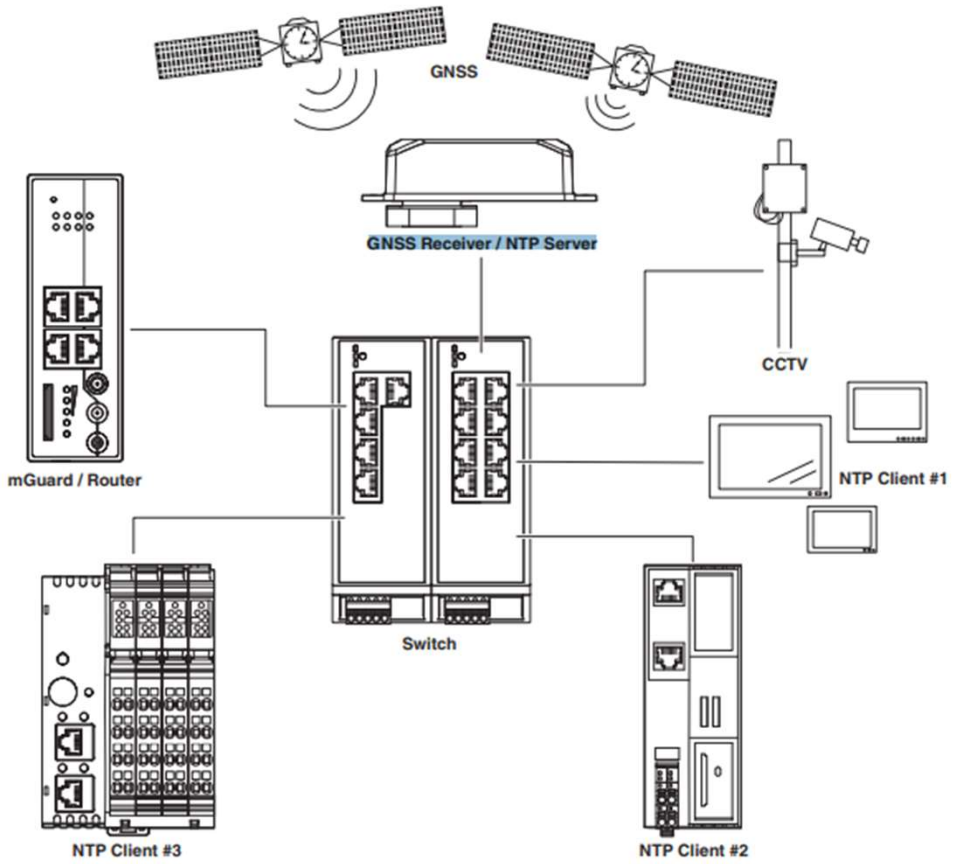
INSPIRING INNOVATIONS

TIMESERVER NTP

	TIMESERVER NTP
Type	FL TIMESERVER NTP
Order number	1107132
Description	NTP timeserver with GNSS receiver

GNSS Receiver / NTP Server

Application



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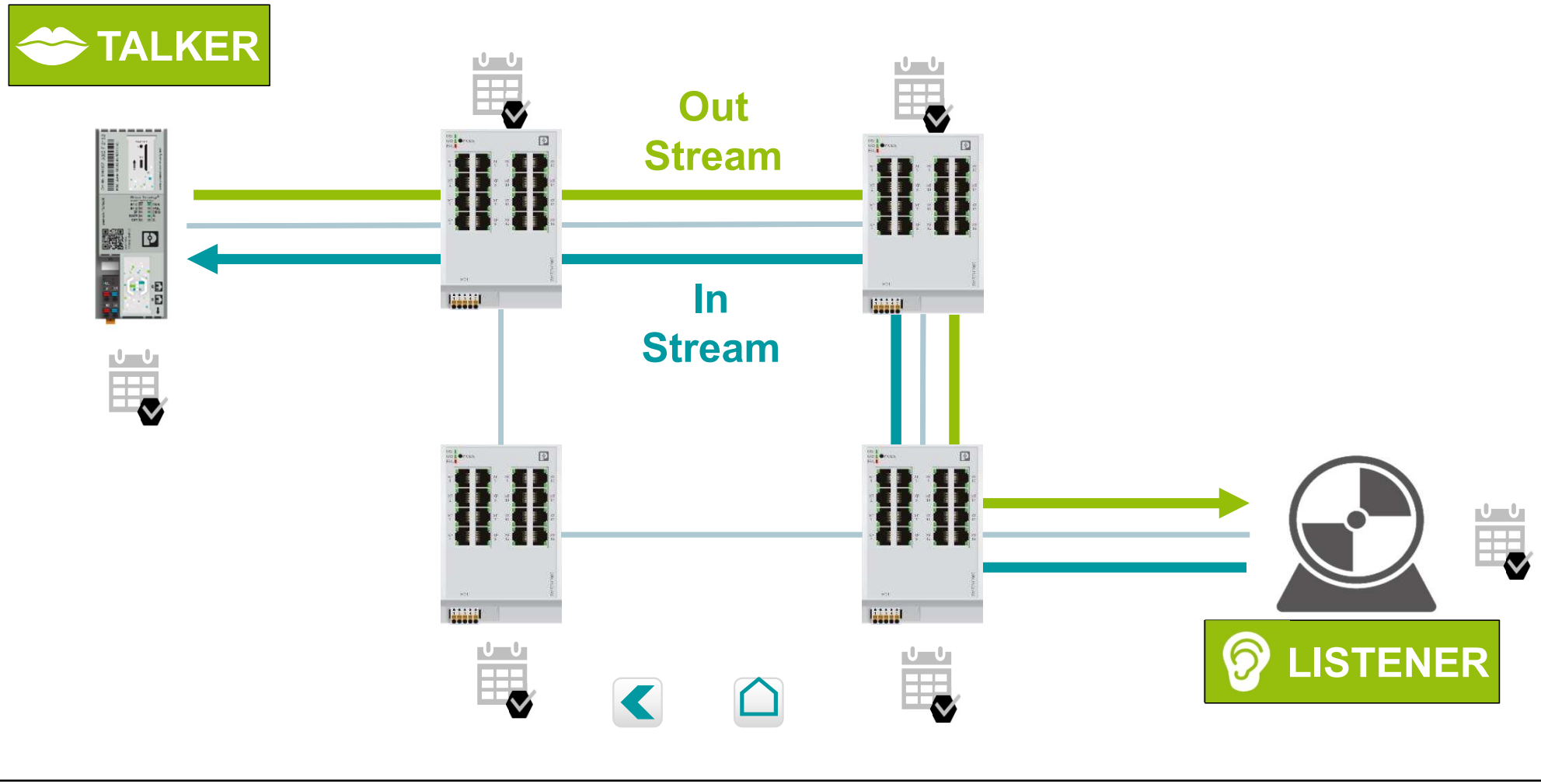
STREAMS



FRAME PREEMPTION

Standard traffic
(not time critical)

Realtime traffic
(time critical)

Large frames

FRAME PREEMPTION

Loss of realtime capability

Standard traffic
(not time critical)

Realtime traffic
(time critical)

Large frames

FRAME PREEMPTION

Standard traffic
(not time critical)

Realtime traffic
(time critical)

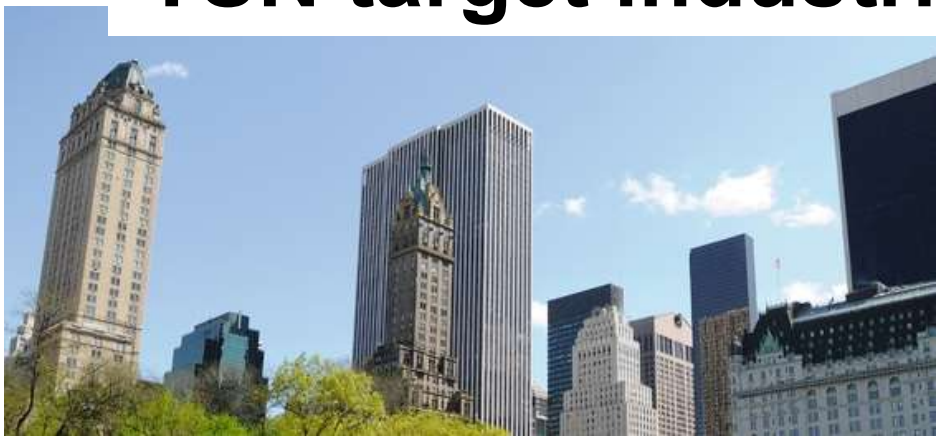
Large frames

FRAME PREEMPTION

- ✓Reduced residence times in switches
- ✓No bandwidth loss (no reserved phase)
- ✓Low complexity
- ✓High flexibility
- ✓High robustness

Where is it being used?

TSN target industries = Same as today!



Advantages and features

TSN ADVANTAGES

Control of data communication
in form of time synchronization and prioritization of data streams

Guarantee's real-time capability
of the system and increases the availability of the network

Convergence between IT and OT
Real-time critical & data-intensive applications in one network without mutual interference

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What do we offer?

TSN

To be launched soon

Highlight 2021

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SUPPORT OF 1st TSN PROFILE

PROFINET® TSN

- Precise time synchronization
- Frame preemption
- Stream management via Profinet

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Traditional networks

TSN networks

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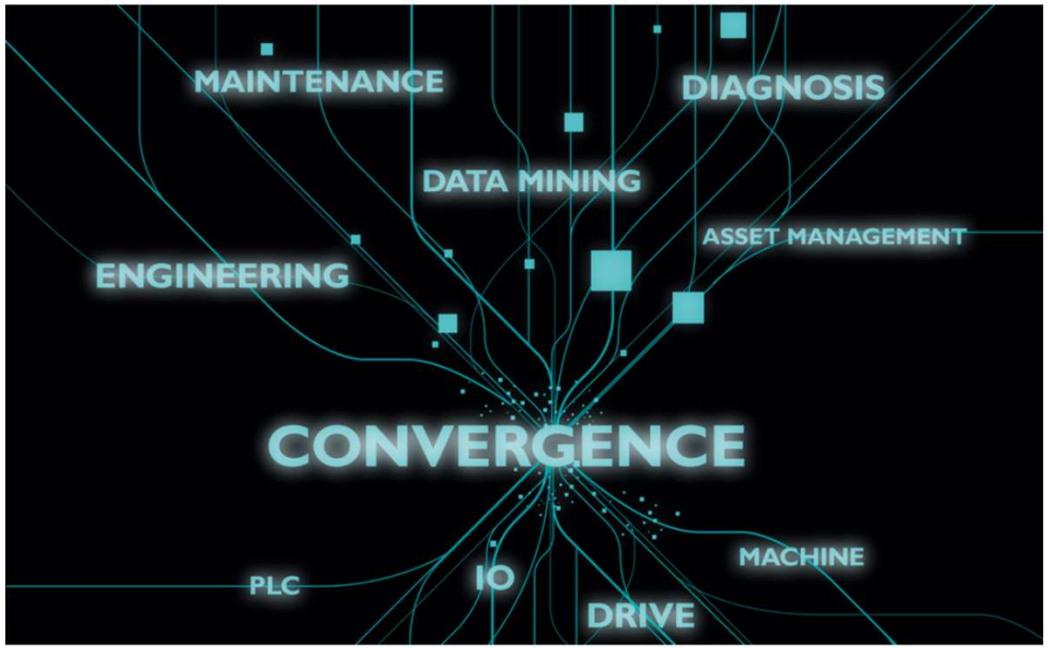
TSN enables a convergence of IT and OT

Advantages and Future

The data transmission of real-time-critical applications (e.g., quick controls, signal acquisition in power grids, or motion control) and data-intensive applications (e.g., video streams or IT systems) is currently implemented in separate networks in order to prevent mutual interference.

However, the growing flexibilization and digitalization of work processes requires the increasing convergence of IT and OT, and therefore the consolidation of previously separate systems.

By extending and adapting existing Ethernet standards, TSN creates a convergence between information technology (IT) and the industrial operational technology (OT) in industrial networks. This means that both real time-critical data and data-intensive applications (e.g., video streams) can be implemented via a shared Ethernet cable, without interfering with each other.



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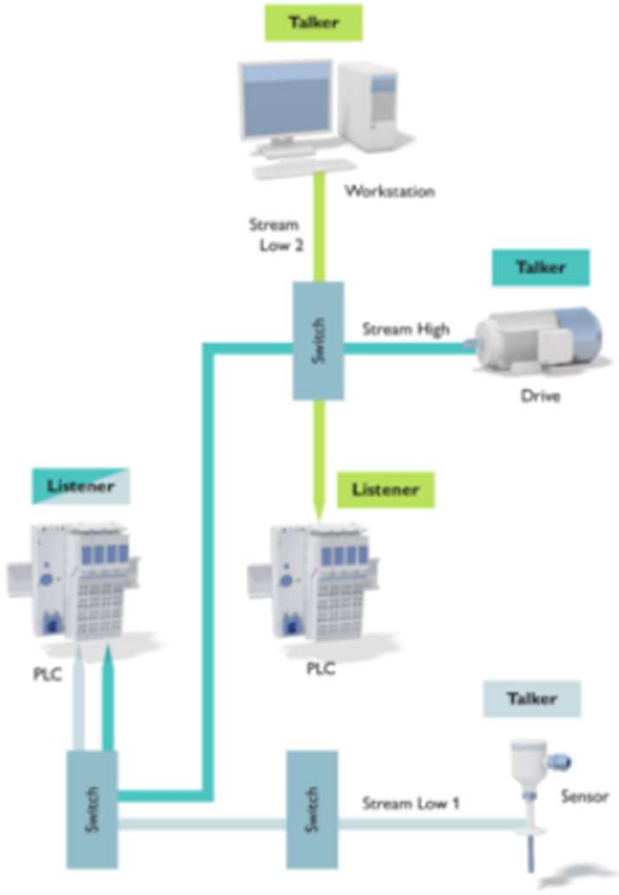
TSN stream from the talker to the lister

TSN streams describe the route of the real-time packets from the talker to the listener. They therefore secure a channel for the transmission of data through the entire network in line with real-time requirements.



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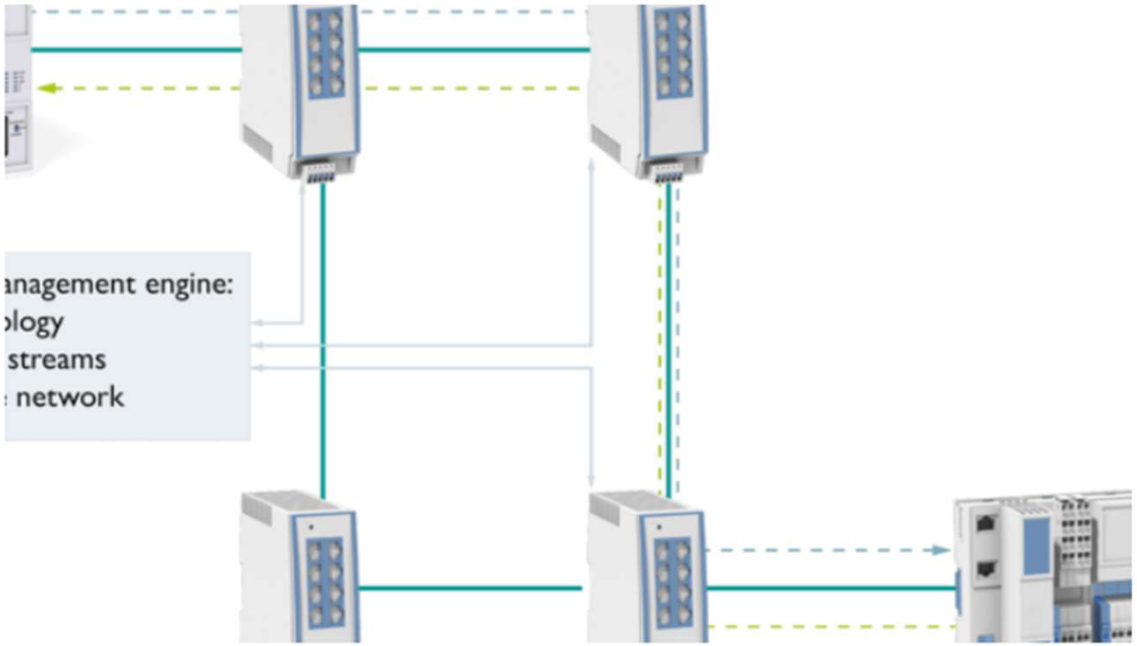
The network management engine configures the network

A network management engine enters the streams in all switches installed along the route from the sender to the receiver. The streams are updated automatically in the event of changes.



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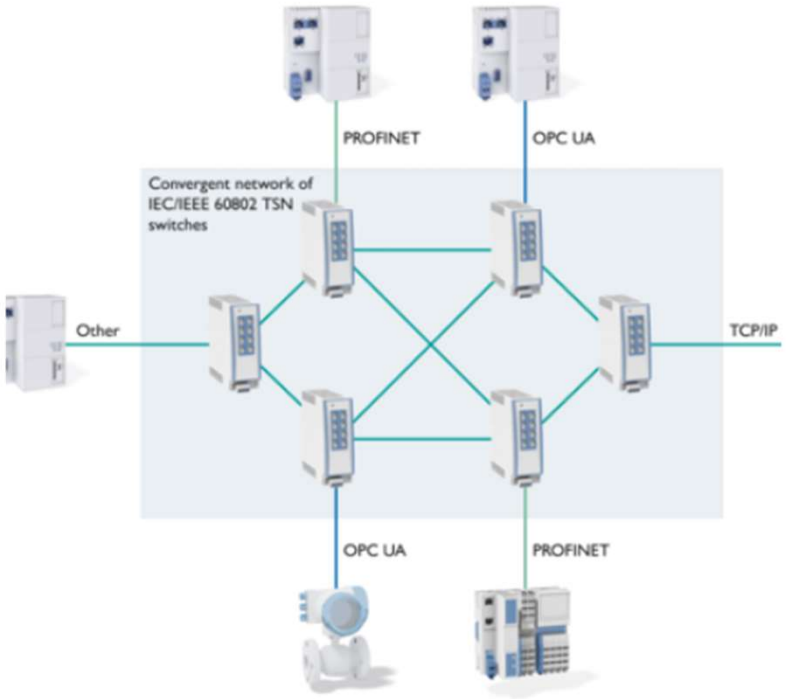
Convergent TSN network with different protocols

The TSN streams can be used by different protocols, which necessitates cross-manufacturer and cross-protocol standardization.



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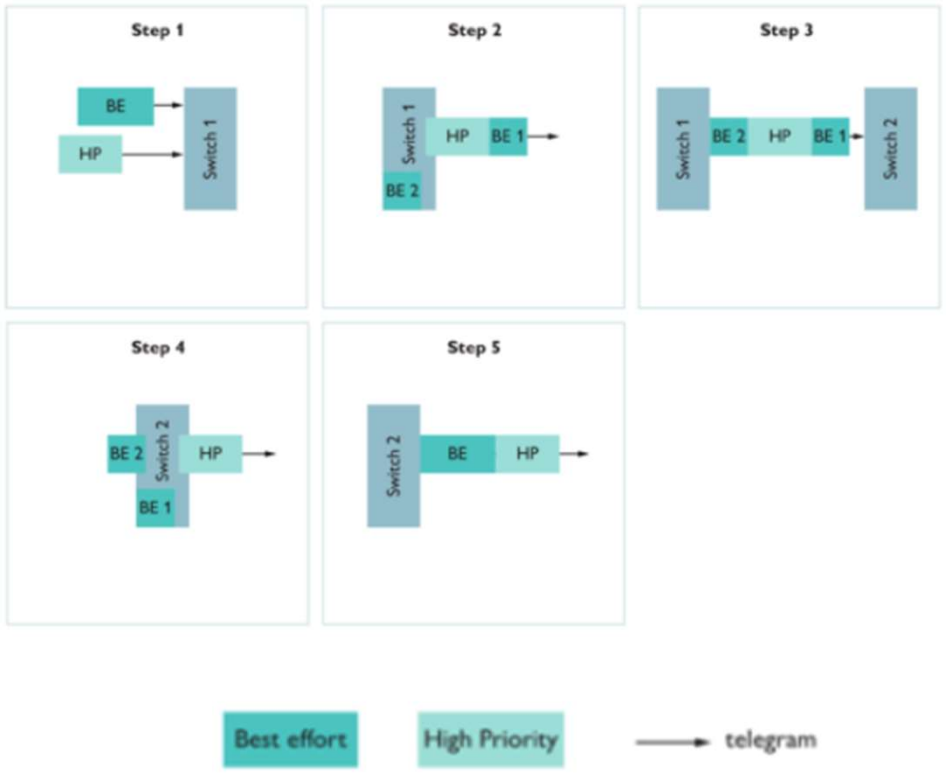
Frame preemption

With the help of frame preemption, a short, high-priority telegram (HP) can “overtake” a long, low-priority telegram (BE).



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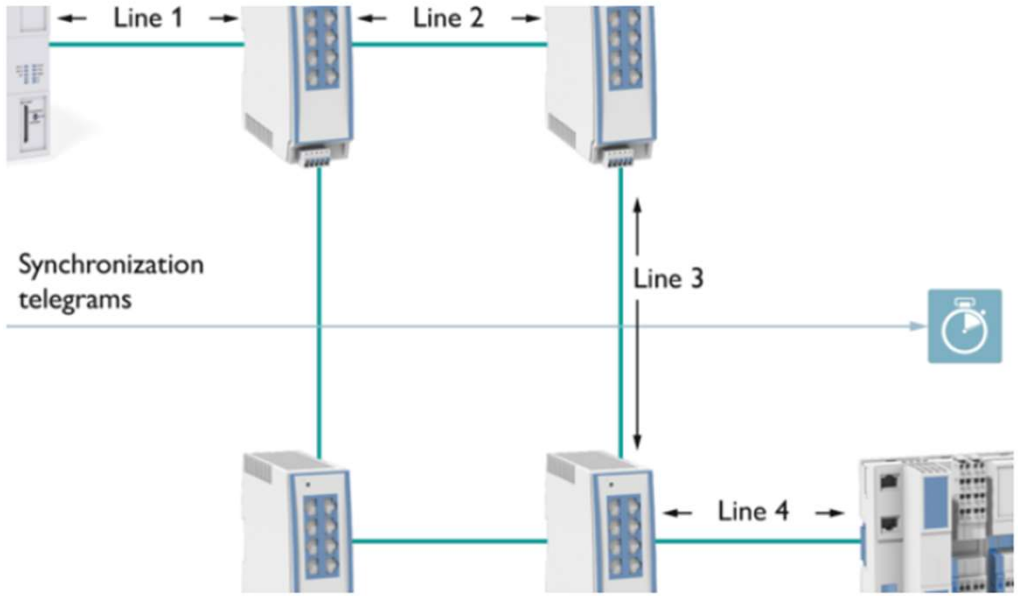
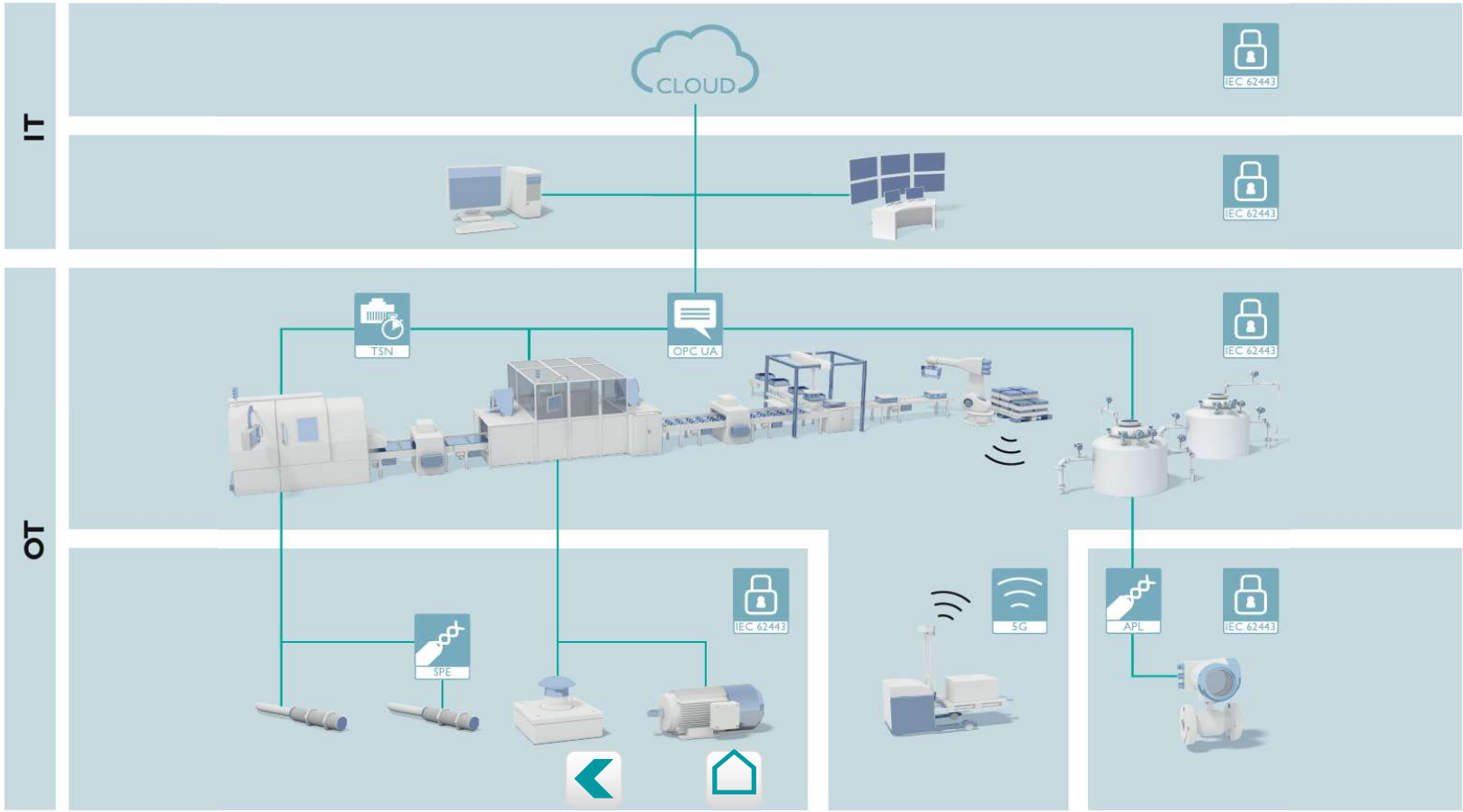
Time synchronization

To synchronize the time, a synchronization master sends its local time to the network; the switches along the route measure and correct the runtime of the synchronization telegrams when forwarding.



SEAMLESS COMMUNICATION FROM THE SENSOR TO THE CLOUD

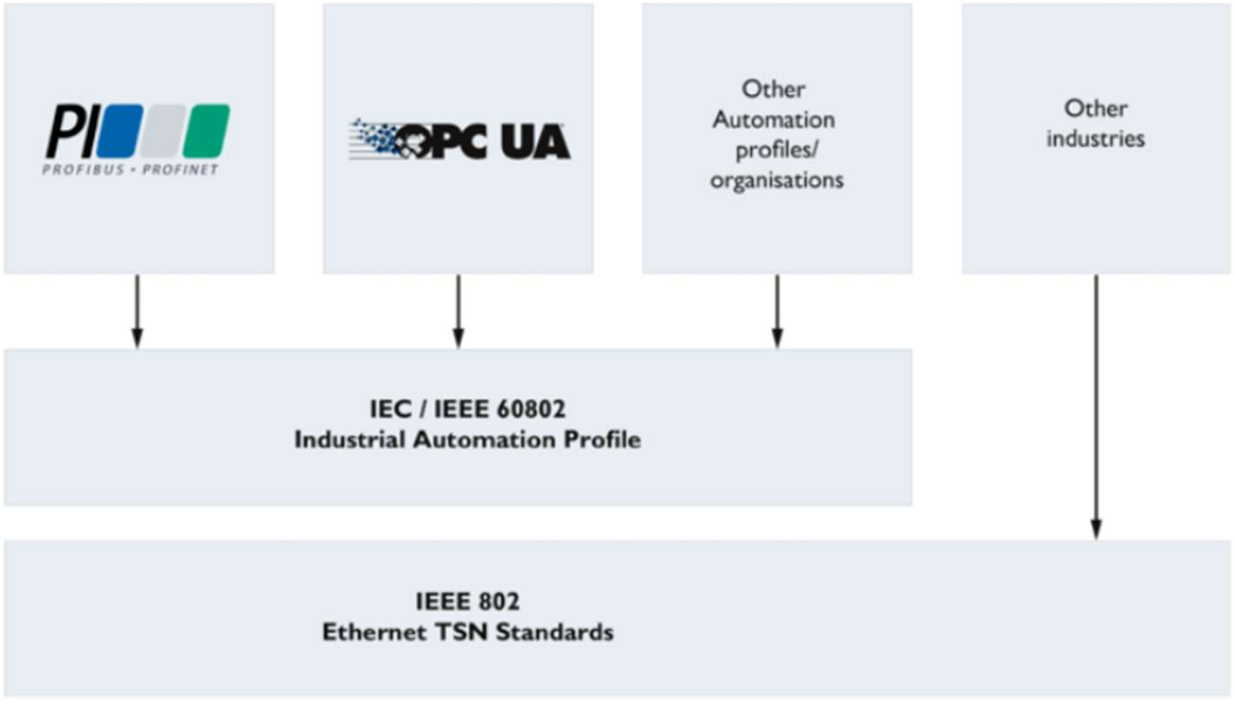


TSN

PROFINET and OPC UA via TSN

Time-Sensitive Networking enables the simultaneous transmission of several automation and IT protocols in one convergent network.

The most commonly discussed protocols here are PROFINET and OPC UA; however, other systems such as CC-Link IE are also specified for use with TSN. To ensure that these protocols do not cause mutual interference in a network, they need to agree on a common profile of how TSN mechanisms are used in the network. This profile is currently being defined in a joint working group for IEC and IEEE under the umbrella of IEC/IEEE 60802-IA.



Joint TSN profile in accordance with IEC/IEEE 60802 – IA

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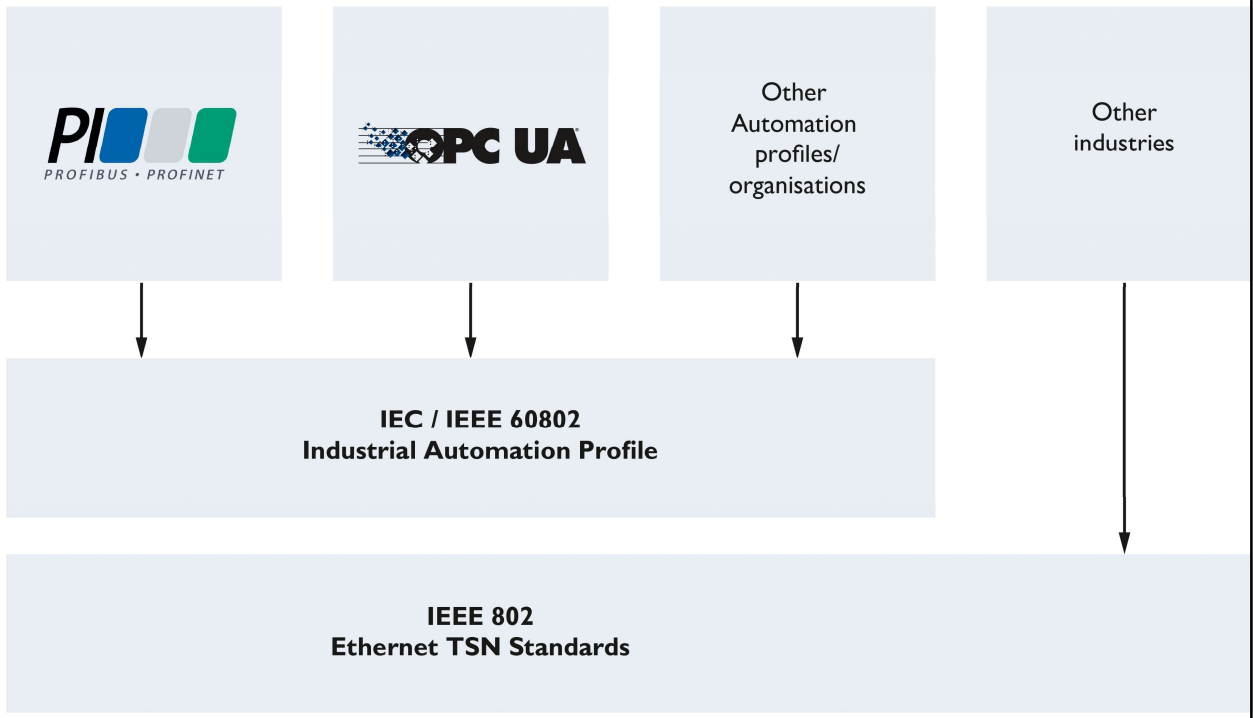
A new Standard

TSN

Ethernet

IEEE	Designation	Details
802.1Q	Streame	Robust routing through the network
802.1AS	Time synchronization	One synchronous time in the system
802.1Qtw	Scheduled Traffic	Communication acooring to timetable
802.1Qbu	Frame Preemption	High priority interrupts low priority
802.1Qcc	Stream Router Configuration	Configuration options of TSN networks
802.1….		



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TSN

The use of TSN standards

The use of TSN standards (“Streams & Configuration”, “Time & Cycle Synchronization”, and “Frame Preemption”) is already specified in version 2.4 or later of the PROFINET standard. The corresponding IEEE standards have been used in such a way that the fundamental properties of PROFINET have been retained. Devices are therefore already being developed with the PROFINET TSN profile and will soon be available on the market.

The Field Level Communication (FLC) Initiative of the OPC Foundation is currently working on the standardization of the OPC UA in combination with TSN. As soon as standardization is complete, corresponding devices will also be developed here that support the OPC UA PubSub in conjunction with TSN.

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TSN

Time Sensitive Networks from a Tools Perspective

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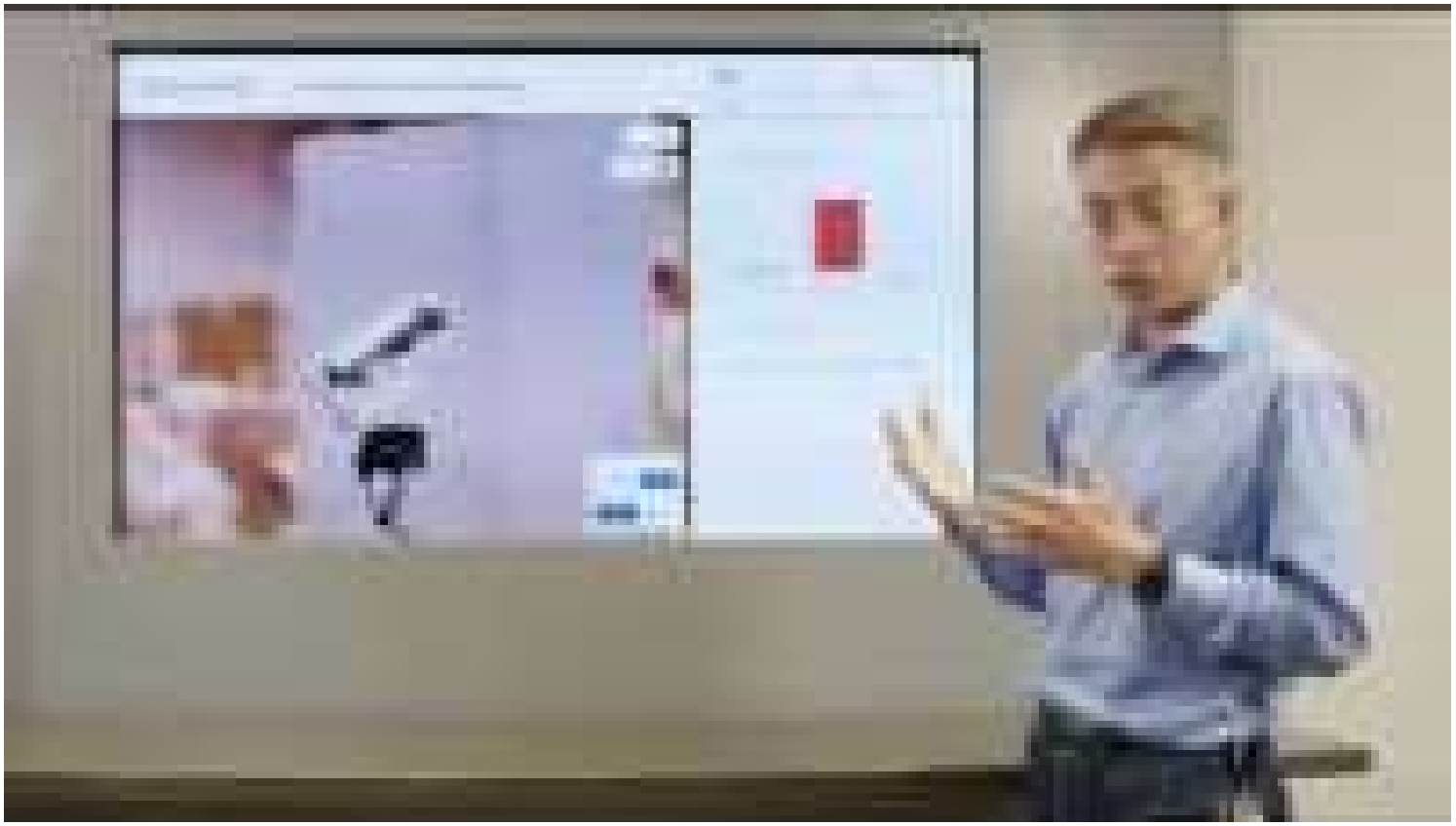
FL SWITCH TSN 2000

Pre-Launch Information

FL SWITCH TSN 2000 – Portfolio

Product key: DNN127

Ord.-No.	Designation			Function description
1232304	FL SWITCH TSN 2316			Managed TSN switch with 16 gigabit RJ45 ports



Qualcom TSN 5G ACIA

Networking in the age of digitalization

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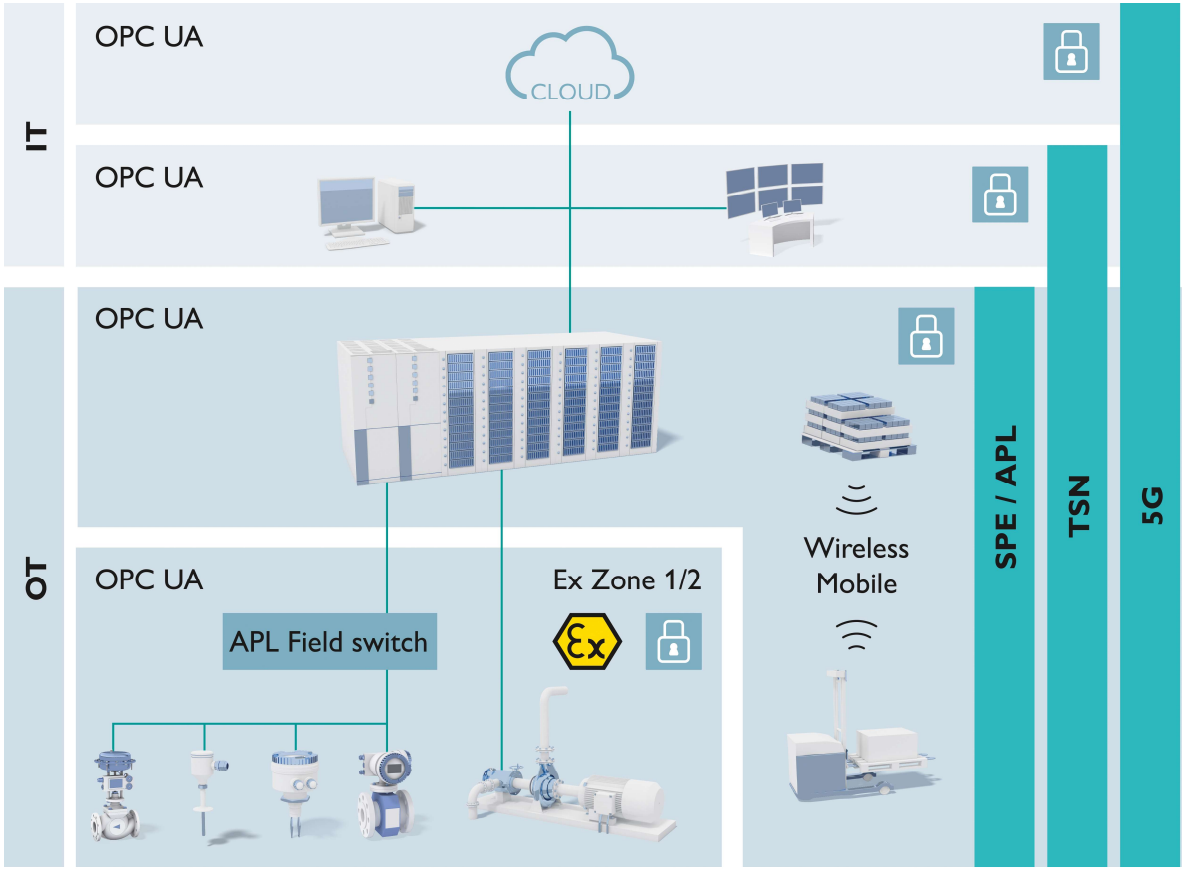
TSN Technology

FL SWITCH TSN 2000

- Understanding Architecture



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Thank you

TSN Time Sensitive Networking

Antonio Gordillo Marketing 13 Agosto 2021

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