SESAM seminar • March 1st, 2018

Digital connectivity in Manufacturing

TSN - MQTT - OPC UA - ODVA

Get input for evaluating TSN, MQTT, ODVA and OPC UAs influence on the Automation Industry and the related solution.
TSN, MQTT, ODVA and OPC US might be the technology for obtaining the Industy 4.0 connectivity.

The seminar will be held at:

Siemens A/S

Borupvang 9
2750 Ballerup

The seminar has been prepared in cooperation with companies and organizations

The growing importance of connectivity in automation

Demanding new applications require precisely timed system control

We live in a world with self-driving automobiles, and reusable self-landing rockets. Such complex systems of multiple sensors, computers, and actuators form a Cyber-Physical System. Some Cyber-Physical Systems will operate at scales that will challenge comprehension. From autonomous vehicle convoys communicating with each other and highway infrastructure, to **Smart Cities** coordinating resources, avoiding traffic congestion, coordinating parking, reducing emissions and power consumption, to Smart national power grids and beyond.

To enable such automation, precisely **timed system control** must be possible. One prime example of the need for such precise timing is taking data from two or more sensors that are precisely timed along with the compute node where the data is merged and processed.

Prior to the availability of **Time Sensitive Networks (TSN)**, **MQ Telemetry Transport** and **OPC UA** various proprietary technologies (e.g. Fieldbus) have been used to provide such capability, or even more simplistic but costly approaches have been used, such as precisely measured sensor cabling to ensure a uniform delay from sensor or actuator to controller. However, with an increasing number of IEEE standards adopted, the ability to use a standards-based approach to TSN has grown considerably.

TSN provides the three essential elements of precise timing: bounded jitter and latency, and guaranteed bandwidth on a network either Ethernet or wireless.

MQTT is an OASIS standard, and is a machine-to-machine (M2M) connectivity protocol. It is designed as a extremely lightweight publish/subscribe messaging transport, with low-bandwidth and high-latency. The design principles are to minimize network bandwidth and device resources requirements whilst also attempting to ensure reliability and some degree of accurance of delivery. These principles also turn out to make the protocol ideal of the emerging “machine-to-machine” (M2M) or “Internet of Things” world of connected devices.

Key mechanisms enabling a Time-Sensitive Network

IEEE TSN standards enabled a solution to be deployed with microsecond timing precision, across seven network hops or more hops with reduced timing precision, with guaranteed worst-case latency, and guaranteed bandwidth.

The TSN standards from 2011, had the essential elements for industrial and automotive environments, such as the need for static, dynamic configuration of stream paths and reservations to ensure rapid, robust operation in a known setting.

These changes are being driven by industry leading companies (eg: BMW, GE, Intel, Rockwell, CISCO, etc.) who recognize the benefits of establishing a common foundation across a disparate set of industries that share the need for reliable, networked solutions that are broadly supported and adopted.

TSN Key Benefits

Standards-based: Part of IEEE 802 standards suite

Partitioned: Virtual separation of traffic classes, enables convergence of other protocols on one physical network.

Compatible: Integrates existing industrial Ethernet protocols including Profinet and EtherNet/IP.

Scalable: Scales from small to very large systems without compromising safety, security or performance.

Secure: Existing security standards and management features can be implemented, partitioning prevents denial of service.

MQTT Key Benefits

Standard: Part of OASIS suite, and the Internet Assigned Numbers Authority (IANA) have reserved the TCP/IP port 1883 for MQTT trafic.

Openness: The protocol specification has been openly published with royalty-free license.

Compatible: The principle of MQTT turn out to make the protocol ideal of the emerging “machine-to-machine” (M2M of “Internet of Things” (ioT).

Secure: Existing security standards and management features can be implemented via SSL or as an application encrypting of data.

Newer TSN standards are adding features for central control, time synchronization of all network devices, and even -lower latency. To achieve the absolute lowest possible latency, IEEE 802.1Qbv defines a Time Aware Shaper, which defies timed traffic gates which act as stop-lights on different priorities of traffic flowing through a switch.

The MQTT protocol specification is public, and openly published with a royalty-free license.

The Internet Assigned Numbers Authority (IANA) have reserved the TCP/IP port 1883 for MQTT trafic. TCP/IP port 8883 is also registrated, for using MQTT over SSL.

This seminar will focus on the opportunities that TSN technologies offer in relation to the connectivity of Factory Floor application - automation world.

The presentations will try to illustrate what TSN gives of possibilities for interconnection of automation equopment. MQTT supports security, for example by encryption across the network can be handled with SSL. Be aware that SSL is not the lightest of protocols, and does add significant network overhead.

Attend the seminar and hear about TSN, MQTT and OPC UA and the influence on factory floor automation environment. Get a picture of the future opportunities that TSN, MQTT and OPC UA will give in conjunction with automation connectivity.

IoT, Automation, Cloud and related communication protocols

IoT / IIoT + Cloud software	Automation platform (PLC, SCADA og MES)
Handling business critical data	Management of technical information
OEE and performance measurements energy Measurements Order optimization Process optimization	Process control Order settlement OEE and performance measurements
Agile and flexible	Structured and less flexible
Can be installed for a short period of time to get data that can be used commercially. Can be installed without affecting the already running systems.	Fixed installation and it may be critical to add additional sensors and data points as it may affect the already running prodution.
IoT and Cloud vendors challenge automation vendors by taking over parts of data management in production.	Automation vendors now offer IoT models and Cloud solutions based on modules like Raspberry Pi, Arduino, .. Listen why this change or add new technology platforms in the automation industry.
Non real-time and real-time communication. Mainly non high speed communication protocols.	Real-time communication and non real-time communication. High speed communication protocols.

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Pictures from previous SESAM meetings.

Registration: www.sesam-world.com/tilmelding