

Connected Factories lecture 4/6: Interconnections

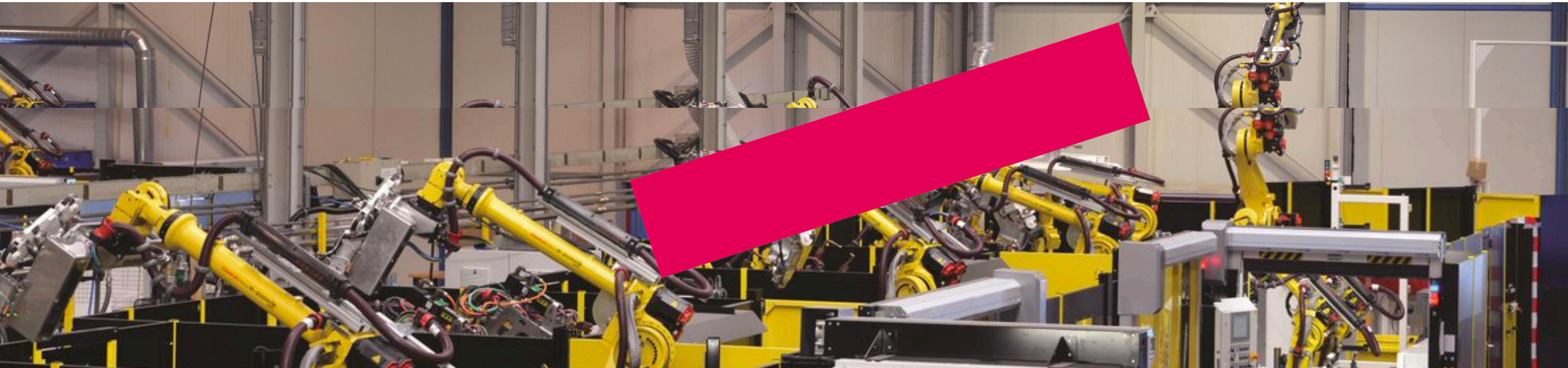


Image: AWL-Techniek

Associate Degree Smart Industry
Faculty of Engineering and Automotive

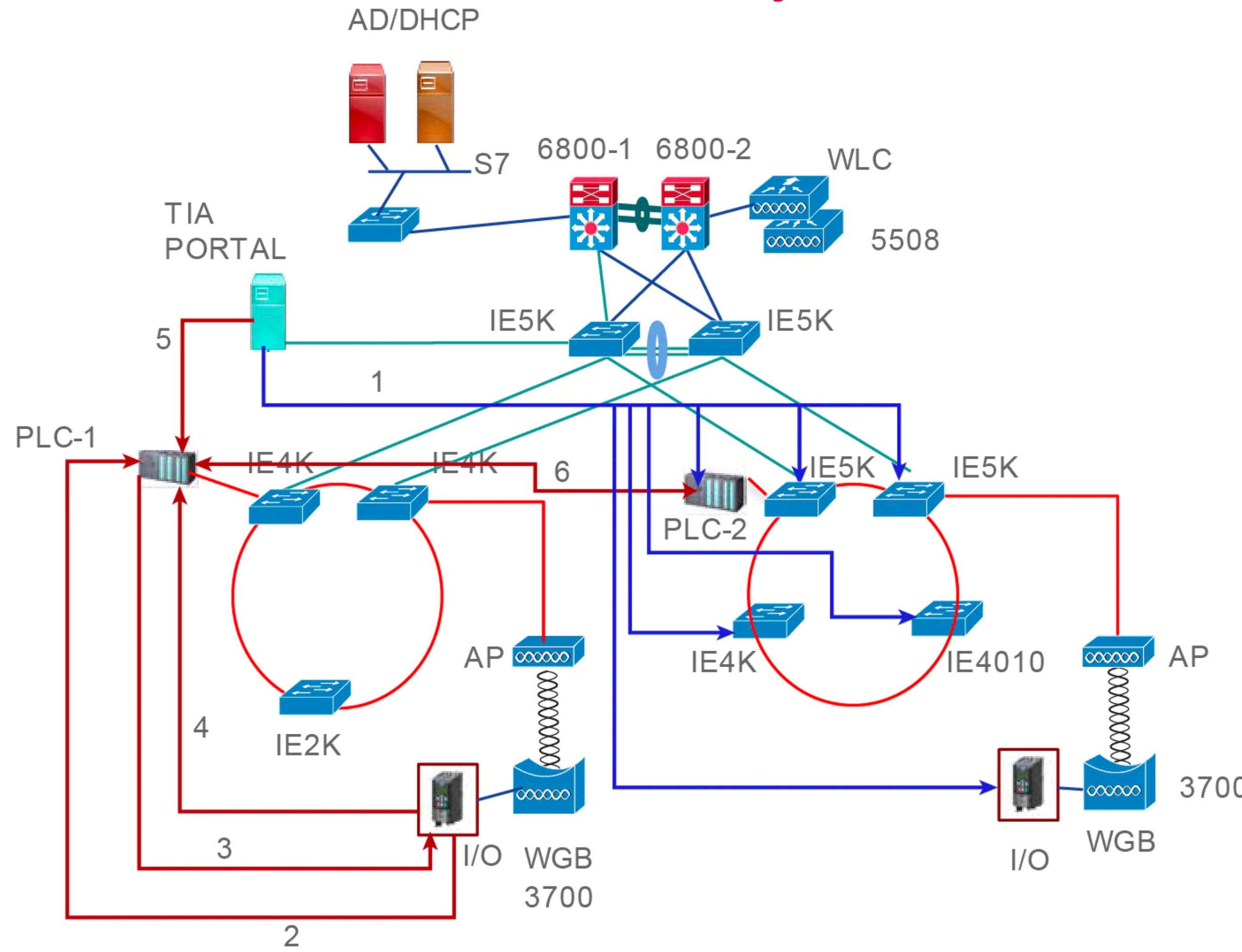
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Schedule

	Theme	
Lecture 1	Introduction	
Lecture 2	Network connections	
Lecture 3	Network protocols	
Lecture 4	Today: Interconnections	
Lecture 5	Security	
Lecture 6	Safety	
Assessment		

Cisco Connected Factory—PROFINET Wireless Design



High-level Overview of the Exchanges Occurring in PROFINET

<https://www.cisco.com/c/en/us/td/docs/solutions/Verticals/PROFINET/2-0/DIG/PROFINET2-DIG/PROFINET2-DIG-Chapter.html>

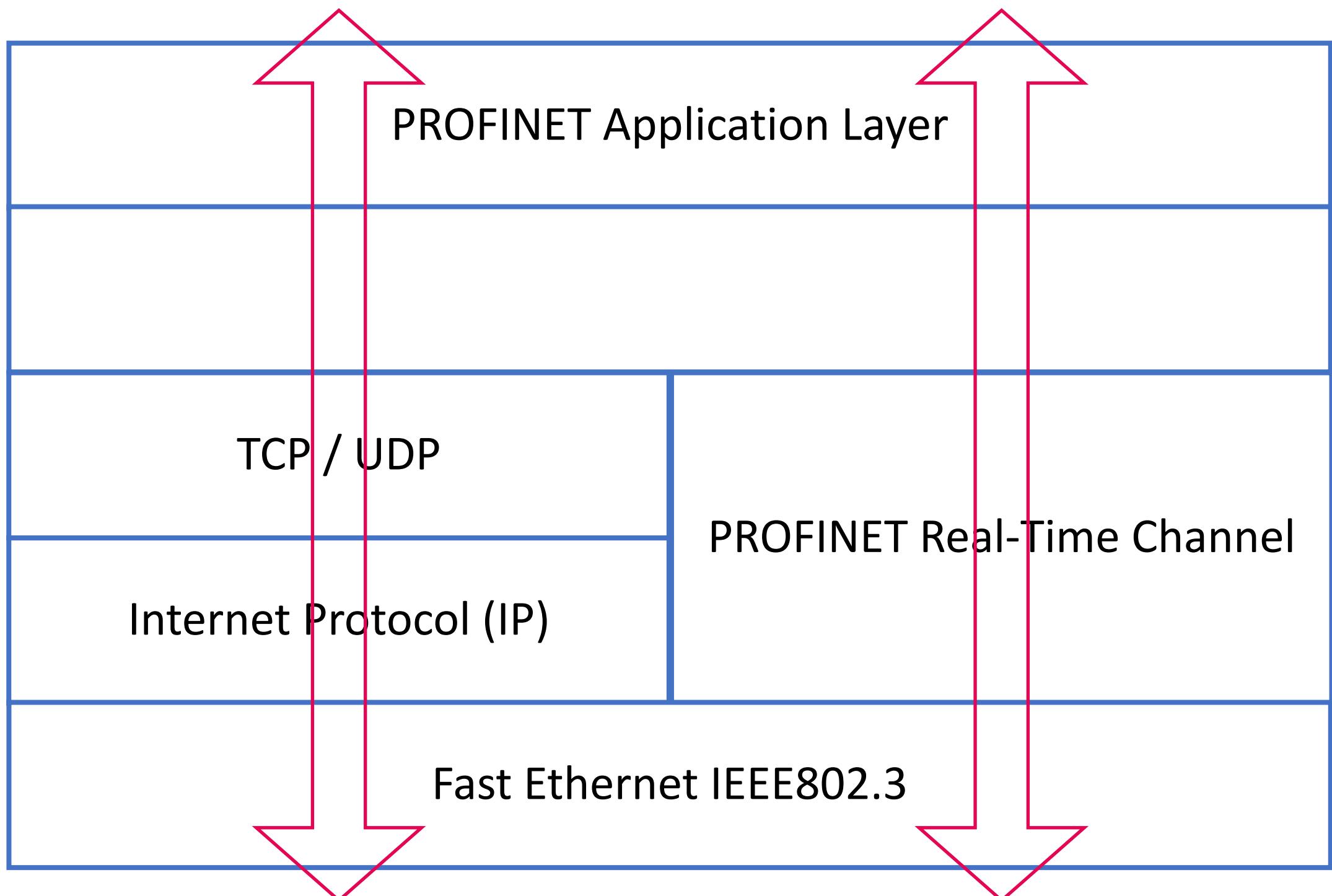
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Profinet: Two types of messages

Non time-critical
Time-critical (Real-time)

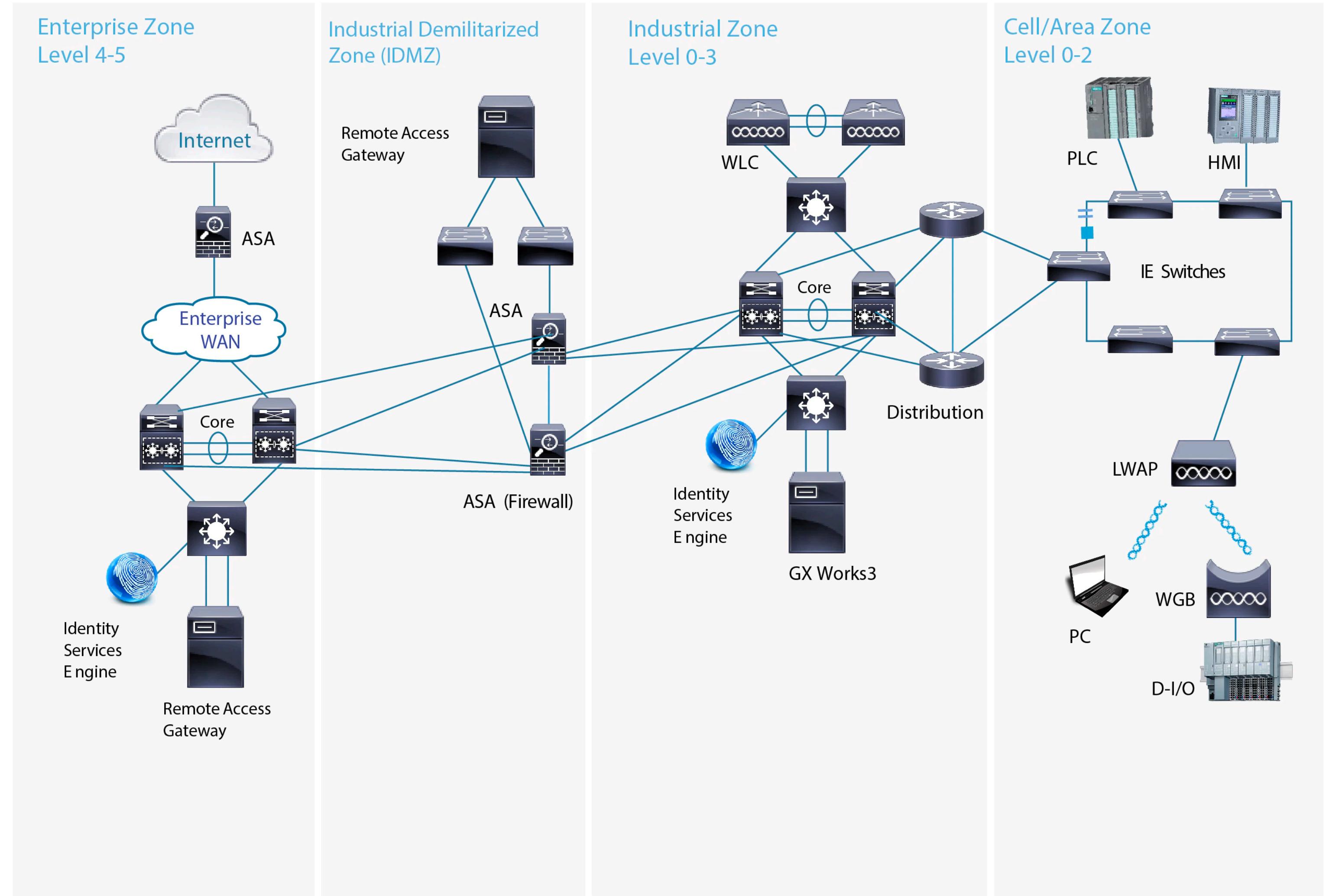
Non time-critical
communication

Real time-critical
communication



Infrastructure zones

Why would Cisco suggest to implement these different zones?



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Industrial Connections: more specific standards

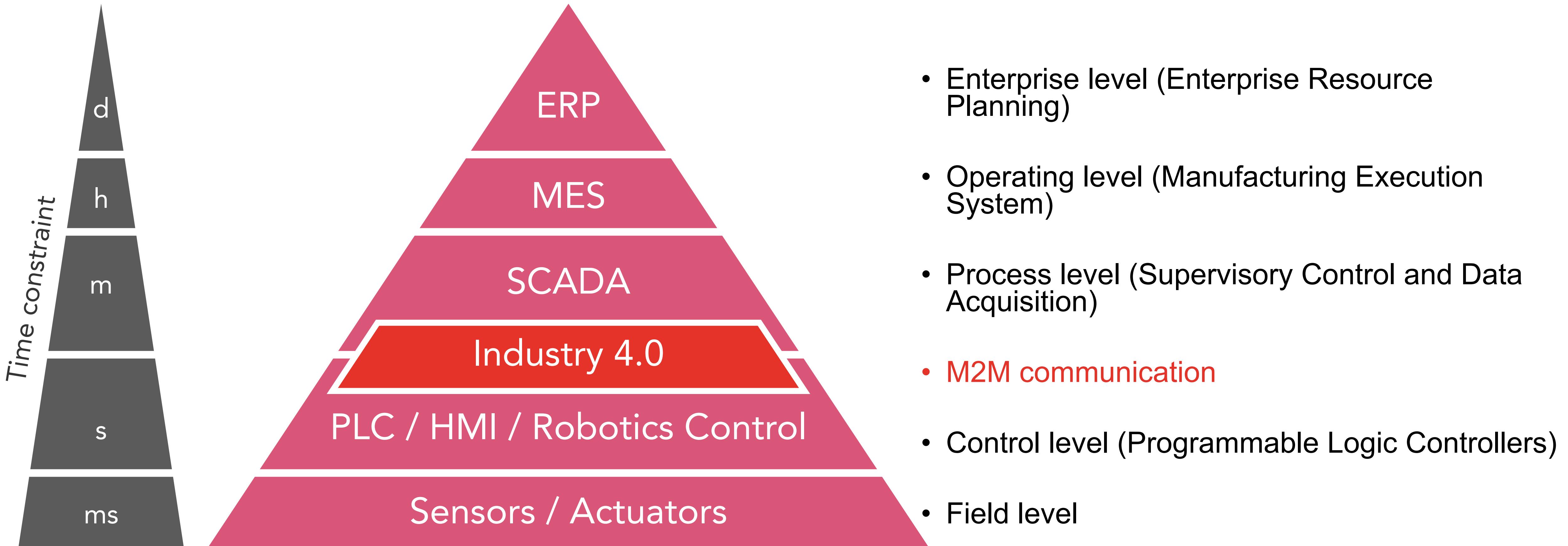
High level Protocol	Type / Characteristic	Standard(s) / Organization
MQTT	Message Queuing Telemetry Transport for M2M communication	ISO/IEC PRF 20922
CIP	Common Industrial Protocol	ODVA
CoAP	Constrained Applications Protocol	RFC 7252

<https://www.odva.org/Technology-Standards/Common-Industrial-Protocol-CIP/Overview>

<https://www.embedded.com/industry-adoption-of-iot-a-constrained-application-protocol-survey/>

https://en.wikipedia.org/wiki/Constrained_Application_Protocol

Industrial Connections: Automation Pyramid (IEC 62264 / IEC615112)



Modbus

Developed by Schneider Electric (Modicon, 1979)

- developed for industrial applications
- royalty-free and open standard
- easy deployment and maintenance
- moves raw bits or words without placing many restrictions on vendors.

Examples of usage:

- Connecting RTU (Remote Terminal Unit) in SCADA (Supervisory Control And Data Acquisition) systems

Modbus: varieties

Modbus RTU

Modbus ASCII

Modbus TCP(/IP)

Modbus over TCP/IP

Modbus over UDP

Modbus Plus (Modbus+, MB+ or MBP)

Pemex Modbus

Enron Modbus

See: <http://www.modbus.org>

Modbus object types

Object type	Access	Size
Coil	Read-write	1 bit
Discrete input	Read-only	1 bit
Input register	Read-only	16 bits
Holding register	Read-write	16 bits

PROFINET: varieties

- TCP/IP (Standard) reaction time ± 100 ms
- RT (Real-Time) cycle times up to 10 ms
- IRT (Isochronous Real-Time) cycles times of less than 1 ms

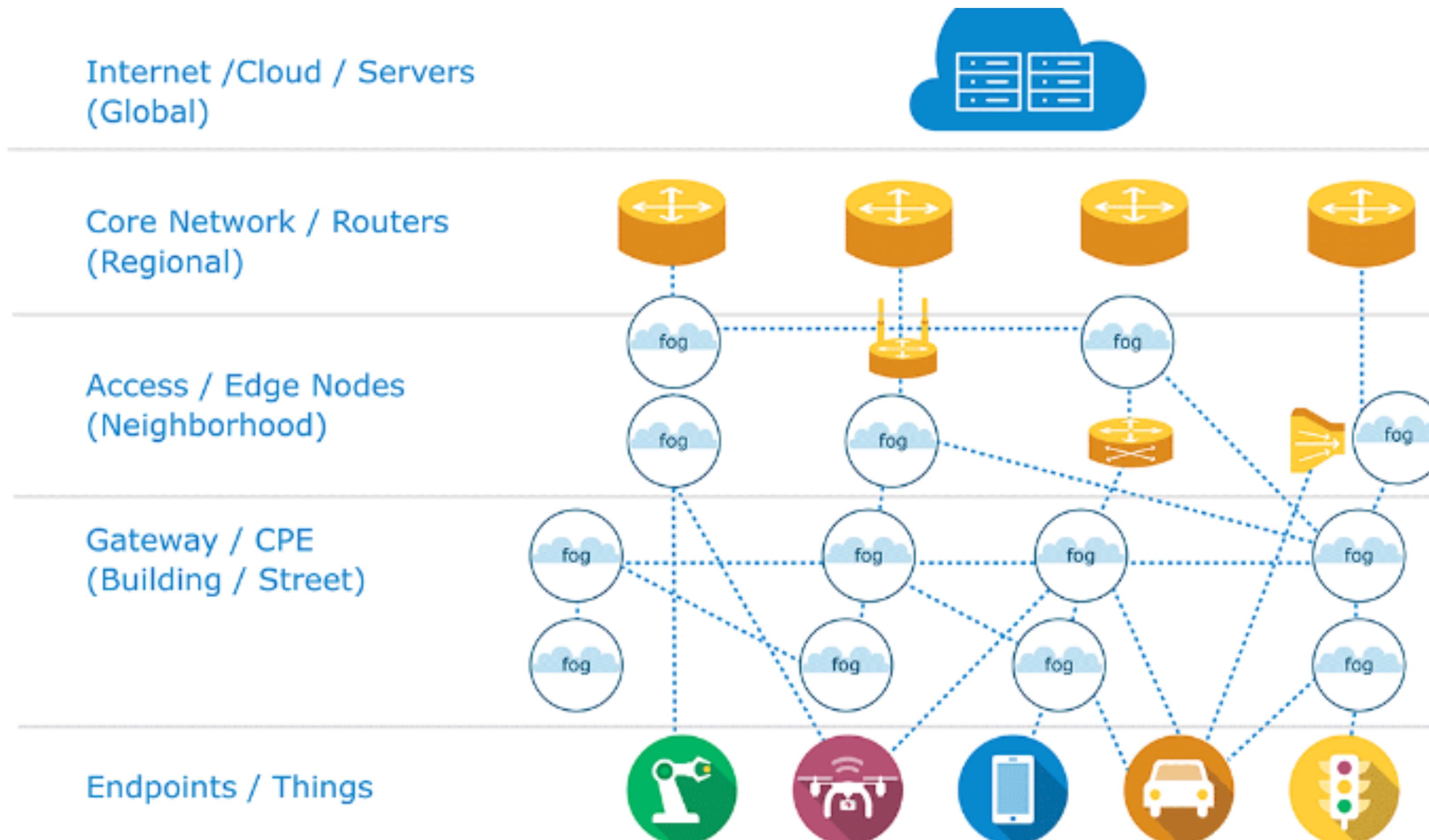
PROFIsafe (PROFIBUS safety or PROFINET safety) (IEC 61508) (Verder uitwerken)

See: <http://www.modbus.org>; https://en.wikipedia.org/wiki/Isochronous_timing;

Mobile Edge Computing (MEC)

- MEC: extends cloud-computing capabilities and services to edge of network.
- Reduced latency and improved QoS:
 - dense geographical distribution
 - proximity to consumers,
 - support for high mobility, and open platform
- important enabler of:
 - services that demand real-time operations
 - consumer-centric IoT applications

MEC / Fog computing



MEC / Fog computing

Fog computing is for IoT, 5G and AI systems which need SCALE.

- S**ecurity : Additional security to ensure safe, trusted transactions.
- C**ognition : Awareness of client-centric objectives to enable autonomy.
- A**gility : Rapid innovation and affordable scaling under a common infrastructure.
- L**atency : Real-time processing and cyber-physical system control.
- E**fficiency : Pooling of local unused resources from participating end-user devices.

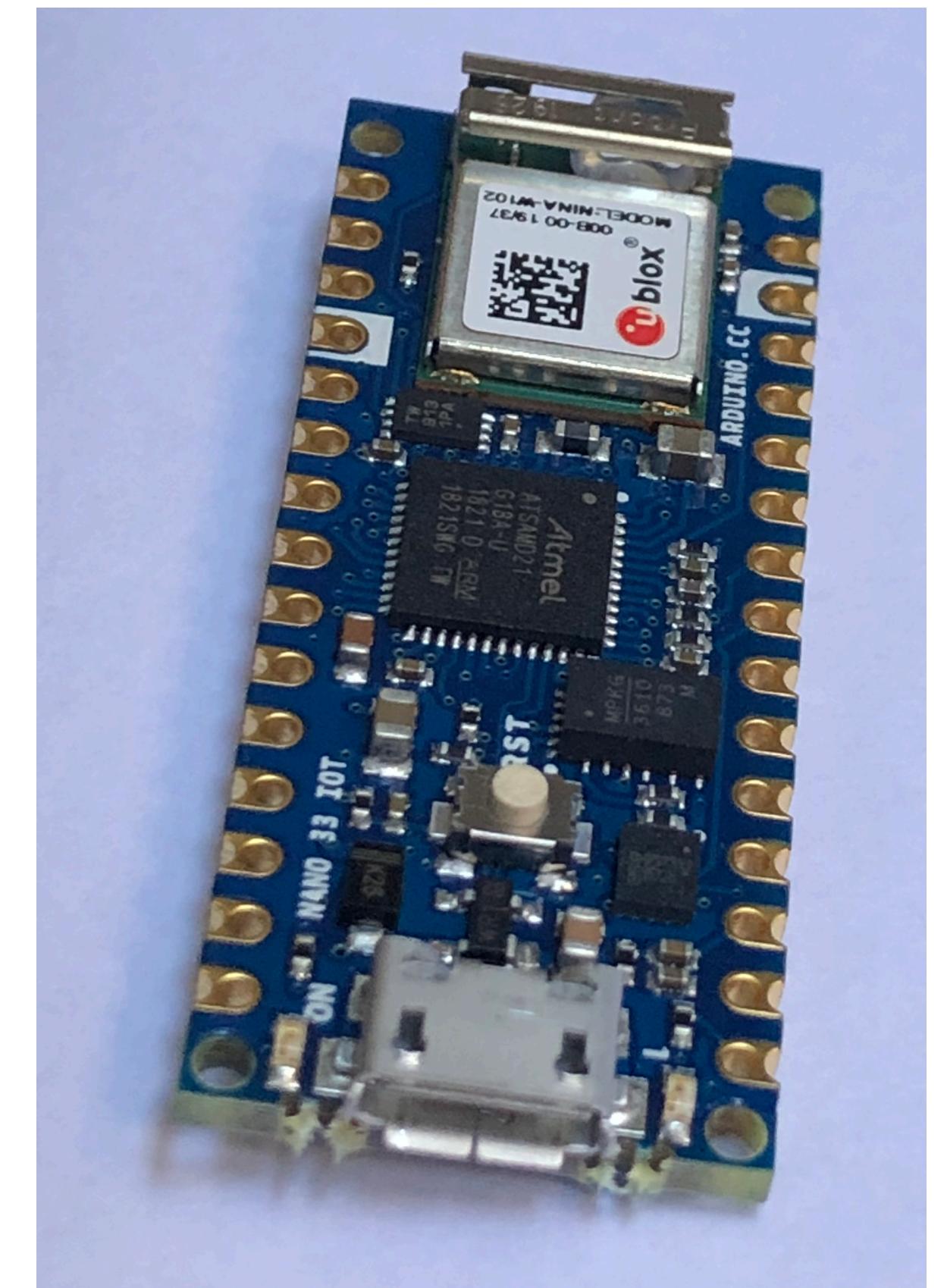
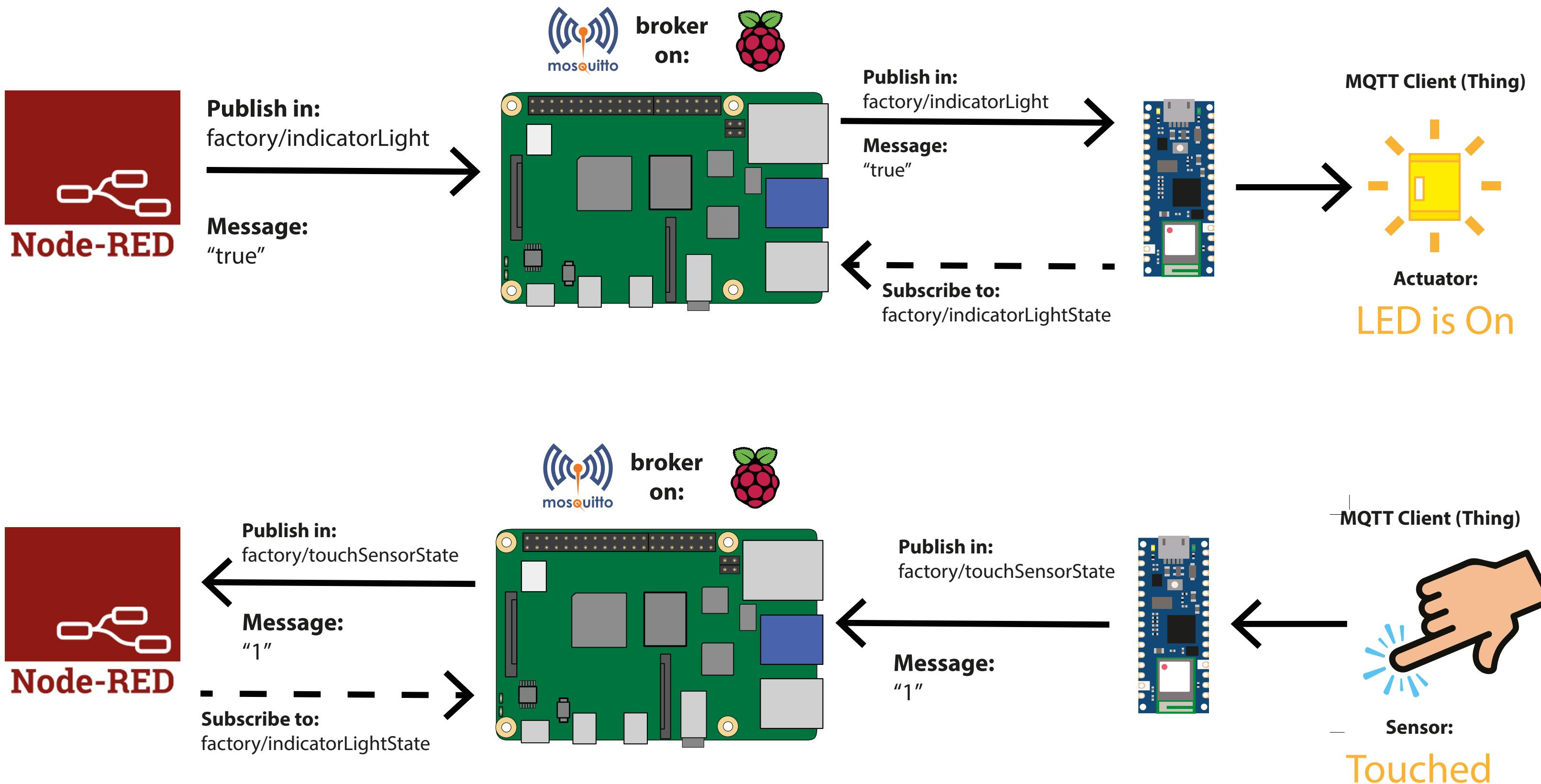
Cisco modules

Remember, course URL: <https://www.netacad.com/portal/learning>

Homework for next session:

- Les 7. Het internet

Next step: Raspberry Pi, Node-RED and MQTT.



Links

Cisco Profinet:

<https://www.cisco.com/c/en/us/td/docs/solutions/Verticals/PROFINET/2-0/DIG/PROFINET2-DIG/PROFINET2-DIG-Chapter.html>

Node-RED forum:

<https://discourse.nodered.org>

