

# ICT for Industrial Applications

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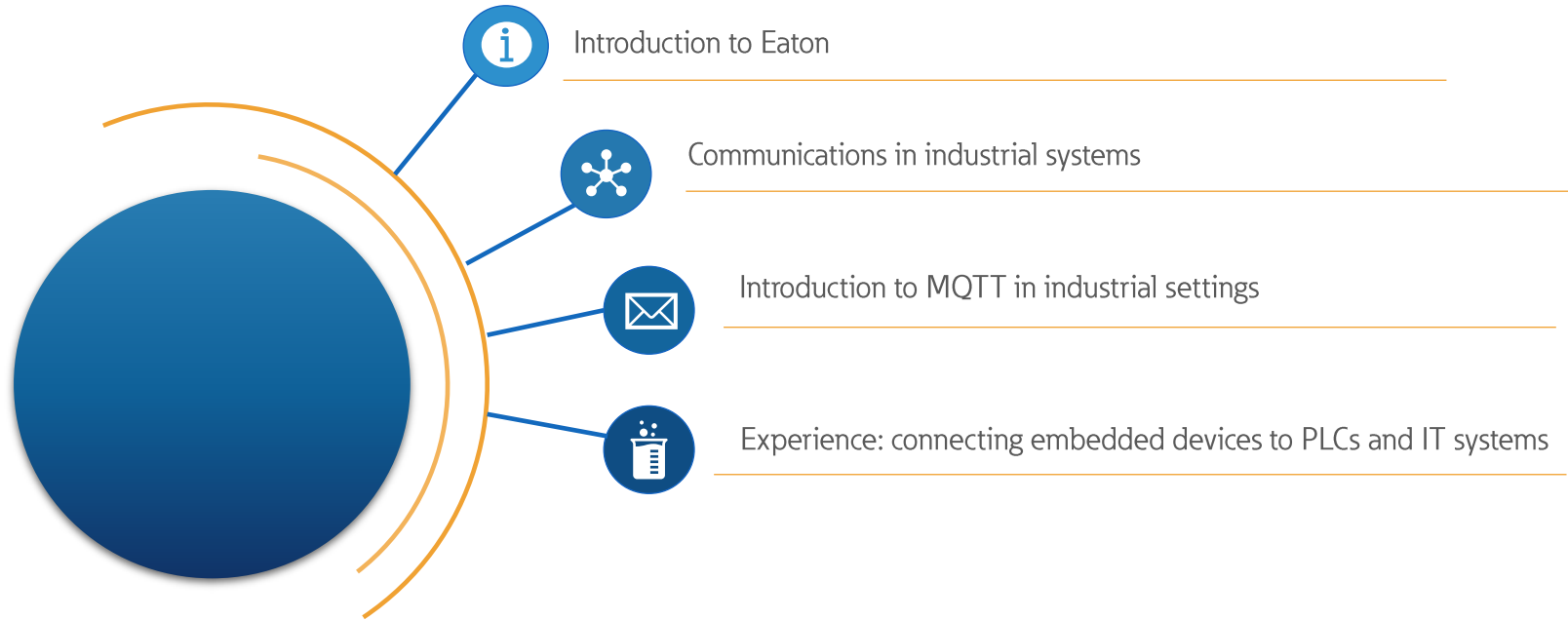
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*Powering Business Worldwide*

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# Contents



# Who am I and what does Eaton do?

# About me

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## My experience

- Master in Telecommunications Engineering from University of Padova
- Software developer at Patavina Technologies (UniPD's spin-off)
- Ph.D. from University of Padova, Dept. of Information Engineering
- Intel Labs in Ireland

**Current role:** Specialist engineer at Eaton – Centre for Intelligent Power, Dublin, working on On-premise architecture and embedded solutions for analytics and AI

# Introduction to Eaton

**We are a power management and distribution company**

We make equipment that transports and transforms electrical power on utility networks, industrial factories, data centres, residential and commercial buildings.

We distribute mechanical and electrical power in vehicles (including aircrafts)

If something has power, we almost certainly have a product for it.

**EAT•N**

Powering Business Worldwide

# Headquarters and key locations

Our 2022 revenue was \$20.8 billion, and we have customers in more than 175 countries. Today, we employ approximately 85,000 people.



- Chairman & CEO – Craig Arnold
- Two-thirds of our Board of Directors are women or U.S. minorities

**Electrical Sector:**  
2020 Sales \$11.4 B

**Industrial Sector:**  
2020 Sales \$6.5 B

**Total sales:**  
\$17.9 Billion USD

**Net income:**  
\$2.5 Billion USD

# Global Headquarters: Dublin

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Sales, research & development, finance, supply chain and purchasing



150 Employees



Diverse and Multinational Environment



Recognised as a Prime Employer for Women



32,600 square-foot office designed by 80% with Eaton products creating a sustainable and eco-friendly environment

# We make what matters work



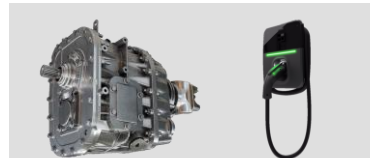
Power distribution and circuit protection



Power quality and energy storage



Filtration



eMobility



Life safety and security



Utilities and power grid solutions



Aerospace



Vehicle



Monitoring and prognostics



Industrial control and automation



# The Centre for Intelligent Power

Dedicated to develop advanced analytics and artificial intelligence solutions across our portfolio



# Centre for Intelligent Power - Key Competencies

## Data Science

- Machine Learning
- Artificial Intelligence
- Advanced Analytics & Data Mining

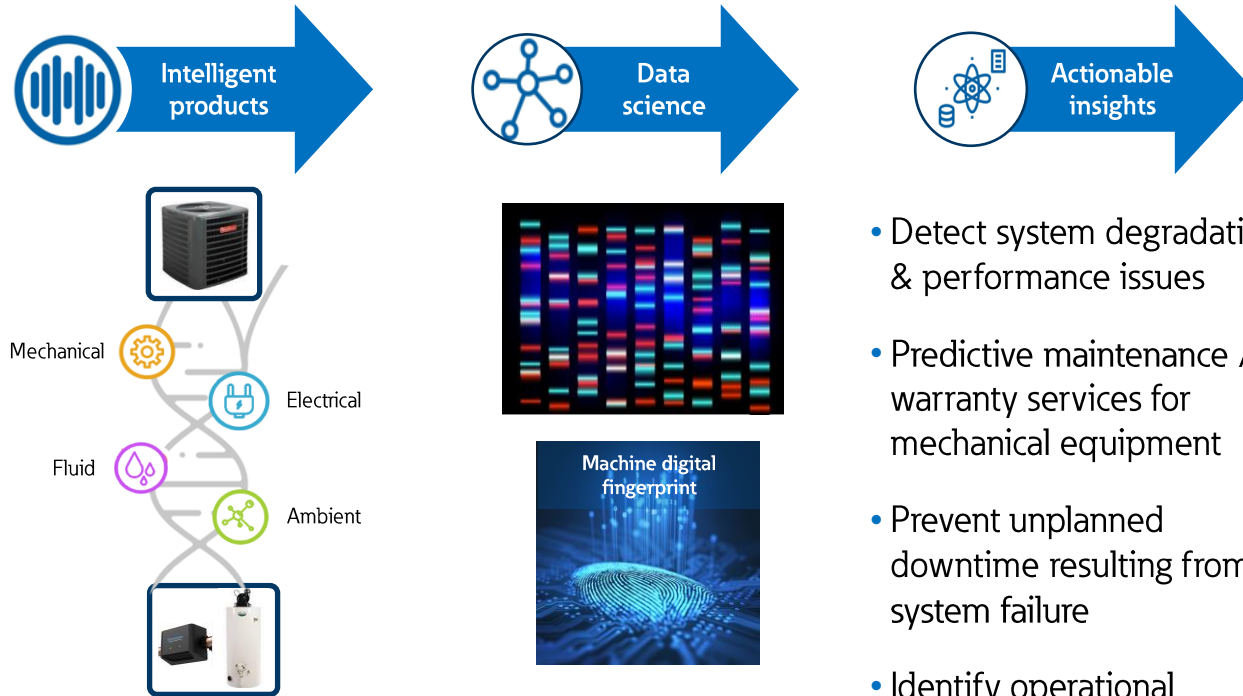
## IoT Architectures

- Edge Computing
- Cloud Platforms
- Machine Learning Platforms
- Data processing pipelines

## User Experience

- User Interaction Design
- Information Visualisation
- Novel interfaces

# We manage power through actionable insights



- Detect system degradation & performance issues
- Predictive maintenance / warranty services for mechanical equipment
- Prevent unplanned downtime resulting from system failure
- Identify operational inefficiencies



# The split between Information Technology / Operational Technology

# In automation systems, there are two zones

## Operational Technology (OT)

- Industrial machines
- Automation control
- Sensors
- Conveyor belts
- Electrical panels

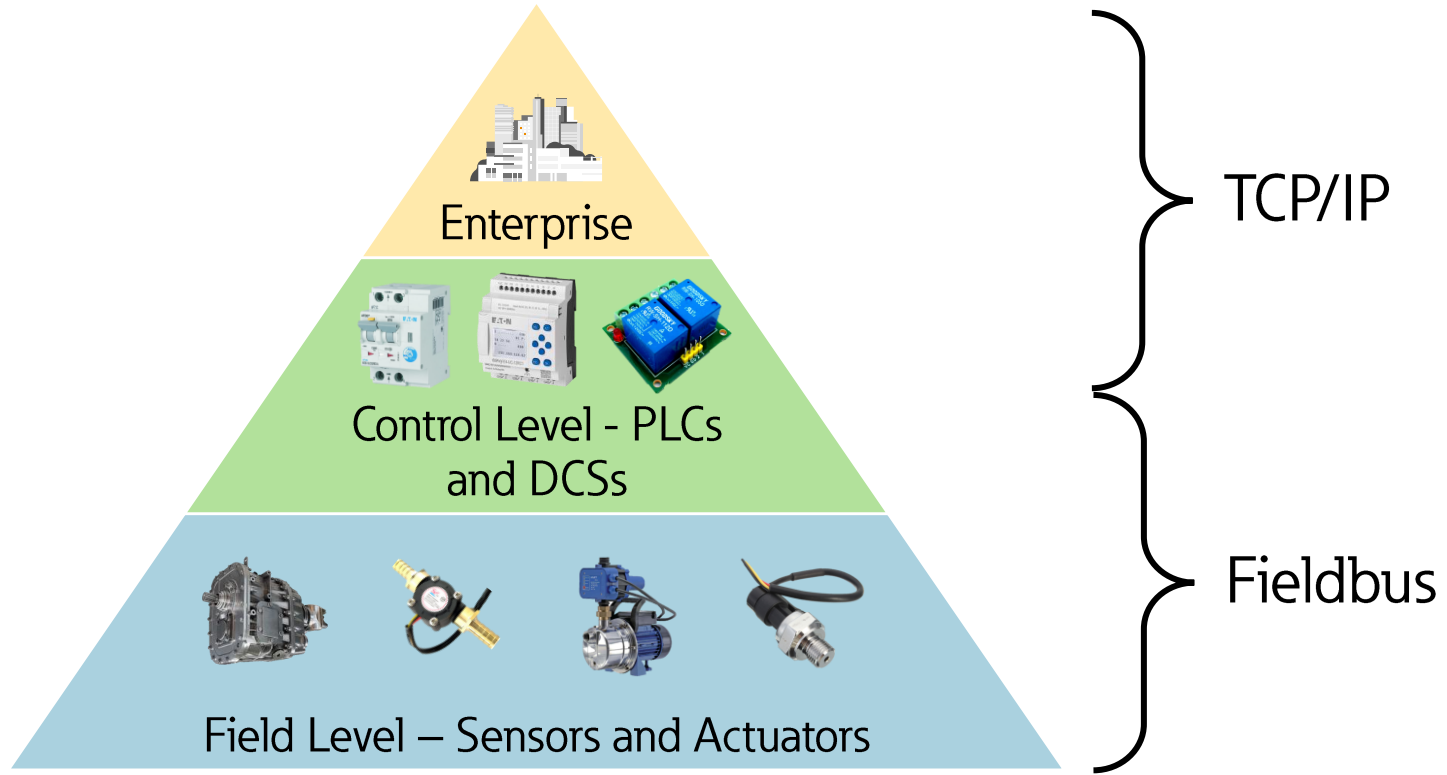
Real-time control of  
machines/devices on the factory  
floor, buildings, vehicles

## Information Technology (IT)

- Servers
- Laptops
- Internet
- Cloud
- Printers

Operation reports, supplies  
and orders tracking

# Layers of an automation system



# Fieldbus

## Characteristics:

- Resistant to electromagnetic noise
- Low latency
- Upper-bounded latency
- Delivery guarantee

## Example payload:

- Diagnostics
- Real-time action commands
- Sensor output used in control cycle

## Fieldbus examples:

- Modbus, Profibus, CAN, EtherCAT

# TCP/IP Network

## Characteristics:

- Easy to install
- Large bandwidth and data transfer rate
- Highly configurable
- Flexible payload type and format
- Advanced security

## Example payload:

- Diagnostics
- Operational parameters
- Averaged or processed output
- High-level commands (e.g., whole system on/off)

## Network examples (level 1-2):

- Ethernet, WiFi, Cellular LTE



# MQTT for industrial applications

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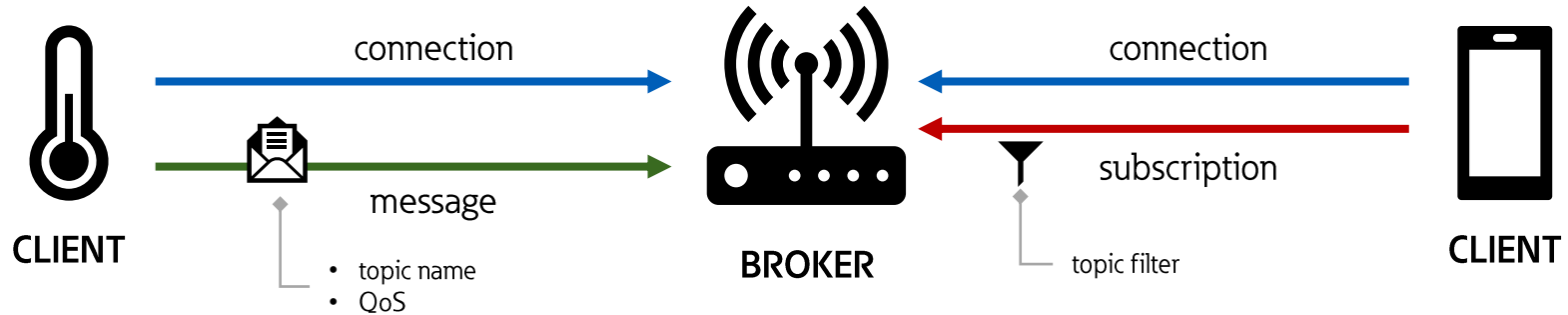
- IT technologies usage is expanding towards the OT field, particularly for less time-sensitive applications
- MQTT is such an example
- In industrial settings, MQTT is increasingly used to interface the Control level and Enterprise level

# Sparkplug-B

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- Sparkplug-B was created by CirrusLink (2016), and is maintained by the Eclipse Foundation
- Extension of MQTT v3.1.1/v5
- Used to package industrial data and communicating it to an MQTT infrastructure
- It standardises the topics and payload of messages for industrial applications

# How MQTT works



**Topic example:** factoryA / telemetry / productionLine03 / seatAssemblyPLC

**Subscription filter example:** factoryA / telemetry / \*

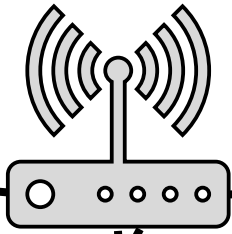
**Payload:** often JSON, but no restrictions are imposed by the MQTT specifications

# Introduction to the lab experience

Eaton easye4 PLC



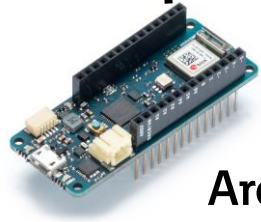
WiFi Access Point



IoT gateway  
MQTT broker



Arduino



Computer  
NodeRED

