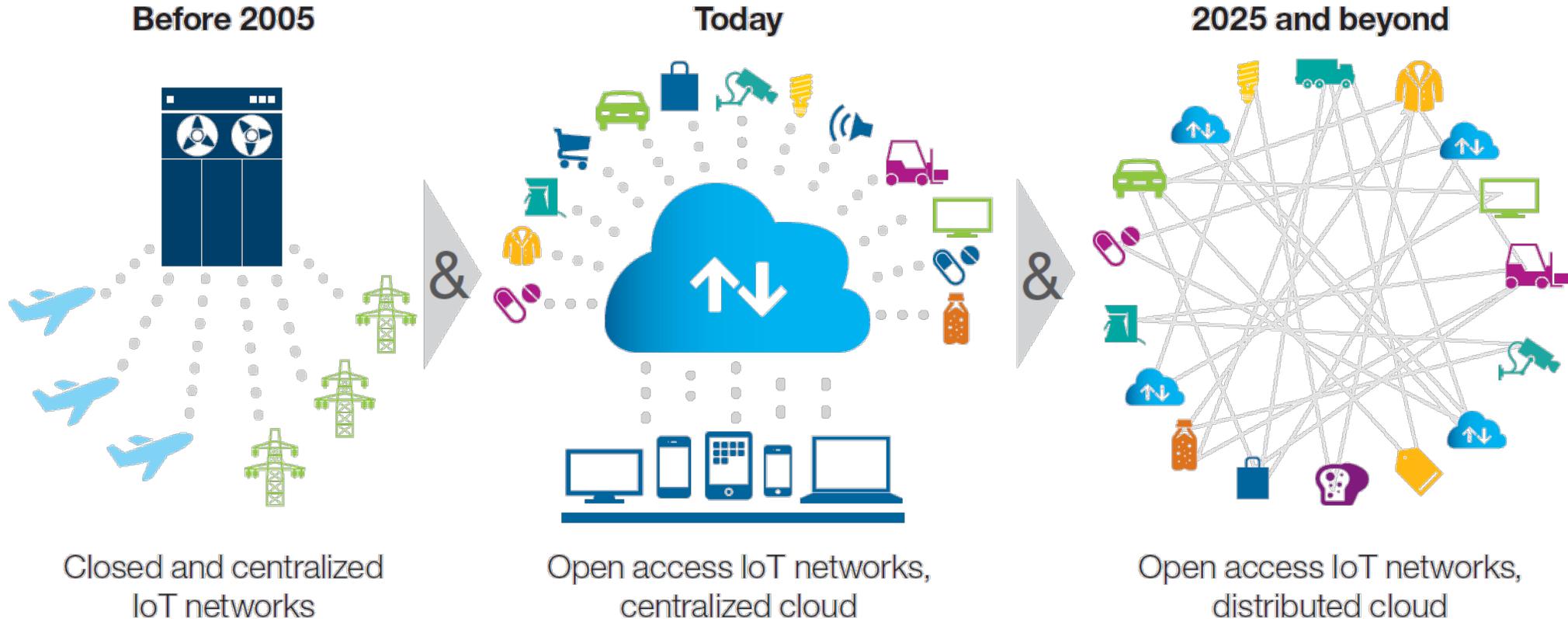


# IBM Edge Analytics on Industrial Automation Data with Hilscher's netIOT Edge Gateway

# IBM Institute for Business Value Executive Report 2015

## *Device democracy – Saving the future of the Internet of Things*



*"To be safe, scalable and efficient, Internet of Things networks must be re-architected to gradually shift from managing billions of devices to hundreds of billions of devices"*

Source: [http://www.ibm.com/common/ssi/cgi-bin/ssialias?subtype=XB&infotype=PM&appname=GBSE\\_GB\\_TI\\_USEN&htmlfid=GBE03620USEN&attachment=GBE03620USEN.PDF](http://www.ibm.com/common/ssi/cgi-bin/ssialias?subtype=XB&infotype=PM&appname=GBSE_GB_TI_USEN&htmlfid=GBE03620USEN&attachment=GBE03620USEN.PDF)

# Topics

1. Hilscher at a glance
2. IBM Edge Analytics with Hilscher's netIOT Edge Gateway
3. Key business benefits of distributed Edge Analytics
4. Life Cycle Management and Business Model
5. Use Cases
6. IBM Summary value proposition

# Technology Leadership in Industrial Communication

We unlock the value of Shop Floor data for the I4.0 digital factory automation



Private Company, Owner managed

- Headquarter: Hattersheim, Germany
- CEO & Owner: Hans-Jürgen Hilscher
- CTO: Sebastian Hilscher
- Founded: 1986
- Employees: 310+
- Offices located in USA, China, France, India, Italy  
Japan, Korea, Switzerland



[www.hilscher.com](http://www.hilscher.com)



Embedded netX multiprotocol technology

Used by 14 out of 15 major global automation companies

# What is the “EDGE”?



The edge of the Industrial IoT is where the action is



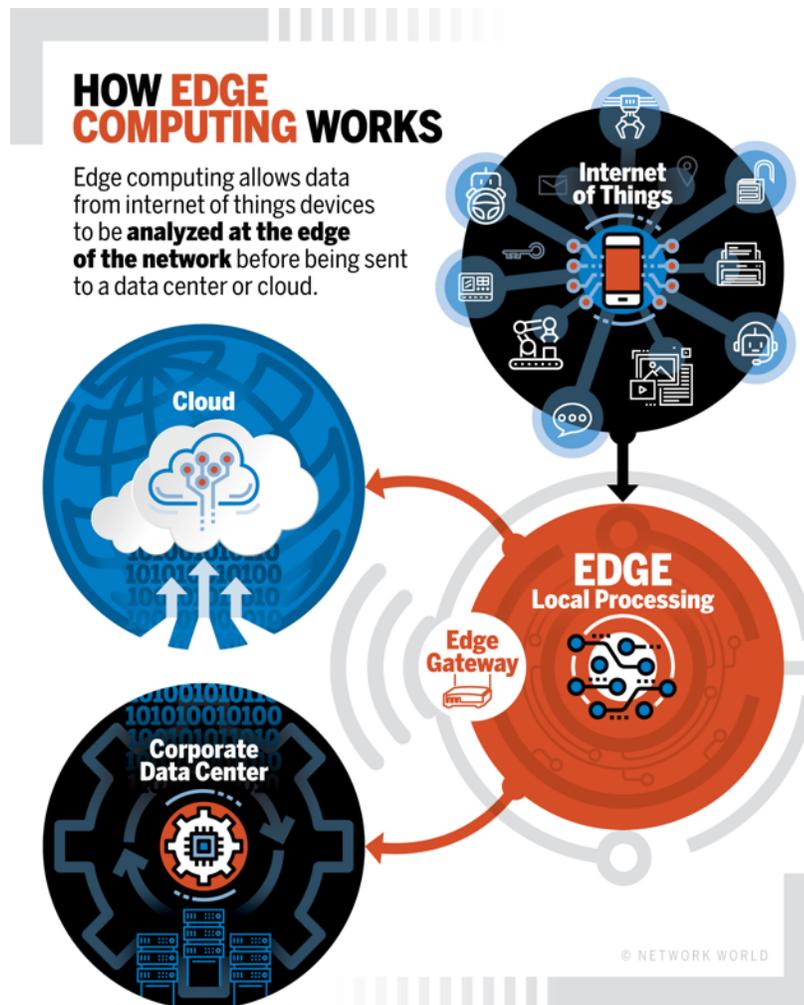
Where IT meets OT on the Factory Floor



It includes a wide array of sensors, actuators, and devices—those system endpoints that interact with and communicate real-time data from smart products and services.



Gateways provide a place to put your IoT agent code and often include an SDK to make the coding and deploying of an agent straightforward. They connect legacy and new systems and enable data flow between edge devices and the cloud.



# Solutions netIOT Edge Gateways help bring to Customers

- Process Data Collection
- Prescriptive Maintenance on Machine Control Systems.
- Asset Management Tracking in Real-time.
- Real-Time Process Analytics.
- Diagnostics on Customers Control and I/O networks.

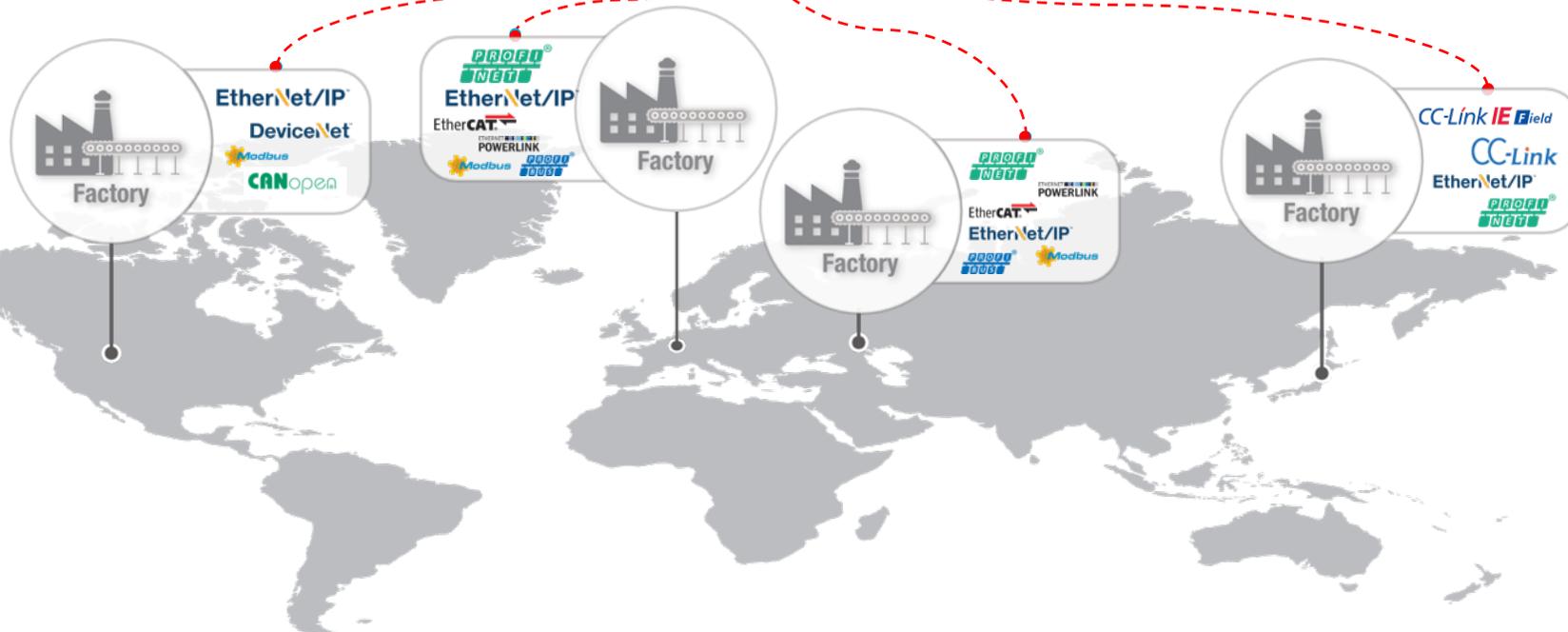
# OT / IT Connectivity

Data from sensors to the cloud



**Cloud and  
Datacenter**

IBM, SAP, AZURE,  
AWS, Google



# Hilscher Core Competence



One Network controller for all relevant real-time Ethernet & fieldbus system

## Multi-protocol on Chip

Stacks / Firmware

Network controller with 2-Port real time Ethernet

From PC Card to ASIC, to Edge Gateway

## Embedded Technology



Machinery automation



Car manufacturing



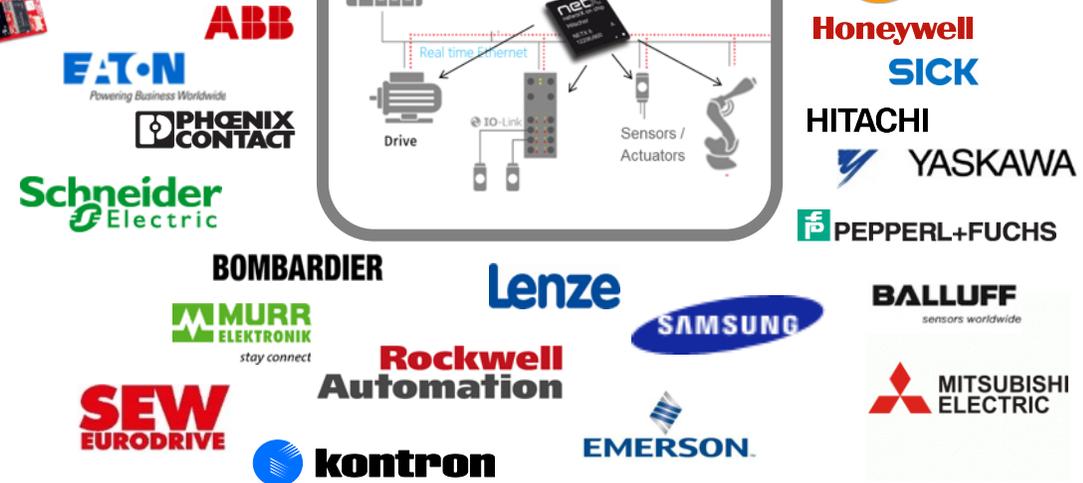
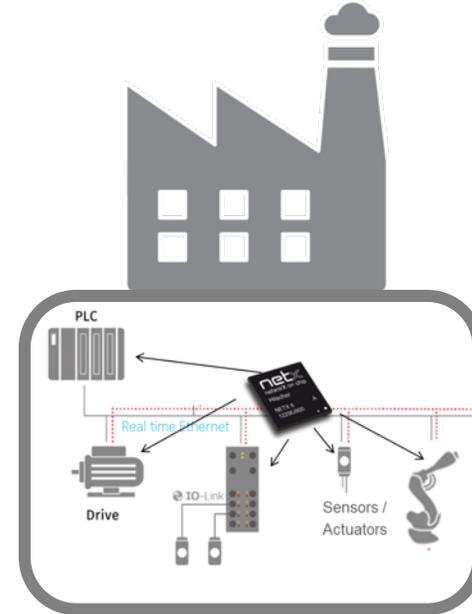
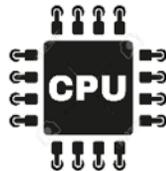
Warehouse systems



Baggage claim



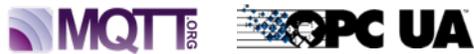
Host-controller



# Hilscher Core Competence in Industrial IoT

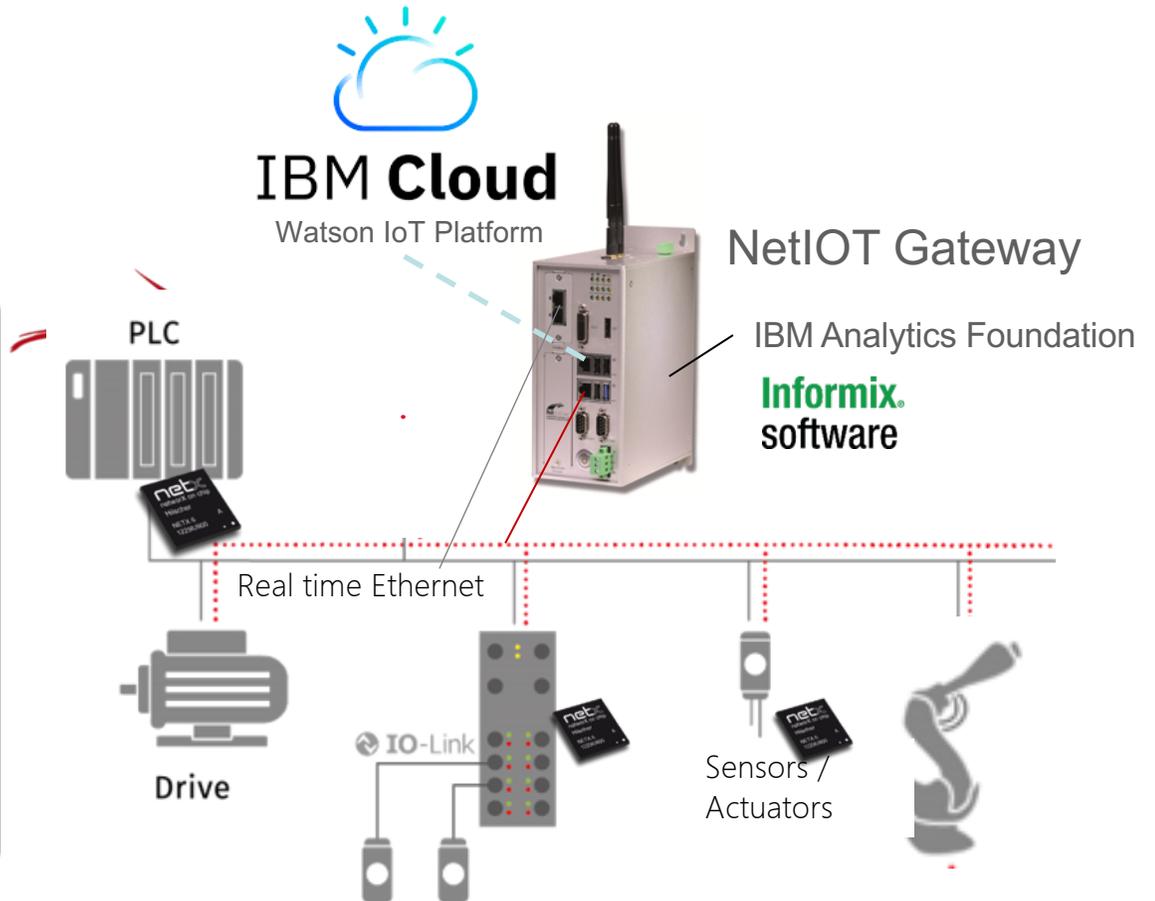
Data from OT into the IT

- IoT Protocols

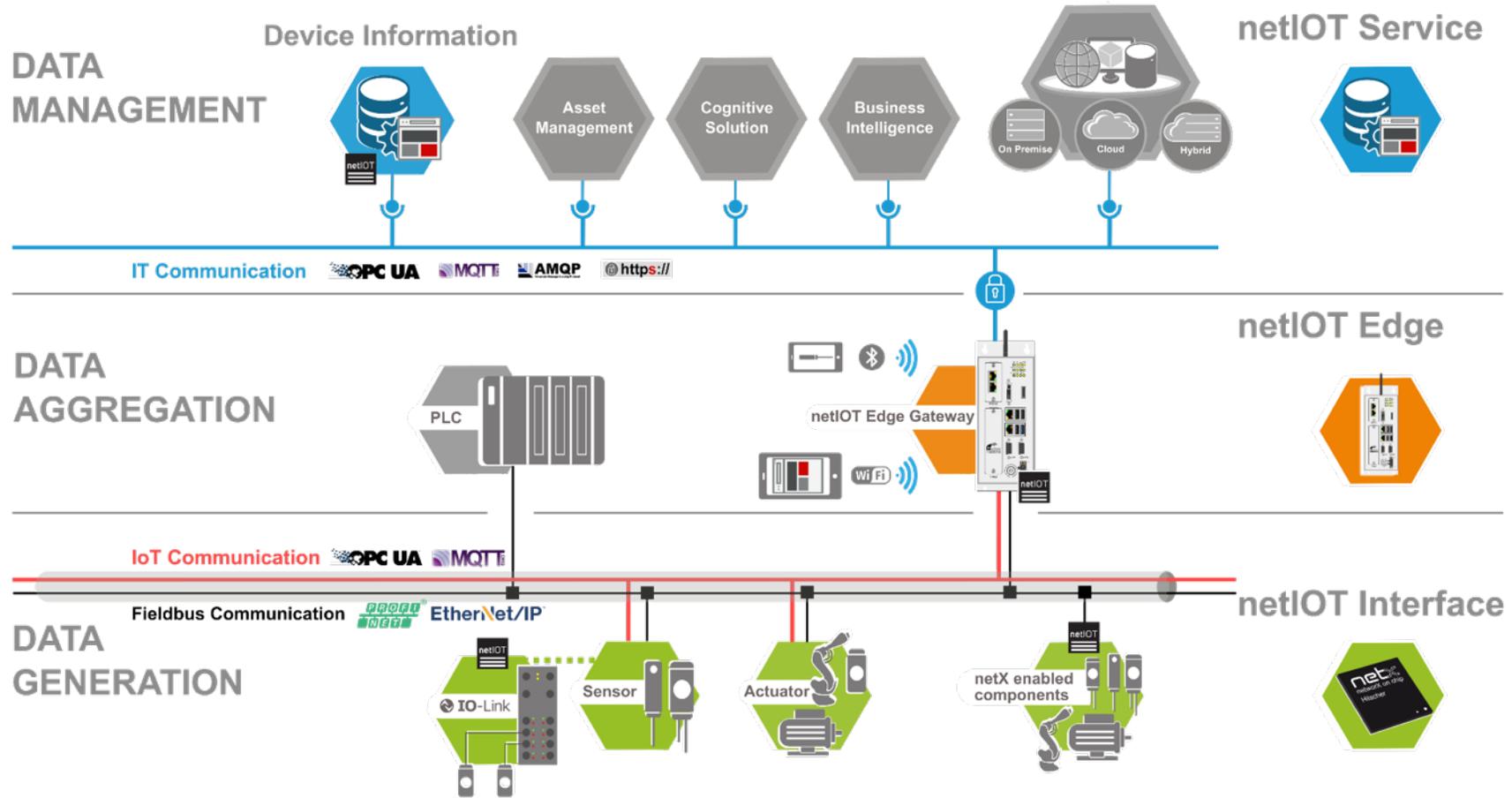


Extensive OT Knowledge

- Network analyzing systems
- Protocol Stacks



# Hilscher's netIOT architecture



Hardware, software and service solutions

# netIOT Edge Gateways



\*On-Premise



Remote



Connect

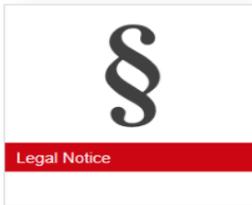
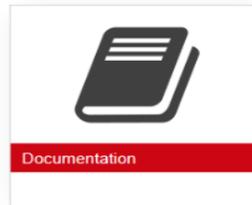
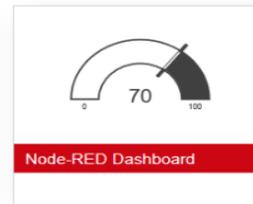
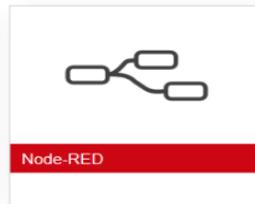


netPI

# netIOT Edge Gateway Manager



## Edge Gateway Manager



# Access to the shop-floor from the Edge

Support Greenfield / Brownfield installations

Process Data Aggregation – In Real-time

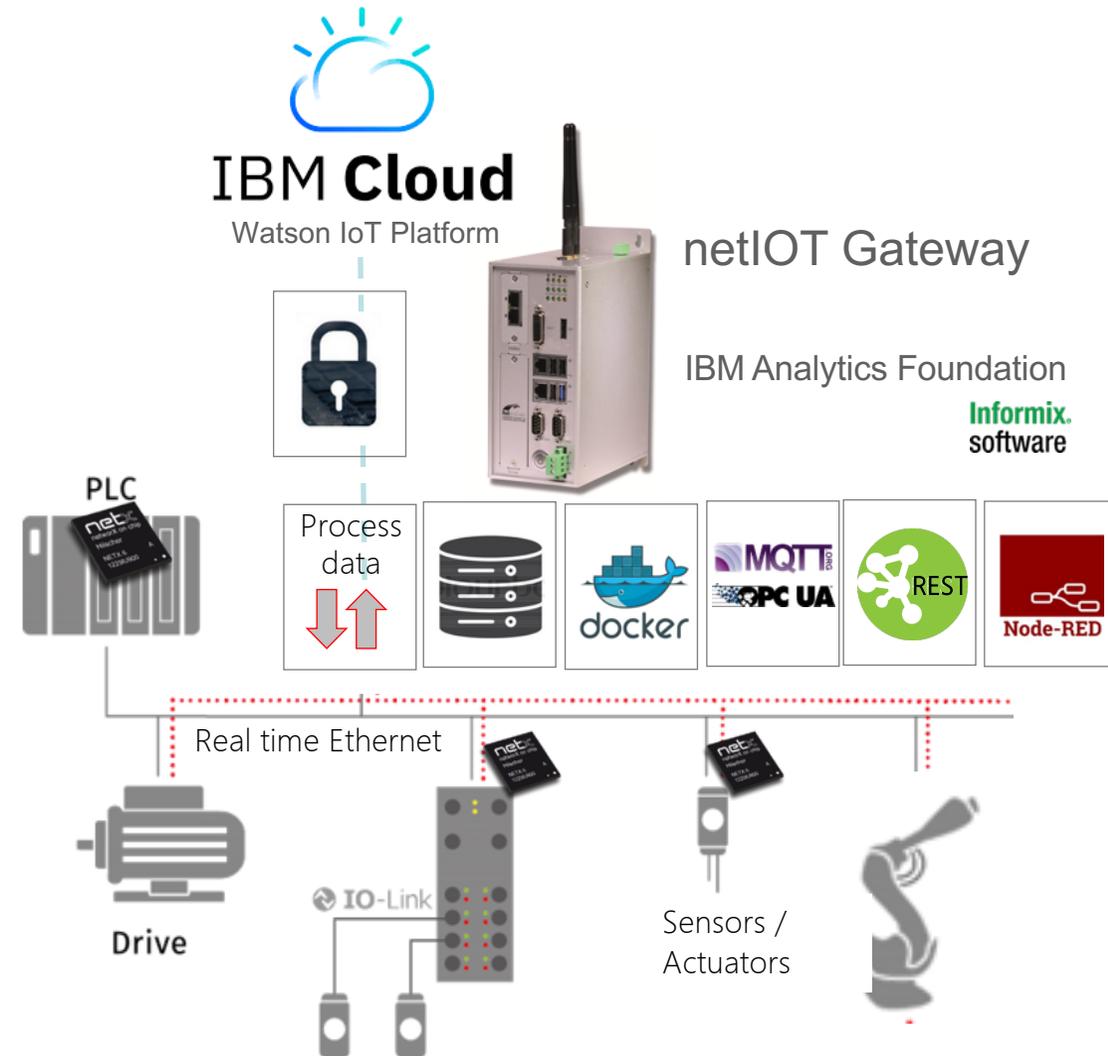
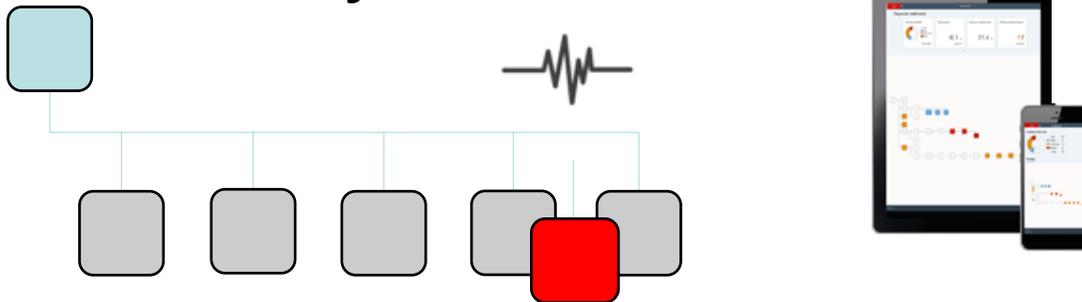
Device scanning and illustration as **digital twin**

Auto illustration of **network topology**

**Auto detection of device “meta data”**

**Auto detection of device changes / errors**

**Network analysis** and illustration



# Proliferation of IIoT & Connected devices

**Huge amount of data generated by  
Machines, Scanners and  
Controllers.**

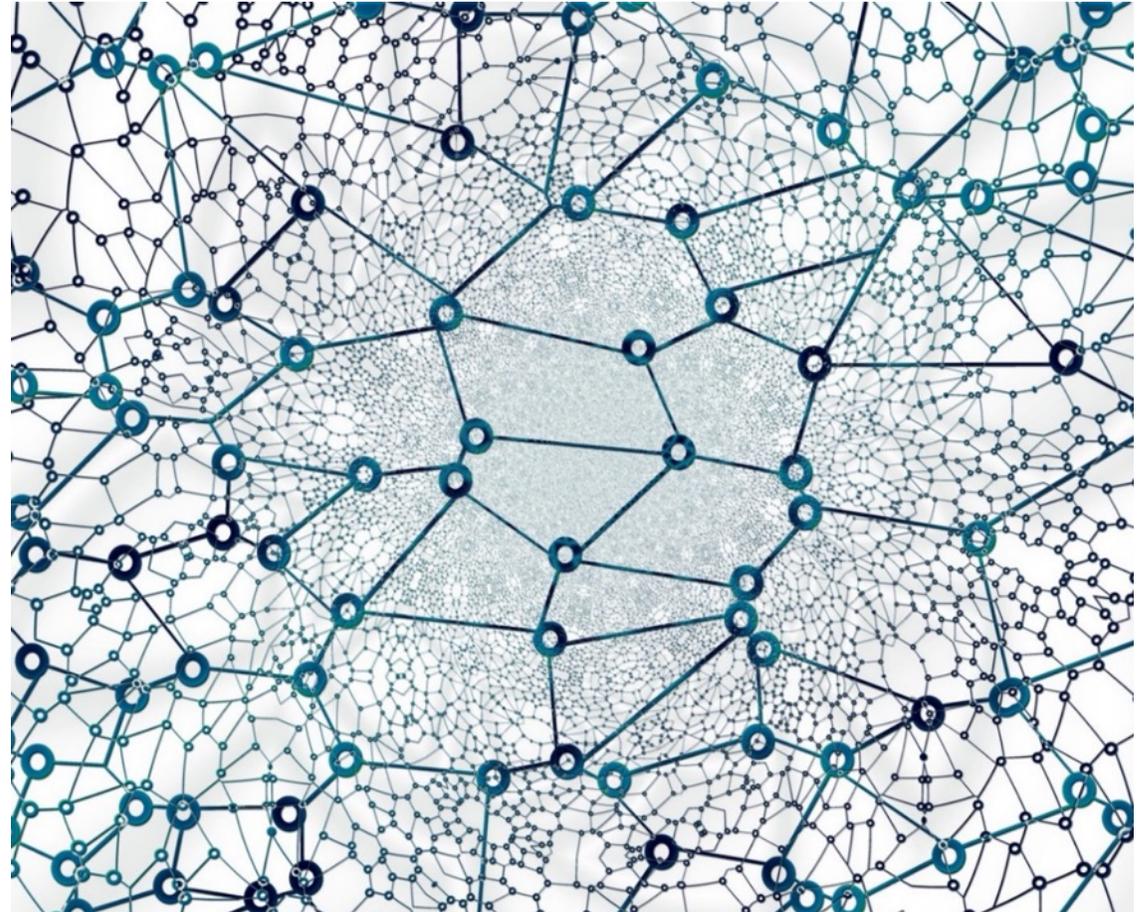


-THIS IS THE CNC MACHINE" HafeezJD, licensed under [CC BY-SA 4.0](https://commons.wikimedia.org/wiki/File:CNC_MACHINE.jpg) [https://commons.wikimedia.org/wiki/File:CNC\\_MACHINE.jpg](https://commons.wikimedia.org/wiki/File:CNC_MACHINE.jpg)

# Proliferation of IoT & Connected devices

Huge amount of data

**High latency in cloud transferring  
due to uncontrolled data flow**



„A traffic jam in Bangkok“, Gemma Longman, licensed under [CC BY 2.0](https://commons.wikimedia.org/wiki/File:Bangkok_traffic_by_g-hat.jpg) [https://commons.wikimedia.org/wiki/File:Bangkok\\_traffic\\_by\\_g-hat.jpg](https://commons.wikimedia.org/wiki/File:Bangkok_traffic_by_g-hat.jpg)

# Proliferation of IoT & Connected devices

Huge amount of data

High latency in cloud transferring  
due to uncontrolled data flow

## Pressure on network Infrastructure

Internet availability

Network latency

High bandwidth required

How big is your pipe?



„Netzwerk total“, Gerd Altmann, licensed under CC0, <https://www.publicdomainpictures.net/de/view-image.php?image=266331&picture=netzwerk-total>

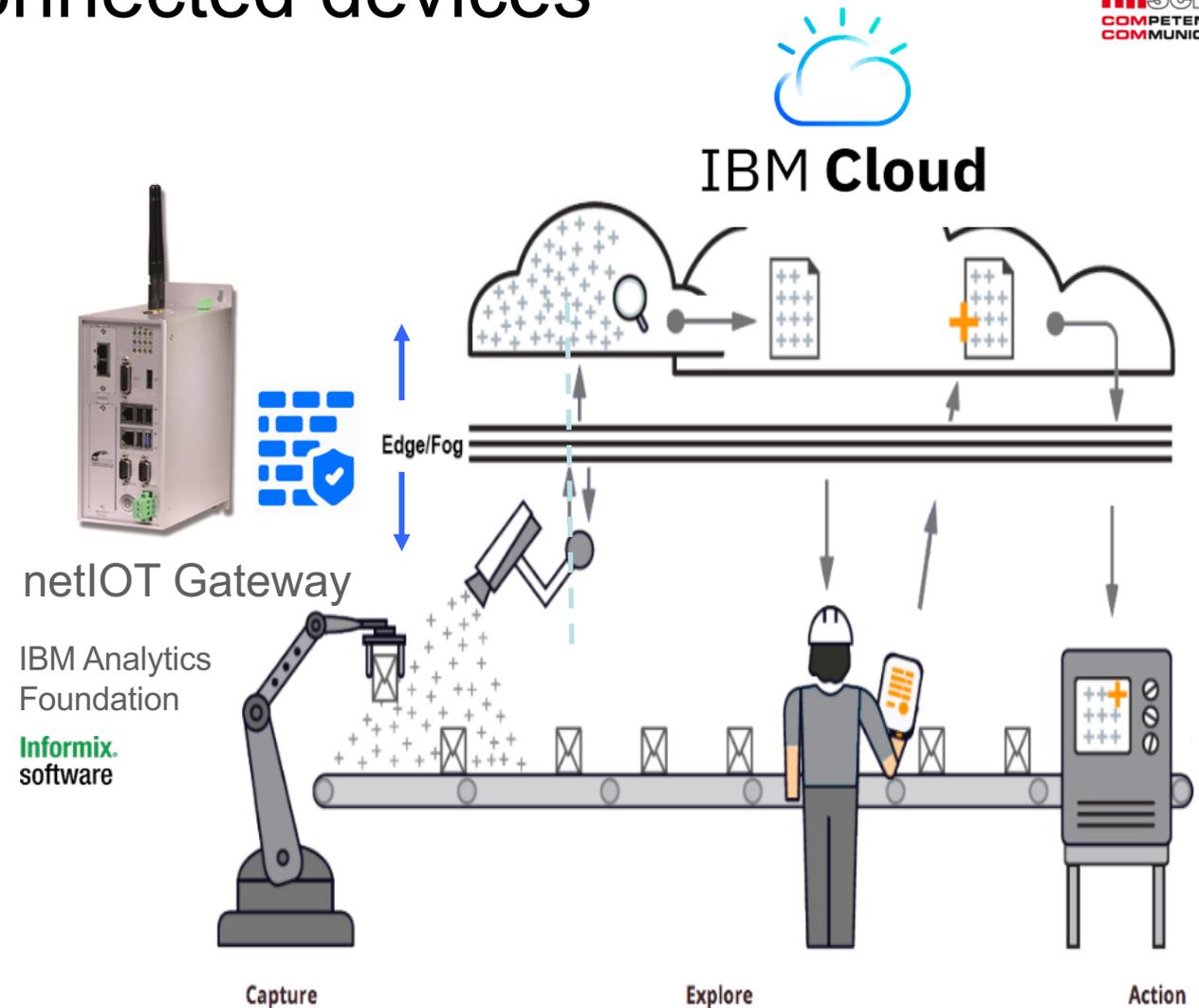
# Proliferation of IIoT & Connected devices

Huge amount of data

High latency in cloud transferring  
due to uncontrolled data flow

Pressure on network Infrastructure

**Security - how to prevent from  
data leak & hacking**



# Security

## 1. Encryption

### a) IEC 62443 Cybersecurity Standard

- Security standard for both IT(information technology) and OT(operational technology)
- Aim is to protect apparatuses and networks from intrusion and disruption by unauthorized entry
- Helps to identify the vulnerabilities to reduce the risk of compromising confidential information of processes under control

## 2. Edge Gateway in Promiscuous (Passive) mode – no write capability on Fieldbus ASIC

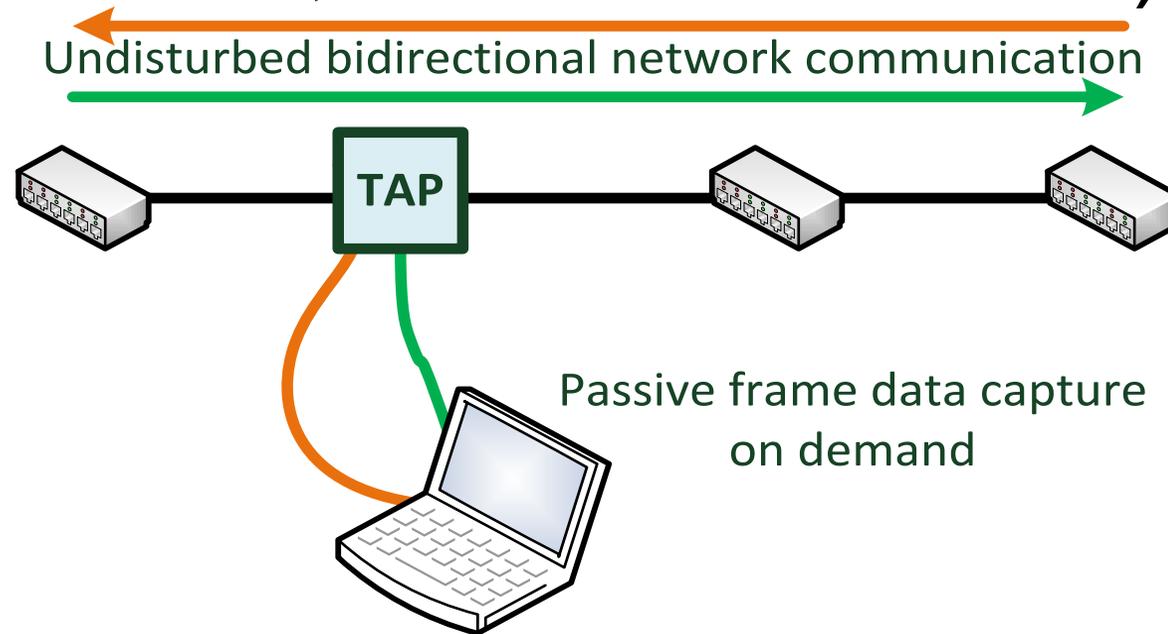
## 3. Data Diode

- a) netMIRROR - Passive access point to network for IIoT Connectivity

# netMIRROR

## Data Diode

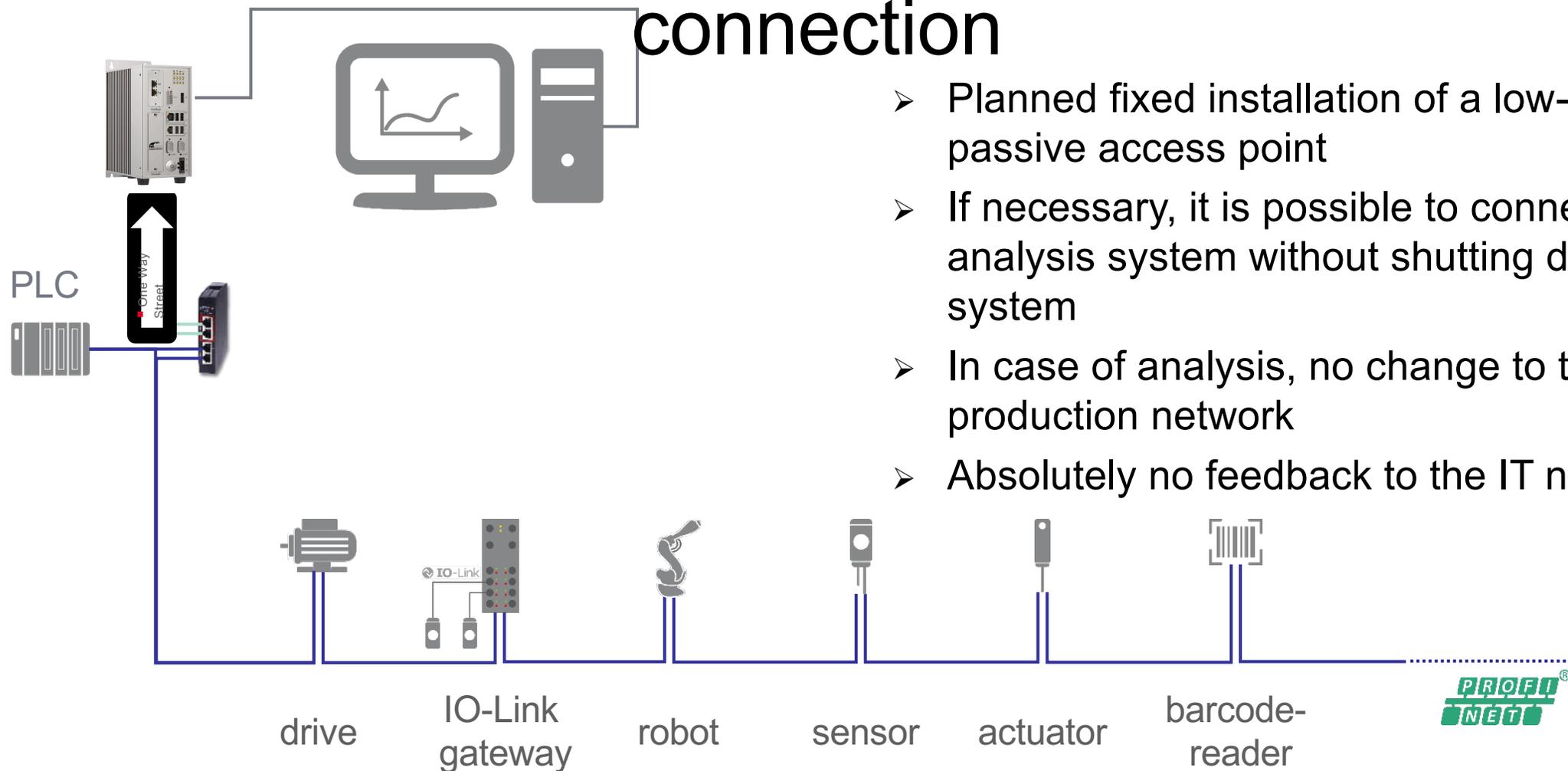
# TAP – Principle (Air GAP, Passive mode, Data Diode, Promiscuous mode)



TAP = Test Access Point

Network access point for direct frame data capture from an Ethernet connection

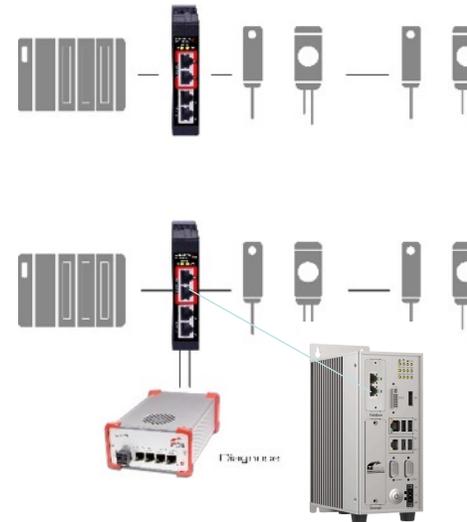
# Access points for network diagnostics and IoT connection



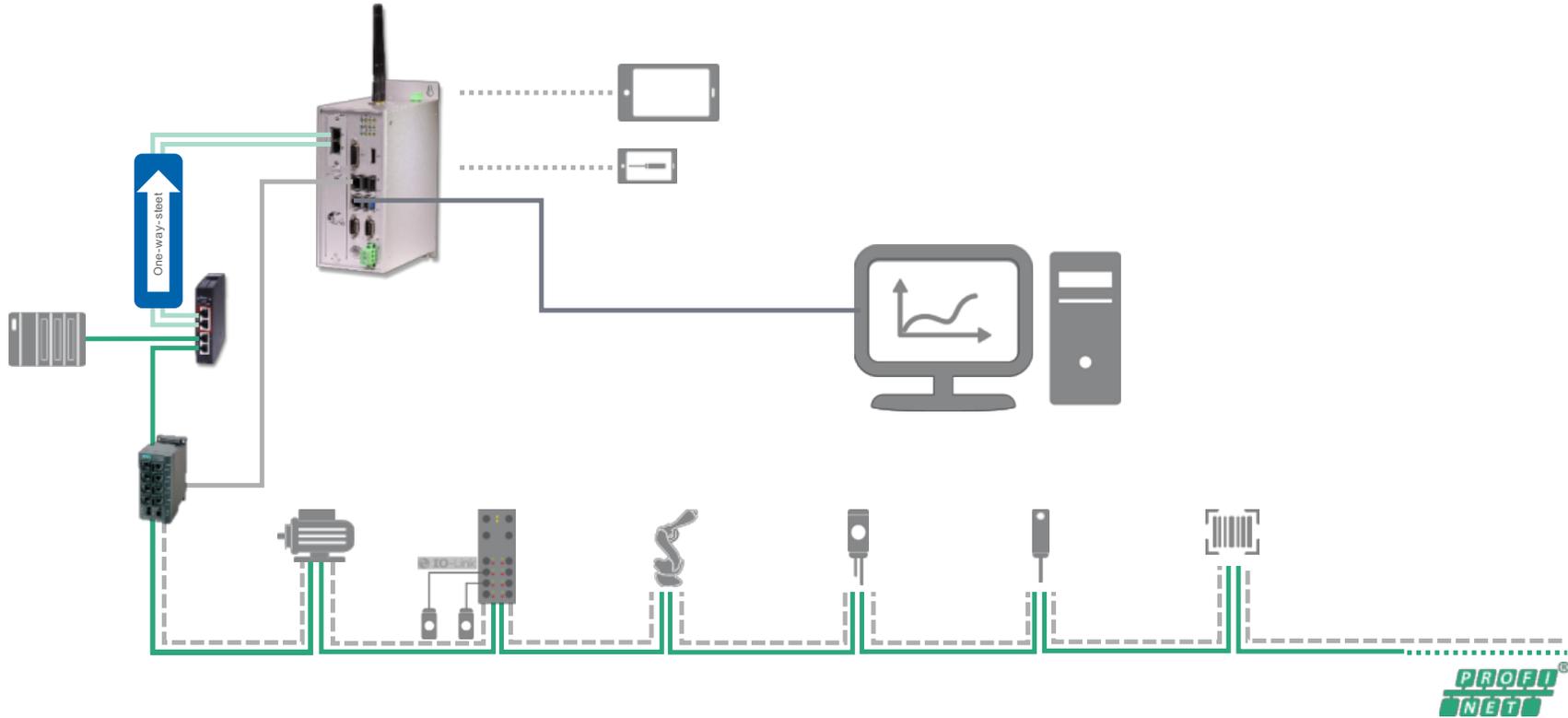
- Planned fixed installation of a low-cost passive access point
- If necessary, it is possible to connect an analysis system without shutting down the system
- In case of analysis, no change to the production network
- Absolutely no feedback to the IT network

# ➤ netMIRROR

- Fully passive network access for 10BASE-T and 100BASE-TX networks
- Zero-Delay (< 1 ns)
- Network connection stays active, even without attached power supply
- 1:1 mirroring of network data traffic usable as a diagnostic access point
- No shutdown of the plant network necessary



# Diagnosis of the shop floor



Active and Passive mode

# The most important diagnostic data

## Active network access

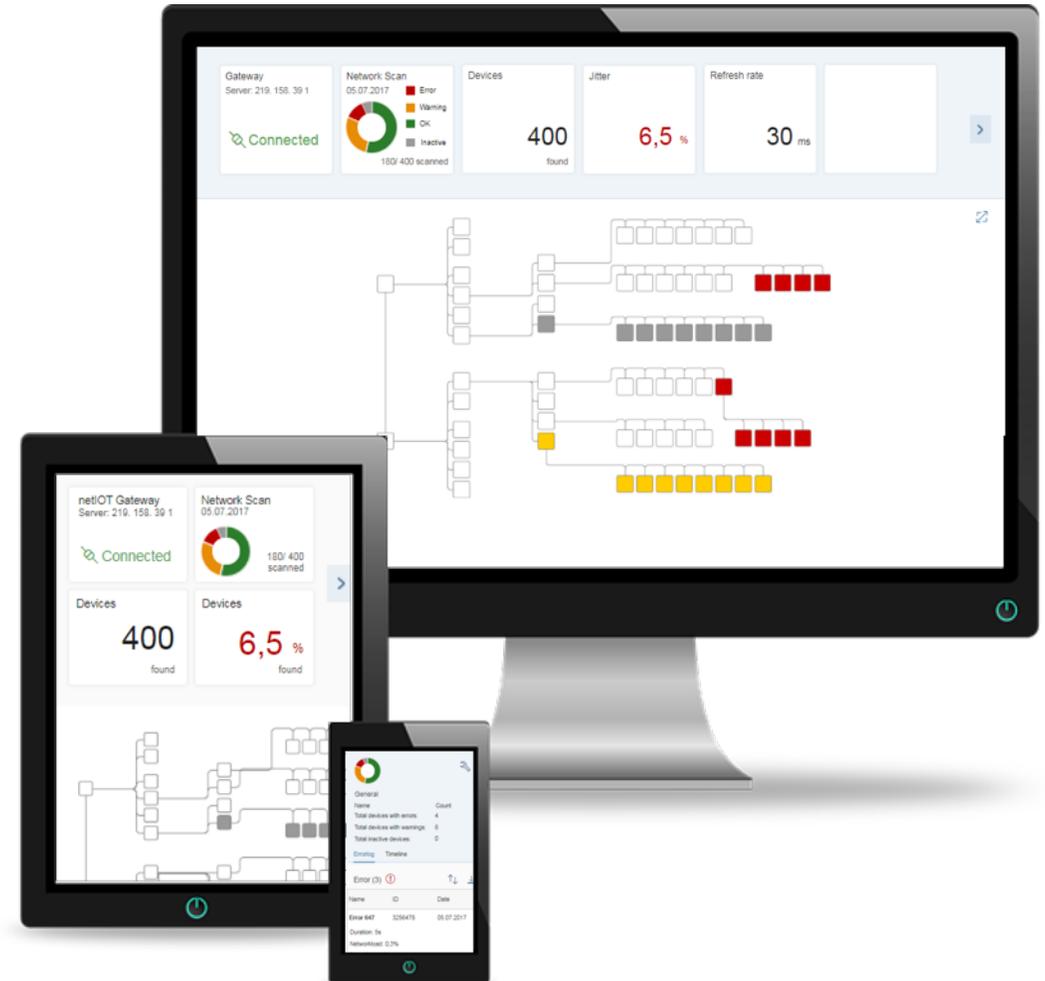
- Asset information, e. g.
  - device type
  - firmware version
  - installation location
- Physical network topology
- Load distribution within the entire facility
- Frame error frequency within the entire facility

## Passive network access

- Logical data connections
- Alarm messages of devices
- Real-time communication behavior
- Ratio of PROFINET to non-PROFINET traffic
- Frame snapshots for detailed troubleshooting

# Diagnostic access on all end devices

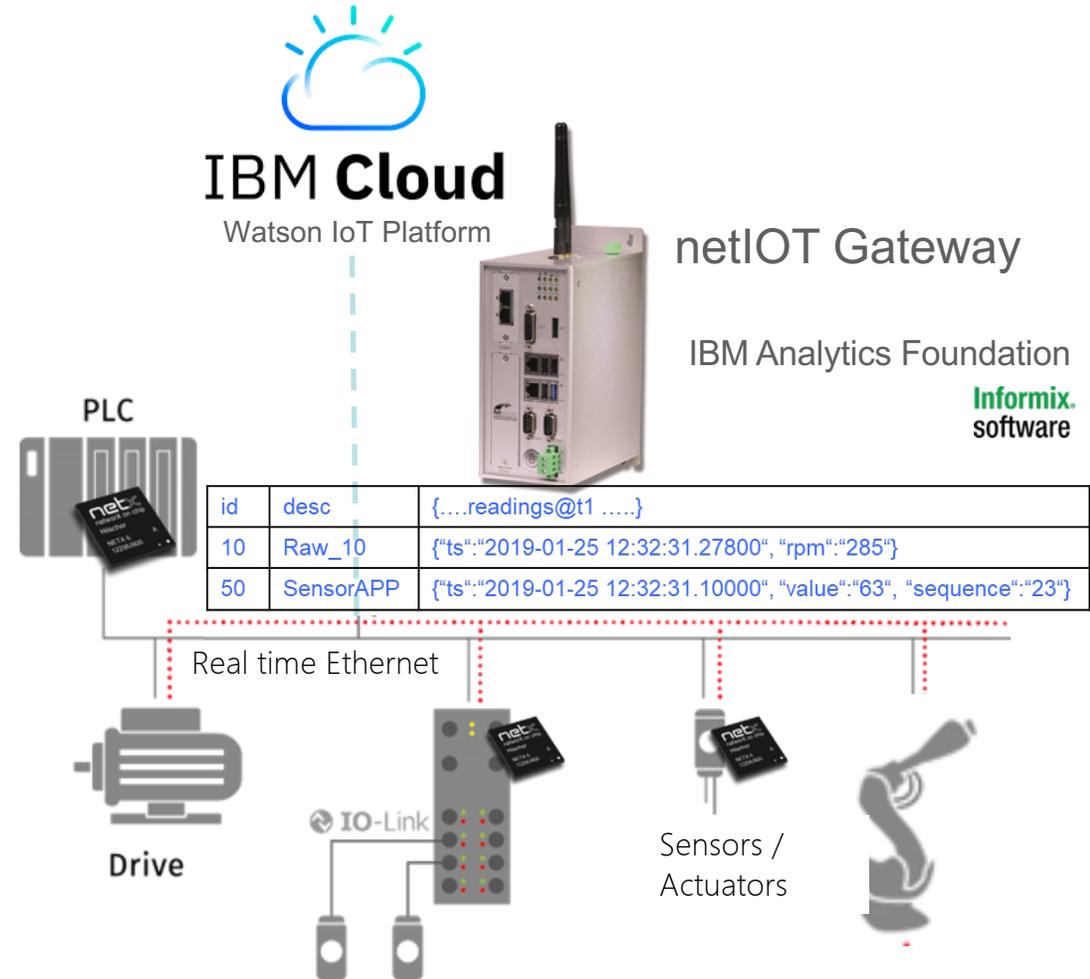
- Responsive user interface for optimal display on
  - personal computer
  - tablet
  - smartphone
- Diagnostics dashboard for instant overview
- All measurement data presented clearly and quickly accessible



# IBM Edge Analytics

# Key business benefits of distributed Edge Analytics

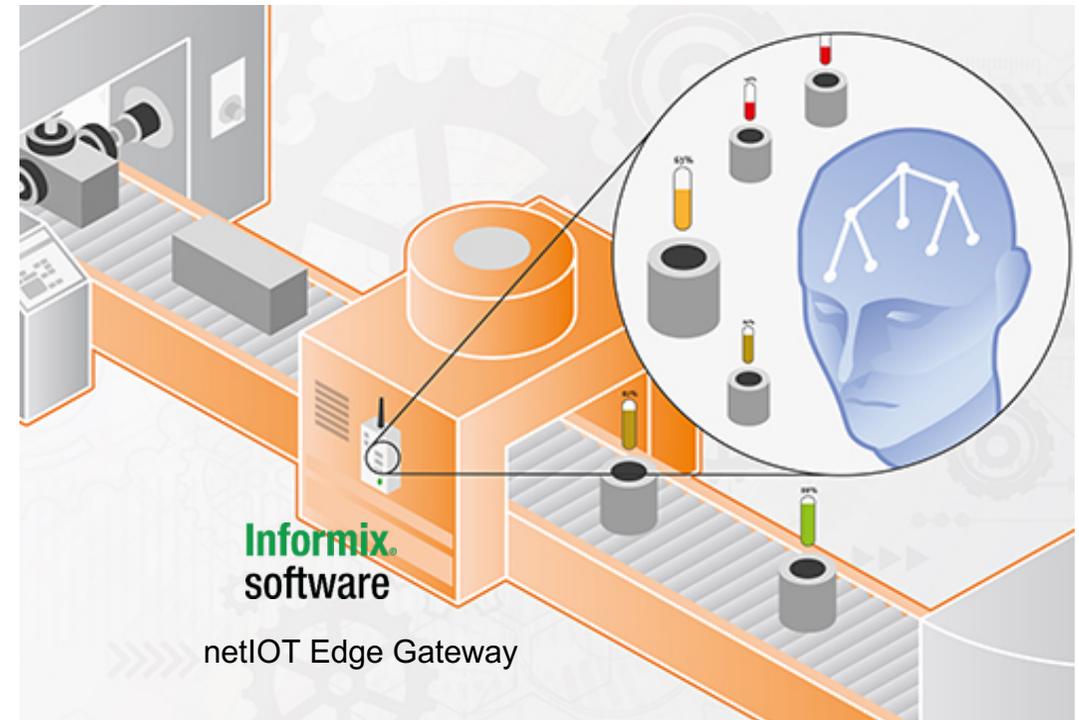
1. Reduced data transfer latency
2. Fast access to the faulty areas
3. Fast response to the cloud
4. Optimal control over data sovereignty
5. Local storage and process of time series



# Predictive analytics procedure at the edge

Automotive supplier specialized in tube cold forming

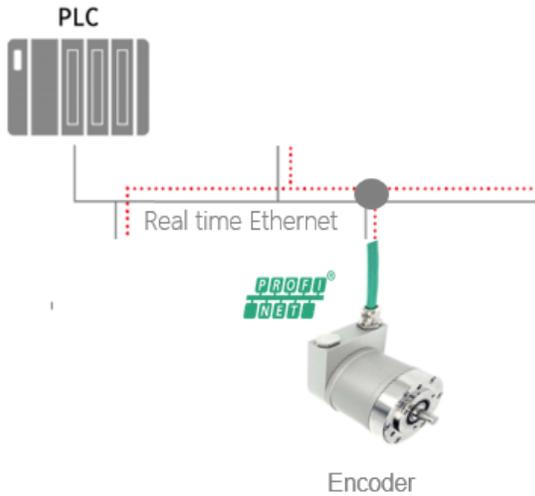
- Classic inspection intervals replaced by prescriptive maintenance
- Prediction model : Scoring solution on the edge gateway
- IBM SPSS analytics & statistics software directly on the machine (Docker)
- Increased efficiency of the manufacturing process and quality



**Benefits:** the entire scoring solution on an Edge Gateway in the shop floor - a hardened hardware component that supports industry connectivity standards – non-“invasive”,

# NetIOT Edge Analytics Use Case

## ACQUIRE



Rotary encoder  
Data Acquisition

## PROCESS



Stream Processing  
Storage, Analytics

RAW



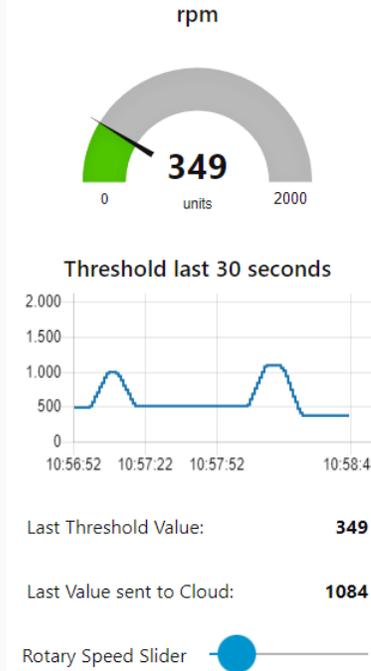
ANALYZED



FILTERED

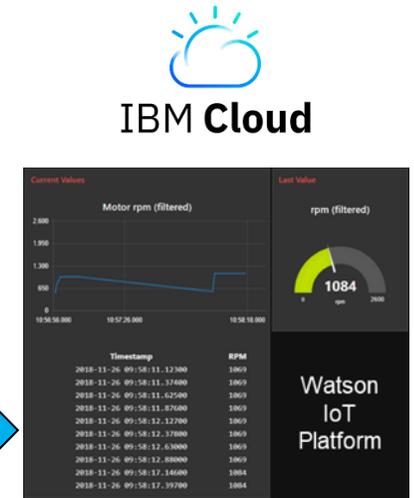


## VISUALIZE



Local  
dashboard

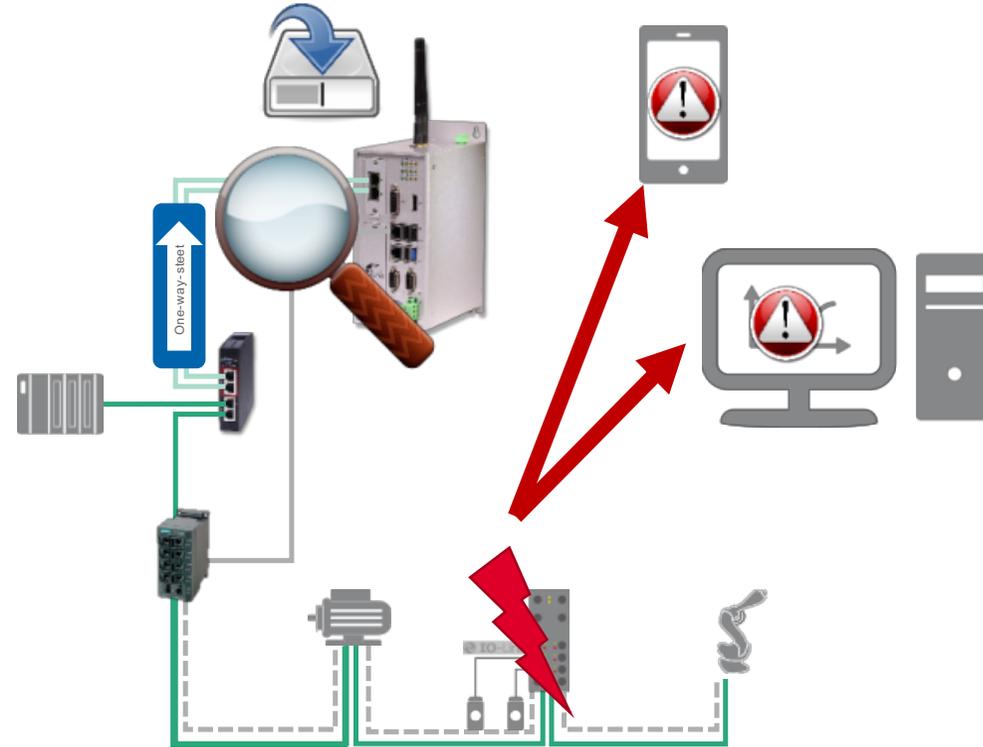
## ANALYZE & DECIDE



Cloud  
dashboard

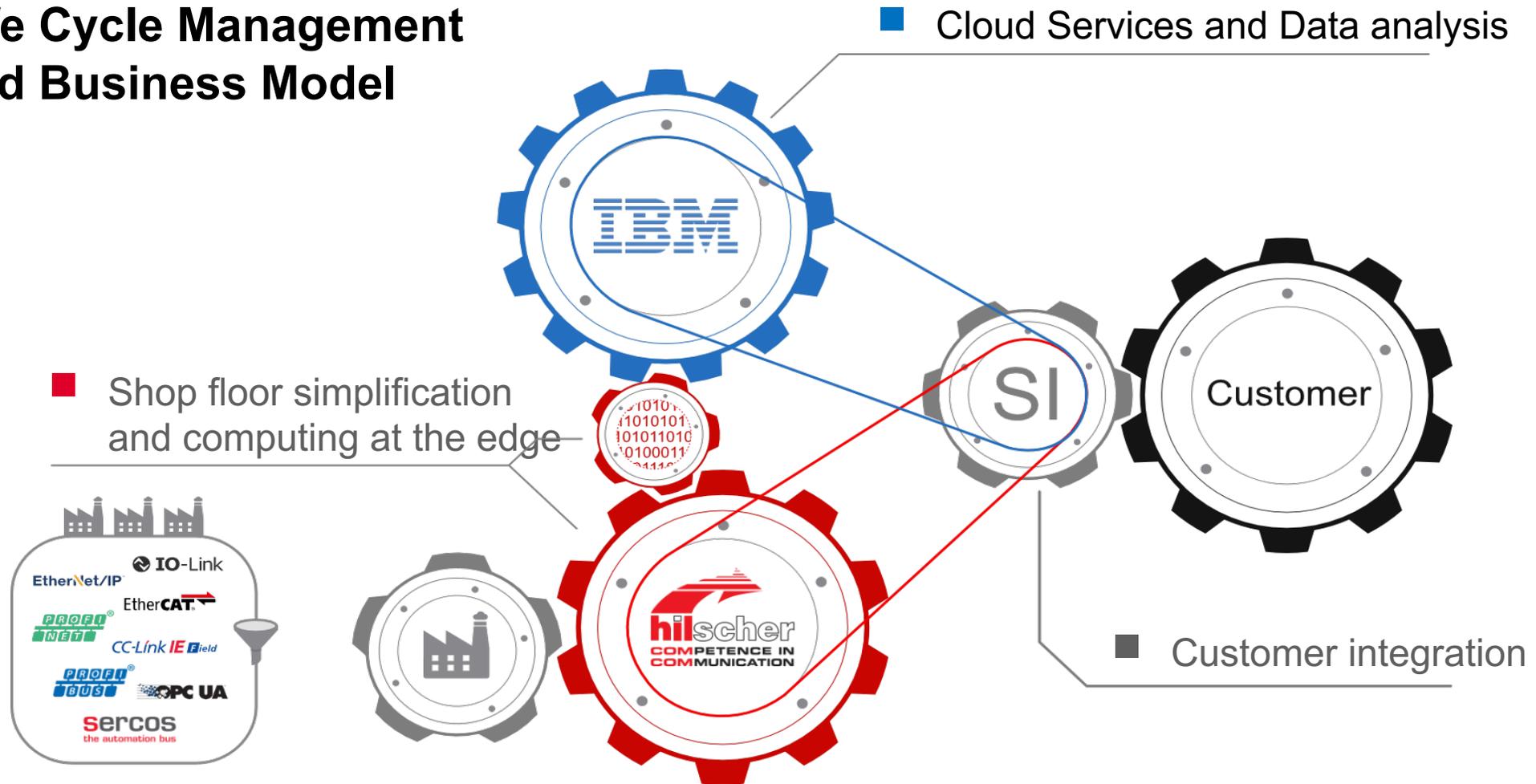
# Automatic notification in case of error

- Measurement data are continuously and automatically monitored in the gateway
- A notification is generated for defined events
- Events appear immediately in the diagnostics App
- Use REST-API to connect to customers IT alarming infrastructure



# Partner Collaborations Yield Solutions for the Customer

## Life Cycle Management and Business Model



# Edge Gateways and how they're used



## Edge gateway:

*A gateway is the buffer between where edge computing processing is done and the broader fog/cloud network.*

*The gateway is the window into the larger environment beyond the edge of the network.*

## Here are four Edge Gateway Use Cases



**Use case 1 – Agricultural Equipment Manufacturer**



**Use case 2 – Cosmetic Company**



**Use case 3 – Machinery Manufacturer – Honing Machinery**



**Use case 4 – Large Retail Distribution Company**

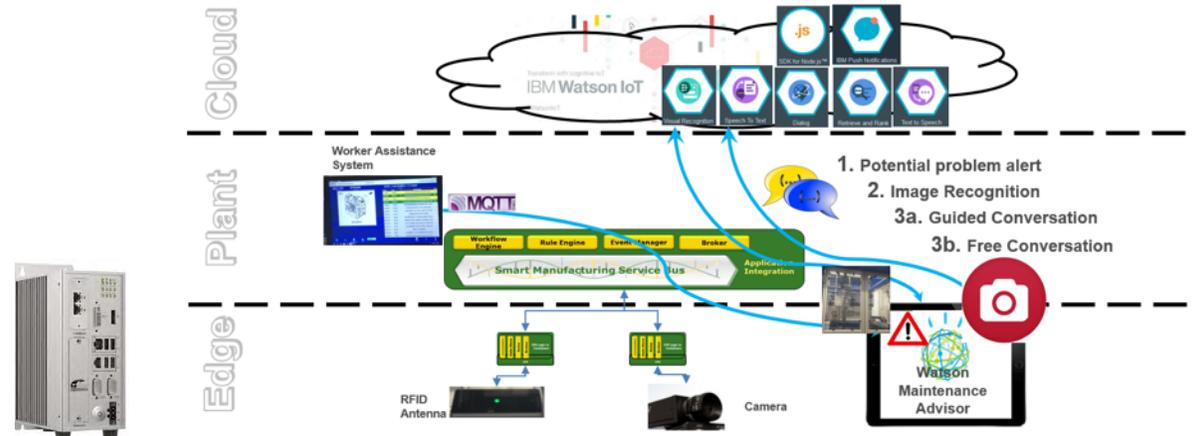


# Edge Use Case #1 – John Deere – Sense & Act

John Deere brought together IBM and Hilscher in order to understand the benefits of Industry 4.0 architectures in their production plants.

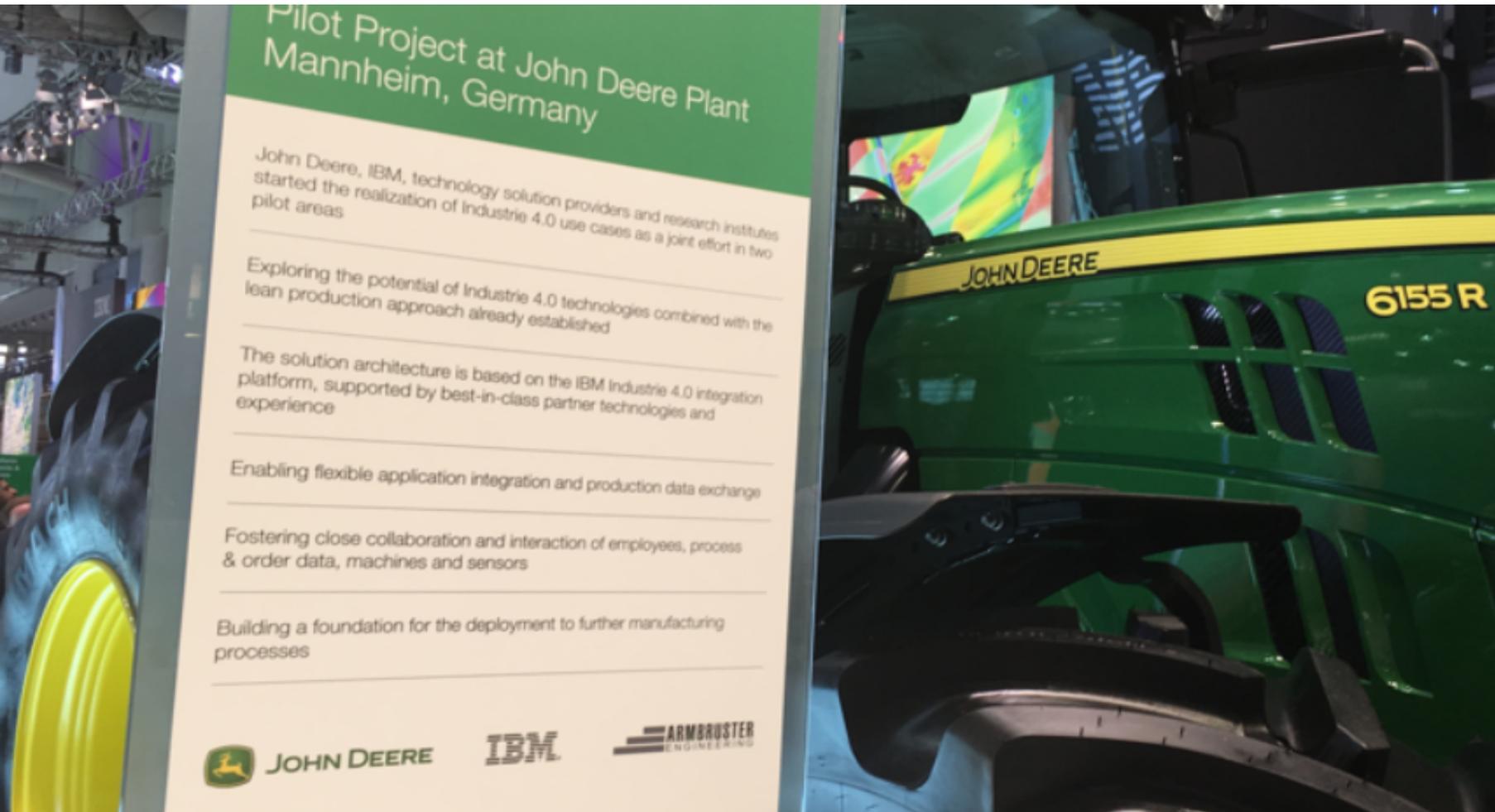


## IIoT/IIoT Enabling @ John Deere, Mannheim



# Ready to Plug & Analyse at the Edge

## NetIOT Edge Gateway



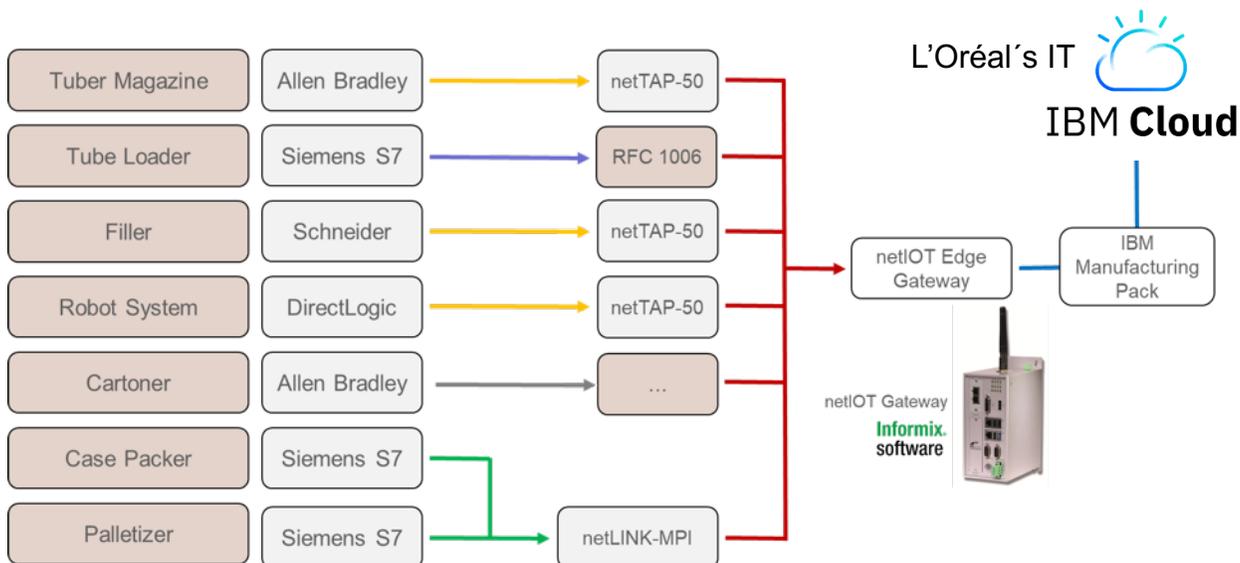
# IoT Connectivity in L'Oréal's Packaging Lines



Realtime dashboards

Improve **Efficiency & Performance**

Become agile to develop **new services** while maintaining high **quality** of the products.



# Edge Gateway Use Case #2

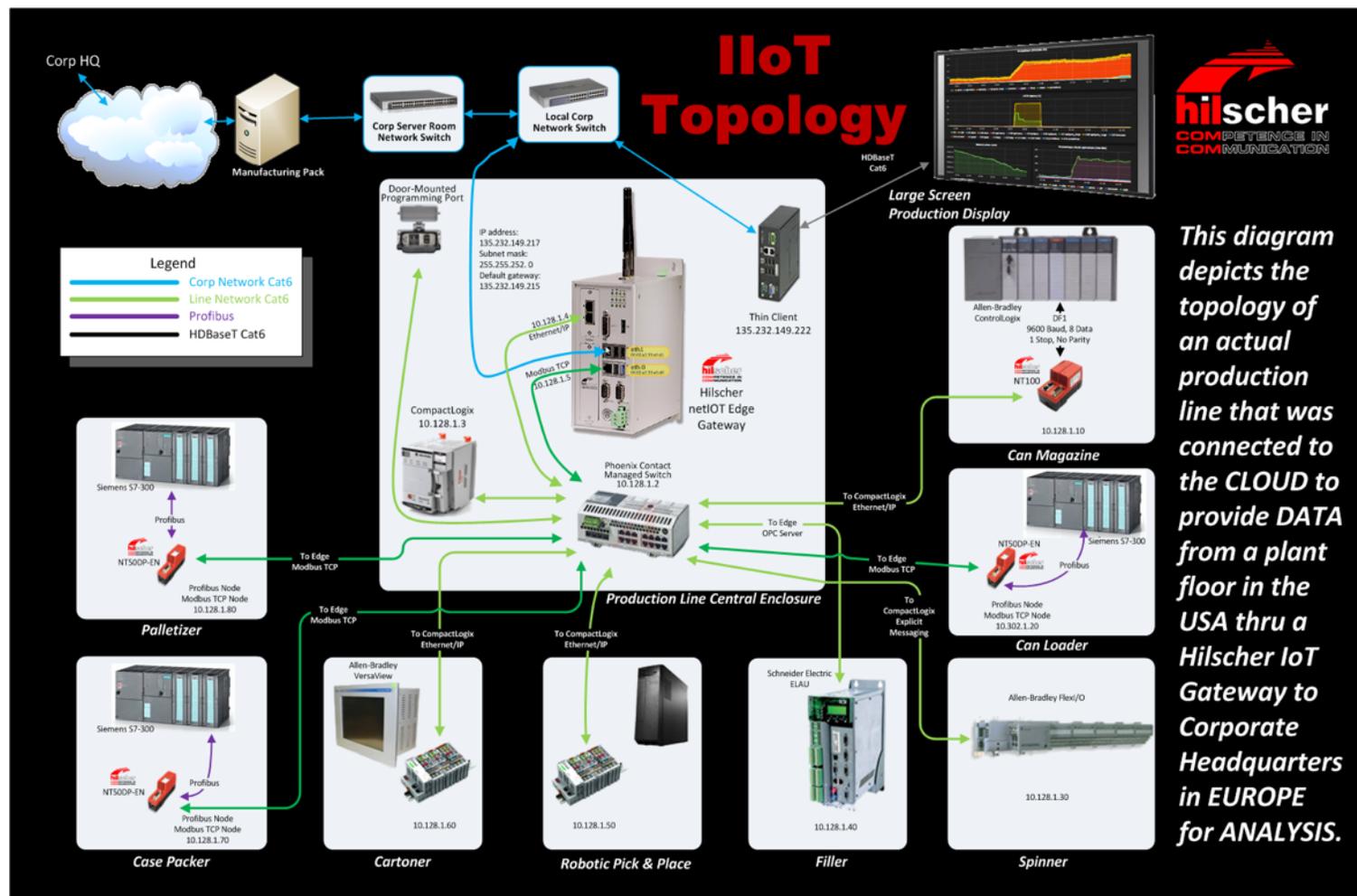


Implemented use case  
@ L'Oréal Paris

Realtime dashboards

Improve **Efficiency & Performance**

Become agile to develop **new services** while maintaining high **quality** of the products.



This diagram depicts the topology of an actual production line that was connected to the CLOUD to provide DATA from a plant floor in the USA thru a Hilscher IoT Gateway to Corporate Headquarters in EUROPE for ANALYSIS.

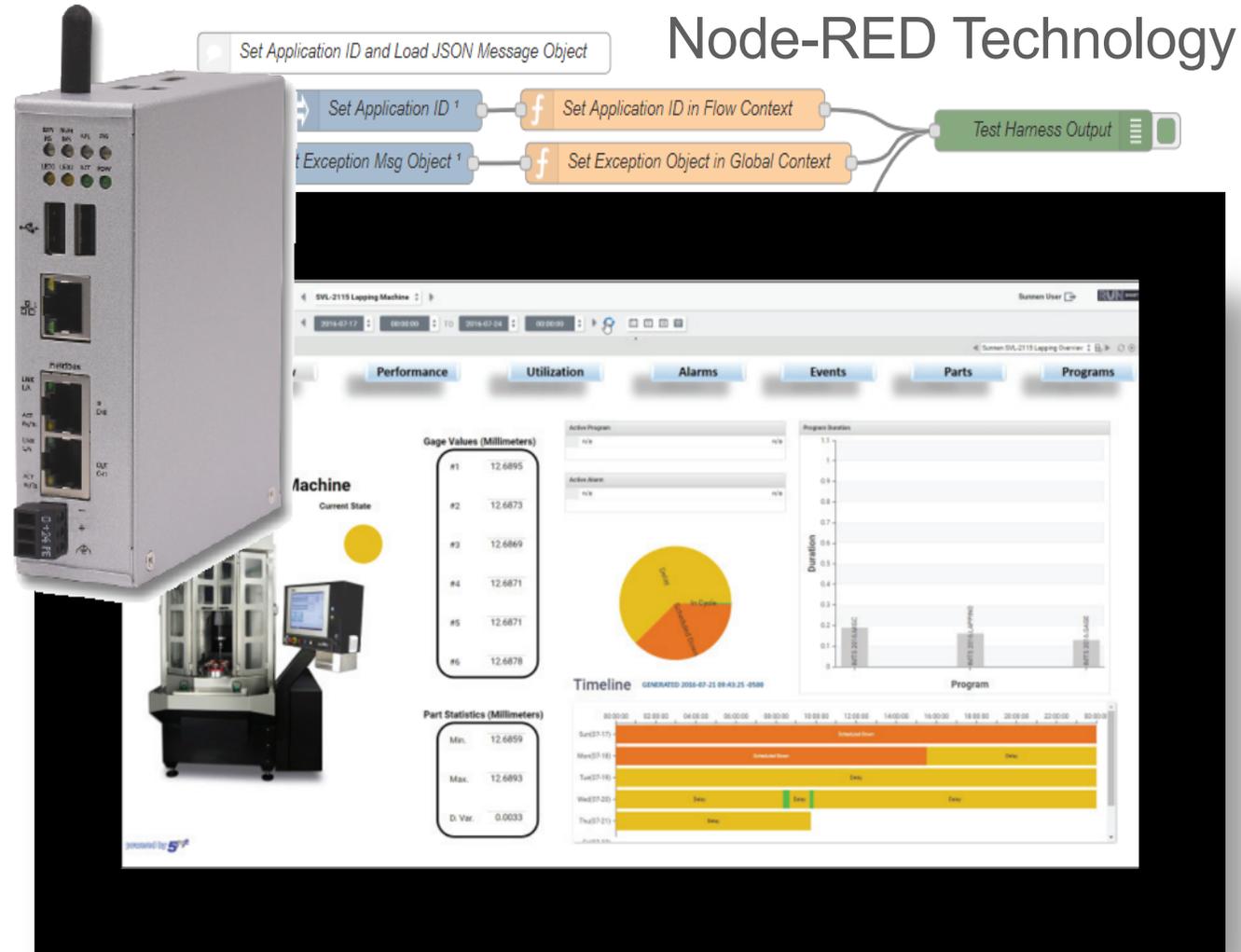
# Edge Gateway Use Case #3



## Implemented use case @ Machine Manufacturer

- The machines can report current state, cycle times, delay times, part counts, gaging data, events, and many other data points needed to evaluate OEE, future maintenance needs, and process performance.
- The device is integrated with the machines' industrial controls and provides a secure gateway to an Ethernet network for local sharing of machine data and visualization of manufacturing metrics. It includes multiple Ethernet ports, VGA/HDMI ports, built-in WiFi, digital and analog I/O, and an expansion slot for fieldbus cards.
- With this technology the company can provide customers a means to remotely monitor machine utilization and process efficiency.

### Node-RED Technology



The image displays a physical edge gateway device on the left, a Node-RED flow diagram in the top right, and a machine monitoring dashboard in the bottom right. The dashboard includes a 'Machine Current State' section, 'Gage Values (Millimeters)' table, 'Part Statistics (Millimeters)' table, and a 'Timeline' chart.

**Machine Current State**

#1	12.6895
#2	12.6873
#3	12.6869
#4	12.6871
#5	12.6871
#6	12.6878

**Part Statistics (Millimeters)**

Min.	12.6859
Max.	12.6893
D. Var.	0.0033

**Node-RED Flow Diagram:**

```
graph LR; A[Set Application ID and Load JSON Message Object] --> B[Set Application ID 1]; A --> C[Exception Msg Object 1]; B --> D[Set Application ID in Flow Context]; C --> E[Set Exception Object in Global Context]; D --> F[Test Harness Output]; E --> F;
```

**Dashboard Metrics:**

- Gage Values (Millimeters):** A list of 6 values ranging from 12.6859 to 12.6895.
- Part Statistics (Millimeters):** Min: 12.6859, Max: 12.6893, D. Var: 0.0033.
- Timeline:** A horizontal bar chart showing program durations from 00:00:00 to 00:00:00.
- Programs:** A list of programs with their respective durations.

# Edge Gateway Use Case #4



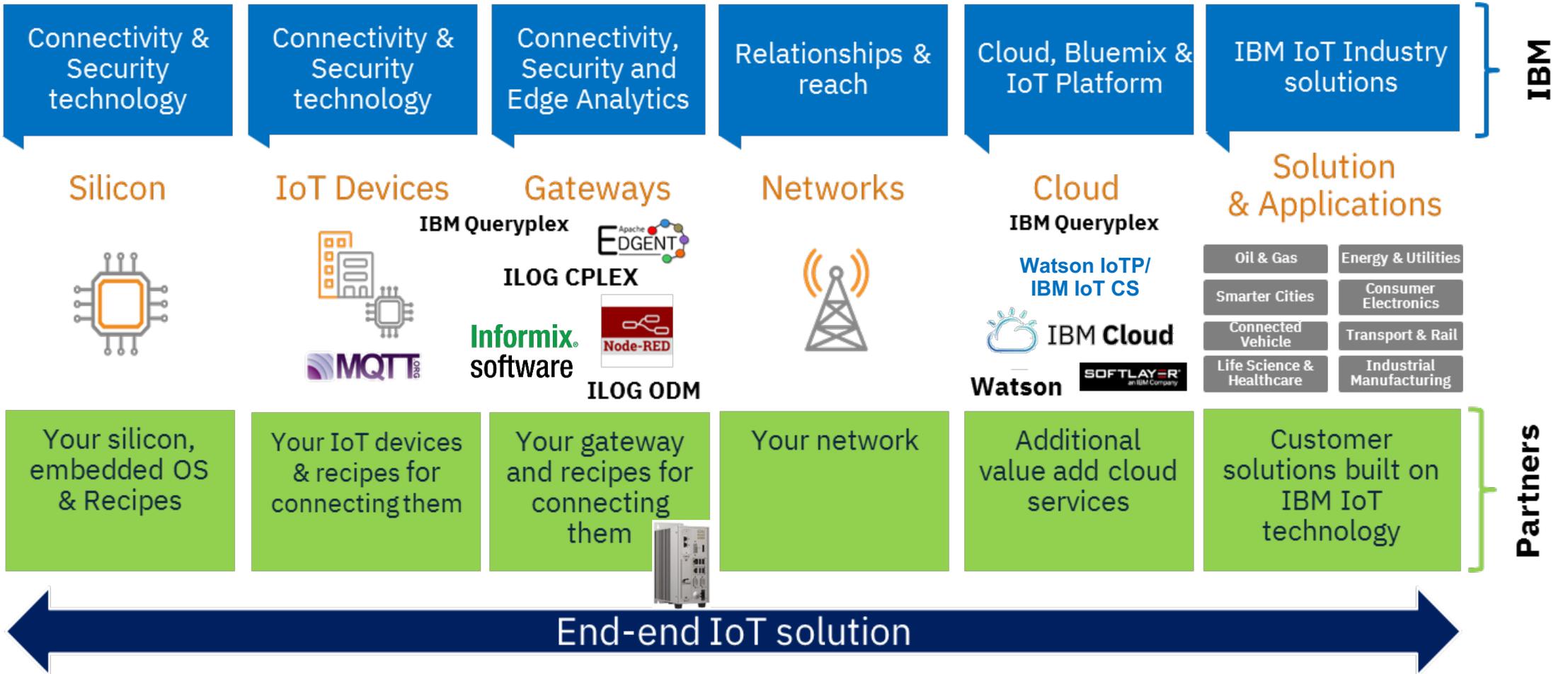
Implemented use case @ Large Retail Distribution Company

A netIOT 'Connect' variant was used to create a proprietary interface for handling equipment. CODESYS, a modular single-source runtime system was used in conjunction with Docker Containers. Integration into existing system architectures was done by means of lean proprietary interfaces or standards, such as OPC UA and MQTT.



# IBM's big picture – IoT from Sensor to Edge to Cloud to App

AI enabled IoT @ Edge & Cloud



# Hilscher Intelligent Solutions for Industrial Communications

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