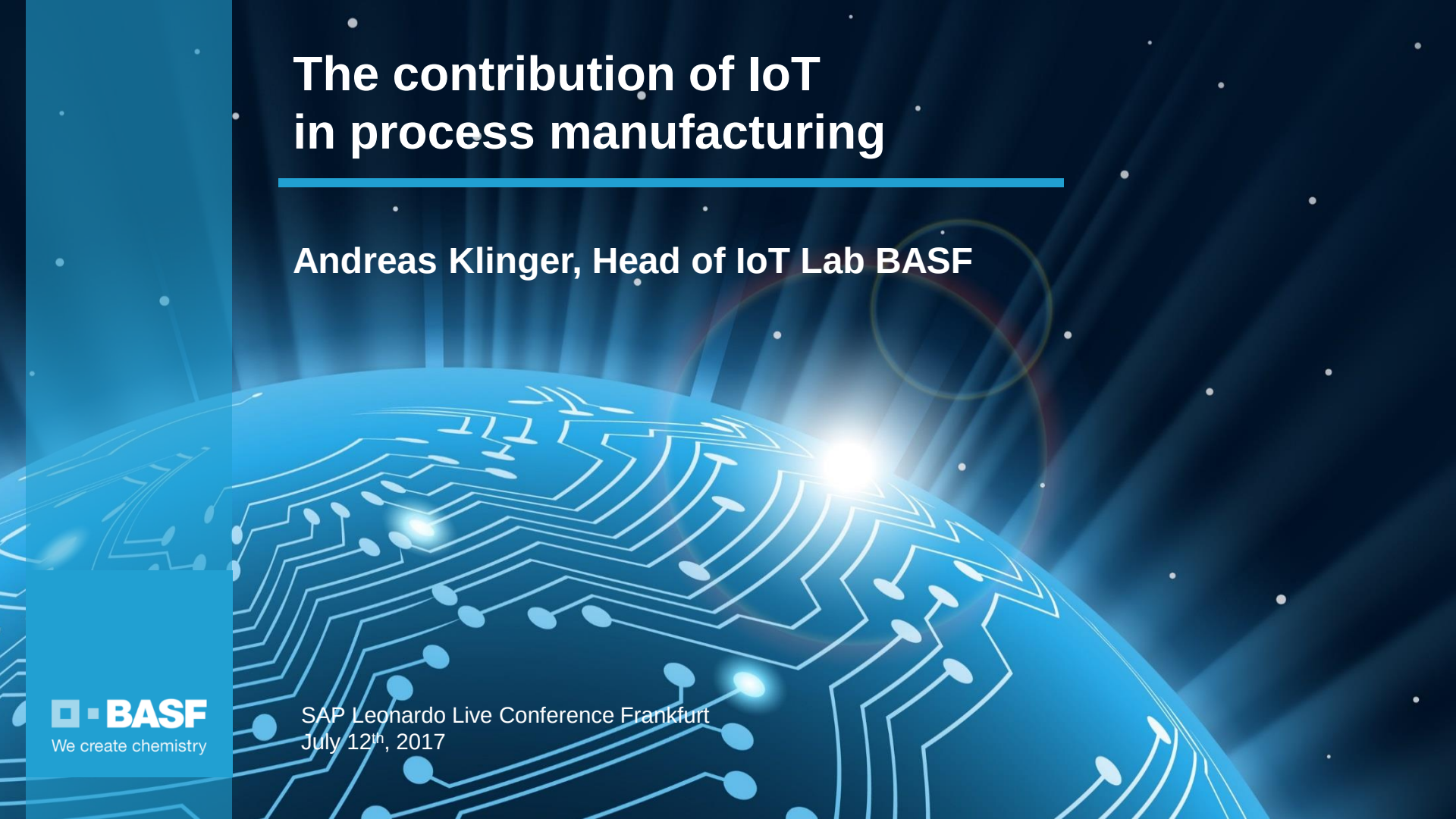
The contribution of IoT in process manufacturing

Andreas Klinger, Head of IoT Lab BASF



BASF
We create chemistry

SAP Leonardo Live Conference Frankfurt
July 12th, 2017

Agenda

1. BASF – We create chemistry
2. BASF 4.0 – Leading the digital transformation in chemicals
3. IoT Strategy – From Benefits to Measures
4. IoT in Process Manufacturing
5. Examples for IoT Solutions in Process Manufacturing
6. Summary

BASF – We create chemistry

- Our chemistry is used in almost all industries
- We combine economic success, social responsibility and environmental protection
- Sales 2016: €57,550 million
- EBIT 2016: €6,275 million
- Employees (as of Dec. 31, 2016): 112,435
- 6 Verbund sites and 352 other production sites

BASF's segments

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Chemicals

- Petrochemicals
- Monomers
- Intermediates

Performance Products

- Dispersions & Pigments
- Care Chemicals
- Nutrition & Health
- Performance Chemicals

Functional Materials & Solutions

- Catalysts
- Construction Chemicals
- Coatings
- Performance Materials

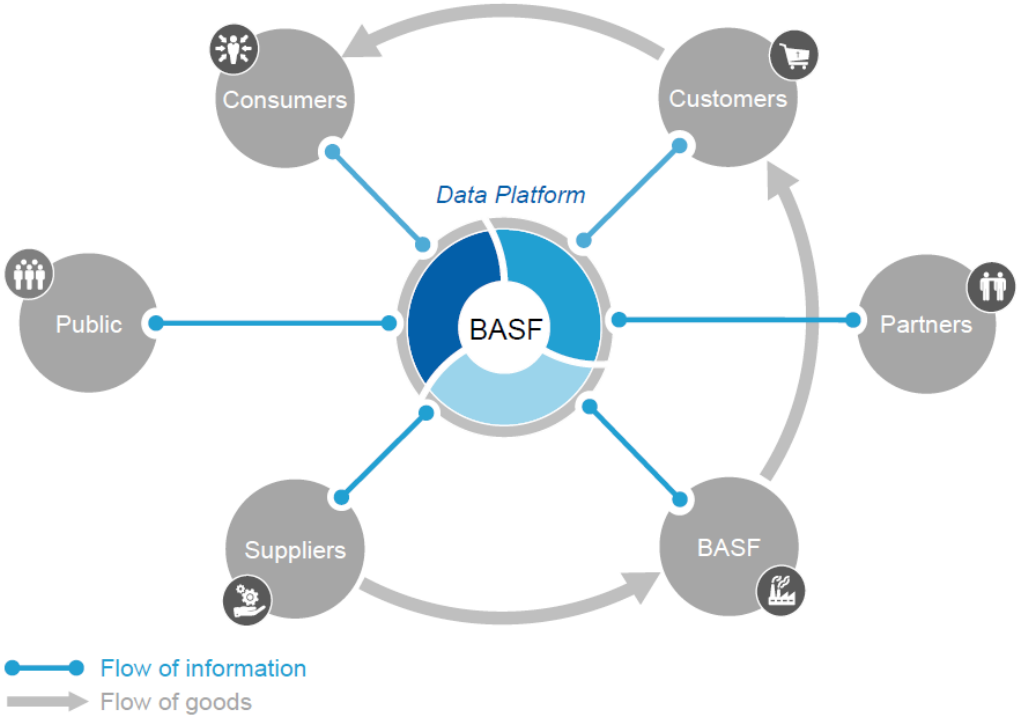
Agricultural Solutions

- Crop Protection

Oil & Gas

- Oil & Gas

BASF 4.0 – Leading the digital transformation in chemicals



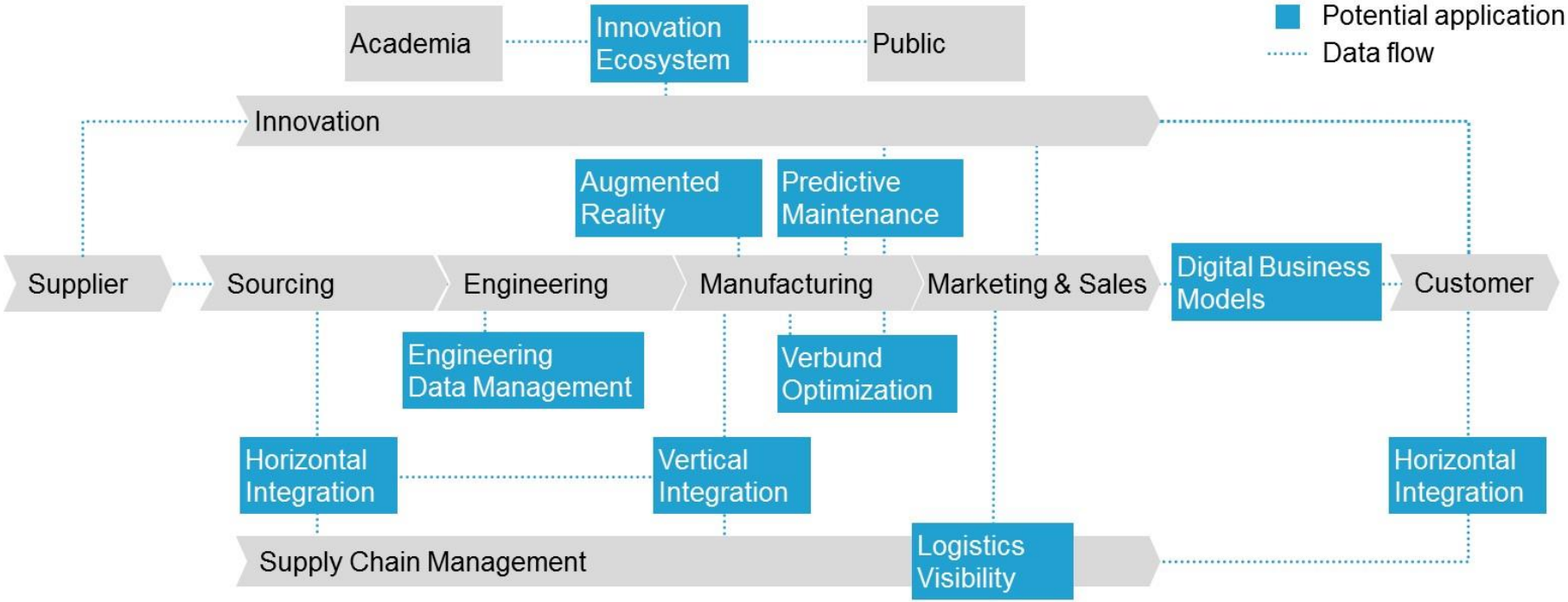
BASF's digital vision

BASF adds value to customers through digitally enabled products and services.

BASF enhances effectiveness and efficiency through horizontally and vertically connecting value chain data and applying advanced data analytics to enhance decision making.

The BASF team understands and leverages the value of data and new digital technologies.

Attractive applications identified along the value chain



Seven core technologies will enable Industry 4.0 in chemicals

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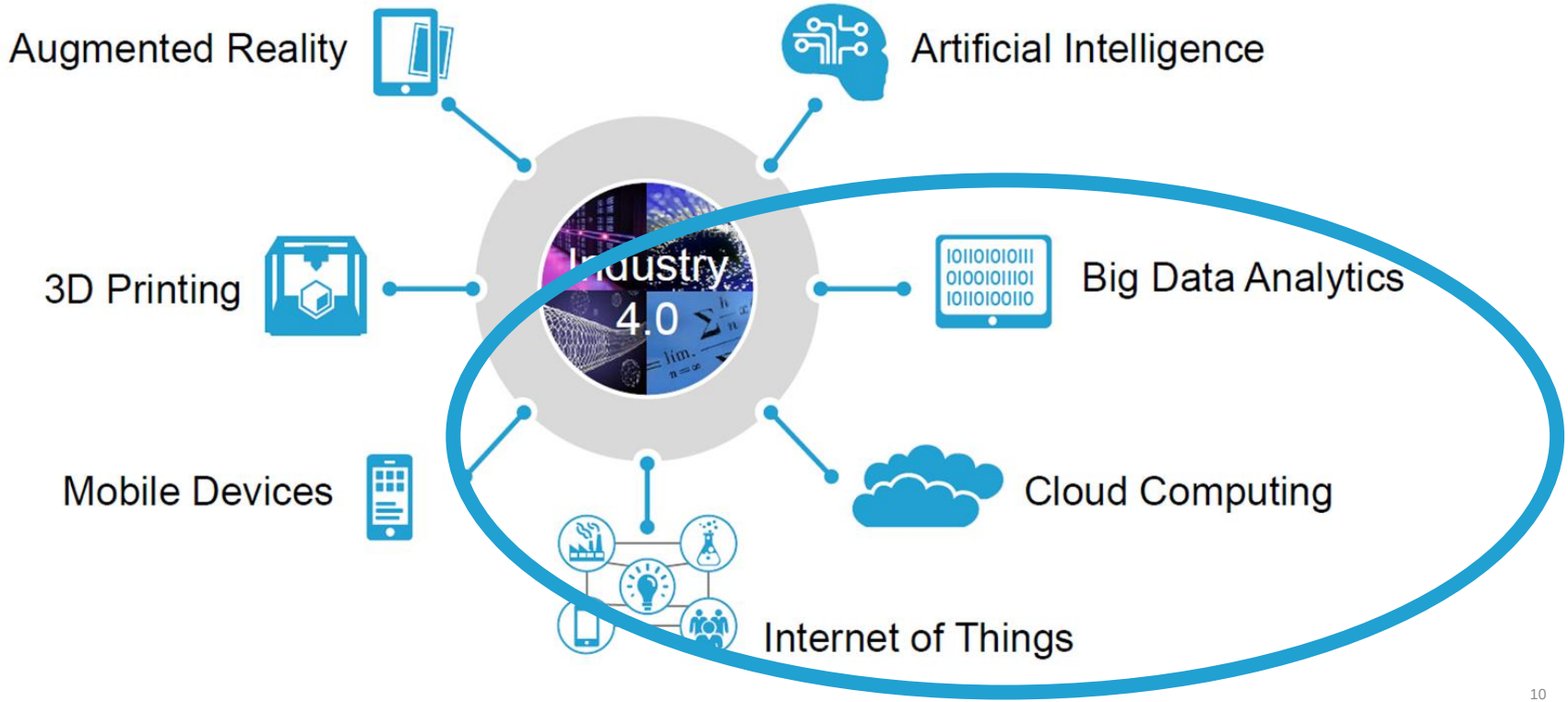

IoT Strategy – Topic Introduction

Internet of Things (IoT)

Enabling **advanced services** by equipping objects with **sensors or actuators** and capability to **exchange data** amongst each other or with computer systems via an **IP based** network infrastructure

A **thing is a physical object** that can be **identified, managed** and integrated in **communication networks**
= **Cyber Physical Systems (CPS)**

Machine to Machine Communication (M2M)

Direct communication between two or more Cyber Physical Systems

IoT Strategy – Topic Introduction (cont.)

Industrial Internet of Things (IIoT)

Subset of IoT with **physical systems from manufacturing** environments.
IIoT-enabled solutions combine appropriate elements of both operational technology (OT) and information technology (IT) and are characterized by additional operational and safety requirements.

Industrie 4.0

German initiative focusing on use of **IoT in industrial processes** including its implications for value creation, business models, downstream services and organization. It relates to fourth industrial revolution that describes full connection of machines, products and processes in smart factories.

Similar international initiatives include Smart Manufacturing Leadership Coalition (SMLC) in North America, Industrie du Futur in France and Made in China 2025 in China.

Major Benefits of IoT

Benefit	What it means for a company in process manufacturing
1. Improve customer satisfaction 	▪ New product / service offerings ▪ Reliable product delivery to customers
2. Create opportunities for top line growth 	▪ Use drivers above for top line growth ▪ Enable new business models ▪ Combine IoT with Big Data & Analytics, Cloud and Ecosystems
3. Increase efficiency 	▪ Improve monitoring and integration of manufacturing facilities with business processes ➢ Reduced maintenance efforts and downtime, increased asset lifetime ➢ Optimized consumption of raw material and energy
4. Safety and work condition improvements 	▪ Enhance occupational, transport and distribution safety

Objectives and Measures to support realization of Business Benefits

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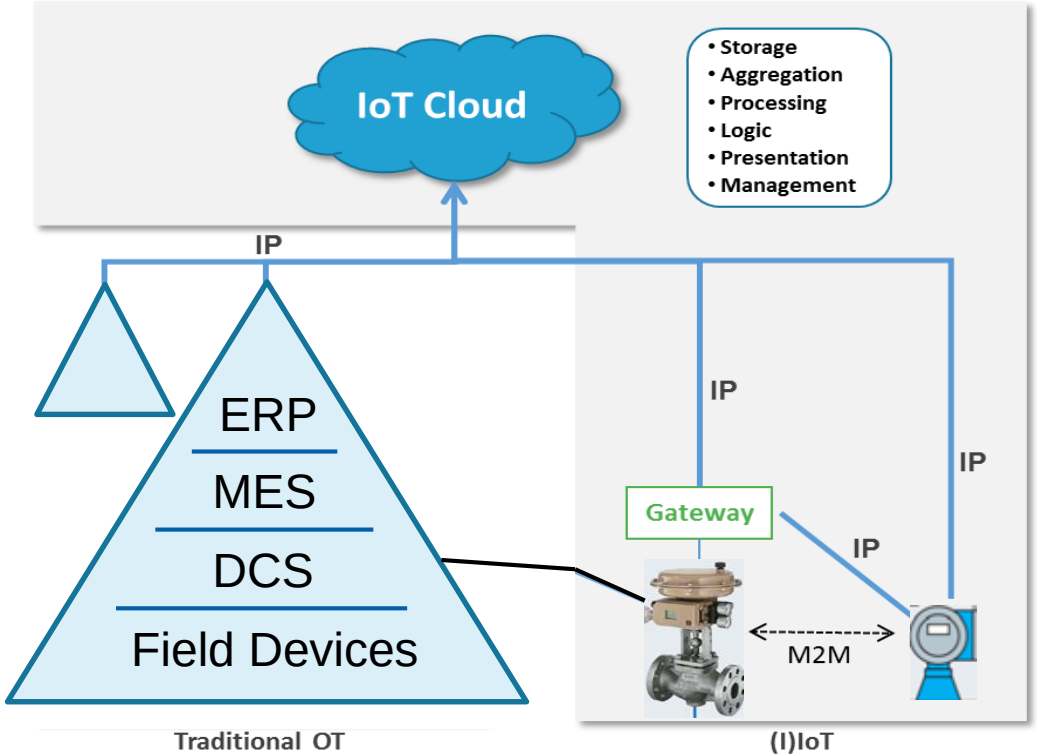
Organizational

- Setup (virtual) Center of Expertise
  - Closer collaboration of OT and IT
- Identify, pilot and share use cases
- Develop IoT capabilities, skills and resources
- Ensure Cyber Security

Technical

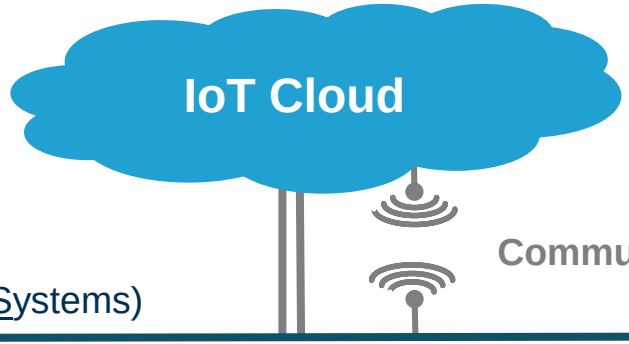
- Create IoT Lab
- Plan, implement and run IoT landscape
  - Cyber Physical Systems
  - Communication
  - Cloud platforms
- Ensure Cyber Security

IoT and (traditional) Operational Technology



- IoT enables new types of solutions
  - ✓ Lean → flexible and low cost
  - ✓ Open ecosystem of apps
  - ! Security, reliability
- (I)IoT and traditional OT will **coexist**
  - **Traditional OT** to **control** the plant
  - **IoT** as additional option to **optimize** production processes and assets

IoT in Process Manufacturing



- **Storage**
- **Processing / Logic**
- **Presentation**
- **Management**
- **Ecosystem of Apps**

Communication

„Things“ (Cyber Physical Systems)

Manufacturing

Predictive Applications

Site

Mobility, Buildings

Supply Chain

Track & Trace

Digital Business Models

Intelligent Products

Operational Excellence ….. **Differentiation and Growth**

Cyber Security

Farmland sensing

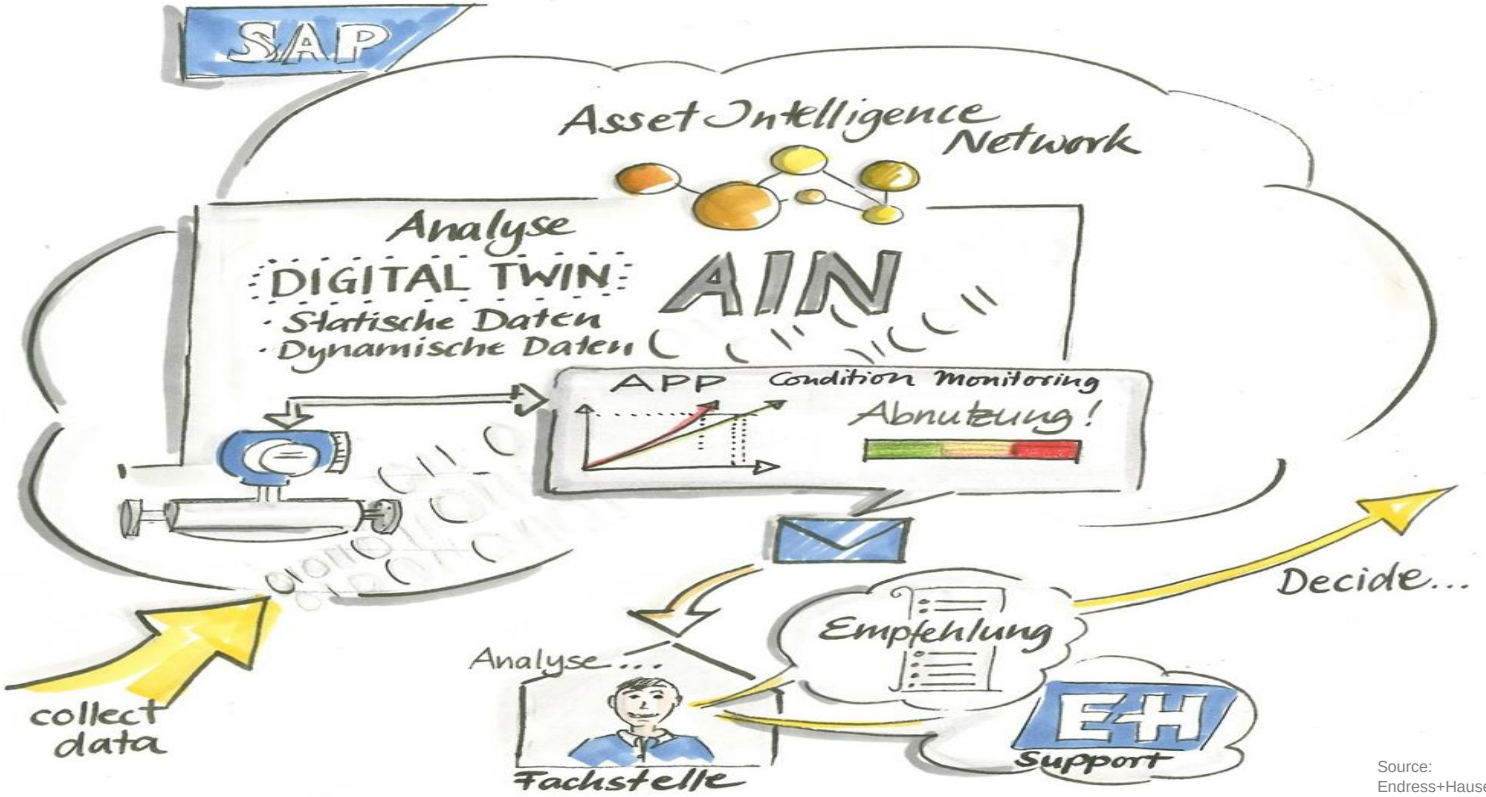
Wireless, solar-powered Agrosensor to optimize the application of plant protective agents.

Sensors:

- Air temperature
- Air humidity
- Air pressure
- Soil temperature
- Soil humidity
- Leave humidity
- Luminosity

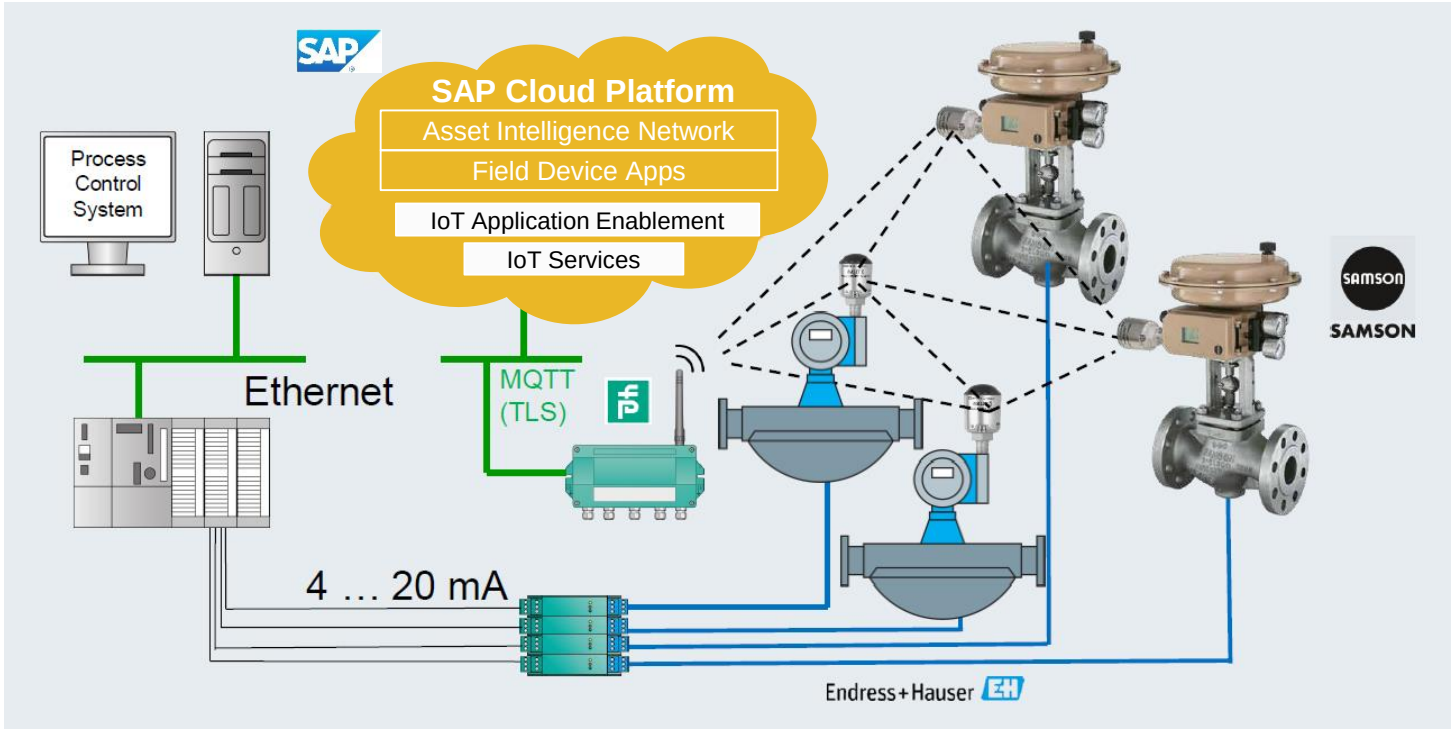
Source: Libelium

Use Case: Industrial Fleet Management for Field Devices



Source:
Endress+Hauser Flowtec AG

Industrial Fleet Management – Wireless



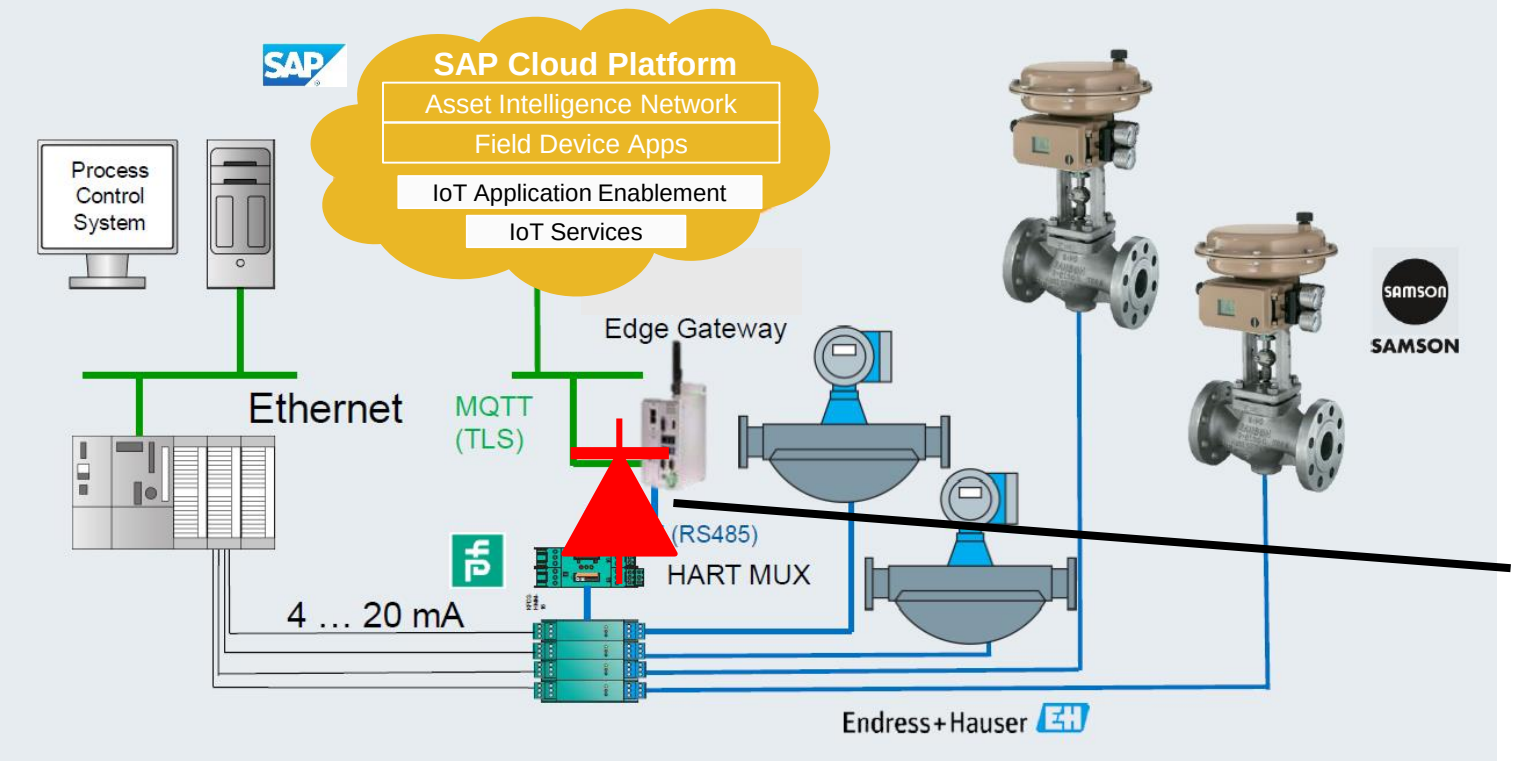
Wireless:

- Second channel
- Independent from plant control
- Easy retrofit
- “Read only” configuration of HART interface

Wireless options:

- Wireless HART
- LoRa
- Sigfox
- NB-IoT
- …

Industrial Fleet Management – Wired



Data Diode to prevent break-in from Cloud

Summary

- Achieve clarity on your benefits, objectives and measures (aka strategy)
- Identify use cases with tangible benefits
- Start implementation with existing technology
- Gain “real” hands on experiences - allow to fail, but fail fast and learn
- Consider:
  - Platforms, ecosystems, services, standards
  - Low cost & low power sensors and networks
  - Security

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