The contribution of IoT in process manufacturing

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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. Exemplary IoT Solutions for Process Manufacturing
6. Summary
Our chemistry is used in almost all industries

We combine economic success, social responsibility and environmental protection

Sales 2015: €70,449 million

EBIT 2015: €6,248 million

Employees (as of Dec. 31, 2015): 112,435

6 Verbund sites and 338 other production sites
BASF’s segments

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.
Seven core technologies will enable Industry 4.0 in chemicals

- Augmented Reality
- Artificial Intelligence
- 3D Printing
- Big Data Analytics
- Mobile Devices
- Cloud Computing
- Internet of Things
Attractive applications identified along the value chain
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.
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**

1. Improve customer satisfaction

2. Create opportunities for top line growth

3. Increase efficiency

4. Safety and work condition improvements

**What it means for a company in process manufacturing**

- New product / service offerings
- Reliable product delivery to customers
- Use drivers above for top line growth
- Enable new business models
- Combine IoT with Big Data & Analytics, Cloud and Ecosystems
- 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
- Enhance occupational, transport and distribution safety
# Objectives and Measures to support realization of Business Benefits

## 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

**Demarcation** of IoT to traditional OT:
- CPSs connected to IP based network
- Smartness to exchange data amongst each other or with computer systems

**Traditional OT** to control the plant

**IoT** to optimize production processes and assets

(I)IoT and traditional OT will **coexist**
- A thing may be part of both worlds

x: non-IP, e.g. analog or proprietary communication
IoT in Process Manufacturing

IoT Cloud

"Things" (Cyber Physical Systems)

- Manufacturing
- Site
- Supply Chain
- Digital Business Models

- Predictive Applications
- Mobility, Buildings
- Track & Trace
- Intelligent Products

Operational Excellence

Cyber Security

Storage
- Processing / Logic
- Presentation
- Management
- Ecosystem of Apps
Process Optimization

Azure IoT Suite
- Stream Analytics
- Blob storage
- Power BI
- Notification Hub

Azure IoT Hub
- Internet
- Firewall
  - Intranet – IoT VLAN
  - MQTT over SSL
  - IP

IoT Gateway
- (Wireless) HART

Coriolis Mass Flow Meter
Predictive Maintenance - Wireless

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

**Wireless options:**
- Wireless HART
- LoRa
- Sigfox
- NB-IoT
- …
Predictive Maintenance – 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