The contribution of IoT in process manufacturing

Andreas Klinger, Head of IoT Lab BASF
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
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

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

- Augmented Reality
- Artificial Intelligence
- 3D Printing
- Big Data Analytics
- Mobile Devices
- Cloud Computing
- Internet of Things
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)

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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

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<tr>
<th>Benefit</th>
<th>What it means for a company in process manufacturing</th>
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| 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

### 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

„Things“ (Cyber Physical Systems)

- Manufacturing
- Site
- Supply Chain
- Digital Business Models

Predictive Applications

Operational Excellence

Mobility, Buildings

Track & Trace

Intelligent Products

Cyber Security

- Storage
- Processing / Logic
- Presentation
- Management
- Ecosystem of Apps
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
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
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
150 years

BASF
We create chemistry