The Factory of the Future: Industrie 4.0 in Practice

Dr. Stefan Ferber
Forum Industrial IT, Halle 8/D19, 10.04.2013

Bosch Software Innovations
Industrie 4.0 in Practice

Agenda

1. Company Overview: Bosch and Bosch Software Innovations
2. Technology Trend: Internet of Things & Services
3. Example Applications of Internet of Things & Services
4. Industrie 4.0: acatech Study
5. Industrie 4.0 in Practice: Predictive Maintenance
6. Conclusion
Industrie 4.0 in Practice

Agenda

1. Company Overview: Bosch and Bosch Software Innovations
2. Technology Trend: Internet of Things & Services
3. Example Applications of Internet of Things & Services
4. Industrie 4.0: acatech Study
5. Industrie 4.0 in Practice: Predictive Maintenance
6. Conclusion
## Bosch 2011 key figures

<table>
<thead>
<tr>
<th>Bosch Group total</th>
<th>51.4 billion EUR in sales</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>303,200 associates</td>
</tr>
<tr>
<td></td>
<td>including 38,750 in research and development</td>
</tr>
</tbody>
</table>

### Automotive Technology

- 59% share of sales
- World's largest supplier of cutting-edge automotive technology

### Industrial Technology

- 14% share of sales
- World's leading manufacturer of large gearboxes and of powertrain, packaging, and process technology

### Consumer Goods and Building Technology

- 27% share of sales<sup>1</sup>
- World's largest power tool manufacturer, leading the field in household appliances, heating and cooling, and security systems

<sup>1</sup> Including other segments
Bosch Software and Systems House

Overview Bosch Software Innovations

Industry Solutions
- Automotive/OEM, Energy, Finance, Health, Insurance, Manufacturing, Public, Retail, Telco

Technologies
- M2M (Device Management)
- BPM (inubit)
- BRM (Visual Rules)

Professional Services
- Planning, Implementation and Operation of Solutions, based on our Software Products

• Locations:
  Immenstaad, Stuttgart, Berlin, Chicago, Palo Alto, Washington D.C., Singapore, Shanghai and Melbourne

• Personnel:
  ~ 535 worldwide
Industrie 4.0 in Practice

Agenda

1. Company Overview: Bosch and Bosch Software Innovations
2. Technology Trend: Internet of Things & Services
3. Example Applications of Internet of Things & Services
4. Industrie 4.0: acatech Study
5. Industrie 4.0 in Practice: Predictive Maintenance
6. Conclusion
Industrie 4.0 in Practice

People connected to the internet

- 1995: 0.7% are connected out of 5.7 billion
- 2005: 15% are connected out of 6.5 billion
- 2015: 75% are connected out of 7.3 billion

World population: Green
People connected to the internet: Green
Industrie 4.0 in Practice

Devices connected to the internet

6.593 billion devices in 2015

- 0.062 billion vehicles
- 0.019 billion in telemedicine
- 0.070 billion in security
- 0.120 billion smart meters
- 0.260 billion TVs
- 0.625 billion tablets
- 3.000 billion mobile phones
- 1.498 billion laptops
- 0.895 billion desktops
- 0.044 billion servers
Massive Distributed System of Systems

Internet of People
$10^9 - 10^{10}$

System and Service Platforms

Internet of Things
$10^9 - 10^{12}$

Smart Grid
Smart Home
Smart Building

Internet of Services
$10^5 - 10^7$
Industrie 4.0 in Practice

Bosch Software Innovations Offering

Solutions

Bosch Software Innovations Offering

Suite

BPM+
Design, optimize and automate business processes and rules

IoTS
Enable business models and processes in the IoTS

(Business Process Management) Solutions

Suite

BPM+ Editions

IoTS

Software-Suite

Editions

Core Products

Agenda

1. Company Overview: Bosch and Bosch Software Innovations
2. Technology Trend: Internet of Things & Services
3. Example Applications of Internet of Things & Services
4. Industrie 4.0: acatech Study
5. Industrie 4.0 in Practice: Predictive Maintenance
6. Conclusion
Industrie 4.0 in Practice

Enabling business success in a connected world

Connected Mobility
Connected City
Connected Energy
Connected Life
Connected Industry
Connected Enterprise
eMobility “pioneering technology in Singapore”

eMobility Solution
Technology and service provider

- Openness to 3rd party vendors
- Integration of new business models
- Local operation of infrastructure

Project figures

- **2011**: Launch of Charging Service
- **2012**: 60 Electric Vehicles, 63 charging stations
- **2014**: break-even 1,500-3000 EV (ca. 2% of vehicles)
- **By 2016**: Develop business model, partners & drivers

- Second highest population density
- Top ranked on Innovation Index
- Living city lab and talent hub (AP)
Industrie 4.0 in Practice

Bosch Healthcare: “Closer to the patient”

Platform for the Internet of Things

Bosch Telehealth Plus

- Constant IP-based exchange of vital & behavioral parameters between doctors & patients
- Rule-based analysis of health
- Regular refinement of detection parameters by trained medical staff

Benefits

- Improved adherence to therapy, reduced mortality, improved quality of life
- Increased efficiency of medical service providers
- Very good acceptance among patients & attendants

- USA successfully implemented
- Projects Charité, Bosch, Asklepios
- Techniker Krankenkasse: COPD patient
REWE retail group (Germany): “No customer need goes unanswered”

**Individual Software**

*Transaction-oriented inventory control system*

- Systematic mapping of all processes along the value-added chain
- Connection of all data suppliers, from back office to the store shelf, including external suppliers

**Project figures**

- **Shortening** of delivery times from the point of order to **less than 1 day** in some cases
- **Updating** of products and inventories from checkout or shelf in **less than 5 minutes**

- Leading position in Europe
- 2010 sales: EUR 51 billion
- > 15,000 stores worldwide
Industrie 4.0 in Practice

John Deere machines (U.S.): “Machine health revolution”

Rules Technology

*Machine diagnosis with telemetrics*

- Range of services for John Deere customers
- Intelligent monitoring of machine KPIs and fluid analysis
- Optimum servicing intervals

Project figures

- Minimization of downtime
- Price reduction for servicing contracts
- Competitive advantage:
  “Move More Dirt for Less Money” (quote, John Deere)

- Global market leader
- 2010 sales: USD 26 billion
- > 50,000 employees worldwide
Industrie 4.0 in Practice

Agenda

1. Company Overview: Bosch and Bosch Software Innovations
2. Technology Trend: Internet of Things & Services
3. Example Applications of Internet of Things & Services
4. Industrie 4.0: acatech Study
5. Industrie 4.0 in Practice: Predictive Maintenance
6. Conclusion
Industry 4.0 – The next industrial revolution

- From the 1st to the 4th industrial revolution

- Connecting systems and machines
- Increasing variance with maximum productivity (batch size = 1)
- Decentralization

Source: DFKI / Forschungsunion Wirtschaft & Wissenschaft
Chancellor Dr. Angela Merkel visiting Hannover Messe with President Vladimir Putin receives the report „Industrie 4.0“ from Prof. Dr. Henning Kagermann (acatech) and Dr. Siegfried Dais (Bosch)
Perspektive der IKT-Automatisierungstechnik heute

Quelle: Festo / Forschungsunion Wirtschaft & Wissenschaft
Industrie 4.0 in Practice

Smart Factory

➤ New business models through the convergence of IT & production

Networked Production
Customer Integrated Engineering
Resilient Factory
Up-Cycling
Adaptive Logistics
Technology Marketplace

Predictive Maintenance

Source: Forschungsunion Wirtschaft & Wissenschaft
Industrie 4.0 in Practice

Agenda

1. Company Overview: Bosch and Bosch Software Innovations
2. Technology Trend: Internet of Things & Services
3. Example Applications of Internet of Things & Services
4. Industrie 4.0: acatech Study
5. Industrie 4.0 in Practice: Predictive Maintenance
6. Conclusion
Industrie 4.0 in Practice

Predictive Maintenance

How it works

- Real-time compilation of machine and sensor data
- Rule-based analysis of machine data to create malfunction prognosis
- Mapping of maintenance processes
- Flexible integration into Business-IT

Optimizing the service offering
Benefits & advantages for manufacturers

**Increased efficiency in the maintenance process**
- All maintenance applications united in one portal
- Integration of existing processes and systems
- Comprehensible and accurate accounting of warranty services
- End-to-end process solution

**Optimized maintenance services**
- Optimize maintenance and repair costs
- Increase customer satisfaction
- Competitive advantage

**Developing new business models**
- Optimize service offer for customers
- Revenue through new services (resource conservation, etc.)
- Increase margins by offering services from remote

Industrie 4.0 in Practice
Industrie 4.0 in Practice

Benefits & advantages for users

Increase Overall Equipment Effectiveness (OEE)

- Maximize uptime
- Avoid costly downtime by better planning of maintenance activities
- Efficient use of maximum service life time of spare parts and products
- Increased productivity
- Resource conservation
Remote Service Portal – Stages and features

Predictive Maintenance
- Tool supported data analysis for malfunction prognosis
- Automated maintenance process
- Integration of 3rd party process (logistic, purchasing etc.)

Central Service Management
- Monitoring and reporting of maintenance processes
- Service Ticketing Management
- Integrating business processes (e.g. ERP System, CRM System)

Central Machine Health
- Capturing machine sensor data
- Monitoring of machine health and production status
- Data analysis using predefined algorithms

Remote Service Portal Basic
- Central access to machines and systems via Web-UI
- Remote Software Updates
- Transparent and centralized documentation

Service Portal with central access for customers and employees
Industrie 4.0 in Practice

Solution Architecture

- Portal
- Applications
  - BPM
  - BRM
  - Data Analysis
  - CRM
  - ERP
- Device Management
  - M2M
  - Device Abstraction
  - Device Data
  - Device Access
  - Event Management
  - Big Data
- Agents
  - Edge Controller
- Device & Machine Level
  - Direct Nodes
  - Indirect Nodes

CRM = Customer Relationship Management, ERP=Enterprise Resource Planning, M2M=Machine to Machine
Industrie 4.0 in Practice

Agenda

1. Company Overview: Bosch and Bosch Software Innovations
2. Technology Trend: Internet of Things & Services
3. Example Applications of Internet of Things & Services
4. Industrie 4.0: acatech Study
5. Industrie 4.0 in Practice: Predictive Maintenance
6. Conclusion
Conclusion

- The Internet of Things & Services stands for the progressive linking of the physical and virtual world.
- Model driven approach and Open Platforms are key: Process to Device & Device to Process.
- Technology itself is not the key factor - much more the development of applications and business models.
- Quick wins in Industrie 4.0 e.g. Service Portals
- Bosch will consequently utilize the chances and possibilities of the Internet of Things & Services.
Blogging Internet of Things
Technology inspiring a connected life
http://blog.bosch-si.com

Visit us at
Hall 7/C04

Q & A
Dr. Stefan Ferber
Director Communities & Partner Networks
stefan.ferber@bosch-si.com, Tel +49 (711) 811-58114

Follow me on
@stefferber

Bosch Software Innovations