Value Creation in the Digital Economy

Industry 4.0 - Convergence of IT and OT

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Industry 4.0 Head for France
January 2016
ARE YOU READY FOR THE DIGITAL ECONOMY?

Who wants change?

Who wants to change?
Video on Youtube: https://www.youtube.com/watch?v=m3jV6tebTv0
of the FORTUNE 500 companies have Dropped from the index between 1955 and 2014
Why now?

Enablers for Digitization

Hyperconnectivity

Cloud Computing

Smarter World

Big Data Capabilities
Industrie 4.0 – What is it?

Self Organizing Production
Lot Size 1
IoT
Autonomous Systems
Cyber Physical Systems
Performance Management
Big Data
Connected Machines
Integration Interaction Intelligence
The fourth Industrial revolution based on cyberphysical systems

Enablers:

1. Mobile networked computing
   - Embedded software
   - Ubiquitous computing
   - Unlimited network access

2. Cloud Platforms
   - Performant
   - Secure
   - Available

3. Big data capabilities
   - IoT optimized data acquisition
   - Event streaming
   - Geo spatial
   - Predictive
SAP Point of View:
A simple Systems Architecture for the Digital Manufacturing Company

- Workforce engagement
- Mobility
- Collaboration
- Contingent labor

- Intelligent products
- Embedded software
- Internet of Things
- Solution business
- Digital content

- Collaborative R&D
- Supply networks
- Networked procurement
- Solution provider network

- Segment of One
- Omni-channel engagement, sales, and service
- IoT-based engagement
SAP’s Portfolio for the Digital Manufacturing Company

- SAP HANA Cloud Platform
- SAP Embedded Technology
- SuccessFactors
- Concur
- Ariba
- FieldGlass
- hybris software

Digital Core

- Service
- Design
- Production
- Sales

Sourcing

Workforce

Suppliers and partners

Customers
Show the value
Imagine a Producer of industrial robots
Vertical Articulated Robot N_021

- Tremendous increase of vibration indicates potential issue of a decelerator in the robot within the next 3 days.
- Max. Vibration: 10 mm

Vibration of Decelerator

- Chart showing vibration levels over time for different robots.
## Vertical Articulated Robot N_021

- **Max. Vibration:** 11 mm

**Warning:**
Tremendous increase of vibration indicates potential issue of a decelerator in the robot within the next 3 days.

**Machine Type:** SEPARATOR
**Machine Subtype:** MSI 350-01-772

### Other Robots

- **Vertical Articulated Robot N_001**
  - Vibration: 8 mm

- **Vertical Articulated Robot N_003**
  - Vibration: 7 mm

- **Vertical Articulated Robot N_005**
  - Vibration: 3 mm

- **Vertical Articulated Robot N_007**
  - Vibration: 5 mm

- **Vertical Articulated Robot N_009**
  - Vibration: 6 mm

- **Vertical Articulated Robot N_011**
  - Vibration: 5 mm
Vertical Articulated Robot N_021

Tremendous increase of vibration indicates potential issue of a decelerator in the robot within the next 3 days.

Max. Vibration: 10 mm

Vibration of Decelerator

- Vertical Articulated Robot N_001: 8 mm
- Vertical Articulated Robot N_003: 7 mm
- Vertical Articulated Robot N_005: 3 mm
- Vertical Articulated Robot N_007: 5 mm
- Vertical Articulated Robot N_009: 6 mm
- Vertical Articulated Robot N_011: 5 mm

Health vs Time:
- Today
- Estimated Failure

Forecast line: dashed red line
Service Order:

- Service Order: 4500017982
- Service Date: 18/03/2015
- Customer Name: CeBIT Automation
- Location: Trammpalt 2 30169 Hannover
- Description: Tremendous increase of vibration indicates cause issue of a decelerator.

Steps (3):
- See if decelerator can be reused. 30 Min
- Replace decelerator. 40 Min
- Test the decelerator. 40 Min

Item (1):

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Delivery Date</th>
<th>Status</th>
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<tbody>
<tr>
<td>45122</td>
<td>Decelerator Type 47/15</td>
<td>1</td>
<td>16/03/2015</td>
<td>Available</td>
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Internal Technician (0 / 2):

<table>
<thead>
<tr>
<th>Technician</th>
<th>Rating</th>
<th>Lead Time</th>
<th>Skill</th>
<th>Hourly Rate</th>
<th>Status</th>
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<tbody>
<tr>
<td>Reinhard Kuntze</td>
<td>★★☆☆☆☆ (35)</td>
<td>15 Days</td>
<td></td>
<td>45 EUR</td>
<td>Not Match</td>
</tr>
<tr>
<td>Bernd Schreiner</td>
<td>★★☆☆☆☆ (47)</td>
<td>7 Days</td>
<td></td>
<td>37 EUR</td>
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## Technician – External Vendor (5 / 30)

<table>
<thead>
<tr>
<th>Technician</th>
<th>Supplier Name</th>
<th>Rating</th>
<th>Avg. Lead Time</th>
<th>Distance</th>
<th>Skill</th>
<th>Hourly Rate</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johannes Dreher</td>
<td>Talent onDemand</td>
<td>⭐⭐⭐⭐⭐</td>
<td>2 Days</td>
<td>19 km</td>
<td></td>
<td>35 EUR</td>
<td>Recommend</td>
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<tr>
<td>Frank Zimmermann</td>
<td>Talent onDemand</td>
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<td>3 Days</td>
<td>45 km</td>
<td></td>
<td>32 EUR</td>
<td>Match</td>
</tr>
<tr>
<td>Thomas Maiie</td>
<td>EVF Global</td>
<td>⭐⭐⭐⭐⭐</td>
<td>2 Days</td>
<td>45 km</td>
<td></td>
<td>31 EUR</td>
<td>Match</td>
</tr>
<tr>
<td>Gerald Wagner</td>
<td>EVF Global</td>
<td>⭐⭐⭐⭐⭐</td>
<td>2 Days</td>
<td>36 km</td>
<td></td>
<td>28 EUR</td>
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</tr>
<tr>
<td>Jochen Lang</td>
<td>Talent onDemand</td>
<td>⭐⭐⭐⭐⭐</td>
<td>2 Days</td>
<td>42 km</td>
<td></td>
<td>32 EUR</td>
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<tr>
<td>Friedrich Busch</td>
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<td>30 EUR</td>
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<tr>
<td>Albrecht Schrempf</td>
<td>EVF Global</td>
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<td>18 Days</td>
<td>69 km</td>
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<td>32 EUR</td>
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<tr>
<td>Anton Tischler</td>
<td>ManPower Co.</td>
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<td>15 Days</td>
<td>45 km</td>
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<td>33 EUR</td>
<td>Not Match</td>
</tr>
<tr>
<td>Ingo Bach</td>
<td>EVF Global</td>
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<td>62 km</td>
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<td>33 EUR</td>
<td>Not Match</td>
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Service Order

Service Order: 4500017982
Service Date: 18/03/2015
Customer Name: CeBit Automation
Location: Trammpaltz 2 30159 Hannover
Description: Tremendous increase of vibration indicates cause issue of a decelerator

Steps (3)

1. See if decelerator can be reused. 30 Min
2. Replace decelerator. 40 Min
3. Test the decelerator. 40 Min

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<th>Hourly Rate</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johannes Diether</td>
<td>★★★★★ (196)</td>
<td>2 Days</td>
<td></td>
<td>35 EUR</td>
<td>Recommend</td>
</tr>
</tbody>
</table>
### Service Order

**Service Order:** 4500017982  
**Service Date:** 18/03/2015  
**Customer Name:** CeBit Automation  
**Location:** Trammpplatz 2 30159 Hannover  
**Description:** Tremendous increase of vibration indicates cause issue of a decelarator.

**Steps (3)**
- See if decelarator can be reused.  
- Restore decelarator.  
- Test the decelarator.

**Item (1)**

<table>
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</table>
Avoid Equipment Downtime
Increase your Service level
Improve Customer Satisfaction
Value creation through deep process and data integration

Value Creation through:

1. **Product Innovation**
   - IoT-enabled products and solutions.
   - Extended product and solution portfolio.

2. **Process Innovation**
   - Adaptive logistics
   - Resilient production
   - Energy management
   - Predictive maintenance and service

3. **Business Model Innovation**
   - Serving the “Segment of One”.
   - Performance and usage based contracting and billing.

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**New Business Scenarios**
- Smart Products
- Performance based Contracting (BRIM)
- Configure, Price, Quote
- Track & Trace
- Connected Logistics
- Connected Manufacturing
- Predictive Quality
- Energy Management
- Predictive Maintenance
- Augmented Reality Apps
- Remote Service Management
- Predictive Maintenance

**Smart Data**

**Supply Chain**

**R&D**

**Sales**

**Manufacturing**

**Aftermarket Service**

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Connected Manufacturing - 5 Scenarios of “Connectedness”

5 Scenarios:

1. Shop floor to Top floor
   Intra company vertical integration

   Autonomous machines

3. eCommerce Integration
   Direct integration of online configurators

4. Manufacturing Collaboration
   - Visibility
   - Genealogy
   - Quality
   - Kanban / Direct replenishment

5. Machine Cloud
   - Predictive maintenance
   - Predictive quality
Leading companies are moving ahead

Value Creation through:

1. Product Innovation
   - I4.0 enabled products and solutions.
   - Extended product and solution portfolio.

2. Process Innovation
   - Adaptive logistics
   - Resilient production
   - Energy management
   - Predictive maintenance and Service

3. Business Model Innovation
   - Serving the “Segment of One”.
   - Performance and usage based contracting and billing.
Company

Harley-Davidson is a legendary motorcycle manufacturer.

Situation: Need to optimize manufacturing processes in a completely rebuilt factory, making one factory out of five.

Solution

- SAP ERP
- SAP APO
- SAP Manufacturing Integration and Intelligence (MII)
- SAP Manufacturing Execution (ME)
- Integration of shop floor equipment like cranes

Process Innovation

- Each bike is customized individually
- IoT-powered manufacturing planning and execution

Benefits

- Costs: -7%
- Delivery time down from 21 days to 6 hours
- Agility and predictiveness
- Improved quality
SAP Predictive Maintenance and Service:

Company

GEA, the leading manufacturer of separators and decanters for industrial usage.

Situation: lacking service contract compliance

Solution

- SAP HANA Cloud Platform
- SAP Predictive Maintenance & Service – Cloud Edition
- ifm adaptor
- SAP IoT connector
- SAP CRM Service

Process Innovation

- Real-time Monitoring
- Remote Service Engineer
- Spare Parts & Tools

Benefits

- Service execution based on real-time machine data
- Increased machine uptime
- Improved service contract compliance
- Higher service productivity
IoT-Powered Customer Service:

Company
Kaeser Compressors is one of the largest providers of compressed air systems and compressed air consulting services.

Situation: changed the business model from selling compressors to selling compressed air through the Sigma Air Utility service.

Solution
- Compressors equipped with sensors
- SAP Predictive Maintenance & Service with Machine Health Fact Sheet
- SAP HANA
- SAP CRM Service on HANA

Process Innovation
- IT / OT Connectivity
- Condition Monitoring Remote Service
- Fault Pattern Recognition
- Machine Health Prediction
- Create Service Order
- Schedule Order
- Execute Order on mobile device
- Visual Support

Benefits
- IoT as an enabler for the new business model
- Improved availability of compressor stations
- Move from unplanned to planned maintenance
Connected Logistics: Port of Hamburg

Company
The Hamburg Port Authority is managing the Hamburg port.

Situation:
• Geographical limitations and constantly growing container throughput
• No transparency through data overflow

Solution
• Location sensors on trucks and trailers
• T-Systems telematic solutions
• Data sources for real-time information like traffic
• HPA solution: smartPORT logistics (SPL)
• SAP HANA Cloud Platform
• SAP Connected Logistics

Process/Technology Innovation

Benefits
• More efficient operations – higher throughput
• Less idle times for truck drivers
• Less traffic jams
Smart Products:

ifm electronic, an industrial automation technology manufacturer and producer of sensors

Situation: intention to grow the business through built-in SAP integration

Solution

- SAP Plant Connectivity (PCo), embedded in the ifm product *Connectivity Port*
- Providing integration to SAP solutions like
  - SAP MII/ME
  - SAP Business Suite
  - SAP HANA
- Business model: OEM

Benefits

- Add value to the technology offering
- Expand the business through innovation
Cloud for Industry: **SIEMENS**

**Company**

Siemens AG (industry sector), the leading global producer of Industry Automation and Drive Technologies

Situation: Siemens wants to offer an open cloud-based platform as a basis for an industrial ecosystem. This will enable OEMs, application developers and customers to integrate devices and to offer data based services.

**Solution**

- Siemens Industrial Service Backbone (ISB)
- HANA Cloud Platform
- SAP analytical tools and apps
- IoT apps from Siemens and partners
- Business model: OEM PaaS

**Technology and Business Innovation**

- Combine the best of both worlds
- A unique, end-to-end and global IoT offering for OEMs, app developers and industrial customers
- Set a new industrial standard to access and make sense of machine data

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Adaptive Logistics:

Company

Still is a leading supplier of forklift trucks, platform trucks and tractors plus the latest intra-logistics systems.

Situation: Still is evolving from a pure product to a services company.

Solution

- Still cubeXX concept forklift truck
- SAP HANA Cloud Platform
- SAP Extended Warehouse Management (EWM)
- Mobile app for warehouse worker

Process/Technology Innovation

- The on-board IoT connector connects the forklift truck with cyber physical systems and cloud apps.
- The warehouse worker uses a smart device to manage tasks between people and machines.
- A 3D picture of the environment is used for orientation and the truck positioning.
- The truck directly receives warehouse tasks from SAP EWM.

Benefits

- Efficient, fast and save logistics processes
- Reduced time effort for material handling
- Also applicable for fleet management optimization
IoT-optimized Engine Testing:

Company

In line with its motto “Driving performance”, Mercedes-AMG develops high performance cars.

Situation: Engine testing is a costly and data-intensive process. While most engine failures occur within minutes, failed tests could not be identified until after completion, resulting in hours of lost time and resources.

Solution

- IoT-enabled test bench
- SAP HANA to manage sensor data
- SAP ERP on HANA for Quality Management
- Real-Time Quality Assurance solution (RQA)
- SAP Business Objects products for analysis
- Mobile app for engineers

Process/Technology Innovation

- Mobile App
- SAP BusinessObjects Platform, Analysis, Prediction
- SAP ERP on HANA
- SAP HANA
- Quality Management
- RQA
- Real-Time Quality Assurance (RQA)
- Sensor data

Benefits

- >76% improved processes
- 94% faster runtimes
- 1 day equivalent increase in weekly testing capacity
Re-Imagine Business with IoT and Big Data: Tennant

Company

Tennant Company provides cleaning machines and solutions.

Situation: Need to differentiate from competition to realize future growth plans.

Solution

• ILS Technology: sensors and device management
• SAP HANA Platform
• Asset management portal on SAP HANA, combining machine and ERP data
• SAP BusinessObjects dashboards

Process Innovation

Benefits

• Competitive advantage through IoT-based offering
• Customer satisfaction and retention
• Higher asset availability and transparency
• Cost reduction
For Manufacturing Industries, becoming truly Digital implies to understand and leverage all drivers from the ongoing 4th Industrial Revolution, the epicenter of which is the Factory.
The Digital Core relies on elastic, unified agnostic computing power capable to reveal low level signals from discrete information, make sense of it through meaningful visualization and process complex events in order to take proper action – starting with the plant.

The Digital Factory at the heart of the Digital Transformation

Hana as the Digital Backbone bridging IT and OT
The Digital Factory at the heart of the Digital Transformation

SAP Perspective on how Digital or the Industrial Internet Enables the Perfect Plant

- Autonomous Production Reorganization
- Optimal Trade-off
- Real time Inventory Management
- Autonomous Production Reorganization
- Adaptive Transportation Management
- Alternative supplier real time evaluation
- Customer Centric

- Predictive Quality
- Predictive Maintenance
- Remote Support

Perfect Plant

Digital Core

- Foresight
- Predictive Quality
- Predictive Maintenance
- Remote Support

Personalized Solutions
- Connect Products, Assets and Manufacturing to Product Networks
- Multi-tenant
- Batch of One
- PLM integration
- Talent Acquisition
- New Downstream services

Customer Centricity
- Transform Supply Chain and Logistics into Demand Networks
- Autonomous Production Reorganization
- Adaptive Transportation Management
- Alternative supplier real time evaluation
- Customer Centric

Plant A
- MES
- Digital Core
- Powered by Hana

Plant B

Plant C

Shop Floor

Top Floor

IT

OT
Thanks / Merci

Philippe GEOFFROY
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Philippe.geoffroy@sap.com
Appendix: IoT / I4.0 Videos
Videos 1

- HMI 2014 short, english
- HMI 2014 long, english
- Hamburg Port, english
- Hagleitner, english
- Predictive Maintenance and Service for Wind Turbines
- Harley Davidson York, english
- AR Service Technician App, english
- IoT will Transform Business
- SAP IoT for Business, english
- SAP BMW Connected Car, english
- AR Warehouse Picker App, english
- SAP IoT for Business, english

SAP IoT for Business, english

Predictive Maintenance and Service for Wind Turbines
And more here: https://www.youtube.com/user/SAPInternetofThings/videos