M2M, Internet of Things and Industry 4.0 – An Industry Perspective

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SAP AG
Agenda

• SAP and Industry 4.0

• IoT and M2M activities – the Why now and the How

• Show me examples!

• Background information and Key Takeaways
R&D @ SAP - A world class team around the globe
Manufacturing @ SAP
Extending the Reach

SAP past

- SAP ERP
- SAP PLM
- SAP SCM

SAP today

- SAP Manufacturing Execution (ME)
- SAP Manufacturing Integration & Intelligence (MII)
- SAP Plant Connectivity (PCo)
- SAP Visual Enterprise (VE)

ERP

Manufacturing Execution

Process Control

SAP is a key player in Manufacturing
Future Factory in Dresden
because: “Vision without implementation is hallucination.” (Benjamin Franklin)

- Space for Co-Innovation & Demonstration
- End-to-end process w/ SAP products + prototypes
- Local or webcam tours for customers, partners
- ~500 visitors/year in Dresden/Germany
- 24x7 3D tour at www.sap.com/futurefactory

Come visit us!
Industry 4.0 – Media Hype or more?

THE topic in business, science and politics – and, especially in the media … pushed by many organizations.

→ Hype or our future? The new ‘Made in Germany’?
5 Elements of Industry 4.0

- You & Machines
- Vert. Integration
- E2E Process
- Business Models
- Life Cycle
## 5 Elements of Industry 4.0 / Integrated Industry

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>1</strong></td>
<td><strong>You &amp; Machines</strong></td>
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<tr>
<td></td>
<td>Increasing Digitalization – Virtual World and Real World coming together – &quot;White Collar Robots&quot;</td>
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<td>What can be automated, will be automated</td>
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<td>Human – Machine Interface need to be developed new</td>
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<td><strong>2</strong></td>
<td><strong>Vertical Integration</strong></td>
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<td>Automation of business processes</td>
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<td>Creation and processing of data on all levels of details</td>
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<td>Assembly &amp; Sub Assembly processes are self-controlled</td>
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<td>People Safety needs to be reached on the highest level possible</td>
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<td><strong>3</strong></td>
<td><strong>E2E Process</strong></td>
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<td>Networked and decentralized organized services (Fractal)</td>
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<td>Cyber Physical Networks; Usages of Vision and Noise</td>
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<td>Heterogynous system structure need to need harmonized</td>
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<td><strong>4</strong></td>
<td><strong>Business Models</strong></td>
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<td>Plug &amp; Produce – Dynamic Processes</td>
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<td>Collaborative Consumption; Sharing Economy; Asset Light lifestyle</td>
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<td>New Industrial Downstream Service e.g.&quot;Machine Benchmarking&quot;</td>
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<td>Pay on Production Models; Scan and Copy (3D); Usage Based Billing</td>
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<td>Asset Life Cycle Business Models with continuously changing partners</td>
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<td><strong>5</strong></td>
<td><strong>Life Cycle</strong></td>
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<td>Alignment of the different life cycle of Software, Mechanics, Automatisation and the respective area for usage in production, energy, process areas need to be aligned over a longer period of time</td>
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<td>Incentive &amp; Registration Models to stay connected</td>
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### “Idea to performance” strategic structure and direction
Integrated business solutions to accelerate idea to product and service performance

#### Business Models

<table>
<thead>
<tr>
<th>1-Concept</th>
<th>2-Development</th>
<th>3-Introduction</th>
<th>4-Production</th>
<th>5-Sales</th>
<th>6-Service</th>
</tr>
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</table>

#### Visualization
- Mobile and flexible work force
- 360-degree analytics on products, assets, and services

#### Modular design
- Invent, plan, visualize
- Design for customer needs
- Systems engineering

#### Adaptive manufacturing
- Interactive manufacturing networks
- Machine-to-machine communication
- Cyber physical systems

#### Connected systems
- Connecting machines and humans
- Just-in-time local 3D production
- Predictive maintenance

#### Collaboration across boundaries
- Embedded sustainable operations

#### Integration

**SAP ERP**

**Computer-aided applications**

**SAP PLM**

**Smart sensors**

**Social networks**

Manage Big Data: Understand the past ➔ Predict the future ➔ React Now!
Machine-to-Machine and Internet of Things Trends

12 – 50 bn
Devices connected by 2020*

40 – 50 %
CAGR for M2M market until 2020**

1/5
Price of communication module today vs. four years ago

*Source: EIU “The rise of the machines”
**Source: Gartner
Towards the Internet of Things

Benefits
- Cost efficient devices
- Viable device deployments
- Large developer community
- New roles in the value network
- Reaching the long-tail
- Business inter-connect
- Open market place of data and info

Transformation
- Multi-purpose devices
- Service enablement
- Web paradigm
- Apps migrate to cloud
- Standardization driven

Applications
App Enablement
Connectivity
Devices
Standards Accelerating Widespread Adoption

IP and Embedded Web Services
Standardization in IETF
Application framework in IPSO Alliance
Liaisons between IPSO Alliance and other device-oriented alliances

Momentum in industry and standardization
Embedded web services in ETSI, ZigBee, OMA
Products available and deployed
Verticals to cover

Smart House  Smart Vending  Smart Logistics  Smart Equipment  Smart Automobile  Smart Cities

REQUIRES

Big Data  Analytics  Cloud  Mobile

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Internet of Things Technology Stack

Application Enablement
- Develop, Deploy & Run
- Application Integration

Device Management
- Configuration
- Monitoring

Connectivity
- Network
- Network Connectivity Management

Hardware
- Embedded Hardware
- Communication Modules

Applications

Analytics
- Application Services
- Event Processing
- Cloud Services
- Machine Data Collection
- Access
- Device Lifecycle

IoT Security

Derived from IDC’s Worldwide M2M Taxonomy
IoT-specific Capabilities (1/2)

**Device Modeling**
- Abstract view of devices (attributes, data and control functions)
- Relationship to real world entities
- Device hierarchies

**Device Instantiation**
- Device registration
- Device configuration (incl. remote and mass configuration)
- Device lifecycle management

**Device Communication**
- Secure communication with devices
- Synchronous and asynchronous
- Streaming and batch
- Reliable and best-effort

**Device Control**
- Remote device control
- Device health checks
- Executes commands described in device model
IoT-specific Capabilities (2/2)

- **Device Data Processing**:
  - End-to-end data flows from the edges to the center and back
  - Modeling with design time tools
  - Instantiation, monitoring and auditing at run time.

- **Device Alert Management**:
  - Dealing with alerts from devices (locally and centrally)
  - Manages states of alerts as defined in the device modeling component
  - Alert notification and alert query processing

- **Operator Console Services**:
  - Services for real-time operator consoles
  - APIs
  - Tables/views in HANA
Personas to be considered

**Application developers**
who are responsible for creating an IoT application from scratch. They are expected to have good programming skills and be familiar with the application development tools of the HANA platform and associated products and technologies.

**Application configurators**
who are responsible for configuring and deploying an instance of an IoT application. This includes doing the necessary customizations for each specific instance. They are expected to have good technical but not necessarily deep programming skills, and should be familiar with the configuration and deployment tools of the HANA platform.

**Application operators**
who are responsible for operating an IoT application once it is deployed. The skills required depend on the application domain, but familiarity with the operational tools of the HANA platform is a plus.
Solution Architecture

IoT Workbench
- Device Modeling
- Data / Event Modeling
- Alert Management

IoT Core
- HANA Platform
- IoT Messaging
- Device Management
- Operator Console Services

IoT Connector
- Device Adapters
- Data Processors
- Network Modules

IoT Dev Tools
- Adapter SDK
- Scripting Toolkit

Device

Device Agent
Example: Remote Service Management

- Real time asset monitoring
- Remote diagnostics and updates
- Warranty and recall management
- Consumables management
- Marketing / cross- and up-selling
- Usage-based billing
Example: Connected Vehicle

- Fleet Management
- Pay-as/how-you-Drive
- Smart Parking
- Electric Vehicle Charging
Background information – which may actually be your

Key Takeaways
M2M actually has a Maturity Model

**Offline**
- Traditional processes
- Fragmented information
- Assets connected
- RT sensor reporting
- Basic analytics & insight in assets
- Faster insight and alerts but traditional reaction mode
- High cost of service
- No asset information
- Imprecise processes

**Integrated**
- Traditional processes
- Complete information RT sensor reporting
- Predictive analytics
- Efficient processes
- Enterprise integration
- Automatic execution of processes
- Examples
  - Pay per use
  - Demand based pricing
  - Compliance Monitoring

**Managed**
- Traditional processes
- RT sensor reporting
- Serviceable devices & assets
- Process augmentation w/ Mobile Apps
- Value through reducing operating cost

**Actionable**
- New business processes
- New business models
- Examples
  - Distribution Automation
  - Service Automation
  - Geo Fencing

**Current State of M2M Market**
- Level 0
- Level 1
- Level 2
- Level 3
- Level 4
- Level 5

**Value Proposition**
- Value through new revenue sources
Competing in today’s demanding marketplace means going beyond “what happened / happens”

- What happened?
- What is happening now?
- What will happen?
- How and why did it happen?
- What is the risk if it does/doesn’t happen?
- How do you prevent / ensure it happens again?

Tom Davenport International Institute for Analytics
Business happens in a networked work

M2M support has an enabling aspect, but basically all the projects I did with it eventually had that “different partners working together / Networked Business” aspect

- Remote Service as well as Asset Information Management
  – where it is about information federation and lifecycle support

- Connected Vehicle
  – where new partner relations and interactions come up

- Smart Vending
  – where it’s about targeted offers, retail and supply chain but also service
It needs system engineering skills and an holistic approach

And this is just the technical part, don’t forget to add what we also just heard about business aspects!
We are there, count on us!

Because:

“A goal is a **dream** with a **deadline**!”
Thank you!

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