Digital Asset Management: Optimizing the Asset Life-cycle with new generation of tools

Filip Kowalski, SAP CEE
Digital Transformation of Asset Management
Transformational drivers and topics

Managing **IoT and Connected Assets**
- **IoT platforms** and **Cloud computing** allowing to connect all types of data sources
- **IT/OT Convergence**
- Capability to manage and process **Big Data in Real time**
- Deep data analytics with **predictive and prescriptive capabilities**

**Machine Learning and Artificial Intelligence**
- **Simulation and Digital Twins of Assets**
- **Augmented and Virtual Reality**
- **Mobility**
- Collaboration via **Business Networks**
- **Asset Management Process Integration** (from Data into Insight)
- **Asset Management Standards** (e.g. ISO55001)
The Aim of Digital Asset Management is the Optimization of the Asset Life-cycle

Connecting all stakeholders alongside the asset lifecycle

Connecting corporate objectives with the asset system

Cost
Risk

Plan and design
Procure and build
Commission
Operate
Maintain
Decommission

Manufacturer
Supplier
EPC

Service provider
Owner/operator
Dealer

IT
Connecting IT with OT

OT

Connecting IT with OT

ISO 55001
SAP Innovations enabling Digital Asset Management

- Work Manager
- Asset Intelligence Network
- Predictive Maintenance and Service
- FEDEM
- Cloud for Energy
- Master Data Governance for EAM
- Geo Enablement Framework
- SAP HANA Platform

Connecting all stakeholders alongside the asset lifecycle
SAP Innovations enabling Digital Asset Management

- Work Manager
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- Cloud for Energy
- Workforce Engagement
- Supplier Collaboration Business Networks
- Digital Core
- S/4 HANA
- SAP ERP
- Master Data Governance for EAM
- Geo Enablement Framework
- Customer Experience Omnichannel
- SAP HANA PLATFORM
SAP Predictive Maintenance and Service (PdMS): Stakeholders

3\textsuperscript{rd} Party Service Provider
Installation and repair services

Asset Manufacturer
Remote Service Management
New business models around the device

Service Engineer

Service Technician

Asset Operator
Predictive Maintenance for critical assets
Investment Planning

CRM, Customer Service

Physical Asset Level

Enterprise Asset Management

SAP Predictive Maintenance and Service

How can I prevent unplanned asset downtime?
How can I prioritize maintenance activities and operate with reduced risks?
How can I improve asset renewal and investment planning?
SAP PdMS is a synthesis of over 20 Customer Projects
From sensor to outcome: The SAP Predictive Maintenance and Service solution

Connected assets
- Onboarding
- Connectivity
- Device management
- Security

IT/OT convergence
- Big Data ingestion
- Big Data infrastructure
- Merging sensor data with business information

Data analysis
- Root-cause analysis
- Asset health monitoring
- Machine learning
- Anomaly detection
- Triggering of corrective actions

Maintenance activities
- Prioritized maintenance and service activities
- Optimized warranty and spare parts management
- Prescriptive maintenance
- Quality improvements

Business value
- Customer experience
- Increased quality
- Lower costs
- Operational efficiency
- R&D effectiveness
- Material procurement

Sensor  
Data  
Insight  
Action  
Outcome
## Predictive Maintenance: Business Benefits

**Manufacturing**

<table>
<thead>
<tr>
<th>Percentage Range</th>
<th>Business Benefit</th>
<th>Potential Economic Impact</th>
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<tbody>
<tr>
<td>10%–40%</td>
<td>Reduction of maintenance costs of factory equipment</td>
<td>US$ 630 billion</td>
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<tr>
<td>Up to 50%</td>
<td>Reduction of equipment downtime</td>
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<tr>
<td>3%–5%</td>
<td>Reduction of equipment capital investment by extending the useful life of machinery</td>
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</table>

**Oil and Gas, Mining, Utilities**

<table>
<thead>
<tr>
<th>Percentage Range</th>
<th>Business Benefit</th>
<th>Potential Economic Impact</th>
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<tbody>
<tr>
<td>5%–10%</td>
<td>Reduction of maintenance costs</td>
<td>US$ 360 billion</td>
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<tr>
<td>3%–5%</td>
<td>Increase in output by avoiding unplanned outages</td>
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<tr>
<td>5%–10%</td>
<td>Reduction of equipment capital investment by extending the useful life of machinery</td>
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</table>

**Source:** The Internet of Things: Mapping the Value Beyond the Hype, McKinsey Global Institute, June 2015
Integration into the End-to-End Maintenance Process

PdMS / PdMS add-on for utilities

IT and OT connectivity
Asset health control center
Fault pattern recognition
Asset health prediction

Create maint. order
Schedule order
Execute order on mobile device
Visual support

SAP Data Services, Smart Data Streaming, PCo, OSIsoft Integrator

SAP Plant Maintenance
SAP MRS, ClickSchedule
SAP Work Manager
SAP Visual Enterprise
Asset lifecycle management: PdMS is expanded to cover the whole asset lifecycle

Emerging issues detection
Identify early, monitor, and manage emerging asset issues using exploration, root-cause analysis, and warranty analytics.

Predictive maintenance and service
Holistically manage asset health by monitoring the condition of assets and providing decision support for maintenance schedule and resource (spare parts) optimization based on health scores, anomaly detection, and spectral analysis.

Asset investment optimization and simulation
Analyze remaining useful life of assets to plan optimally for new investments based on business needs, asset health, and risk of failure.
SAP Predictive Maintenance and Service: Overview

Solution Capabilities

- **Health overview** for all monitored assets with drill down to component level
- Out-of-the-box **machine learning** content for technical assets
- **Visualizations** through 2D, 3D charts and geo spatial
- **Derived signals management** such as KPIs, alerts and health scores
- **Closed-loop integration** with maintenance and services processes such as triggering notifications
- **Flexible extension** concept for partners and customers
SAP PdMS Add-on for Utilities
Utility-specific content: Key Performance Indicators

Sample KPIs
• Transformers
• Circuit Breakers
• Underground Residential Distribution (URD)

<table>
<thead>
<tr>
<th></th>
<th>Critical Transformers</th>
<th>Critical Circuit Breakers</th>
<th>Red Circuit Breakers</th>
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<tr>
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<td>pcs.</td>
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Calculation
• Asset Health Control Center with fleet view
• Asset Health Fact Sheet focusing on single selected asset

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<thead>
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<tbody>
<tr>
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Dissolved Gas Analysis

Example: Dissolved Gas Analysis of Transformers

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<thead>
<tr>
<th>Sample date</th>
<th>Sampler</th>
<th>C2H2</th>
<th>C2H4</th>
<th>CH4</th>
<th>C2H6</th>
<th>H2</th>
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<td>4</td>
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<td>32</td>
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</table>

Legend:
- **PD:** Corona partial discharge
- **S:** Stray gassing of mineral oil
- **C:** Thermal faults T3-C, T2-C, and T1-C, with carbonization of paper
- **O:** Overheating < 250°C
- **ND:** Not determined
- **T2:** Thermal faults of 300°C to 700°C
- **T3:** Thermal faults > 700°C

Gas concentration in [ppm]
PdMS, Add-on for Utilities - Roadmap

subject to change

Release 1

Underground Residential Distribution Analytics
- Operational Analytics on Loop level
- Asset Health Index

Transformer Load Analytics
- Dissolved Gas Analysis
- Operational Analytics

Circuit Breaker Analytics
- Operational Analytics
- Asset Health Index

Release 2

Utilities Linear Assets Analytics
- Overhead Power Lines and Structures
- Extension of Underground Residential Distribution Analytics: Analysis on Span level

Extension of Transformer Load Analytics
- Dissolved Gas Analysis for Load Tap Changers
- Extension to Oil Quality Analytics with additional methods and visualisations
- Effective Ageing of Transformers
- Fleet perspective
- Text Analysis

Extension of Circuit Breaker Analytics

Future Release

Wind Power
Solar Power
Gas Pipelines
Water Management
Generation

12/2016 Planned: Q3 2017
Customer Example:
Asset Health Management

Challenges
• Optimize asset investment program
• Reduce risk of outage
• Increase safety of crews

Solution
• Asset Health Management application based on the **SAP Predictive Maintenance and Service Foundation**
• Implementation provided by **SAP Custom Development** and **Accenture**

Value
• Determine true age of the assets and likelihood to fail. Concentrate on high priority assets
• Long-term planning for asset maintenance and replacement
• Prepare crew with regards to condition and site
SAP Innovations enabling Digital Asset Management
Our mission is to enable Digital Inspections of Wind Turbines based on real-time Digital Twins
SAP Fedem - Product Definition

SAP Fedem monitors structures and mechanical systems in real-time

SAP Fedem is a solution to monitor structures and mechanical systems under the influence of complex loads in real-time.

It leverages the concept of structural finite element models, newtonian physics and big data to represent an asset through a Digital Twin in real-time.

It can be applied to monitor (virtual with 3D visualization) structural health conditions like material fatigue or remaining lifetime.

SAP Business Process Integration into Predictive Maintenance & Services, Plant Maintenance and S/4HANA.
FEDEM Capabilities (2/2): …and the visualization of the current state of physical assets in real-time…

What kinds of analytics can we deliver?

What can we use it for?

- Digital twin of the real system
- Real-time visualization of physical state
- Assessment of structural damage
- Identification of wear and damage, erosion/corrosion
- Discovery of abrupt change in behaviour/structural integrity
- Scenario evaluation
- Calculation of structural loading
- Lifetime indication of wind turbine components
SAP Innovations enabling Digital Asset Management

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- Cloud for Energy
- Workforce Engagement
- Supplier Collaboration Business Networks
- Digital Core SAP S/4 HANA SAP ERP
- Master Data Governance for EAM
- Geo Enablement Framework
- Customer Experience Omnichannel

SAP HANA PLATFORM
A Global Registry of Industrial Equipment built and shared between Multiple Parties used Across The Industry by all stakeholders. This will enable New Collaborative Business Models resulting in True Operation Excellence and be The Future Way We Manage Assets.
Challenges for collaboration around assets

- Old documentation
- Too much administration
- Vastness
- Incompleteness
- Uncertainty
- Inconsistency
- Incorrectness

How do I deploy / consume Equipment as a Service?

- No systematic and enterprise-wide collaboration on asset-management processes with business partners
- No standardized / shared model information
  **no common definition** – leading to inefficient & inconsistent collaboration
- Lack of complete and consumable asset information when I buy and use equipment - undermining smart decision making
- Every manufacturer and operator is doing the same manual data work – and its **always out of date**
Streamlining asset driven processes

- Manage Equipment as a Service
- Service Bulletins, Recalls & Warranty
- Usage based Design Enhancements
- Global Equipment Registry
- Business Partner Network Services
- Shared Model Database
- Quality, Inspection & Calibration Results Sharing
- MRO Visual Spare Parts content
- Visual audit and name plate recognition
- Analyse Equipment performance
- Collaborative work execution & results sharing
- Business Context for Predictive Maintenance
- Global Job Catalogue, Visual Work Instructions & Task Lists
Operator’s value:

- Lower asset life cycle costs
- Establish **one** channel to **many** manufacturer’s, EPCs and Service providers
- Higher asset availability
- Reduce manual asset search effort
- Receive notifications, service work summaries and service bulletins
- Push communication and alerts to manufacturers / service providers
- Reduce master data maintenance effort
- Higher process safety by transparent and bundled product – service offerings from manufacturer
- Management of stakeholders by AIN operator (SAP)
Simple, Systematic and enterprise based collaboration:

*Provide real added value focused asset-management processes with business partners (manufacturers, vendors, engineering companies)*

Complete, easy to use asset information:

*Support asset maintenance / purchasing decision and the operation with complete asset information. (master data, parameters, BOM...)*

Up-to-date & automatized data for Asset into CMMS:

*Automated up-to-date data correctness process setup directly into CMMS*

Less administration:

*Centrally manage asset information & reduce manual asset data search and master data maintenance effort*
Customer feedback / 2

Costs:

*Reduces asset lifecycle costs and establishes one duplex channel to manufacturers / service providers.* Incorrect master data can result in the incorrect operation of equipment, the installation of the wrong spare parts, or incorrect maintenance strategies (Prev, Pred), tasklists / activities as direct impacts on the cost of asset lifecycle.

Alerts:

*Receive notifications, MTN work summaries.* Support to push communication and alerts to operators and service providers from the manufacturers.

Asset utilization:

*Help to improve asset availability through collaboration with asset manufacturers.*

Operation:

improve process safety by transparent and bundled product service offerings / strategies from the manufacturer/vendor.
Application overview
SAP Innovations enabling Digital Asset Management

- Work Manager
- Asset Intelligence Network
- Predictive Maintenance and Service
- FEDEM
- Cloud for Energy
- Workforce Engagement
- Supplier Collaboration Business Networks
- Master Data Governance for EAM
- Assets & Internet of Things
- Geo Enablement Framework
- SAP HANA PLATFORM
Enrich business processes with geospatial information
Multiple use cases across industries
Spatially enabled SAP solutions
Example: Enterprise asset management

Desktop (geo.e) Mobile (SAP Work Manager)
EDF RE – Project Overview

- Geo-location through ArcGIS
- SAP HANA IoT Connector by OSIsoft
- OSIsoft PI System
  High volume sensor data infrastructure

First Implementation of SAP HANA IoT Connector by OSIsoft

- Futureproof Big Data platform
- Near Real-time operational & business intelligence
- Predictive analytics & preventative maintenance

SAP HANA power & advanced analytics

Business Data from SAP ERP
SAP Innovations enabling Digital Asset Management

- Work Manager
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- Cloud for Energy
- Workforce Engagement
- Supplier Collaboration Business Networks
- Master Data Governance for EAM
- Geo Enablement Framework
- SAP HANA Platform

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SAP Cloud for Energy
Vision for Cloud for Energy Platform

Assets
- Meters
- Devices
- Head-End-Systems
- Sensors
- Etc.

Machine Integration

Energy Analysis
SAP Solutions
Customer Apps
Partner Apps

IoT Solutions

SAP HANA Cloud Connector

SAP Cloud Platform

Data Storage & Processing
- In-Memory Engines

SAP HANA

SAP Cloud Platform for the Internet of Things
Cloud for Energy

Business
- SAP Business Suite
  - SAP S/4HANA
- 3rd Party Enterprise Systems
- Any Data Source

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SAP Energy Analysis
First Utilities Application on the SAP IoT Platform

Leveraging the power of **CLOUD, IoT, SAP HANA** and **SAPUI5** to create a state-of-the-art, next generation energy analytics solution

- **Aggregation**
- **Consumption Pattern Determination**
- **Peak Load Determination**
- **Comparison/Benchmarking**
- **Forecasting**
SAP Innovations enabling Digital Asset Management

... you can start from every side

... digital scenarios are also applicable for non SAP CMMSs/basic EAM landscape
Thank you!