Using the AIN to Enable Digital Interoperability
Leveraging industry standards to build Digital Business Ecosystems
Mark Pyatt, SAP O&G Operational Integrity
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Agenda

- Understanding the AIN
- How is BP Using the AIN?
- Understanding Digitalization and Interoperability Using the OIIE
- Questions / Next Steps
O&G Operators aim for the following…

Maximize asset productivity
- Overall equipment effectiveness
- Return on assets
- Unplanned outages

Drive safe operations
- Annual OSHA related incidents
- Recordable accident frequency rate

Reduce costs
- Annual service and maintenance cost
- Planned maintenance budget vs. actual cost
... but face different challenges in Asset Management

Data Quality
siloed sources
Manual data transfer

Incompleteness
Old documentation
Vastness
Uncertainty
Inconsistency
Incorrectness

Initial Costs 10%
Environmental Costs 7%
Installation Costs 9%
Operating Costs 9%
Energy Costs 32%
Disposal 4%
Maintenance Costs 20%
Downtime 9%

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Asset specific documentation is complex and difficult to manage

Digital manufacturing information for all stakeholders
SAP AIN Enables You to ‘Rethink Technology Architecture’
Standardize Asset Information Models; Create a Digital Twin

Business Semantic used to organize and share data between different parties

abstract instantiated

Class

Subclass

Model Template

Model Template

Model

Equipment

Predefined Content – provided and kept up to date by SAP as the AIN application provider. Based on common best practices (e.g. ISO 14224, API 610 data sheets). This is the class and characteristics template.

CLASS: PUMP
SUBCLASS: CENTRIFIGUAL
RATED POWER (BHP)
EFFICIENCY %

Model Family & Model Information
provided by the individual manufacturer or OEM

FAMILY: 384 - PUMP ASSEMBLY, SEAWATER
MODEL: 384XL – PUMP ASSEMBLY, SEAWATER, EXTRA LARGE
Manufacturer: ACME Instruments
RATED POWER: 1500RPM – 2500RPM

Equipment/Asset Information – provided by Owner/Operator or by the EPC (on behalf of the OEM).

EQUIP: PU815 – JETTY PUMP ASSEMBLY
Site Data: Dusty Environment,
Liquid: Pumping water
Service: Continuous

AIN Supports SAP and Non-SAP Information Models
Multi-tenancy capabilities support many data sources and formats found within your ecosystem

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOTOR TYPE</td>
<td>DC</td>
</tr>
<tr>
<td>NUMBER OF PHASES</td>
<td>3P</td>
</tr>
<tr>
<td>POWER RATING</td>
<td>570KW</td>
</tr>
<tr>
<td>NUMBER OF POLES</td>
<td>2P</td>
</tr>
<tr>
<td>VOLTAGE RATING</td>
<td>690 V</td>
</tr>
<tr>
<td>ROTATIONAL SPEED</td>
<td></td>
</tr>
<tr>
<td>FREQUENCY</td>
<td></td>
</tr>
<tr>
<td>FRAME NUMBER</td>
<td></td>
</tr>
</tbody>
</table>

Maintenance strategy/ intervals and tasks

<table>
<thead>
<tr>
<th>Equipment Subdivision</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric motor</td>
<td></td>
</tr>
<tr>
<td>Stator</td>
<td></td>
</tr>
<tr>
<td>Rotor</td>
<td></td>
</tr>
<tr>
<td>Excitation</td>
<td></td>
</tr>
<tr>
<td>Radial bearing</td>
<td></td>
</tr>
<tr>
<td>Thrust bearing</td>
<td></td>
</tr>
<tr>
<td>Coupling</td>
<td></td>
</tr>
<tr>
<td>Control and monitoring</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
</tr>
<tr>
<td>Actuating device</td>
<td></td>
</tr>
<tr>
<td>Monitoring</td>
<td></td>
</tr>
<tr>
<td>Valves</td>
<td></td>
</tr>
<tr>
<td>Internal power supply</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
</tr>
<tr>
<td>Hood</td>
<td></td>
</tr>
</tbody>
</table>

Table 8-4: Rolling-contact bearing faults

<table>
<thead>
<tr>
<th>Bearing overheat</th>
<th>Remedial measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Low shaft vibration</td>
<td>Replace the drive belt tension.</td>
</tr>
<tr>
<td>X Ball bearing</td>
<td>Add lubricant.</td>
</tr>
<tr>
<td>X Ball bearing</td>
<td>Replace the drive belt tension.</td>
</tr>
</tbody>
</table>

Asset owner #1
- Chemicals
- Mining
- Oil & Gas

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SAP Asset Intelligence Network UI is flexible, adaptable
Real-time updates for equipment, specifications, catalog and part numbers for SAP PM
Logical Architecture for Asset Management System and Product View

Engineering Systems

SAP Asset Intelligence Network

SAP Asset Strategy and Performance Management

SAP Predictive Maintenance and Service

SAP Leonardo

IoT Foundation

SAP Extended Enterprise Content Management

SAP Master Data Governance EAM extension

SAP Geo Enablement Framework

Digital Core

Connected Assets

OT Systems

Other Sources

Mobile

IoT

OSI/PI

MII/PCo
Agenda

- Understanding the AIN
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- Questions / Next Steps
What’s the status on adoption of the Asset Intelligence Network?

SAP Pilot Participants (2016):
Shell Oil / Endress Hauser
BASF / Sigma-Aldrich
Rio Tinto / Metso
Others…

2017 POCs (not a complete list):
Siemens Conglomerates
Pfizer BioPharmaceuticals
Bayer Group BioPharma / Chemicals
ThyssenKrupp Conglomerates
….

OIIE* Pilot Participants:
BP / Yokogawa, TechnipFMC

Future Pilots (MIMOSA / Fiatech Members):
Caterpillar
Chevron
DOW Chemical
Southern Company
U.S. Armed Forces
….

* OIIE = Open Industrial Interoperability Ecosystem

40+ Companies on the list
Enabling asset lifecycle business processes via the SAP AIN OII Gateway

- 3rd Party Application/ System A
- 3rd Party Application/ System B
- 3rd Party Application/ System C

**AIN Administration**
Synchronization for Asset Management Information Using Digital Twin

**SAP AIN Applications**
- O&G
- Co-Innovatns.
- O&G

**MIMOSA SDAIR**
Services Directory

**OIIE Administration**
- ISDD Instances
- TAGS, DOCS
- Relationships (ILAP)
- Systems/Channels/Topics

**3rd Party Application/ System A**
- SAP PM, MM
- SAP MDG, AIW
- SAP Ariba

**3rd Party Application/ System B**
- OpenO&M ISBM

**3rd Party Application/ System C**
- SAP AIN Applications
- O&G
- Co-Innovatns.
- O&G

**Maintained at MIMOSA.org**
- OIIE Standards and Specifications
- ISDD Baseline Versions Mapped to CFIHOS and ECCMA RDLS

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Starting: OIIE Proof-of-Concept with Yokogawa, TechnipFMC
Enabling: OIIE Proof-of-Concept to Test / Initiate Transactions

KEY:
- OIIE CCOM
- OTHER TBD

Using MIMOSA / OIIE Standards to set-up and populate AIN library

Uses OIIE to get Supplier Content Loaded to the AIN for use by Upstream Operations

MIMOSA / OIIE Library
- CCOM Templates
- ILAP Definitions
- JIP33 Specifications
- Equipment Hierarchy
- JSON Schema
- Digital Twin Template

Uses OIIE to Publish Engineering Content to Operator AIN

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Enabling: OIIE Production Using the AIN for Interoperability

AIN Cloud

SAP AIN

Uses OIIE to get Supplier Content Loaded to the AIN for use by Upstream Operations

Uses OIIE to Publish Engineering Content to Operator AIN

Uses OIIE to Publish Engineering Content to Operator AIN

Uses OIIE to Publish Engineering Content to Operator AIN

AIN Cloud

SAP AIN

Uses OIIE to Publish Engineering Content to Operator AIN

Uses OIIE to Publish Engineering Content to Operator AIN

MIMOSA / OIIE Library
CCOM Templates
ILAP Definitions
JIP33 Specifications
Equipment Hierarchy
JSON Schema
Digital Twin Template

Transfer from POC to Production

Using MIMOSA / OIIE Standards to set-up and populate AIN library

Digital Twin

SAP PM
System of Record

KEY:
OIIE CCOM
OTHER TBD

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Any Questions?
Thank you!

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Systems of Systems and Individual Enterprise Ecosystems Must Interoperate In Digital Business Ecosystems

Nodes → Network of Enterprise Eco-systems → Digital Business Ecosystem

The Open Industrial Interoperability Ecosystem (OIIIE) defines the basis for Supplier-Neutral Digital Business Ecosystems composed of Enterprise Ecosystems which share the required standards.
OIIIE Features

- Supplier-Neutral Systems of Systems & Networks of Networks
- Collections of which can form Digital Business Ecosystems

EPC Firms

Engineering and Construction

OIIIE Includes

- Industry 4.0 Workflows
- PERA and SCM with IIOT

IT Networks

(OEM)
Device Manufacturers

Enterprise Business Systems

Requirements

Functional Locations & Requirements

(Make/Model Information, Serial#)

(Monitoring, Diagnostics, Prognostics)

Plant/Facility Operators

Enterprise Business Systems

IT Networks

Automation and Control

Manufactured Asset
ISDD Project Build and Use Processes

**ISDD BUILD**

- Discipline Engineers
- Information Engineers
- Subject Matter Experts

**EXISTING INDUSTRY STANDARD DATA SHEETS (ISD)**

API

ASME

ISA

PIE

**BUILD Process**

Industry Standard Data Sheet Definitions (ISDD) (Version Managed)

**INDUSTRY REFERENCE DATA LIBRARIES**

- 15926 RDL2
- CFIHOS
- ECU MA EOTD

**ISDD USE**

An Industry Rosetta Stone

Custom Mappings which enable normalization for property sets “on the wire” in M2M exchanges

**Version Managed ISDDs**

CCOM

Owner/Operators

Map Elements

EPCs

Capital Equipment Suppliers

**MIMOSA**

**POSC Caesar Association**

**Fiatech**

**USPI**

**ECMA**
Prototype ISDD Status

- Developed a workflow/pipeline to increase automation

8) Export to Excel, e.g., for collaboration on STANDARD MAPPINGs for CFIHOS, ECCMA and ISO 15926 RDL2
Full Asset Life-cycle Management
Physical and Digital Asset are included in O&I
Key OII Industry Use Cases Cover the Lifecycle of the Asset

- **Plan / Program / Contract**
- **Engineer / Design**
- **Procure**
- **Fabricate / Construct**
- **Complete / Commission / Startup**
- **Operate / Maintain**
- **Decommission / Dispose**

**Continuous Handover (Structured Digital Assets, Tags, Docs)**
Establishing an Environment for Lifecycle System of Systems Interoperability

**Sustained Lifecycle Digital Asset Management**

**OGI Use Case 1**: Capital project handovers to O&M
**OGI Use Case 4**: Enterprise Product Data Library Management
**OGI Use Case 10**: Automated provisioning of O&M systems

**Continuous Handover of Structured Digital Assets**

**Sustained Lifecycle Digital Asset Management**
Sustaining the Interoperable O&M Environment

**OGI Use Case 2**: Recurring Engineering Updates to O&M
**OGI Use Case 3**: Field Changes to Plant/Facility Engineering
**OGI Use Case 4**: Enterprise Product Data Library Management
**OGI Use Case 5**: Asset Installation/Removal Updates
**OGI Use Case 6**: Preventive Maintenance Triggering
**OGI Use Case 7**: Condition-Based Maintenance Triggering
**OGI Use Case 8**: Early Warning Notifications
**OGI Use Case 9**: Incident Management/Accountability
**OGI Use Case 10**: Provisioning of O&M systems