Standards-based Interoperability for Physical Asset Lifecycle Management and the Open Industrial Interoperability Ecosystem (OIIE)

Alan Johnston
MIMOSA President, ISO TC 184/WG 6 Convenor, ISA95 Voting Member, ISO/IEC JWG 21 TF 8 Member
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ISO TC184 Manufacturing Asset Management Integration Task Force
Total Asset Life-Cycle Summary

FIATECH
POSC CAESAR

Product Design
Asset MFG
Construction

Commissioning
Operations & Maintenance (O&M)
End of Life

Continuous Improvement Feedback Loops

Product/Asset/Plant/Facility/Vehicle Life-Cycles

SC1 & SC4
Other Standards
IEC TC 65 Standards
SC5, SC5-IEC/JWG5, SC4-SC5/JWG8
OpenO&M & Other Standards
Other Standards

Services Oriented Architecture Using Standards-based Federated Data Model

Task Force TR
October 2008
Led to Start of ISO TC 184/WG 6
Interoperability for Asset Intensive Industries
Some ISO Technical Committees & Activities

**Industry Specific** Practices and Content (ISD versus ISDD)

- **ISO TC 67** Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries
- **ISO TC 108** Mechanical vibration, shock and condition monitoring
- **ISO TC 184** Automation systems and integration
  - **WG 6** ISO 18101-Asset intensive industry interoperability

**Cross-Industry** Digitalization and Interoperability
Sensors Through Enterprise, Digital Twins, IT/IM Architecture (Machine Interpretable)

- **ISO 14224** Petroleum, petrochemical and natural gas industries — Collection and exchange of reliability and maintenance data for equipment
- **ISO 13374** Condition monitoring and diagnostics of machines — Data processing, communication and presentation
- **SC 4** Industrial Data
  - ISO 15926-Process Plant Data
  - ISO 8000–Data Quality
- **SC 5** Interoperability, integration, and architectures for enterprise systems and automation applications
  - ISO 18435-O&M Integration

**ISO 55000 Provides High Level Asset Mgt Guidance**
Cooperation also exist with IEC TC 65 and IEC/ISO JWG 21
Model, Monitor and Manage Complex Physical Assets
Circa 2000

MIMOSA OSA-CBM
ISO 13374
Plan to re-open in 2020
Industry Example of Asset Management Standards Domain Mapping—Circa 2007

Slide Initially developed by BP in 2003. ALL general principals of Asset Management Information Modeling in process industries were established in actual industry use by 2007.
Owner/Operators Objective
Shared Industry Foundation Architecture

From:
OpenO&M Owner/Operator Leadership Team
(BP, Chevron, Dow, Dupont, Nova Chemical, Saudi Aramco, Suncor)
Circa 2008

Request for Standard Architecture for Interoperability
Inter-Enterprise OIIIE Digital Ecosystem

- **TC 184**
- **Manufacturers**
  - IT Networks
  - Automation and Control Systems
- **Enterprise Business Systems**
- **OEM Manufacturers**
- **EPC** Engineering, Procurement and Construction Systems
- **IT Networks**
- **Functional and Technical Requirements**
- **Model and Instance Information**
- **PFD R&D, Tags, Docs & Requirements**
- **Business Requirements**
- **Operations & Maintenance Data** (Monitoring, Diagnostics, Prognostics)
- **Manufactured Asset Data** (Make/Model Information, Serial #)
- **Owner/Operators**
  - Enterprise Business Systems
- **IT Networks**
  - Automation and Control Systems
Secondary Business Process

Derived from ISO TC 184
Manufacturing Asset Management Integration Task Force Final Report
“This document was prepared by Technical Committee ISO/TC 184, Automation systems and integration.

This document provides an overview and outlines the fundamental principles of the ISO 18101 series. Future parts of the ISO 18101 series will be developed including sets of industry developed use cases, once the use cases have been documented using the Open Industrial Interoperability Ecosystem (OIIE) use case architecture and validated using the OIIE Oil and Gas Interoperability (OGI) Pilot, with the results captured in Technical Reports. These use cases will incrementally define industry prioritized elements of the secondary business process, which is the scope of the ISO 18101 series.”
Build on Success from OIIE OGI Pilot Phase 3.1

1. P&ID Creation and Export of Condenser Unit P&ID to Proteus XML Format
   (Worley)

2. Transform to CCOM XML Format
   (UniSA)

3. Greenfield RFI/RFI Response
   - RFI based on functional requirements (UniSA)
   - RFI Response, Models (Yokogawa)

4. Capital Project Asset Installation
   (UniSA)

5. (Simulated) Handover of As-Built Data to PdMA
   (UniSA)

6. CBM—Collection of Measurement data and output of Advisory
   (PdMA)

7. Remove and Replace Maintenance Activity
   (UniSA)

8. Brownfield Information Remediation
   - RFI based on limited asset data (UniSA)
   - RFI Response, Model/Asset data (Yokogawa)

OIIE Use Case 1 (As-Designed)

OIIE Use Case 12

OIIE Use Case 15

OIIE Use Case 1

OIIE Use Cases 14, 7, 5 (CBM Acquisition, Triggering, and Resulting Maintenance)

OIIE Use Case 12

24 July, 2020
OIIE Standard Use Case List
Derived from OpenO&M Standard Use Case List – Circa 2007

OIIE Use Case 1 – Information Handover from EPC to O/O
OIIE Use Case 2 – Engineering Updates
OIIE Use Case 3 – Field Changes to Plant/Facility Engineering
OIIE Use Case 4 – Online Product Data Library Management
**OIIE Use Case 5 – Asset Installation/Removal Updates**
OIIE Use Case 6 – Preventive Maintenance Triggering
**OIIE Use Case 7 – Condition-Based Maintenance Triggering**
OIIE Use Case 8 – Early Warning Notifications
OIIE Use Case 9 – Incident Management/Accountability
OIIE Use Case 10 – Information Provisioning of O&M Systems
OIIE Use Case 11 – Enterprise Reference Data Library Management
**OIIE Use Case 12 – RFI and RFI Response for Models Meeting Requirements (Greenfield & Brownfield)**
OIIE Use Case 13 – Lockout-Tagout
**OIIE Use Case 14 – Condition-Based Maintenance Data Acquisition**
OIIE Use Case 15 – Capital Project Asset Installation
The Open Industrial Interoperability Ecosystem (OIIE) and ISO 18101 Australia Energy Sector OIIE Network (Subnet of AU Critical Infrastructure)
MIMOSA CCOM and OPC UA Companion Specification

Dr. Matt Selway
Research Fellow University of South Australia
January 31, 2020
MIMOSA CCOM Purpose

- Conceptual model for Physical Asset Lifecycle Management
- Exchange model enables *Enterprise Application Interoperability*
- O/O, EPC, and OEM *secondary business process* requirements:
  - “As-Engineered”
  - “As-Designed”
  - “As-Built” / “As-Constructed”, and
  - “As-Maintained”
- Information spanning manufacturing, plant, facility, fleet, critical infrastructure, etc., environments
Identifiers in CCOM

• CCOM provides a federating capability
  – Identification, and
  – Provenance (Owner, System of Record)

• Every entity has an immutable, globally unique identifier: UUID

• ISO/IEC 9834-8

• Mapping to other local and global identifiers
  – OIIE specification includes a mapping and query service to resolve IDs
MIMOSA CCOM and Digital Twins

• CCOM supports the creation and management of *Digital Twins*
• Digital Twins provide the context for Transactions, Events, and Sensor-based data
  – Simultaneously updating the Digital Twins
• CCOM traditionally enables analytics for Condition-Based Maintenance and Reliability Management
• Semantic linkages in conjunction with industry partners open new possibilities in advanced analytics, reasoning, and AI capabilities

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CCOM Modules

Configuration Management:
- Assets
- Asset Tracking
- Locations
- Manufacturers/Models
- Specifications
- Organizations/Sites
- Hierarchies
- Mesh Networks
- Geospatial Tracking

Work Management:
- Pre-Planned Work Packages
- Work Requests
- Work Order Tracking

Resource Management:
- Materials/Labor/Tools (MRO)
- Bill of Materials
- Agents

Operation and Condition Management:
- Sensor Registry
- Measurement Locations/Meters
- Regions/Alarms
- Measurements
- Tests/Samples
- Events
- Health Assessments
- Prognostic Assessments
- Advisory Generation

Reliability Management:
- Model Registry
- Component Tracking
- Failure History

Reference Data and Metadata Management:
- Types
- Taxonomies
- Templates/Definitions
- System of Record

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CCOM Modules
CCOM OPC UA Companion Specification

• Joint purpose:
  – Bring Asset Lifecycle Management capabilities to OPC UA systems
  – Bridge the gap to non-OPC UA systems through CCOM and the OIIE

• Does not cover entire scope of CCOM at present

• Focuses on modules:
  – Configuration Management, and
  – Operation & Condition Management
CCOM and OPC UA Working Together
For More Information Please Contact

• Alan T. Johnston, MIMOSA President:
  – atjohn@mimosa.org

• Prof. Markus Stumptner, MIMOSA Co-CTO
  – University of South Australia: mst@cs.unisa.edu.au

• Dr. Matt Selway: Research Fellow
  – University of South Australia: Matt.Selway@unisa.edu.au