The Oil and Gas Interoperability Ecosystem
Enabling Sustainable Interoperability for the Oil and Gas Industry

Energistics PRODML SAM Working Meetings
Houston, TX

Sep 23 2013
Alan Johnston
MIMOSA President
ISO TC 184/WG 6 Convener
Presentation Outline

- Quick overview of
  - OpenO&M Initiative - A history of Collaboration
  - Standards Leadership Council
  - OGI Solutions Process and OGI Ecosystem

- Overview of MIMOSA CCOM and ISBM – Dr. Avin Mathew

- Review of existing OGI Pilot content on MIMOSA.org website
  - OGI Ecosystem Systems Architecture
  - Existing OGI Use Cases
  - OGI Pilot Participation Team

- Leveraging the ISO Process

- Quick look at iRING Today article about OGI Pilot

- Q&A
2004 International Maintenance Conference

Function Legend
- HMI
- EAM
- DSS
- ALM
- MRB
- ICDM

Organization Legend
1 - 3eTI
2 - Ivara
3 - Indus
4 - Iconics
5 - ESRG
6 - IFS
7 - Honeywell
8 - AspenTech
9 - Matrikon
10 - PdMA
11 - Synergen
12 - Yokogawa
13 - Rockwell
14 - DEI

December 2004
OpenO&M™ Initiative 2006
Standards Fill The Gaps

Enterprise Business Systems
Enterprise Resource Planning (ERP)

OpenO&M™

Physical Asset Control
Real-time Systems
Points of intersection

- Data in Motion
- Life Cycle
- Facility Mgmt
- Seismic
- Data at Rest
- PPDM
- Spatial Data
- eBusiness
- Reference Data
- OGC
- OGP
- Communication Protocols
- Advocacy
- OPC Foundation
- MIMOSA
Problem Statement – Current Oil and Gas and other Asset Intensive industry enterprise solutions are too complex and too difficult to sustain.

- The current enterprise solutions model is critically dependent on large amounts of custom Systems Integration and this is a weak link.
  - Expensive to sustain (20% annual recurring maintenance cost)
  - Fragile – Vulnerable to breakage

- The current solutions model also forces data to be re-entered many times rather than managing it on a full life-cycle basis
  - Increases costs
  - Decreases quality

Owner/Operators are asking for a better Solutions Model
Transforming the Oil and Gas Industry Solutions Model

- **OGI Solutions-Process**
  - Transforming industry solutions model from integration to sustainable interoperability
  - Driven by owner/operators, with standards org & supplier participation
  - Prioritized fully dressed industry use cases

- **To Be State - OGI Ecosystem** - Full life-cycle industrial ecosystem – “Unwalled Garden”
  - Enables sustainable system of systems interoperability for key classes of systems
  - Portfolio of published, supplier-neutral standards-incorporated by reference
  - Semantics, Objects, Services Oriented & Event-Driven Architecture
  - “Black Box” approach for included solutions components - **External Performance Specification**

- **OGI Pilot** - Developmental and interoperability testing grounds
  - Participating standards bodies suppliers help shape the ecosystem rules
  - COTS solutions components must support fully dressed use cases-evaluation matrix
  - Develops core of permanent OGI eco-system test-bed

- Provide basis for ISO OGI Technical Specification (ISO 18101)
Oil and Gas Interoperability (OGI) Pilot - Methods

- Owner/Operator leadership
- Not a “reference architecture’, but an open industrial ecosystem
- Fully based on published standards, which are incorporated by reference
- Industry Use Case driven - (OpenO&M, PCA and SPE DSA-TS) Use Cases
- Cooperatively aligned with PCA under Joint MIMOSA/PCA O&M SIG
- Overall Solutions Architecture under Joint MIMOSA/PCA IT Architecture SIG
- Managed like a true capital project- Worley Parsons-Lead EPC for downstream pilot
- Pragmatic focus on Commercial Off The Shelf (COTS) products
- Suppliers assume responsibility for compliance of their own products
  - All OGI Pilot Intellectual Property managed under MIMOSA IPR Policy
  - Publication – All working documents and results are on the mimosa website at www.mimosa.org

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Various Interoperability Definitions

- **IEEE:** The capability:
  - of two or more systems or elements to exchange information and to use the information that has been exchanged.
  - for units of equipment to work together to do useful functions.
  - that enables heterogeneous equipment, generally built by various vendors, to work together in a network environment.
  - of two or more systems or components to exchange information in a heterogeneous network and use that information.

- **SEI:** The ability of a set of communicating entities to
  - (1) exchange specified state data
  - (2) operate on that state data according to specified, agreed-upon, operational semantics

  Data/information interoperability is necessary, but only part of the requirement for Interoperable Systems of Systems.
Context for Collaboration

Enterprise Business Systems

Reference Information Environment
- ISO 15926
- Engineering & Construction
  - PCA
  - RDL/Ontology

Semantic Context

- ISO 18435
- MIMOSA
- PCA
- Engineering & Construction
- O&M Requirements Repository
- Registry
- OpenO&M Information Service Bus
- Transform Engine
- ISO 13374

Execution Environment “P2B Stack”

Controls

Physical Assets

ISO TC 184/WG 6

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OGI Pilot Business Use Cases Roadmap - Part 1

Enterprise Capital Project Data Management Standards

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

Continuous Handover of Structured Digital Assets
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
OGI Use Case 11: Enterprise Reference Data Library (RDL) Management

Fiatech EDRC Use Case 1: Pump Replacement Specification Handover (O/O to EPC)
Fiatech EDRC Use Case 2: Field Instruments & Control System (EPC to Supplier)

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OGI Pilot Business Use Cases Roadmap - Part 2

Enterprise Capital Project Data Management Standards

Plan / Program / Contract

Engineer / Design

Procure

Fabricate / Construct

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Decommission / Dispose

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

OGI Use Case 11: Enterprise Reference Data Library (RDL) Management

Continuous Handover of Structured Digital Assets

Sustained Lifecycle Digital Asset Management

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OGI Use Case 11: Enterprise Reference Data Library (RDL) Management

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Global cooperation between industry organizations to enable open standards-based interoperability for asset management through an industry-use case driven solutions process.
Worley Parsons - Lead EPC for Downstream OGI Pilot
• Developing and Managing Reference Engineering Data Set
• Providing standard engineering artifacts used for EPC process
DeButanizer Fractionator

Flow Sheet (RED)
MIMOSA LED MAJOR SYSTEMS OF SYSTEMS INTEROPERABILITY EFFORTS FOR THE O&M COMMUNITY

NOW, IN COOPERATION WITH PCA AND FIATECH, WE ARE PROVIDING A FULL LIFE-CYCLE ECOSYSTEM FOR INTEROPERABILITY
Requirements-driven Development of Standards

- MIMOSA has a rich history of developing industry standards which are driven by industry requirements
  - Common Relational Information Schema (CRIS) – 5th Normal Form Relational Model
  - Common Conceptual Object Model (CCOM) – Asset Management Object Model
  - Open Systems Architecture for Condition Based Maintenance (OSA-CBM)
  - OpenO&M Information Service Bus Model (ISBM)
  - OpenO&M Common Interoperability Register (CIR)

- MIMOSA works closely with formal standards bodies to help develop international standards reflecting industry requirements
  - ISO TC 108/SC 5 – ISO 13374 (CBM)
  - ISO TC 184/SC 5 – ISO 18435 (O&M)
  - ISO TC 184/WG 6 – Developing ISO OGI Technical Specification
MIMOSA CCOM Object Identifier

Distinct Objects for Functional Tag (Segment), Product Catalog Object (Model), and Serialized Equipment (Asset)

Immutable, Globally-Unique, Non-Meaningful Integer Object Identifiers

CRIS MED ASCII Document Exchange

CRIS DTD XML Document Exchange

CRIS XML Schema Point-to-Point Web Services

CRIS XML Schema for Compound Documents Web Services

CCOM XML Schema with ISBM Web Services

OpenO&M Information Service Bus & Common Interoperability Register

1998

2002

2003

2007

Today

Immutable, Globally-Unique, Non-Meaningful ISO/IEC 11578 Object Identifier
The OSA-CBM MIN Demonstration Concept

Carrier
USS NIMITZ
Remote Maintenance Coordination Center
Remote Diagnostics Provider A
Remote Diagnostics Provider B

MIN-Viewer
MODELED ON THE Microsoft Windows Explorer

MIN-Viewer Segment Navigation 1

User Interface Modeled On The Microsoft Windows Explorer

June 21, 2000
MIN-Viewer
OSA-CBM Presentation
Alan T. Johnston
MIN Project Director
U.S. Army CECOM
Collaborative Telemaintenance Project

Phase I Demonstration Briefing – July 31, 2002
Alan Johnston – MIMOSA
Kenneth Bever – MIMOSA
Bob Walter – Penn State ARL

Demo Architecture Based on
reusable MIN-Client™ & MIN-Server™ Components

Central Maintenance Aid (CMA)
User Interface (CGUI)
CMA Data Services (CDBS)
MIN-Clients
MIN-Servers
Dyn Work
Reg Trend
XML

Portable Maintenance Aid (PMA)
User Interface (PGUI)
PMA Data Services (PDBS)
PMA Clients
PMA Servers
Dyn Work
Reg Trend
XML

Maintenance Technician (MT)

CMA Showing Measurement Events In Alarm

MIN-Clients
MIN-Servers
Dyn Work
Reg Trend
XML

PMA Clients
PMA Servers
Dyn Work
Reg Trend
XML

PMAG

CMA Data Services (CDBS)

PMA Data Services (PDBS)

Persistence DB

CMA Database Services (CDBS)

PMA Database Services (CDBS)

CMA Showing Measurement Events In Alarm
Platform Life-cycle Information Management

Concept Mapping - Aerospace & Defense Industry

ISO 15926-3&4
MIMOSA
OSA-EAI OSA-CBM
ASD S1000D

Step PLCS
DEXs
GEIA STD 0007

- Aerospace and Defense Industry Developed Life-cycle Reference Data Exchange Sets
- Government Developed Military Platform Element Definitions in ISO STEP AP Formats
- Aerospace and Defense Industry Developed IETM Standard
- Cross Industry Developed Physical Asset Management Standards (Sensor To Enterprise)

- Process Industry Developed, Ontology-based Geometry, Topology and Reference Information Standards
BP Refining’s Portal:
Use of standards and future needs

Michael Knight - BP Refining Supply Chain Advisor
ARC Next Generation Manufacturing Forum, February 2006
Mapping of data models to requirements

<table>
<thead>
<tr>
<th>Plant Lifecycle</th>
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<tbody>
<tr>
<td>Engineering</td>
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<tr>
<td>Equipment Databases</td>
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<tr>
<td>Service Contracts</td>
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<td>Process Simulations</td>
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<td>Calculations</td>
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</tbody>
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BP Refining Vision of the Future of Standards-Circa 2006

Materials Model
Mimosa
Equipment Model
Personnel Model
Plant Model
Actuals Model
PIDX
API690
API610
API689
ISA-95
ISO15926
OPC
LEVERAGING THE ISO PROCESS FOR ESTABLISHING STANDARDS AND SPECIFICATIONS
ISO TC 184/WG 6
Oil and Gas asset management operations and maintenance Interoperability (OGI) Technical Specification Project Update

Alan T. Johnston
Convener
Nils Sandsmark
Co-convener

September 23-25, 2012
Orlando, FL
The OGI TS specifies the use of a combination of ISO and industry standards to meet the interoperability requirements of the Oil and Gas industry and appropriate closely related industry groups such as the Petrochemical industry.

Major associated deliverables include:

- Industry developed and owned Pilots driven by industry Use Cases
  - Downstream Pilot
  - Upstream Production Optimization and Drilling Automation Pilots
- Industry developed and owned Use Cases are prioritized by owner/operators and incorporated by reference
- Industry developed and owned pilot & Compliance Data Sets are incorporated by reference
  - Downstream Data Set – Plant Light Ends Unit with debutanizer and depropanizer towers
  - Upstream – Drilling Automation, Rigs and Wells Construction Data Sets – with SPE DSATS
Context for Collaboration

Reference Information Environment
Semantic Context
Execution Environment “P2B Stack”

Enterprise Business Systems

ISO 15926
Engineering & Construction
PCA
RDL/Ontology

Transform Engine
OpenO&M Information Service Bus

ISO 18435
MIMOSA
O&M Requirements Repository
Registry

ISO 13374

Controls
Physical Assets

ISO TC 184/WG 6
key industry use cases

1. “digital handover” as-designed/engineered/built O&M information from engineering, procurement, construction phase to O&M phase
2. recurring updates - send engineering upgrades to O&M systems
3. field engineering changes sent to engineering (bottom up)
4. on-line product data library updated with engineering reference information (asset based data)
5. operations & maintenance configuration changes (e.g. remove/replace transmitter)
6. preventive maintenance (PM) triggering
7. condition-based maintenance (CBM) triggering
8. early warning notification
9. incident management – actual & near-miss information captured and escalated along the lines of accountability
10. O&M systems information provisioning
Some Relevant ISO Related Activities

ISO TC 67
Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries

ISO TC 108
Mechanical vibration and shock

SC5
Condition monitoring and diagnostics of machines

ISO TC 184
Industrial automation systems and integration

SC4
Industrial Data

ISO TC 184
Architecture, communications and integration frameworks

ISO 14224
Petroleum, petrochemical and natural gas industries – Collection and exchange of reliability and maintenance data for equipment

ISO 13374
MIMOSA OSA-CBM
WG6
Formats and methods for communicating, presenting and displaying relevant information and data

15926- Data for Process Industries
10303-Product data representation and exchange
STEP/PLCS
OASIS
Collaborating on the deployment of an international standard for product data exchange (ISO 10303)

ISO 18435
MIMOSA OSA-EAI
WG7
Diagnostic and maintenance applications integration
SLC Conf Call Aug 13th 2012

Pradeep Annaiyappa
Clinton Chapman
Alan T Johnston
Moray Laing
Application Domain Integration Diagram

A4.1 – Intra-enterprise activities: Business Planning, Orders & Production, and Maintenance

A3.1 - Operations Planning & Scheduling

A2.1 - Supervisory Control & Human-Machine Interface

A1.1- Control, I/O, Data Acquisition, Data Historian, Asset Utilization, & Displays

A0.1 - Resource Identification and Location

A0.2 - Asset Identification and Location

A3.2 – Capability Assessment & Order Fulfillment

A2.2 - Asset Prognostics and Health, Quality, Safety, & Environmental Management

A1.2 - Asset Condition Monitoring & Sample / Test / Diagnostic & Quality Monitoring

A2.3 - Maintenance Execution & Tracking

A3.3 - Maintenance Planning & Scheduling

A3.4 – Inter-enterprise activities: Supply Chain Planning, Logistics Strategy

ISO TC184
Global Collaboration

- Center for Integrated Engineering Asset Management (CIEAM)
- Energistics
- FIATECH
- MIMOSA/OpenO&M
- POSC Caesar Association

Global cooperation between industry organizations to enable open standards-based interoperability for asset management through an industry-use case driven solutions process

ISO TC 184/WG 6