MIMOSA and the OpenO&M™ Initiative

Enabling Open Standards-based Interoperability for Operations & Maintenance (O&M) People, Processes and Systems

19 - 22 June 2006
Congress Center Basel, Switzerland

Alan T. Johnston
MIMOSA President
OpenO&M™ Initiative Chair
There is a growing understanding of the need to enable diverse O&M related people, processes and systems to properly communicate (or interoperate) with each other in order to achieve operational excellence.

Standards are not an end unto themselves. They should help enable better, faster, cheaper solutions to achieve and sustain operational excellence.

MIMOSA & the OpenO&M Initiative enable practical open standards based interoperability solutions today.

- Even though academics properly participate, the associated standards are not research projects.
- They are driven by business requirements and based on applied engineering.
- They provide common “language” and communications mechanisms (or transport) to enable diverse people, process and systems to interoperate.

The OpenO&M Joint Working Groups are leading the way with key projects.

- Owner/operator led
- Vendor supported
- MIMOSA facilitated

Maintenance & reliability professionals have a key opportunity to be full peer partners in achieving and sustaining operational excellence.
Participating Standards Organizational Model

OpenO&M™ Initiative
Joint Working Groups

- OpenO&M™ MFG JWG
  ISA-95, ISA-99
  WBF, OAGi

- Life-cycle MGT

- OpenO&M™ Facilities JWG
  NIBS FMOC

- OpenO&M™ Military JWG
  US Army
  US Navy

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Vision
OpenO&M™ Manufacturing Domain Mapping

Inter-Enterprise
OAGIS standards enable business information system interoperability.

Enterprise

Manufacturing Operations
ISA-95 provides process manufacturing conceptual standards to enable O&M process interoperability.

Machine
MIMOSA and B2MML are Implementation Architectures which support the ISA-95 O&M Concept Models. Together, they provide a common “Language” to enable interoperability for people, processes and systems involved in plant O&M.

OPC enables shop floor Data acquisition & transport with existing DA and future UA.

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The OpenO&M™ Solution: Open Standards & Collaboration
Fill the Gaps

Physical Asset Control
Real-time Systems
Activity Domain Integration Diagram

Part 1: Overview and General Requirements

Part 2: Enterprise / Site and Area Levels [Level 4 to Level 3]

Part 3: Area Level [Within Level 3]

Part 4: Area and Work Center Levels [Level 3 to Level 2 & below]

Part 5: Work Center Level [Within Level 2]

Part 6: Work Center and Work Unit Levels [Level 2 to Level 1]

Part 7: Work Unit Levels [Within Level 1]
BP Business

Our business is about finding, producing and marketing the natural energy resources on which the world depends

- Number 2 in Fortune Global 500
- 2005 Revenue ~$320B
- 1998 Revenue ~$40B
- 100+ Countries
- 28,000 Service Stations
- 30 Refineries
BP Refining Operations

Crude Capacity: 2.8 million barrels/day
Refined Product sales: 6.4 million barrels/day

Source: Blackwells, 3Q 2003. Russian interests not represented & Innovene removed.
BP Enterprise Information Architecture

Open O&M Usage Scenario 1 – Application Integration

User Access

Environment & Applications

Data Mgmt

Data Interfaces

Legacy Systems

Controls

Equipment & Devices

Portal

Open O&M Data Model

Ideally application provides Open O&M compatible Web Service

Web Service

Applications

Functions

Process Graphics

Data Services

Applications

Functions

Process Graphics

Data Services

Web Service

Web Service

Web Service

Web Service

Web Service

LIMS

Historian

SAP

EAM

RDMS

DCS

PLC

Valves, Equipment, Analysers, …
BP Refining’s Portal:
Use of standards and future needs

- Michael Knight - BP Refining Supply Chain Advisor
- ARC Next Generation Manufacturing Forum, February 2006
BP Refining’s heritage

- BP Refining has grown through acquisition
  - Mobil (Europe)
  - Amoco (USA)
  - ARCO (US West Coast)
  - Veba (Rhine Region - Germany)
- IT Systems heritage is diverse
  - Enterprise Asset Management Systems (Maximo, SAP, Teroman, MIMS, other)
  - Laboratory management systems diverse (Sample Manager, WinBliss, other)
  - Multiple Real-time Historians (PI, PHD, IP21)
- Each Refinery historically has had autonomy of IT acquisition/implementation
- Diverse Information Landscape
BP Enterprise Portal Project - eRTIS

Approach

• **Problem:**
  - Diverse IT infrastructure
  - Capability to effect corporate business process change hampered by IT Information, applications & infrastructure divergence at sites

• **Requirements:**
  - Project to provide common operating environment & integration infrastructure for 14 majority owned BP Refineries

• **Solution:**
  - Common Data Model
  - Common Integration & Application Infrastructure (Mega Centre)
  - Common Applications (8 Operations & Maintenance Composite Applications)
Where we are today

- Current Applications suite being embedded in the business
  - Application owner teams
  - General environment (data model) has business ownership
- Mimosa Data Model maps to our Operations & Maintenance requirements
- MIMOSA is being used as more than an interface standard – it is a the heart of our portal integration solution and will form a significant portion of our future Refining Roadmap and the basis of links to the trading organisation
- So what next …..
BP Enterprise Portal Project - eRTIS

Way forward

• We will support OpenO&M
  - Scope fits well with business needs
  - S95 and Mimosa seen as the way ahead
  - Balance between Operations and Maintenance priorities
• We will work with suppliers as needed
  - e.g. AspenTech Foundation Client Program
• We will continue to work with some other specific standards bodies
  - e.g. CAPE-Open CoLan
• We will continue to implement in a carefully managed program
Chevron Concurrence With BP Refining Standards Analysis

Data Model Mapping – just one look

Plant Lifecycle

Engineering | Procurement | Construction | Operation | Maintenance
---|---|---|---|---
Crude Assays | MSDS | Spare Parts Lists | Stores Inventory | Materials Model
Service Contracts | Personnel Model | ISA-95
Process Simulations | Purchase Requests | Construction Schedule | Operator Unit Knowledge | Trade skills register | MIMOSA
Calculations | Project P&ID’s | Purchase Orders | As-built P&ID’s | HAZOP minutes | Process Data | Tank inventories | Lab results | Bill of Lading | Transfer Advices | Operator Logs | T&D reports | Inspection records | Work Order History | Work Permits | Plans Model
Purchase Invoices | Actuals Model | OPC

© Chevron 2005 ARRIS Summary – Mar 06

Courtesy of bp
2006 Updated Analysis From BP Reflecting MIMOSA 3.x

Data Model - mapping of Industry standards to requirements

<table>
<thead>
<tr>
<th>Plant Lifecycle</th>
<th>Engineering</th>
<th>Procurement</th>
<th>Construction</th>
<th>Operations</th>
<th>Capability (Maintenance &amp; Reliability)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Material Specifications</td>
<td>Piping Specifications</td>
<td>Tool Catalog</td>
<td>Crude Assays</td>
<td>Spare Parts Lists</td>
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<td>Material Master Catalogs</td>
<td>Material Specifications</td>
<td>Tool Catalog</td>
<td>MSDS</td>
<td>Model Part Reliability Data</td>
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<tr>
<td></td>
<td>Vendor Catalogs</td>
<td>Bill of Material</td>
<td>As-Installed Equip. Data</td>
<td>Operations Procedures</td>
<td>Maintenance Procedures</td>
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<tr>
<td></td>
<td>Engineering Contracts</td>
<td>Service Contracts</td>
<td>Contracted Services Tracking</td>
<td>As-Operated Equip. Data</td>
<td>Component Install. Data</td>
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<td>Eng. Capability Assess.</td>
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<td>Operating Envelopes</td>
<td>As-Operated Reliab. Data</td>
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<td>Design Requirements</td>
<td>Purchase Requests</td>
<td>Construction Schedule</td>
<td>Operations Procedures</td>
<td>Maintenance Procedures</td>
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<td>Design Requirements</td>
<td>Alarm Configuration</td>
<td>Job Plans</td>
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<td>Calculations</td>
<td>Purchase Orders</td>
<td>As-built P&amp;ID’s</td>
<td>Stock Progressions</td>
<td>As-Maintained Equip. Data</td>
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<tr>
<td></td>
<td>Project P&amp;ID’s</td>
<td>Invoices</td>
<td>Design Requirements</td>
<td>Price Sets</td>
<td>Component Install. Data</td>
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<td>Inspection Schedule</td>
<td>As-Operated Reliab. Data</td>
</tr>
</tbody>
</table>

- PISTEP / PIDX
- ISA-95
- MIMOSA
- OPC
- ISO 14224
ISO TC184 Manufacturing Asset Management
Integration Task Force – Chair- Alan T. Johnston

Total Life-Cycle Summary
(Potential Harmonized Implementation Model-DRAFT)

Operations & Maintenance (O&M)

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

- SC1 & SC4 STEP
- Other Standards
- IEC TC 65 Standards
- SC5, JWG 15,JWG8 OpenO&M & Other Standards
- Other Standards

Product Design
Asset MFG
Construction

End of Life

Continuous Improvement Feedback Loops

ISO/IEC UID

Services Oriented Architecture Using Standards-based Federated Data Model
Enabling Collaborative Asset Life-cycle Management
Reliability Management - Configuration Management Model

- Business Systems
- Physical Assets
- Design
- Mfg
- Install
- Buy
- Decommission
- Configuration
- Time-Slices
- Salvage
- Scrap
- Remove
- Remediate

UID Based (ISO/IEC Compliant) MIMOSA Registry
Collaborative Asset Life-cycle Management
Reliability Management Tracing & Tracking Model - A

Continuous Improvement

Buy
Install

Plant Facility Fleet

3rd Party Maintenance Group

Remove
Replace

Remove
Scrap
Salvage

UID Based (ISO/IEC Compliant) CALM Registry

Configuration Time-Slices

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MIMOSA Summary

An Operations and Maintenance Information Open Systems Alliance

- A 501 (c) (6) non profit organization
- Funded by membership and collaborative projects
  - Vendors
  - Integrators
  - End-Users
- Publishing interoperability standards & specifications
  - Free public licensing of final versions since 1998
  - Members licensing of work in progress
    - Standards & Specifications
    - Tools & Technology

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MIMOSA Collaboration For OpenO&M™

- MIMOSA Center of Excellence: U.S. Army AMRDEC SED
- SMRP: Mapping MIMOSA Stds To SMRP Body of Knowledge
- ISO Draft STD 18435: TC 184/SC 5/WG 7–D-Liaison (O&M Integration)
- Chair ISO TC184 Manufacturing Asset Management Integration Task Force
- ISO STD 13374: TC108/SC 5 - Condition Monitoring & Diagnostics- MIMOSA is the Informative Reference

Technical Committee 108
Sub-Committee 5

Accredited Standards Committee S2
MIMOSA
Open Asset Management Information Model

Enabling practical O&M Interoperability with ISO/IEC Compliant UID.

Open Modeling Of:
• Physical Assets
• Functional Segments
• Resources
• Agents

Open Modeling For:
• Plants
• Facilities
• Fleets

Open Capability Management

Open Reliability Management

Open Maintenance Management

Open Object Registry Management

Open Condition Management

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MIMOSA Open Systems Architecture for Enterprise Application Integration (OSA-EAI)
Building Common Language for O&M Interoperability

<table>
<thead>
<tr>
<th>Tech-File Export For XML File Exports</th>
<th>Tech-CDE for Web Services Clients &amp; Servers</th>
<th>Tech-Web For HTTP Tech-XML Clients &amp; Servers</th>
<th>Tech-XML For Web Services Clients &amp; Servers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tech-Doc CRIS Content Producer/Consumer XML Schema</td>
<td>Tech-CDE Large CRIS Data Transaction Client &amp; Server Schema</td>
<td>Tech-XML Small CRIS Data Transaction Client &amp; Server Schema</td>
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</tr>
</tbody>
</table>

CRIS Reference Data Library

Common Relational Information Schema (CRIS)

OSA-EAI Common Conceptual Object Model (CCOM)

OSA-EAI Terminology Dictionary

EAI Application Interoperability

XML Content

MetaData Taxonomy

Implementation Model

Conceptual Model

Semantic Definitions

Technologies Support [Tech-]
- REG (Object Registry Management)
- WORK (O&M Agent Work Management)
- DIAG (Diagnostics / Prognostics / Health Assessment)
- TREND (Operational Scalar Data & Alarms)
- DYN (Dynamic Vibration/Sound Data & Alarms)
- SAMPLE (Oil/Fluid/Gas/Solid Test Data & Alarms)
- BLOB (Binary Data/Thermography Data & Alarms)
- REL (RCM/FMECA/Model Reliability Information)
- TRACK (Physical Asset GeoSpatial Tracking Info.)
OpenO&M™ - 2006 Key Opportunities to Participate

- OpenO&M MFG Joint Working Group Collaboration Activities
  - On Going – Weekly Conference Calls
  - Owner/Operator led, Vendor Supported, MIMOSA Facilitated
  - Pilot Projects and Production Projects moving forward in 2006
- ARC's Fourteenth Annual Forum:
  - Driving Enterprise Performance through Next Generation Manufacturing Concepts
  - June 26-28, 2006 - Boston, Massachusetts
  - OpenO&M MFG JWG Owner/Operator Panel to present collaboration on pilot projects (BP, Nova Chemical, Suncor)
- MIMOSA Technical Committee & OpenO&M MFG JWG Meetings
  - ISO TC184 MAMI Task Force Meeting co-located
  - September 6-8
  - Calgary, Canada
- ISO TC184,SC5,WG7 Meeting
  - September 11-13, 2006
  - Tokyo Japan
- ISA Expo 2006
  - October 17-19, 2006
  - Reliant Center - Houston Texas
  - Discuss Pilot Projects & Upcoming Demo
- 2006 International Maintenance Conference (IMC)
  - December 5-8, 2006 – Daytona Beach, Florida
  - OpenO&M Interoperability Demonstration
OpenO&M™ Initiative For Maintenance and Reliability Professionals Summary

- Open standards-based O&M interoperability is achievable now for substantial functional domains
  - Business Focused – Achieving Operational Excellence by fully leveraging O&M people, processes and systems
  - Practical - The OpenO&M Initiative is focused on practical, applied engineering, not research projects
- Significant open standards-based interoperability projects are proceeding
  - End-user led
  - Vendor Supported
  - MIMOSA Facilitated

- Developing an OpenO&M Economic Opportunity Model For Process Industries
  - Objective – Help establish a consensus industry economic opportunity model for O&M related investments
  - Inclusive of direct and indirect cost savings including risk management
  - Strong focus on identifying opportunity for gains to top-line
  - In collaboration with ISA

- The OpenO&M Initiative provides an important opportunity for Maintenance and Reliability professionals to fully contribute as peer-partners in the development and use of comprehensive enterprise information models
- Get involved now or live with systems created without your expertise!