CBM+ In The Context of Asset Life-cycle Management and Industry Standardization Activities

OSIsoft Federal Workshop
Huntsville, AL
April 16, 2015

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ISO TC 184/WG 6 Convener
Standards Leadership Council Co-chair
Focus on Physical Asset Life-Cycle Management
- Conceptualization through End of Life
- Digital Asset, Physical Asset, **Condition**, Maintenance and Reliability Management
- Develops and publishes industry-driven standards in alignment with ISO and IEC
- Officially organized as a 501 c(6) non-profit industry association in 1997
- International Membership
  - Owner/Operators – Oil and Gas, Chemical, Aerospace and Defense Sectors
  - Suppliers/integrators
  - Academia/Researchers
  - Industrial Media
- Very Large number of non-member users and project participants
- Founding Member and IP Manager for OpenO&M™ Initiative
- Founding Member Standards Leadership Council
Key Asset Management Problems in Industry, US Army and Joint Military Services

- Require improved sustainment & availability, with improved risk management & lower costs
  - Increasing complexity of systems and systems of systems
  - Increasing regulatory pressure (particularly Safety, Health and Environmental)
  - Challenges with Asset Information Management
    - Diversity of often proprietary systems and methods – (Aviation, Ground and Sea)
    - Inconsistent practices with Identifier Management (Functional Locations, Assets, Components)
  - Handover (Platform Builder to O/O) is often chaotic and inefficient
    - Contracts with Platform Builders are not specific enough with respect to providing all information required for handover to O&M in consistent, machine interpretable formats
    - Digital Asset is never aligned with the Physical Asset
- Condition & Operations Data volume is growing quicker than management methods
- **Custom Application Development and Traditional Systems integration** is too expensive and too fragile with high recurring costs
Critical Intersection for a Supplier Neutral Ecosystem
Enabling Multi-domain Systems Interoperability

Enterprise Business Systems
Big Data and Analytics
Supplier Neutral Open Specifications

LIFE CYCLE ENGINEERING Systems
CBM Automation & Control Systems Platform Integrators
**System of Systems**

- **A System of Systems** (SoS) is a collection of task-oriented or dedicated systems that pool their resources and capabilities together to create a new, more complex system which offers more functionality and performance than simply the sum of the constituent systems. – Wikipedia

- SoS has been developed and is **widely used in the aerospace and defense community**, but it is **now being adopted by many other industry groups**

- SoS terminology is linked to the systems engineering community and the International Council on Systems Engineering (INCOSE).

- **Interoperability** is considered to be an intrinsic part of SoS
  - Proprietary approaches have generally not been sustainable
  - Standards provide the rational alternative
IEEE Interoperability Definition

- 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.
The Role of Standards in Sustainable Enterprise Solutions

- Standards help rationalize chaos into widely accepted good practices
- NGO Standards Organizations such as ISO and IEC
- Industry Standards Organizations – API, ISA, ASME, SAE, MIMOSA…
- Asset Management Practice Standards
  - Such as PAS 55 and ISO 55000
  - Define good asset management practices to be followed
- IT Oriented Standards
  - Such as MIMOSA, ISO 15926, OPC and ISO 18101
  - Enable SoS to properly support PAS 55 and ISO 55000 series good practices
Background on Solutions Activities Where MIMOSA has Played A Key Role

A Historical Perspective in Development of Pragmatic Solutions using Standards-based Interoperability

Aerospace and Defense Sector – SoS - Model, Monitor and Manage
The need for Open Operations and Maintenance Specifications (OpenO&M)
OSA-CBM Dual Use Technology Program - Office of Naval Research

MIMOSA Information Network (MIN)

June 21, 2000
MIN-Viewer
OSA-CBM Presentation
Alan T. Johnston
MIN Project Director

The OSA-CBM MIN Demonstration Concept

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

MIN-Viewer Segment Navigation 1

User Interface Modeled On The Microsoft Windows Explorer

MIN-Viewer
OSA-CBM Presentation
Alan T. Johnston
MIN Project Director
ISO 13374 Standard

Machine condition assessment data processing & information flow blocks.

- Sensor / Transducer / Manual Entry
- External Systems, Data Archiving, & Block Configuration
- Technical Displays & Information Presentation

1. DATA ACQUISITION (DA)
2. DATA MANIPULATION (DM)
3. STATE DETECTION (SD)
4. HEALTH ASSESSMENT (HA)
5. PROGNOSTICS ASSESSMENT (PA)
6. ADVISORY GENERATION (AG)
Data Warehousing Architecture

**Where we are Today**
- Vetted MIMOSA OSA EAI CRIS
  - Recommend as the Persistence Layer at LOGSA
- Implemented LOGSA Taxonomy in MIMOSA type tables
- Participating in LIA PoE
  - Providing - “Enterprise Common CBM DW”
- Began Integration of AMCOM CBM DW into the LOGSA Enterprise Common CBM DW 12/31/2007
- Integrated COBRA data with LOGSA Enterprise Common CBM DW 07/08/2008

**Action Plan 09**
- Exercise the LOGSA Enterprise Common CBM DW
  - **Analytical Analysis**
    - Enterprise Data Mining
    - Oracle BI
  - Develop the following tools
    - Platform Integration Management Module
    - Taxonomy Management Tool
    - Enterprise My CBM+ tool
CBM+ IT Bridging Infrastructure

25 Sep 2012
Acquisition Manager’s Guide to CLOE/CBM+ (AMG2CC) And Dashboard

AMG2CC Conference

25 February 2015
The OpenO&M™ Initiative
Enabling Open Standards-based O&M Interoperability

Enterprise Business Systems
Enterprise Resource Planning (ERP)

OpenO&M™

Operations

Maintenance

Physical Asset Control
Real-time Systems

Formed 2006
Key Objective

Transforming
From: Systems Integration To: System of Systems Interoperability

Custom Systems Integration
- Custom development
- Application Specific data adapters
- Owner/operator responsible for sustainment
- Too Expensive and Too Fragile

Open Industrial Interoperability Ecosystem (OIIE™)
- Commercial off the Shelf (COTS) Applications
- Standardized OIIE Adapters (Plug and Play)
- Cloud Friendly Solutions Architecture
- Configuration rather than customization & integration
- Defined by, published supplier neutral open standards

OGI Pilot™
Building an OIIE Instance
OGI Pilot Business Use Cases Roadmap - Part 2

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

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

Sustained Lifecycle Digital Asset Management
Sustaining the Interoperable O&M Environment
The BP interoperability PoC
As Presented at Fiatech Conference 04/15/2015

- Testing has demonstrated capability to deliver interoperability through shared reference data and standard connectors

- Fully integrated testing of PoC scope is ongoing as vendors complete development of standard product adaptors

- We have proved the concept, but collaboration required to deliver benefits at industrial scale

- A pure instance of the OIIE
- No custom systems integration required
- Functional locations, assets, relationships
- CCOM 4.0 exchange payload optimization
ISO TC184 Manufacturing Asset Management Integration Task Force
Total Asset Life-Cycle Summary

March 2009

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

- Product Design
- Asset MFG
- Construction
- Operations & Maintenance (O&M)
- End of Life

Services Oriented Architecture Using Standards-based Federated Data Model

- Product/Asset/Plant/Facility/Vehicle Life-Cycles
- IEC TC 65 Standards
- SC5, SC5-IEC/JWG5, SC4-SC5/JWG8
- OpenO&M & Other Standards
- Other Standards

- Continuous Improvement Feedback Loops
- ISO/IEC UID

- Other Standards

- DB 1
- DB 2
- DB 3
- DB 4
- DB N
- DB N+1
- DB N+2
- DB N+4
Lessons Learned

- Physical Asset Life-cycle Management (ALM) is increasingly critical for all asset intensive organizations
- CBM and Asset Performance Management (APM) need to be performed in the context of ALM for maximum benefit
- Traditional systems integration techniques are proving inadequate for ever more complex systems of systems

- **Commercial off The Shelf (COTS) solutions are preferable when:**
  - A high percentage of user requirements are met without customization
  - COTS suppliers support appropriate standards to enable systems interoperability rather than systems integration

- **A Standards-based Interoperability Ecosystem is the way forward**
OIIE and OGI Pilot To Be Featured At Future Events

- Fiatech Technology Showcase – April 13-16, Boca Raton Resort, FL
- Solutions 2.0 – August 3-7, 2015, Westin Galleria, Houston, TX

Hundreds of Senior Experts from Asset Intensive Industries (including aerospace, integrated energy and critical manufacturing) are Auditing and/or Participating in the OIIE and OGI Pilot.

All OIIE and OGI Pilot Working Documents are available at www.mimosa.org

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