Industry Digitalization and the Open Industrial Interoperability Ecosystem (OIIE)

Nov 16, 2017

MIMOSA Open Meeting to Discuss Industry Digitalization and Interoperability

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Critical Infrastructure: Key Sectors

These Industry Sectors are Highly Interdependent

- Many Industry Sectors are critical parts of each other's supply chains and must **Interoperate**.
- US Department of Homeland Security has IT Security mission for all parts of US critical infrastructure

Digitalization and Interoperability

- **Vision -** Interoperable Components, Systems, Systems of Systems and Networks of Networks composed into adaptable, scalable, secure and sustainable Digital Business Ecosystems

Path Forward:

- **Simplify**
- **Standardize**
- **Digitalize**
- **Interoperate**

Digital Ecosystem

- Wikipedia:
  - ✓ A digital ecosystem is a distributed, adaptive, open socio-technical system with properties of self-organisation, scalability and sustainability inspired from natural ecosystems.
  - ✓ Digital ecosystem models are informed by knowledge of natural ecosystems, especially for aspects related to competition and collaboration among diverse entities.
  - ✓ The term is used in the computer industry, the entertainment industry, and the World Economic Forum.

Major IT/IS firms (Apple, Google, Microsoft, SAP and many others) have all been developing and promoting their own proprietary digital ecosystems for over 10 years.

Ecosystems and Interoperability

- Supplier-specific Interoperability
  - ✓ **Lego**
  - ✓ Enterprise Resource Planning (ERP)
  - ✓ Apple Ecosystem
- Open Source
  - ✓ Linux
  - ✓ Android
- Standards-based Interoperability
  - ✓ **Intermodal Transport**
  - ✓ Internet
  - ✓ Industrial Internet of Things (IIOT)
  - ➢ **Open Industrial Interoperability Ecosystem (OIIE) – Embraces COTS & Open Source**

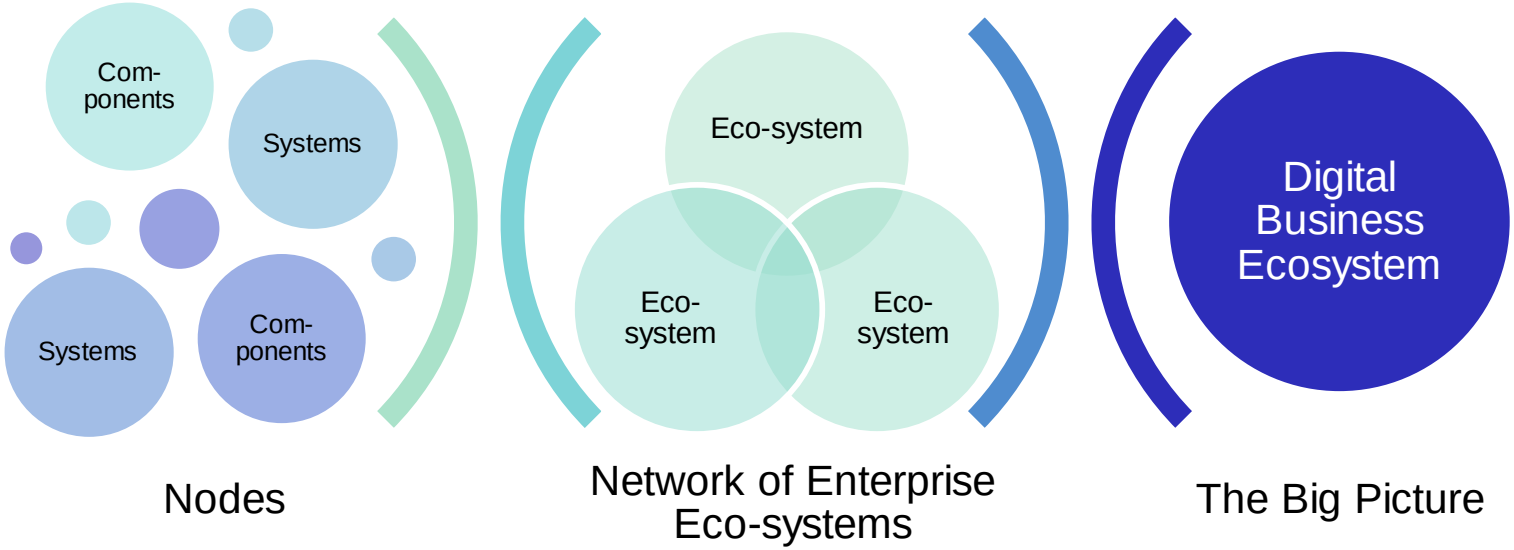
Digital Business Ecosystem-Why?

- Wikipedia: The concept of Digital Business Ecosystem was put forward in 2002 by a group of European researchers and practitioners, including Francesco Nachira, Paolo Dini and Andrea Nicolai, who applied the general notion of digital ecosystems to model the process of adoption and development of ICT-based products and services in competitive, highly fragmented markets like the European one.

Digital Business Ecosystem-Status

- The challenge is to find pragmatic ways of implementing Digital Business Ecosystems which are supplier neutral and adaptive enough to sustainably span the industrial sectors included in for Critical Infrastructure.
- The OIIE provides such an approach where:
  - OIIE uses a standardized intra and inter-enterprise Solutions Architecture
  - OIIE Instances are Cloanable

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



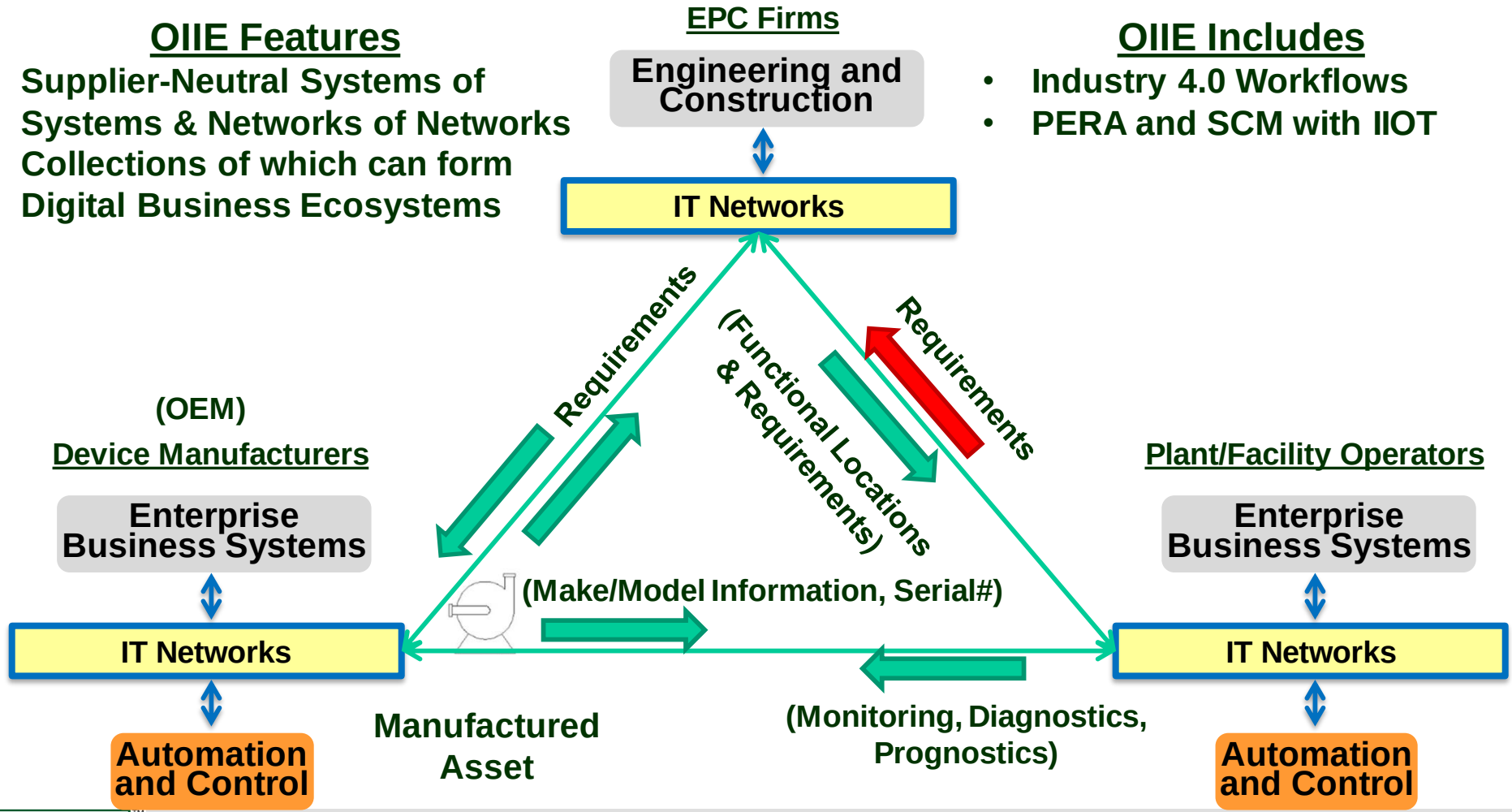
The Open Industrial Interoperability Ecosystem (OIIE) defines the basis for Supplier-Neutral Digital Business Ecosystems composed of Enterprise Ecosystems which share the required standards.

OIIE Features

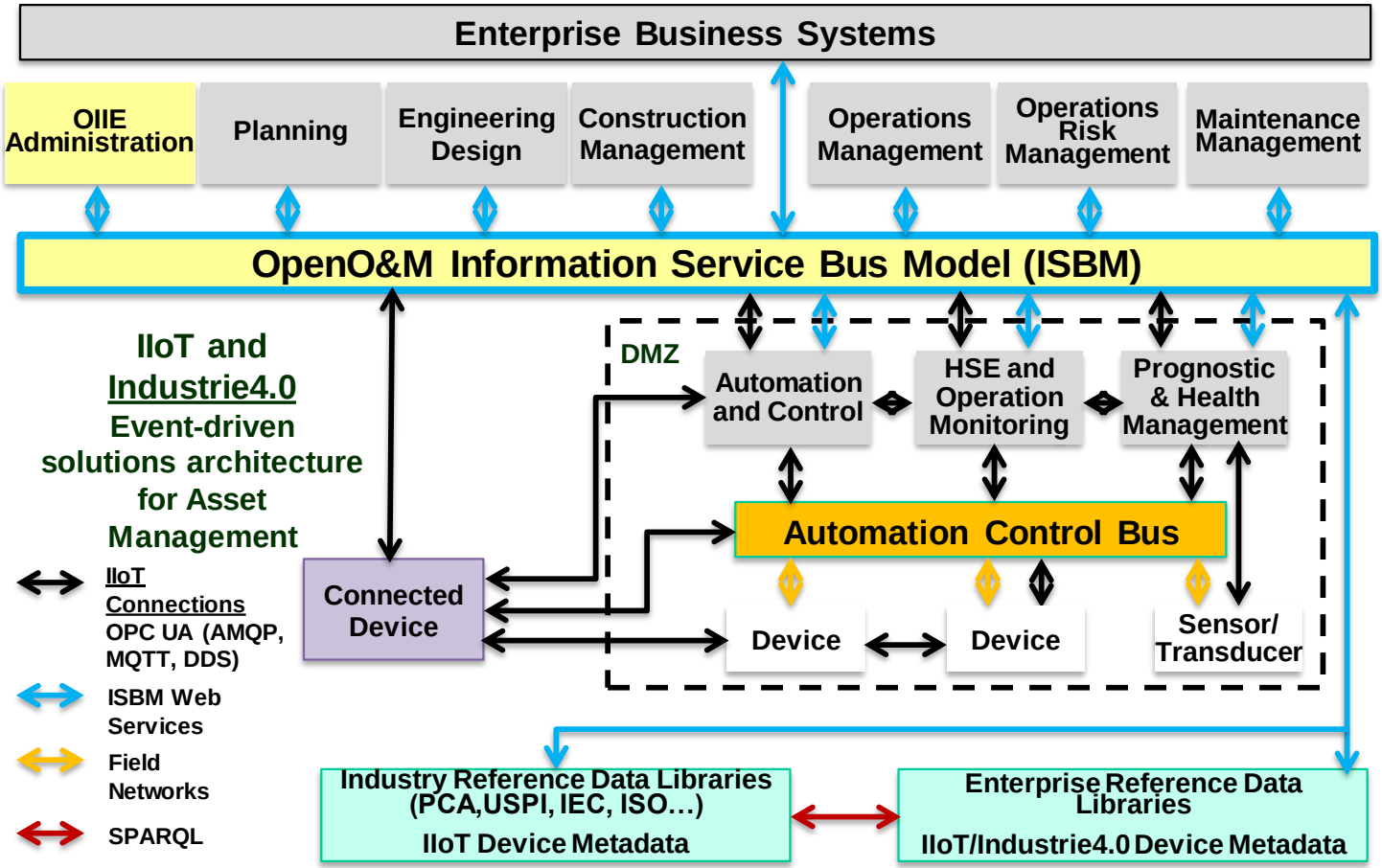
- Supplier-Neutral Systems of Systems & Networks of Networks
- Collections of which can form Digital Business Ecosystems

OIIE Includes

- Industry 4.0 Workflows
- PERA and SCM with IIOT



OIIE Simplified Systems Connectivity and Services Architecture



Major Projects in Support of OIIE

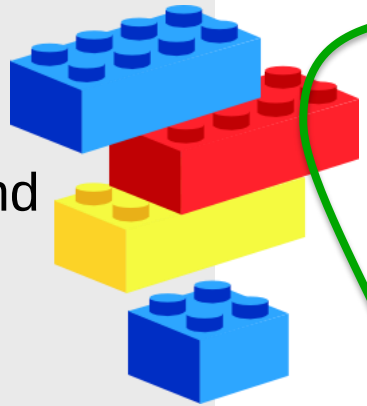
- RESTful Services and JSON Update
  - ✓ Adding JSON Schema
  - ✓ OpenO&M ISBM Update for more REST, JSON and Binary
  - ✓ Associated MIMOSA CCOM Updates
- Industry Standard Datasheet Definitions
- OIIE Oil and Gas Interoperability (OGI) Pilot Program
  - ✓ An Instance using Oil and Gas Assets (Shows how OIIE is cloneable)
  - ✓ Provides the industry R&D Testbed for the OIIE
  - ✓ 2017-2018 OIIE OGI Pilot Phase just kicking off
  - ✓ OIIE OGI Pilot with ILAP – Just kicked off in cooperation with PCA

OIIE/OGI Standardized Use Case Structure

Standardized Methodology to Define and Re-use OIIE Components

Use Case = 11+4

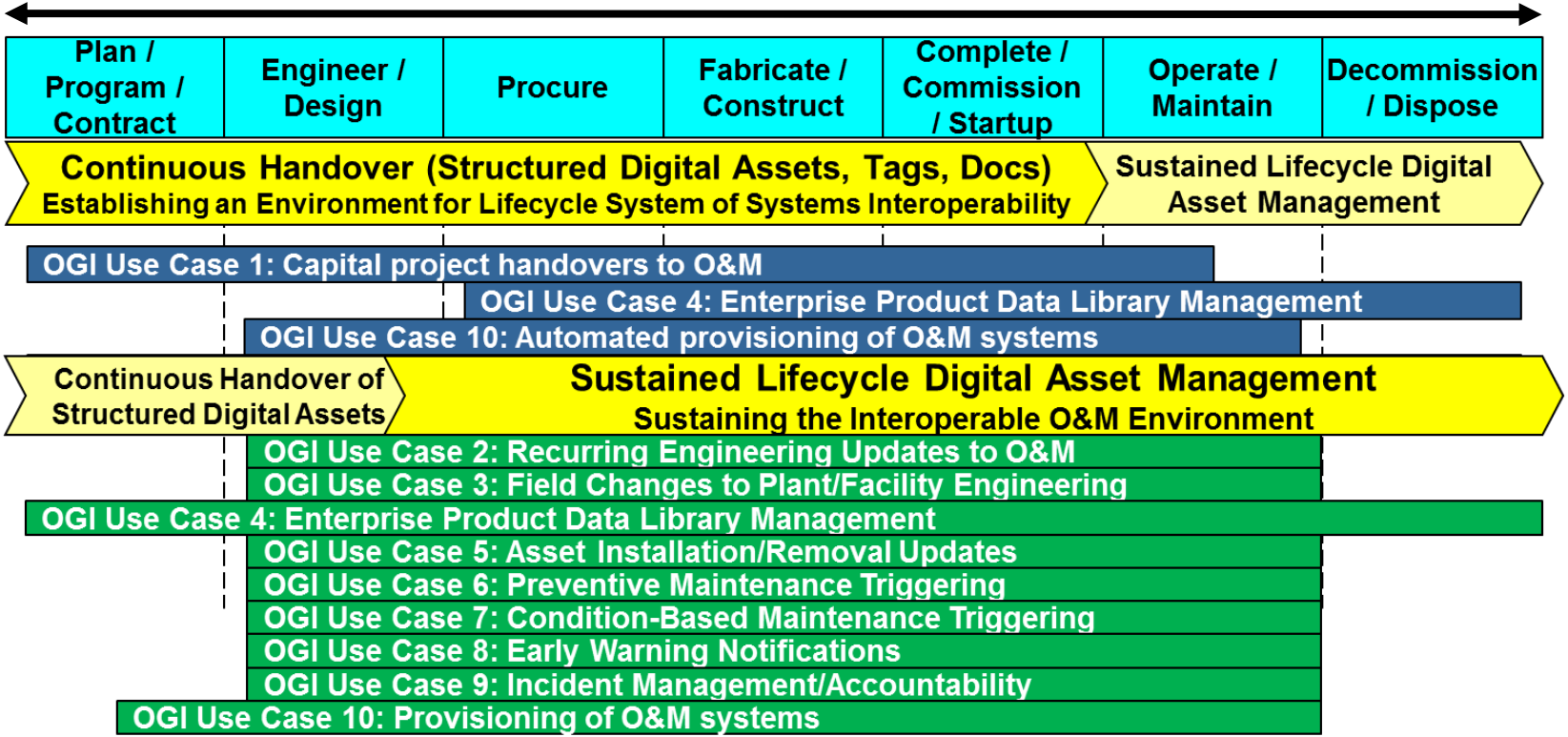
- Background
- Scope
- Preconditions
- Successful End Condition
- Actors
- Triggers
- Process Workflow
- Scenarios



Scenario (OIIE Event/Micro Service Definition for Adaptors)= 32

- Actors
- Data Content
- Data Formats
- Reference Data
- Information Service Bus Configuration

Key OIIE Industry Use Cases Cover the Lifecycle of the Asset



Digitally Enabled Life-cycle Asset Management

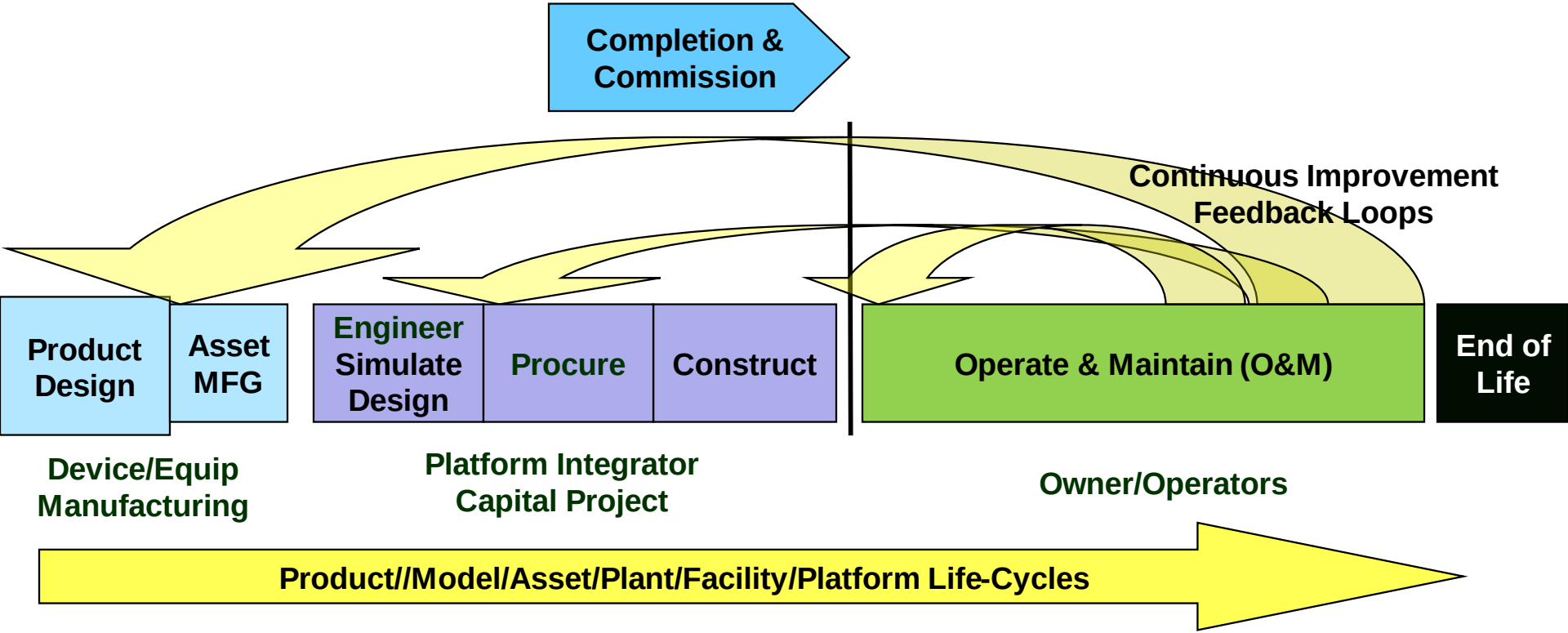
- This is inherently a cross industry topic
  - Most asset classes are manufactured in one industry group, but used in many other industry groups
  - Products leveraging the same core standards can be written once and used in many industries

- This has been the core focus for MIMOSA since the late 1990s
  - OSA-CBM Program – 1998-2001 – Office of Naval Research Funding
  - The OIIE has evolved out of work in the OGI Pilot, which began in 2009

- The role for standards and cooperation between industry associations

Full Asset Life-cycle Management

Physical and Digital Asset are included in OIIE



OSA-CBM Dual Use Technology Program

Office of Naval Research

MIMOSA Information Network (MIN)

June 21, 2000

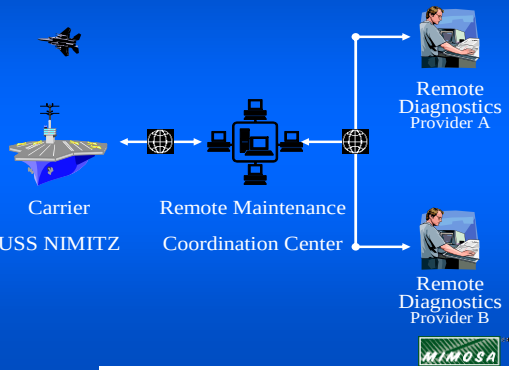
MIN-Viewer

OSA-CBM Presentation

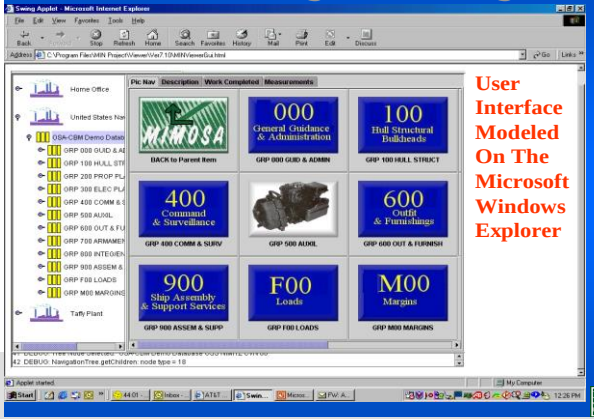
Alan T. Johnston

MIN Project Director

The OSA-CBM MIN Demonstration Concept



MIN-Viewer Segment Navigation 1



User Interface Modeled On The Microsoft Windows Explorer

Army Collaborative Telemaintenance

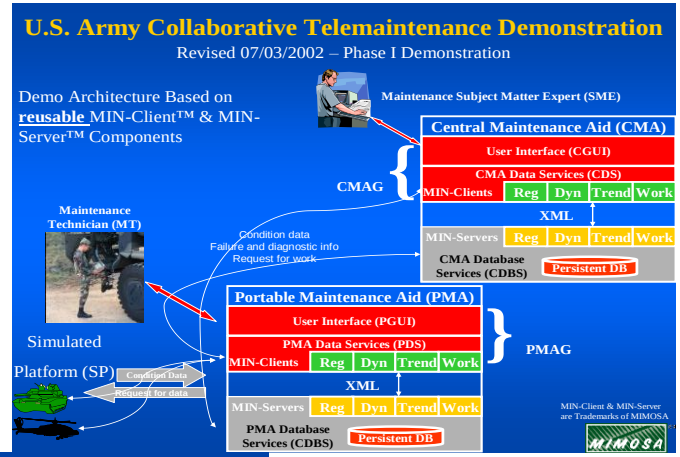
Army CECOM

U.S. Army CECOM
Collaborative Telemaintenance Project

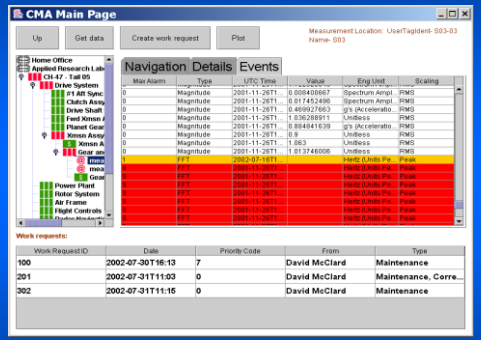
Phase I Demonstration Briefing – July 31, 2002
Alan Johnston – MIMOSA
Kenneth Bever – MIMOSA
Bob Walter – Penn State ARL

U.S. Army Collaborative Telemaintenance Demonstration

Revised 07/03/2002 – Phase I Demonstration



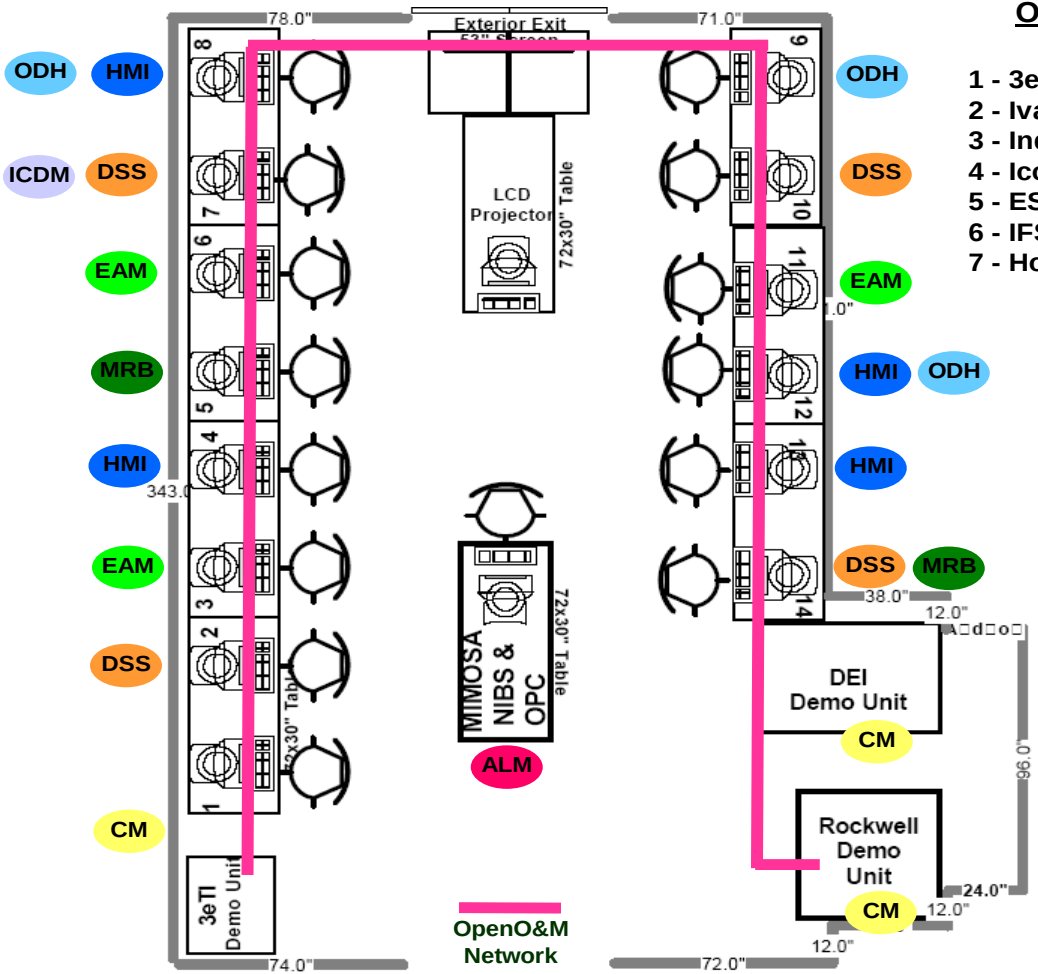
CMA Showing Measurement Events In Alarm



MIMOSA™

International Maintenance Conference 2004

Applying MIMOSA and other key standards to industrial systems



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

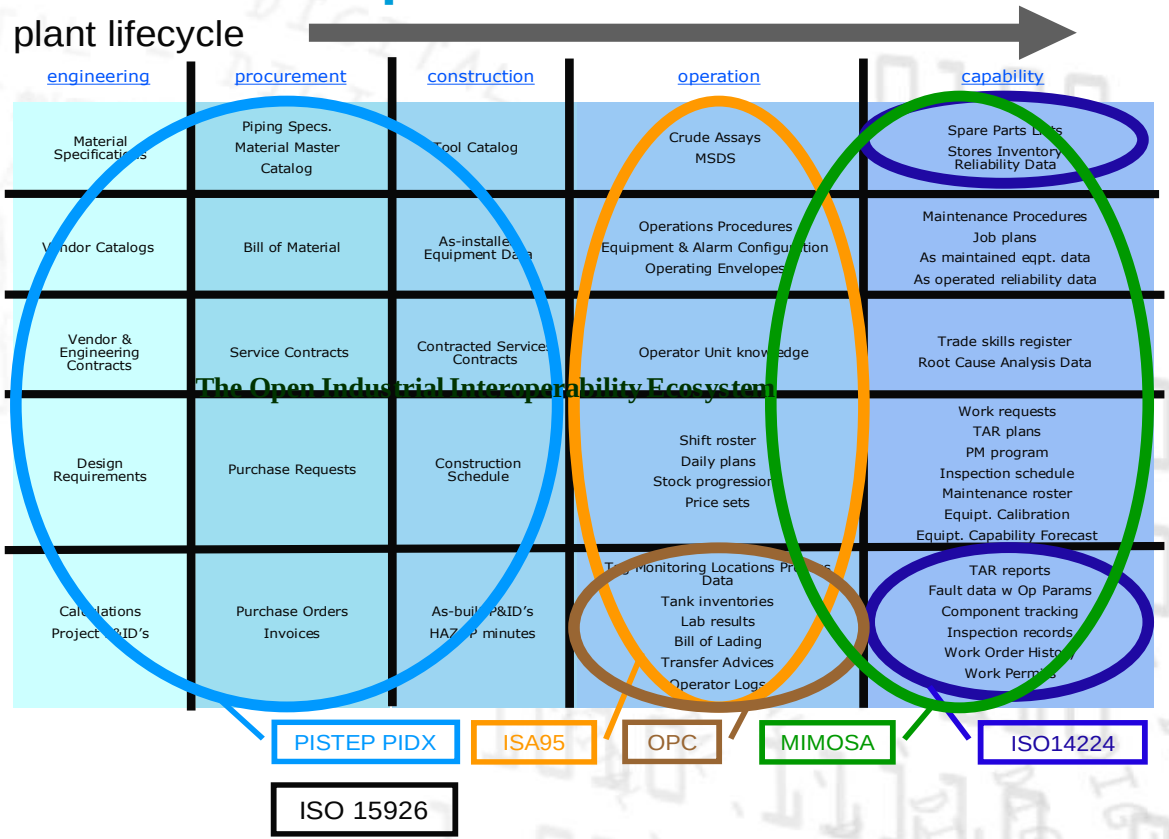
Function Legend

ALM	Asset Lifecycle Mgmt & Universal ID
CM	Condition Monitoring
ODH	Operational Data Historian
HMI	Human-Machine Interface
ICDM	Instrumentation & Control Device Management
DSS	Decision Support System
EAM	Enterprise Asset Management / CMMS
MRB	Maintenance & Reliability Browser

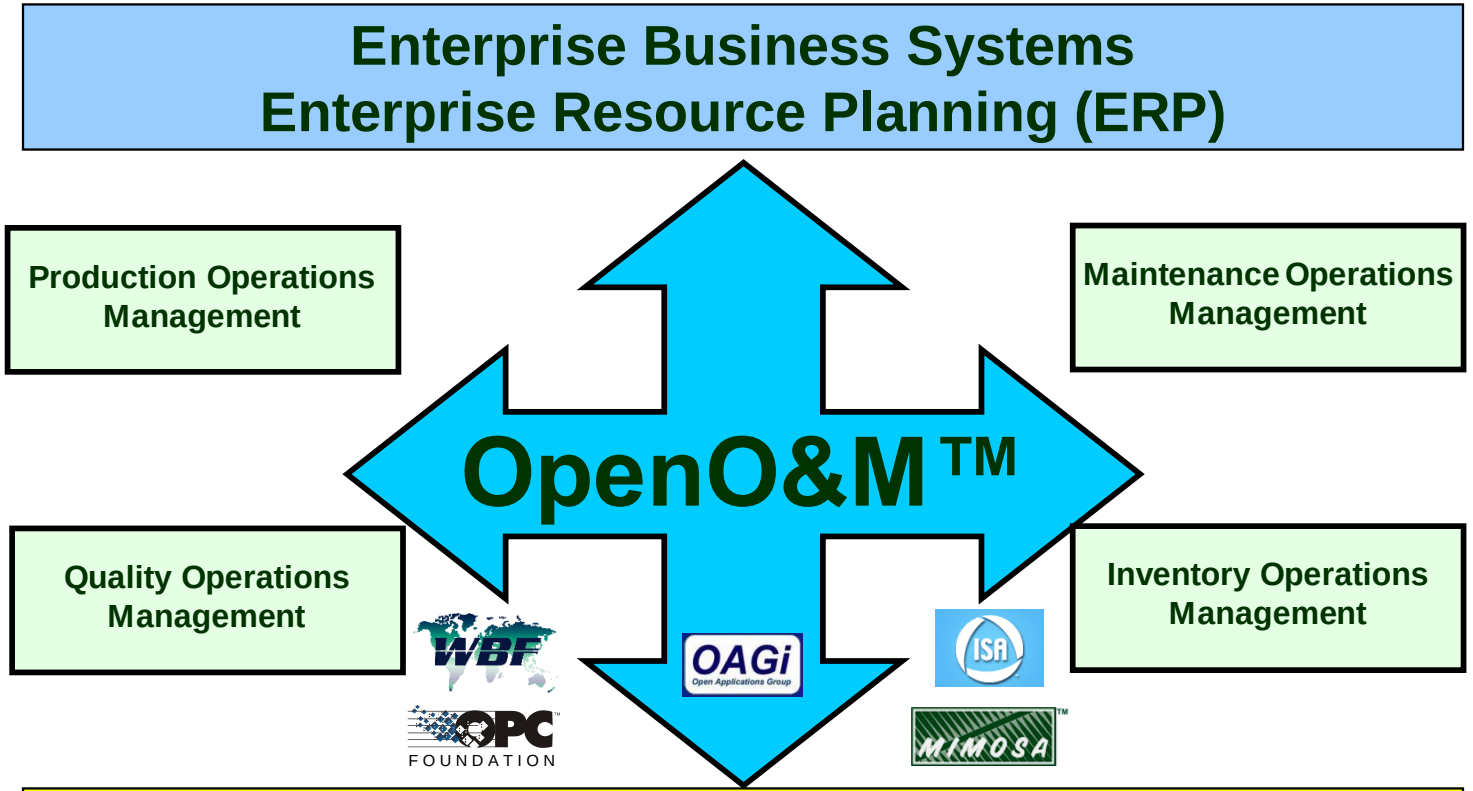
December 2004

MIMOSA™

bp data model map



The OpenO&M™ Solution: Open Standards Fill The Gaps-Formed 2004



Some Relevant ISO Related Activities

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

ISO 14224

Petroleum, petrochemical and natural gas industries -- Collection and exchange of reliability and maintenance data for equipment

ISO TC 108
Mechanical vibration and shock

SC5
Condition monitoring and diagnostics of machines

ISO 13374

MIMOSA OSA-CBM

WG6

Formats and methods for communicating, presenting and displaying relevant information and data

ISO TC 184
Industrial automation systems and integration

WG 6

SC4
Industrial 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)

SC5
Architecture, communications and integration frameworks

ISO 18435

MIMOSA OSA-EAI

WG7

Diagnostic and maintenance applications integration

Industry Digitalization and OIIE Summary

- Industry Digitalization is an imperative
- Digital Business Ecosystems are the most broadly accepted model for accomplishing digitalization
- The OIIE provides a pragmatic, supplier-neutral approach for implementing Digital Business Ecosystems

OIIE and OGI Pilot Credits

- MIMOSA defines the OIIE using a portfolio of published, supplier-neutral specifications and standards, which are used in a consistent, repeatable, scalable and sustainable manner. All rights to included specifications and standards and standards are retained by the organizations which develop, publish and license them, in accordance with their IP Policies.
- MIMOSA owns and operates the Oil and Gas Interoperability (OGI) Pilot testbed as an instance of the OIIE, in accordance with the applicable MIMOSA Policies. The OGI Pilot is used to both validate design elements of the OIIE and for conformance testing for included systems, information and applications software.
- MIMOSA website is located at: **www.mimosa.org**