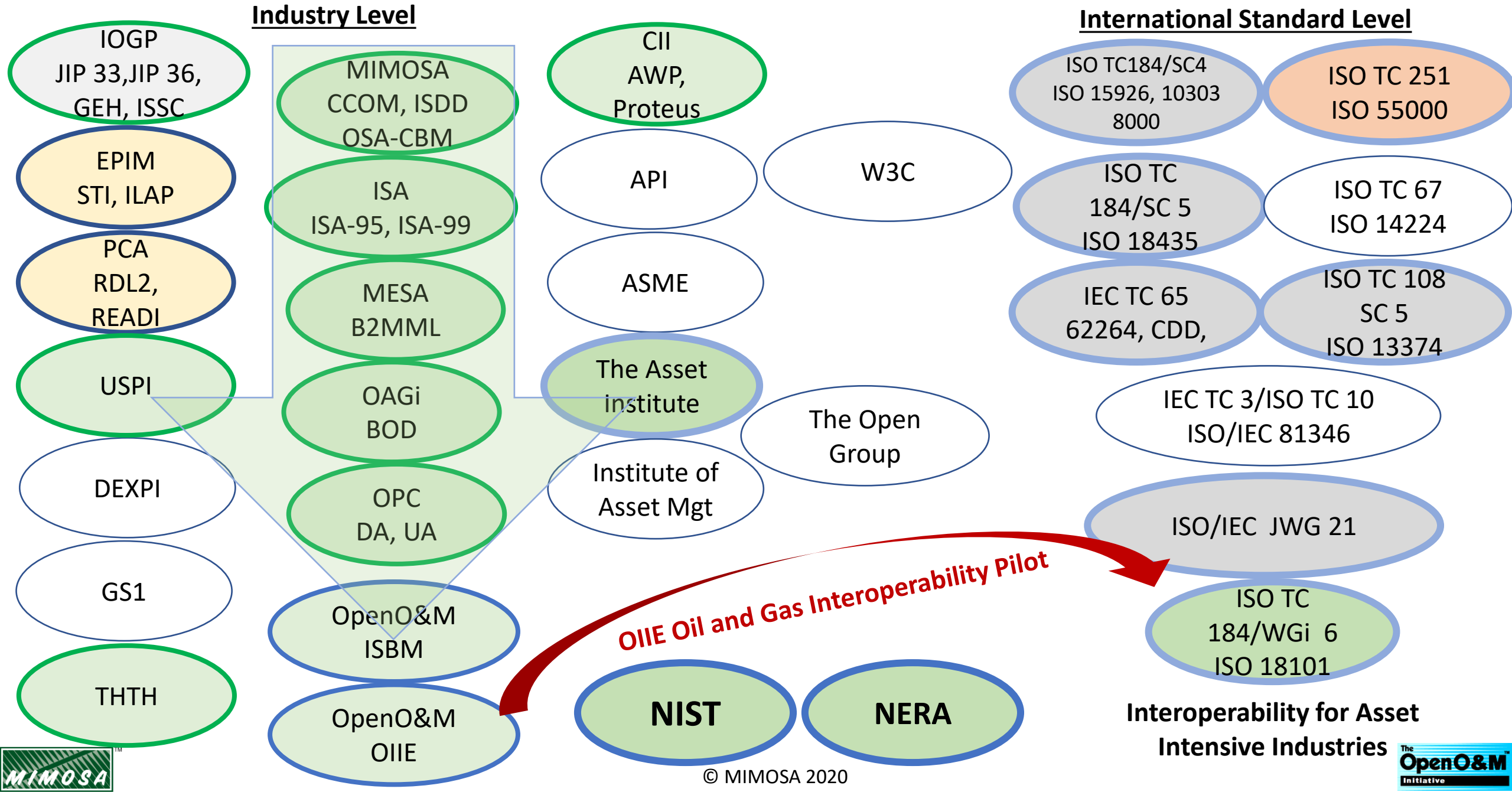
Open Standards for
Physical Asset Management

Enabling Interoperability and Digital Transformation with the Open Industrial Interoperability Ecosystem (OIIE) and ISO 18101

For: THTH Autumn Webinar
October 22, 2020

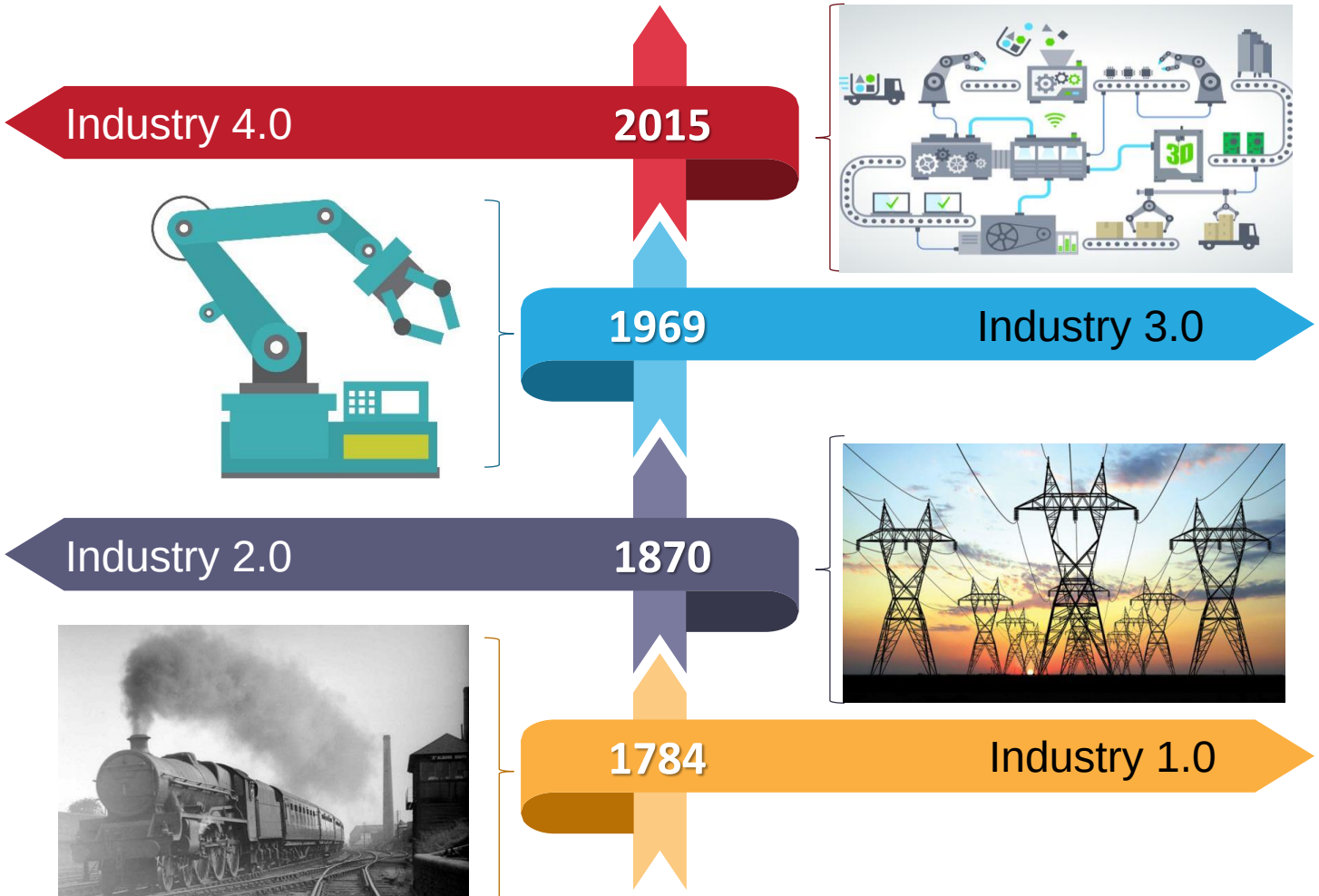
Alan Johnston
MIMOSA President, ISA95 Voting Member
ISO TC 184/WG 6 Convenor
ISC TC 184/AHG 02 – Digital Twin
ISO/IEC JWG 21-TF 8 – Digital Twin

Interoperability for Physical Asset Management-Associations and Activities



Industrial Revolution Phases and Common Principals

Modularity, Interoperability and Standardization



- Each phase has built on top of prior phases including more aspects of industrialization
- All phases have included various aspects of modularity, interoperability & standardization enabling businesses to specialize, scale and cooperate for major efficiency gains
  - Standard gauge railroads, screw threads
  - Electrical/Utility standards
  - Mechanical standards
- Modularity and interoperability were key contributors to Allied victory in WWII
  - Victory ships
  - B-24 Bombers
- **In Industry 4.0**
  - Supply chains need to be fully integrated across many industries
  - Sharing industrial internet and AI
  - Modular, interoperating & standardized **industrial digital ecosystems**

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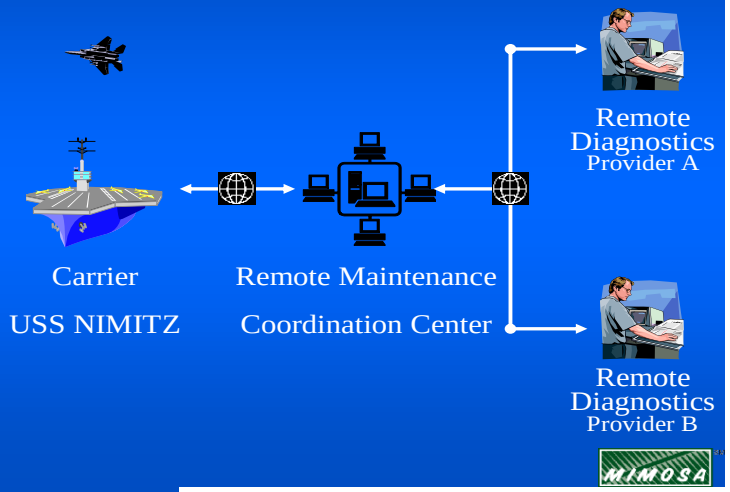
OSA-CBM Dual Use Technology Program - Office of Naval Research

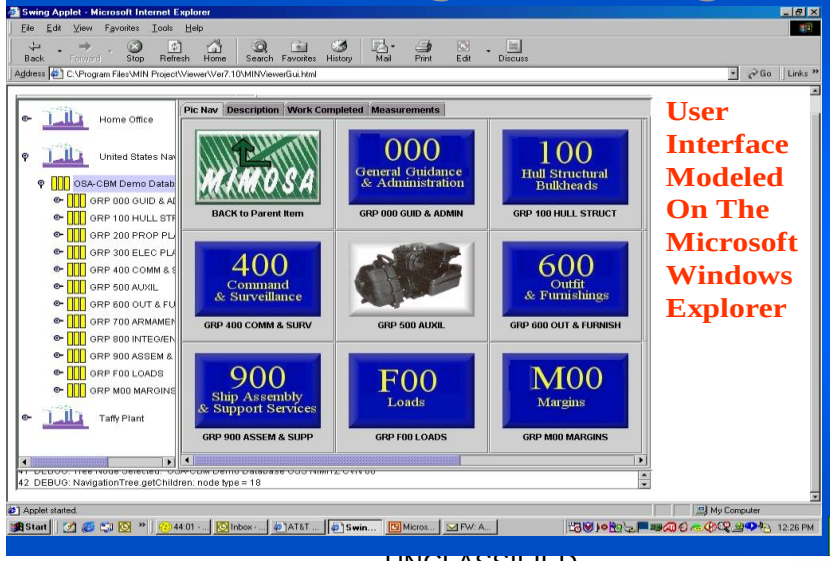
MIMOSA Information Network (MIN)

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

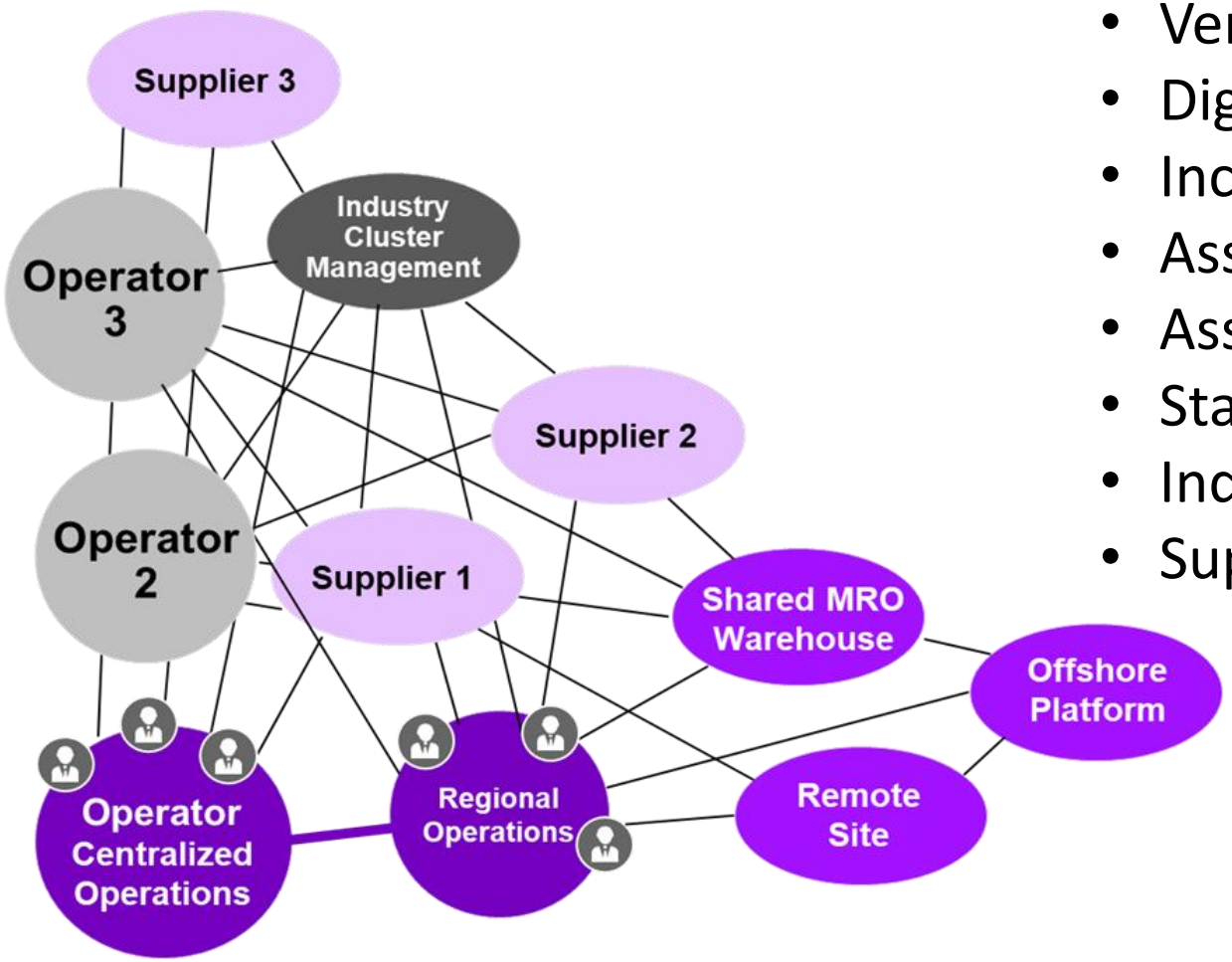


User Interface Modeled On The Microsoft Windows Explorer

Remote Support and Management

MIMOSA Background: Modeling, Monitoring and Managing US Naval Assets circa 2000.

OIIE and ISO 18101
Interoperability Framework for Asset-Centric Connected Digital Ecosystems



Key Features

- Vendor Neutral Industrial Digital Ecosystem
- Digital Twins (synchronized across the lifecycle)
- Includes required Documents
- Asset-centric – Addresses full asset lifecycle
- Asset Intensive Industries
- Standard ID Management
- Industry Standard digital services
- Supports both Functional and Geo-Clusters

Ecosystems Demonstrating Modularity and Interoperability

- Supplier/vendor-specific
  - Lego
  - Enterprise Resource Planning (ERP)
  - Android Ecosystem
  - Apple Ecosystem
- Supplier/vendor-neutral (standardized)
  - Traditional Utilities
  - Internet
  - Industrial Internet of Things (IIOT)
  - ➢ Intermodal Transport

➢ **Open Industrial Interoperability Ecosystem (OIIE)**
- ➢ Standard OIIE Digital Utility Services
  - ➢ Standard Services Definitions
  - ➢ Standard APIs
  - ➢ IaaS /Technology Neutral
- ➢ Standard Data Containers
- ➢ Standard Data Container Labels
- ➢ Standard Data Models
- ➢ Standard Ontologies

Modularity, Interoperability and Standardization

Industrial Digital Transformation – 2020 and Beyond

A Pragmatic Solution: Standards-based Interoperability and the OIIE

Open Standards-based Interoperability

- Defined by vendor-neutral standards
- Highly Heterogeneous, SME Friendly
- System of Systems Interoperability
- Suppliers build and maintain standard adaptors with commercial support model
- Higher quality with lower costs and risks

➢ **Practical basis for industry digital transformation**

Open Industrial Interoperability Ecosystem (OIIE)
ISO 18101

Supports

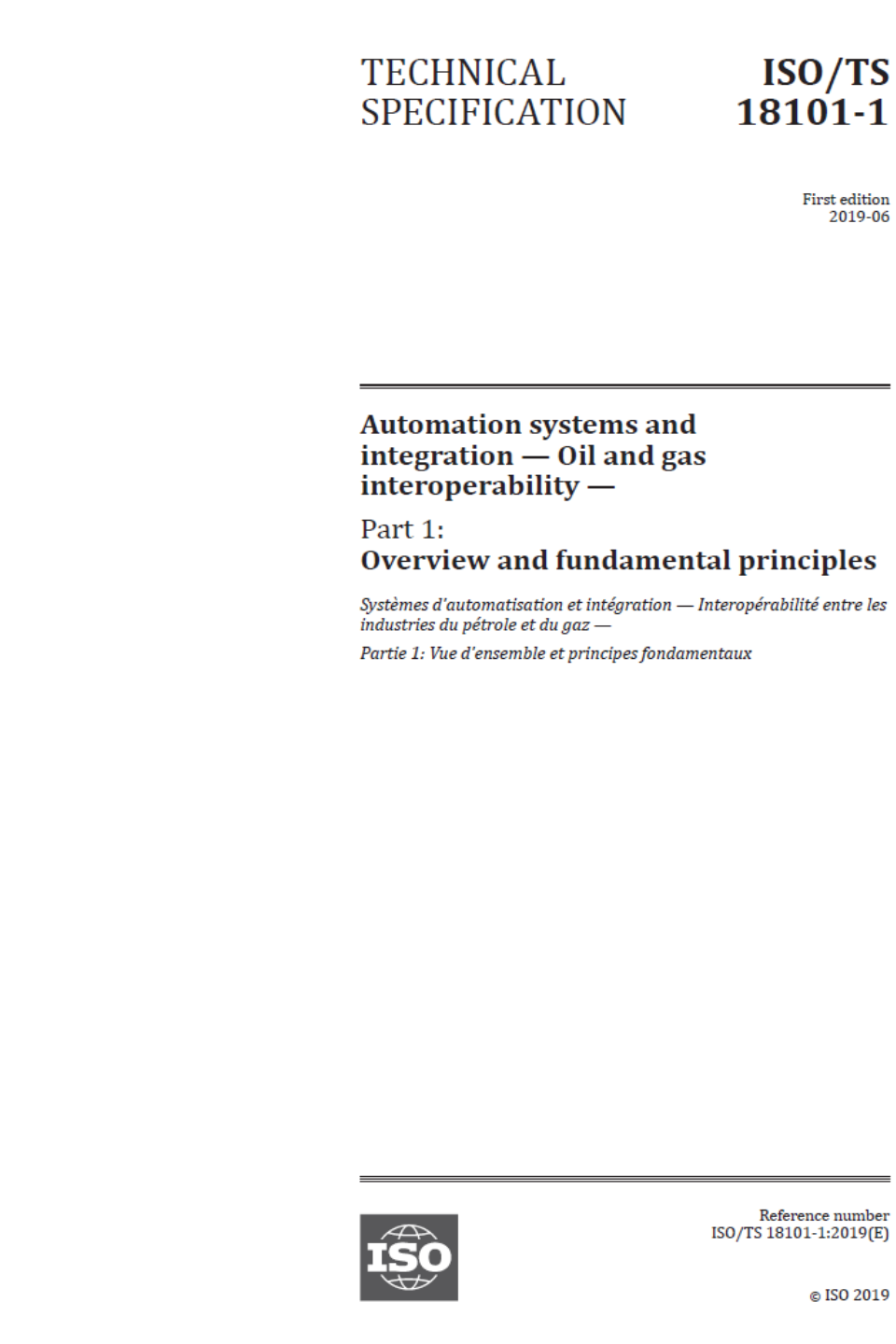
- Digital Twins
- Systems of Systems
- Interoperability
- AI, Ontology, OTDs
- Analytics

Industry Standard Digital Ecosystem

➢ Standard use case architecture
➢ Standard use cases, scenarios & events
➢ Standard data models
➢ Standard message models
➢ Standard reference data
➢ Standard APIs and services definitions
➢ Standard adaptors

OIIE Oil and Gas Interoperability Pilot ⟶ Builds and Verifies OIIE and ISO 18101

Qualifies for NERA and FEnEx matching funds if R&D is based at UniSA


TECHNICAL SPECIFICATION

ISO/TS 18101-1

First edition
2019-06

Automation systems and integration — Oil and gas interoperability —

Part 1:
Overview and fundamental principles

Systèmes d'automatisation et intégration — Interopérabilité entre les industries du pétrole et du gaz —

Partie 1: Vue d'ensemble et principes fondamentaux

ISO

Reference number
ISO/TS 18101-1:2019(E)

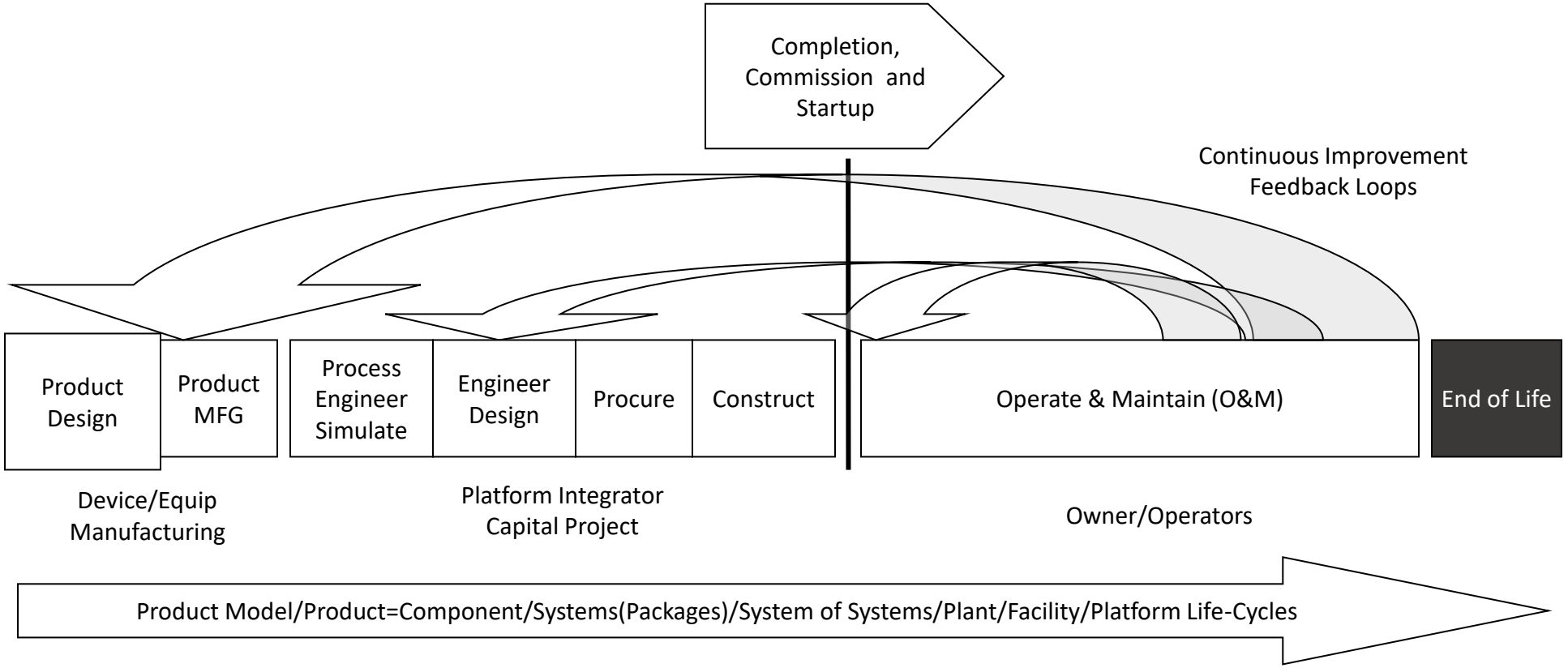
ISO TS 18101-1 Foreword
Paragraph 6

"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."

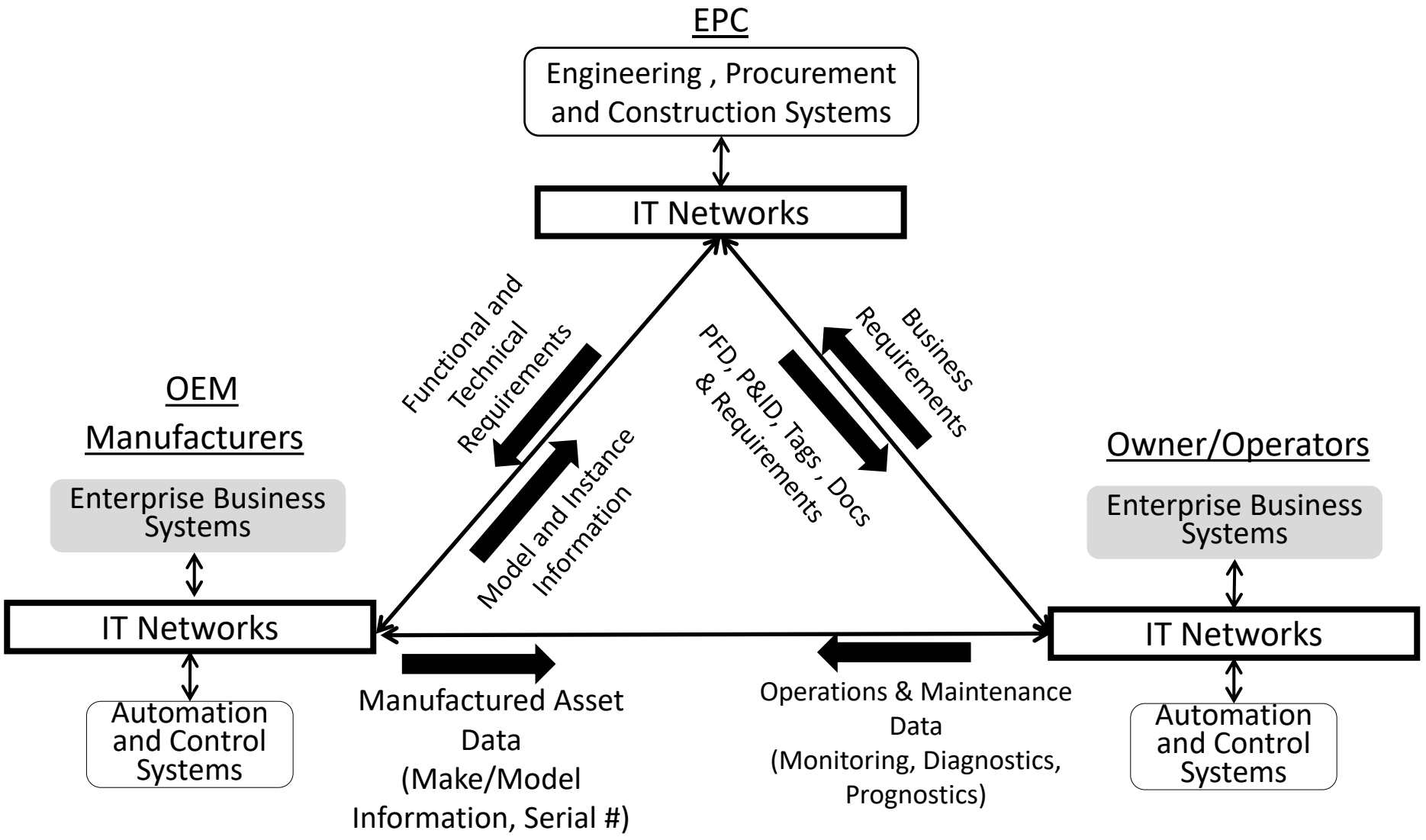
- ISO 18101 is the 1st ISO or IEC Standard to define:
  - Digital Twin
  - Digital Ecosystem
- 1st ISO Standard to define Interoperability is normative reference:
  - ISO 18435
- OIIE Use Case Architecture is Normative Appendix

Secondary Business Process

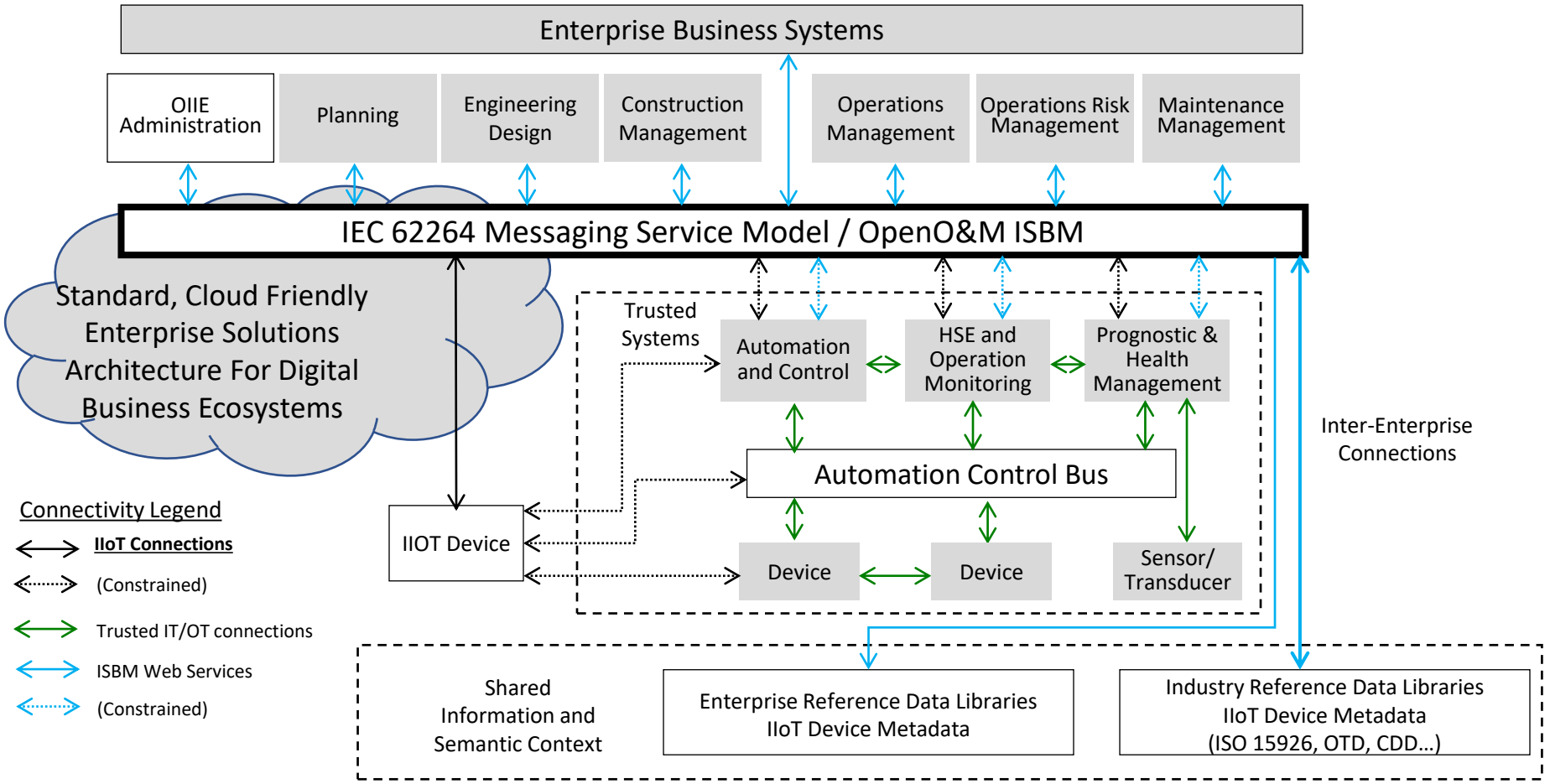


Derived from ISO TC 184
Manufacturing Asset Management Integration Task Force Final Report

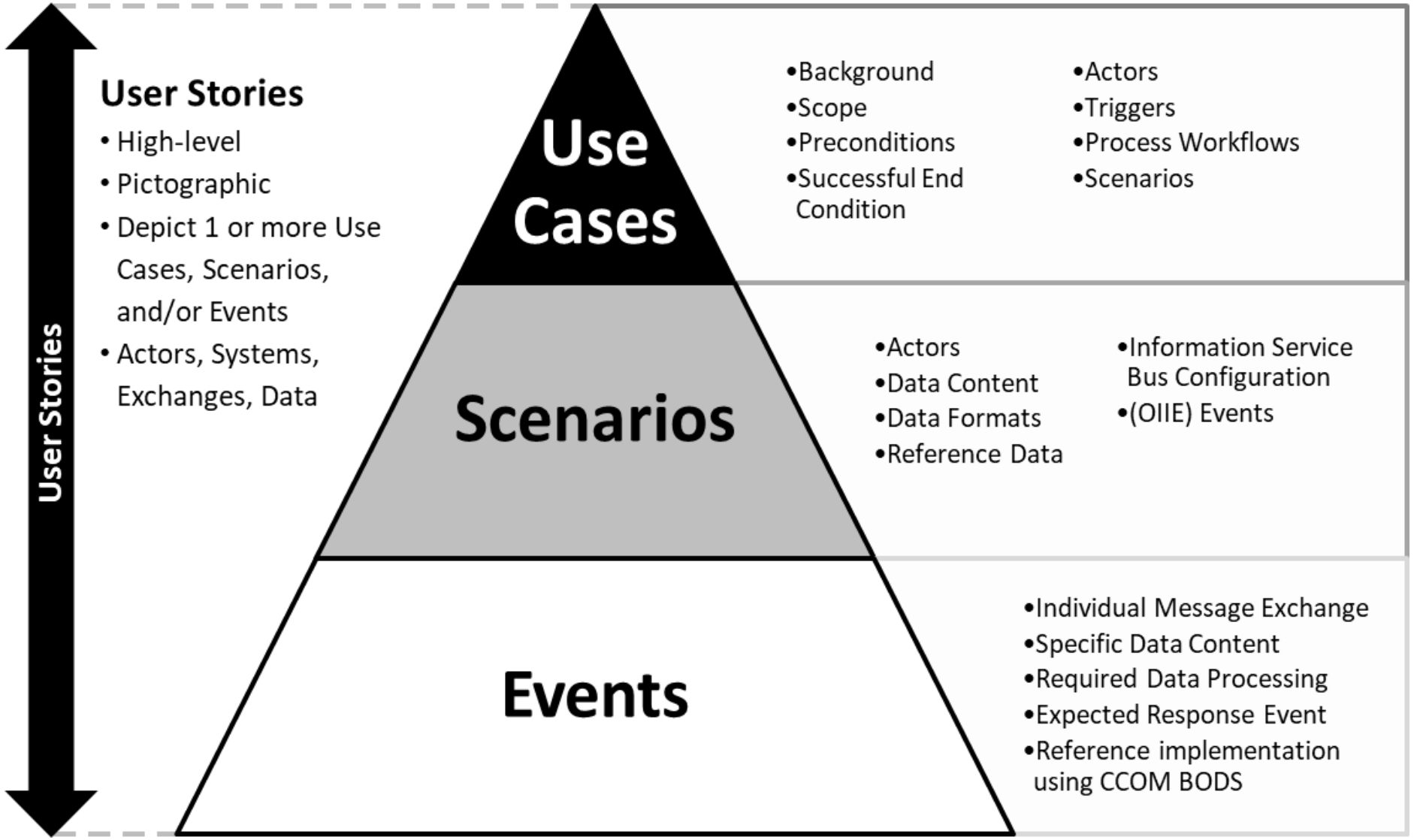
Inter-Enterprise OIIE Digital Ecosystem



Intra-Enterprise OIIE Digital Ecosystem



OIIE Use Case Architecture - 1



Standard OIIE OGI Use Cases

Cross Project Activities	Capital Projects	Complete/ Commission/ Startup	Operate/ Maintain	Decommission/ Dispose

Opportunistic Handover of Structured Digital Assets

Sustained Life-cycle Digital Asset Management

- OIIE Use Case 1: Information handovers to O&M
- OIIE Use Case 2: Recurring Engineering Updates to O & M
- OIIE Use Case 3: Field Changes to Plant/Facility engineering
- OIIE Use Case 4: Enterprise Product Data Library Management (tied to ISDDs)
- OIIE Use Case 5: Asset Removal/Installation 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: Automated Provisioning of O & M systems
- OIIE Use Case 11: Enterprise RDL Management
- OIIE Use Case 12: RFI and RFI Response (Models Meeting Requirements and Model Information, Green and Brown Field)
- OIIE Use Case 13: Lockout/Tagout
- OIIE Use Case 14: CBM Data Acquisition
- OIIE Use Case 15: Capital Project Asset Install

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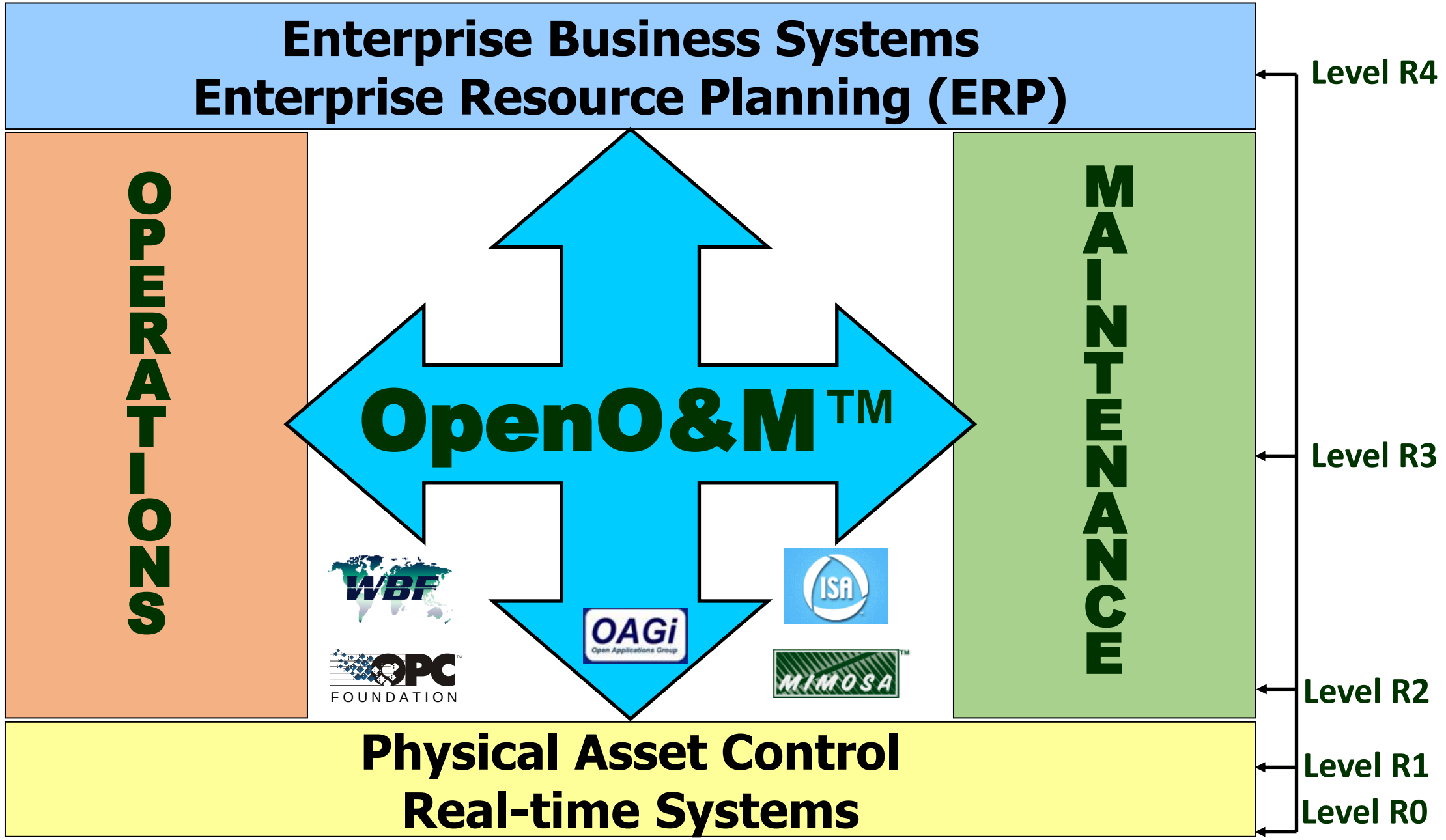
OpenO&M Initiative – Formed 2004



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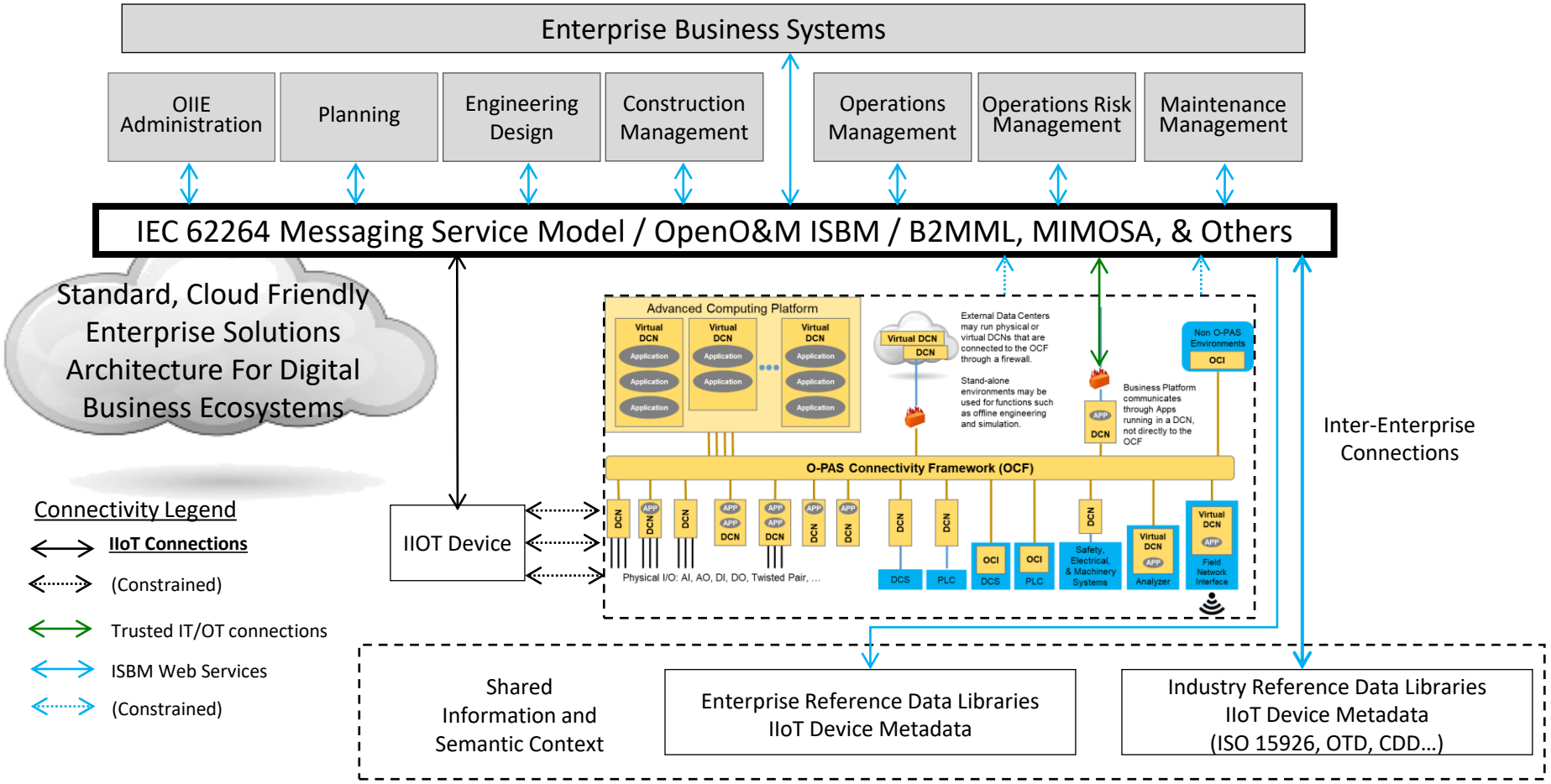
ISA Impact on the Digital Ecosystem Using the OIIE/ISO 18101 Architecture

- Collaboration between MESA, OAGi, OPC, MIMOSA,



ISBM 2.0

Implementation Specification for ISA-95 Message Service Model

OpenO&M Specification

2020-03-06

Editors

MIMOSA

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ISA

Dennis Brandl, BR&L Consulting
Douglas Brandl, BR&L Consulting

Status

This specification was last revised and approved by the OpenO&M ISBM Joint Working Group on the above date. Check the Latest Version for possible later revisions of this document.

This document is considered stable and may be used as reference material or cited as a normative reference from another document.

The latest stable version of the editor's draft of this specification is always available on the MIMOSA ISBM Git repository [https://github.com/mimosa-org/isbm].

If you wish to make comments regarding this specification in a manner that is tracked by the OpenO&M ISBM Joint Working Group, please submit them via the public bug database [https://github.com/mimosa-org/isbm/issues]. You can alternatively contact MIMOSA directly [http://www.mimosa.org/contact] and arrangements will be made to transpose appropriate remarks to the public bug database. All feedback is welcome.

Latest Version

This is version 2.0 which can be found at: http://www.openoandm.org/isbm/2.0
The latest published version of this specification can always be found at: http://www.openoandm.org/isbm/latest

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Defines standard APPLICATION interfaces for

- publish/subscribe,
- query response,
- end-point independent,
- multiple publishers & providers,
- message content independent,
- full security specification,
- WEB/SOAP and REST interfaces

Allows one application code set and architecture to work across any asset owner defined infrastructure.

Business Value To Australian Energy Markets
How The OIIE Supports It

- Digital collaboration
- No single vendor lock-in
- Anyone (quality controlled) can contribute at lower cost
  - Data
  - Knowledge
  - Infrastructure
- Anyone (quality controlled) can use at lower risk
  - Multiple services in parallel
  - Low switching costs
  - No single point of failure
- More value to supplier and consumers of services

The Open Industrial Interoperability Ecosystem (OIIE) and ISO 18101 Australia Energy Sector OIIE Network (Subnet of AU Critical Infrastructure)

MIMOSA.org
OpenO&M.org
Reference Info

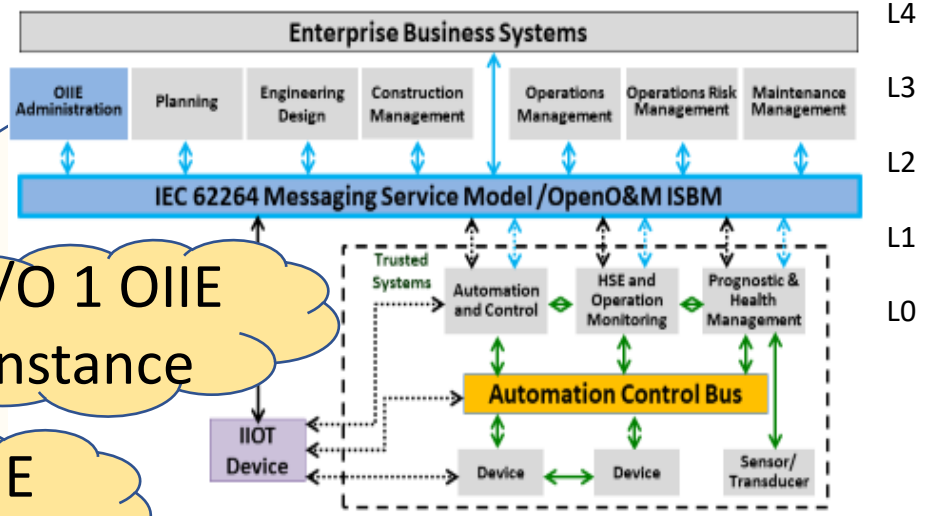
Cloud-based Analytics A

Cloud-based Analytics B

Supplier A Cloud

OIIE
Australian Energy Cluster

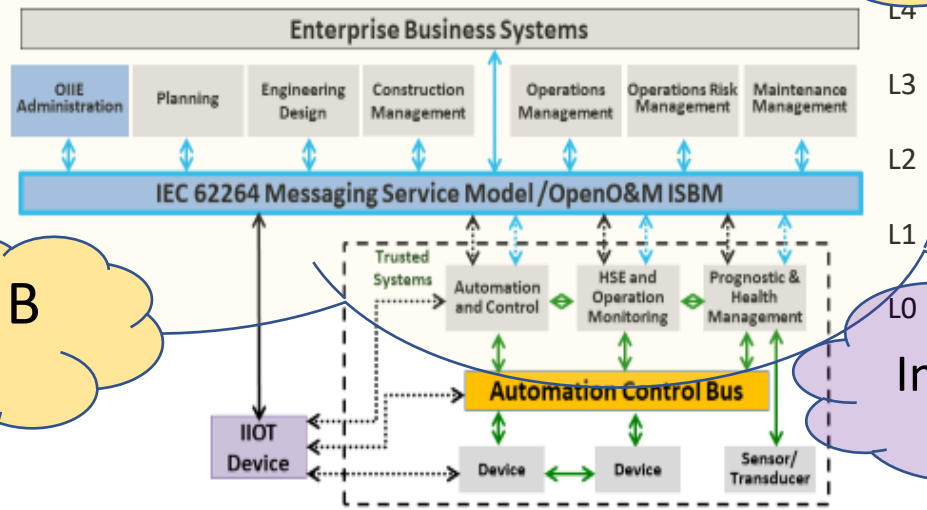
O/O 1 OIIE Instance



O/O 2 OIIE Instance

ISA
Reference info

NERA.org.au
Reference Info



University N...

Supplier B Cloud

UniSA: OIIE Interoperability Lab

OIIE Working Groups

- Australian OIIE Working Group-Co-sponsored by NERA
  - Focused on special concerns of Australia
  - Covers full asset life-cycle
  - SME Centric

- OIIE Capital Projects Working Group-Coordinated with IPA
  - Global
  - Focused on capital projects
  - Responding to IPA industry benchmarks showing inadequate business efficiency
  - First Meeting – November 4, 2020

- OpenO&M OIIE Working Group – Co-Managed by ISA and MIMOSA
  - Global
  - Focused on Operations and Maintenance
  - Process and Batch Industries and their supply chains
  - Includes Cyber-Security
  - Next Industry Meetings – Early 2021

ISO TS 18101-1 Interoperability Framework for Asset Intensive Industries

a supplier neutral industrial digital ecosystem linking digital twins to the full asset life-cycle

For: ISO/IEC JWG 21/TF 8-May 13, 2020

Alan T. Johnston

Convenor ISO TC 184/WG 6

President MIMOSA

Relevant ISO Technical Committees & Activities

Industry Specific
Practices and Content
(ISD versus ISDD)

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

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, shock and condition monitoring

ISO 13374- Condition monitoring and diagnostics of machines — Data processing, communication and presentation

ISO TC 184
Automation systems and integration

WG 6
ISO 18101-Asset intensive industry interoperability

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

Relevant Cooperation also exist between ISO and IEC
IEC TC 65 and IEC/ISO JWG 21

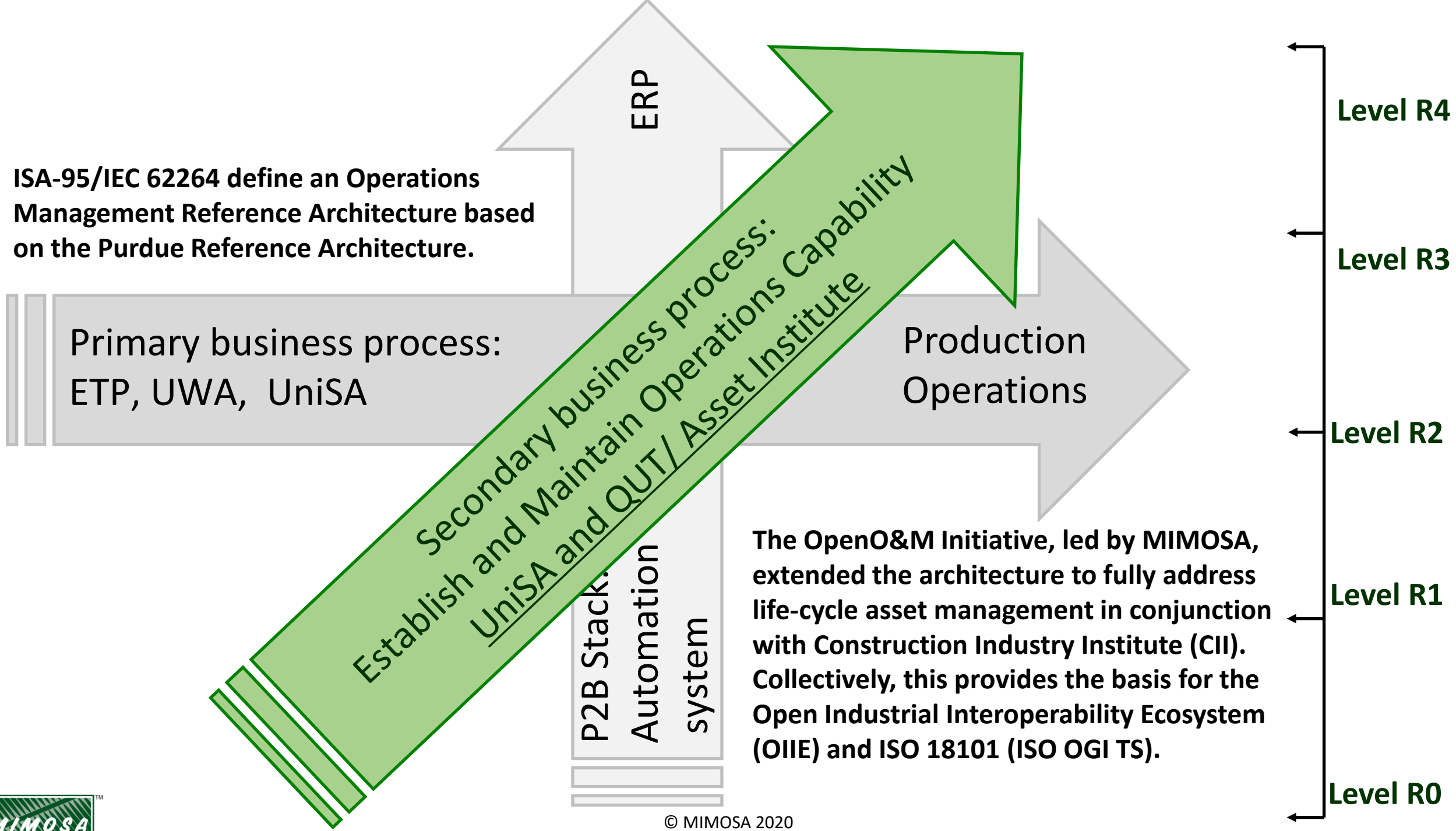
Contact Information

We are happy to have follow-on to discuss the opportunity to help sponsor this important business activity with the ability to gain matching funds.

atjohn@mimosa.com

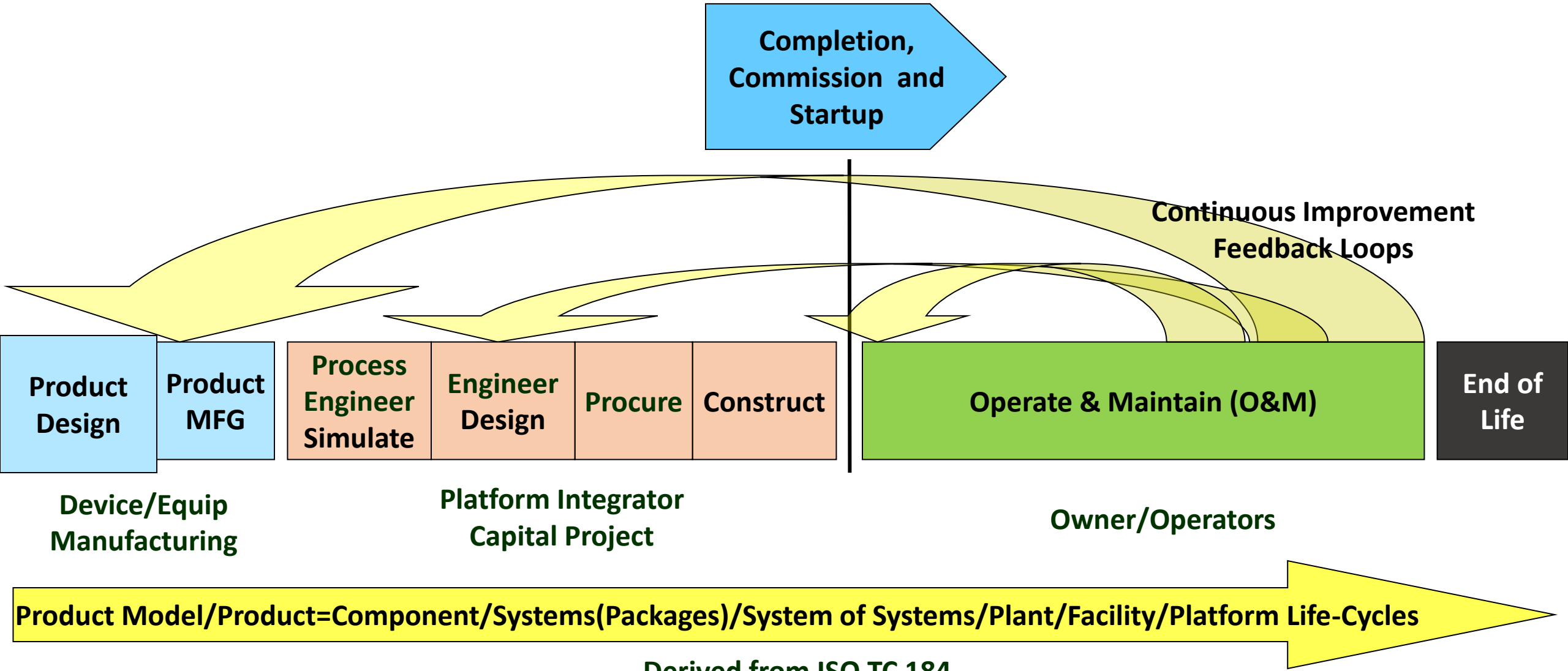
Backup Material

ISA-95/IEC 62264 define an Operations Management Reference Architecture based on the Purdue Reference Architecture.



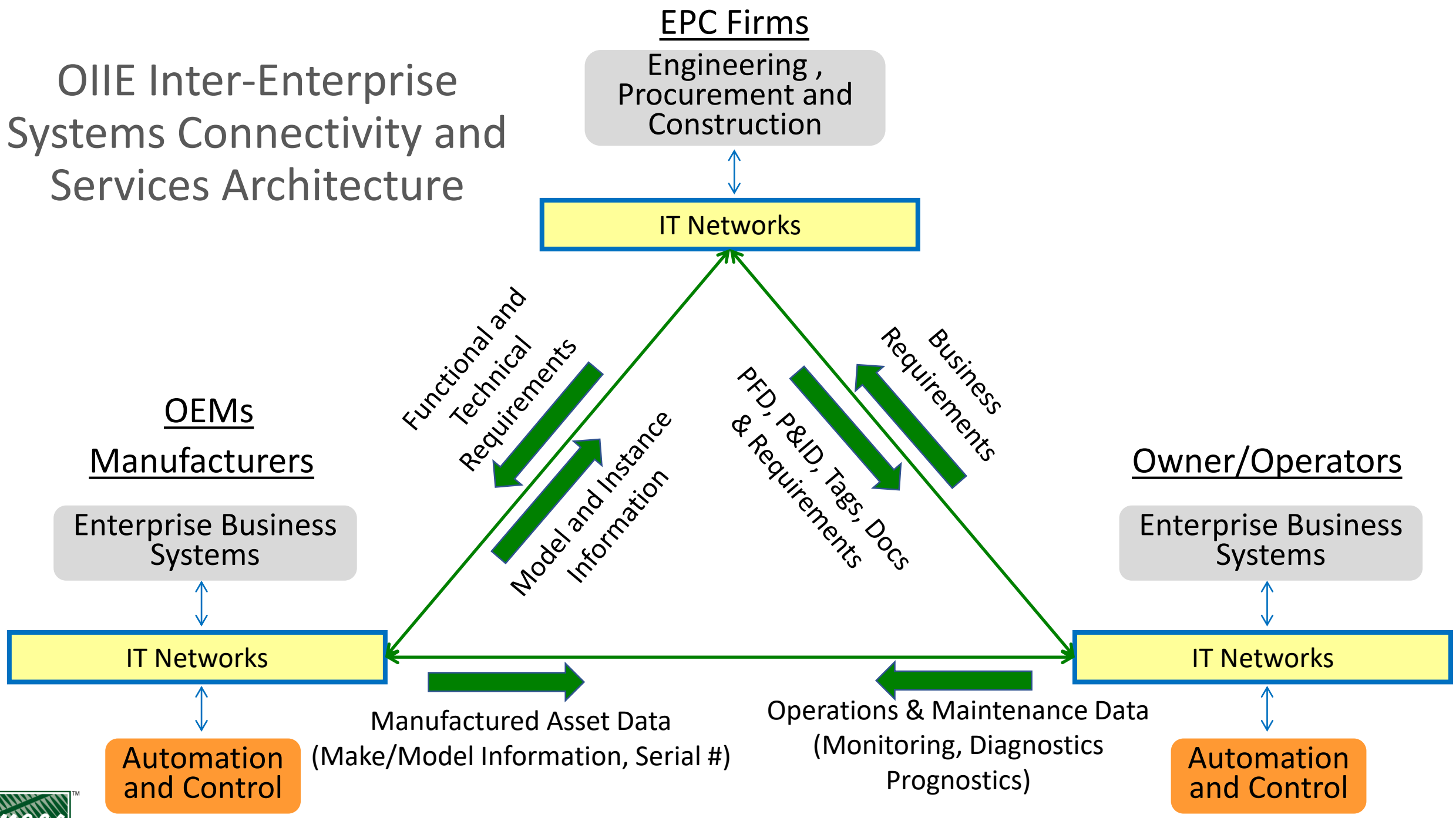
The OpenO&M Initiative, led by MIMOSA, extended the architecture to fully address life-cycle asset management in conjunction with Construction Industry Institute (CII). Collectively, this provides the basis for the Open Industrial Interoperability Ecosystem (OIIE) and ISO 18101 (ISO OGI TS).

Full Asset Life-cycle Management

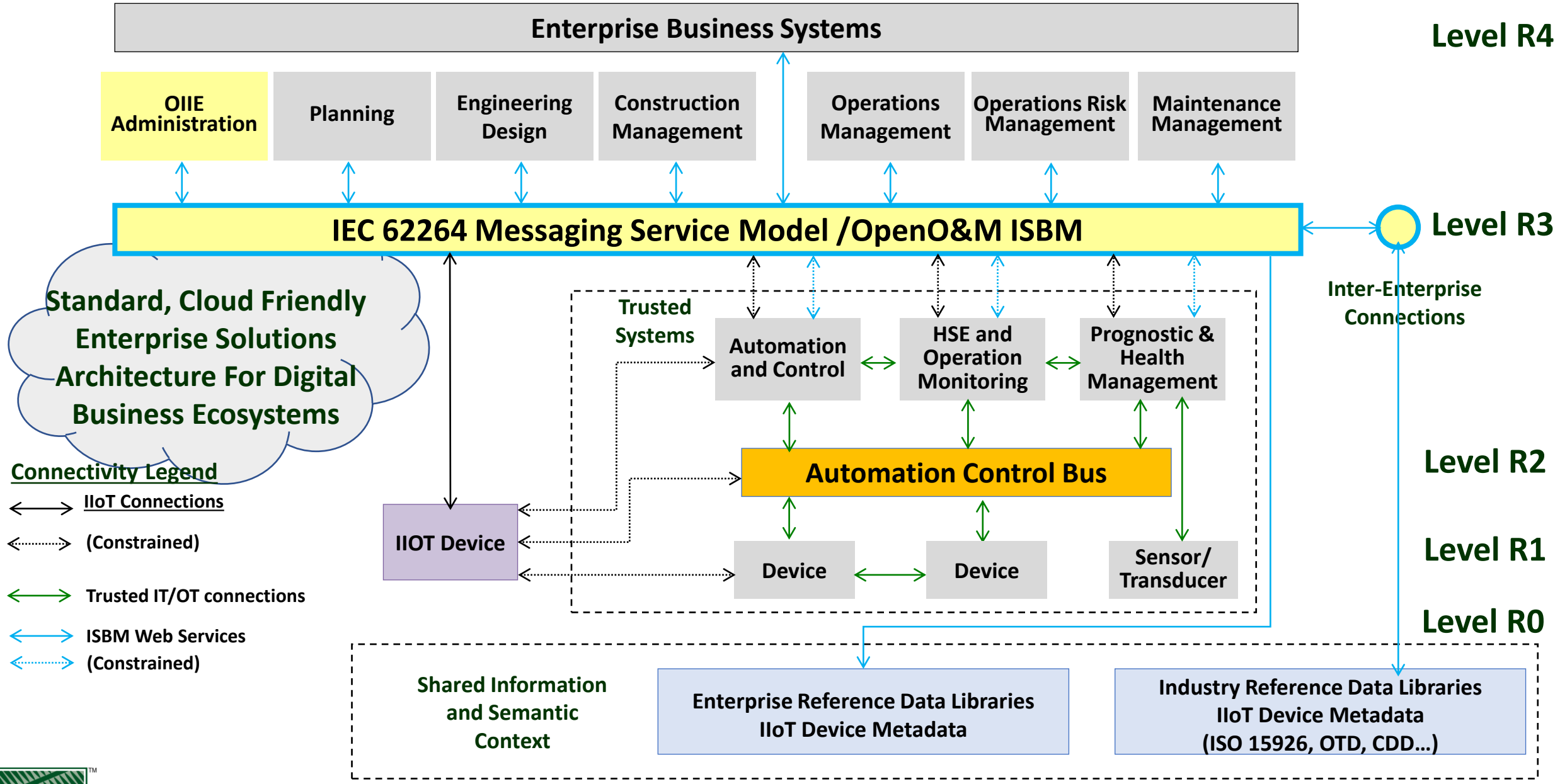


Derived from ISO TC 184
Manufacturing Asset Management Integration Task Force Final Report

OIIE Inter-Enterprise Systems Connectivity and Services Architecture



OIIE Intra-Enterprise Systems Connectivity and Services Architecture



OIIE/OGI Standardized Use Case Architecture

Standardized Methodology to Define and Re-use OIIE Components

User Stories

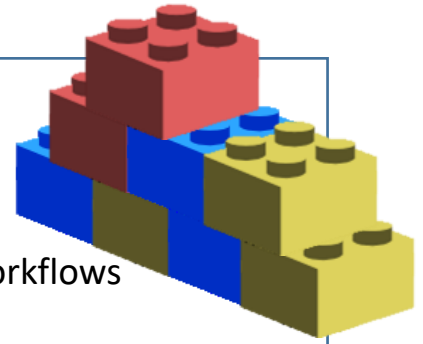
User Stories

- High-level
- Pictographic
- Depict 1 or more Use Cases, Scenarios, and/or Events
- Actors, Systems, Exchanges, Data

Use Cases

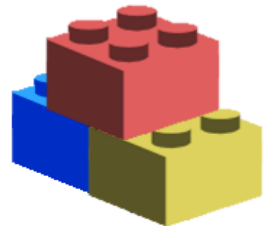
- Background
- Scope
- Preconditions
- Successful End Condition

- Actors
- Triggers
- Process Workflows
- Scenarios



Scenarios

- Actors
- Data Content
- Data Formats
- Reference Data
- Information Service Bus Configuration
- (OIIE) Events



Events

- Individual Message Exchange
- Specific Data Content
- Required data processing
- Expected Response Event
- Implemented by CCOM BODS and possibly others