OpenO&M
Industrial Capital Project
Plant Information Handover
Best Practices Guide

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1 Overview

Accurate plant information handover from capital projects is vital to enterprise profitability. Plant information shall be treated as a valuable asset as important as the physical plant itself. Following handover, plant information shall be kept accurate and accessible for the lifetime of the facility, which typically spans 30-50 years. Inaccurate or missing plant information causes lost revenue due to missed project deadlines, unnecessary material purchases, design rework, start-up delays, production cutbacks, and unplanned shutdowns. This guide focuses on the best practices for periodic information handovers of engineering information from capital project systems for use in plant operations and maintenance (O&M) systems utilizing the information standards provided by OpenO&M standards and ISO 15926. This handover activity is vital to bringing a new plant on line within time and budget as it drives the compilation and validation of the records necessary to pass into and support the operational life of the plant, together with their transfer of ownership from the project team and acceptance by the plant owner.

Information about the “as-designed” engineering structure of a plant with the required operating parameters, and the “as-built” configuration of serialized assets installed in this structure is essential to bring a plant into production and enable plant O&M personnel to safely operate the plant. The specific information needs, however, of engineering, procurement, and construction contractors (EPCs) and plant owner/operators (O/Os) are quite different. The EPC focuses on the capital project design and construction phase, where the O/O is concerned about the long-term needs for the life of the facility.

Studies by FIATECH, estimate that the traditional execution by an EPC of handover is typically quantified as less than 0.3% of the project, but that a further 2-4% of the project cost is required by the O/O to manually correct and key in required O&M information into O&M systems. This means that handover traditionally only equates to $1M on a $400M project for the EPC, but the O/O then has to spend an additional $8-16M in “hidden” data entry and validation costs. **FIATECH studies have shown that periodic, structured, non-proprietary, automated information exchanges from EPC systems to O&M systems are estimated to save 60% of this O/O hidden cost, resulting in a savings of between $5-10M on a $400 million project.** This OpenO&M best practices document addresses the four major problems to achieving these savings to allow EPCs and O/O to agree upon a periodic, structured, non-proprietary, and automated solution.

1.1 Addressing Problem #1: Big Bang Approach to Information Handover

The first barrier to overcome is the **“Big Bang” approach to information handover** from the EPC to O&M personnel. O/Os often experience unexpected delays in startup if information is not periodically assembled, delivered, and reviewed during the project. Often, capital projects wait until startup/handover to “dump” the design and information to O&M personnel to populate their systems. Since this occurs at the end of the project, cost pressures can be extreme due to earlier problems. As a result, it can be tempting to cut handover spending to hit the project budget. It is not uncommon for an O&M organization to have the burden of finding and validating data to populate their systems after startup.

The OpenO&M best practice to address this problem is for both EPCs and O/Os to follow the **periodic, phased handover methodology** captured in NIST's *Capital Facilities Information Handover Guide [CFIHG] (NISTIR 7259)* to improve the efficiency and quality of information handovers throughout the capital facility life-cycle. CFIHG provides a framework for the definition and delivery of information packages to be transferred among participants in capital facility projects. Information handover strategies shall be based on identifying the information created in each phase that will be needed downstream and how it will need to be used. It is essential that the facility life-cycle information strategy and the handover requirements be established before project initiation so that contractual requirements for a continuous information handover can be defined.

1.2 Addressing Problem #2: Unstructured Data Exchange Formats

The second problem is the use of **unstructured data exchange formats** for information transfer from engineering to O&M personnel**.** Traditionally, most plant engineering information is available to O&M solely in unstructured document-oriented formats which cannot be readily machine-interpreted. Examples of these unstructured formats include Adobe Acrobat PDF, JPEG, TIF, Microsoft Excel, and Microsoft Word. While these formats have value for the human reader, they are of limited value to populate O&M systems since it is difficult for computer software to extract information such as the TAG ID from a P&ID diagram represented in a PDF format. Since manual data entry from these unstructured documents is now required, data integrity problems are common between engineering and O&M systems which can result in operating mistakes. Another resulting problem is the existence of redundant equipment files, created by both maintenance and engineering which are not synchronized, creating recurring engineering and maintenance errors. This can result in unplanned shutdowns, delayed maintenance projects, and incidents.

The OpenO&M best practice is to generate structured, computer-readable O&M-meaningful plant information data **linked to** the source unstructured document. Plant structural information shall be generated by engineering systems from logical P&IDs and PFDs and placed into computer system readable formats such as XML or RDF. The extracted structural information packages should be defined as specified in the CFIHG handover plan section and should include the equipment/tag identifiers with requirements such as operating envelope setpoints, I/O port connections with process flow information, as-built serialized asset data, and associated plant breakdown structures.

1.3 Addressing Problem #3: Proprietary Data Exchange Formats

The third problem is the **proprietary format of data exchange handover information**. As specified in CFIHG, handover requirements – content description and exchange format – should be defined in the contract between EPCs and O/Os. Even though structured formats are utilized by an EPC, unless the information is originally created with knowledge of the final desired handover format, it may be difficult and expensive to convert. A study conducted by the Construction Industry Institute (CII) in the United States in the early 1990s (RS106-1: 3D CAD Link) suggested that the effort to convert facility drawings developed manually or in an unstructured CAD format to a structured model was ineffective in controlling construction costs or schedule, while the use of information-rich models during design did result in such benefits.

For industrial facilities, the OpenO&M best practice is to specify that outputs from EPC systems shall be formatted accordingly to OpenO&M-standardized reference data and templates defined in ISO 15926 formats. The Joint MIMOSA/PCA O&M Special Interest Group will work to properly incorporate MIMOSA CCOM concepts in ISO 15926 so that key O&M information can be unambiguously exchanged based on existing O&M information models.

ISO 15926 employs a generic data model that is supplemented with OpenO&M templates and a Reference Data Library (RDL) to support standardized transfers of information packages throughout the complete life cycle of a facility. Specifying only ISO 15926 with OpenO&M-standardized reference data and templates provides a standardized definition of data exchange packages for accessing and presenting model data in any way the end user requires. Templates can be "layered" to create different levels of abstraction. This is referred to as the "onion model." Figure 1 illustrates this concept.

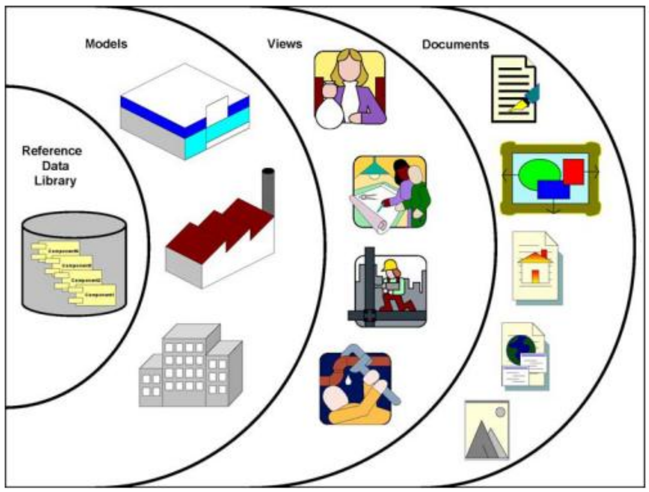

Figure 1 – ISO 15926 "Onion" Diagram

To be consumed in O&M execution environment systems, the reference data transferred in OpenO&M ISO 15926 RDL templates needs to be converted to the standard for registry data – the MIMOSA Common Conceptual Object Model (CCOM) XML format. This conversion process will be described in Section 1.4.

1.4 Addressing Problem #4: Manual Data Exchange Methods from Engineering and Construction Systems to O&M Systems

The final problem to address is the **manual data exchange methods from Engineering and Construction Systems to O&M systems.** Plant engineering and construction systems which contain updated Plant Breakdown Structures, P&ID and PFD "as-designed" and "as-built" data need to periodically publish revisions to O&M onto a safe and secure information bus using a Service-Oriented Architecture (SOA) methodology and subscribe to revisions to the "as-maintained" state of equipment from this same information bus. The OpenO&M best practice is for all systems to support the OpenO&M Information Service Bus Model (ISBM) SOA architecture which can be implemented by major Enterprise Service Bus (ESB) suppliers to provide systemic notifications of information changes in a safe and secure transport with guaranteed delivery. The best practice also includes the use of an OpenO&M-ISO 15926 Transform Engine on an ISBM, transforming ISO 15926 content received by the Active O&M Registry from Engineering to MIMOSA CCOM XML format with the use of the OpenO&M

Common Interoperability Register (CIR) for index lookups and returning this data back to the Active O&M Registry system via the ISBM.

The OpenO&M best practice also includes the use of an Active O&M Registry which subscribes to the output from the Transform Engine and provides a centralized GUID registry for all O&M data dictionary items (REG-DICTIONARY), data dictionary taxonomies (REG-TAXONOMY), system structures (REG-STRUCTURE), serialized assets (REG-ASSET), and product templates with product models (REG-PRODUCT).

Beginning in 2007, representatives from the Oil & Gas and Petrochemical industries participated in an OpenO&M End-User Advisory Group to provide the highest valued Use Cases with interoperability scenarios required for organizations to meet their business objectives.

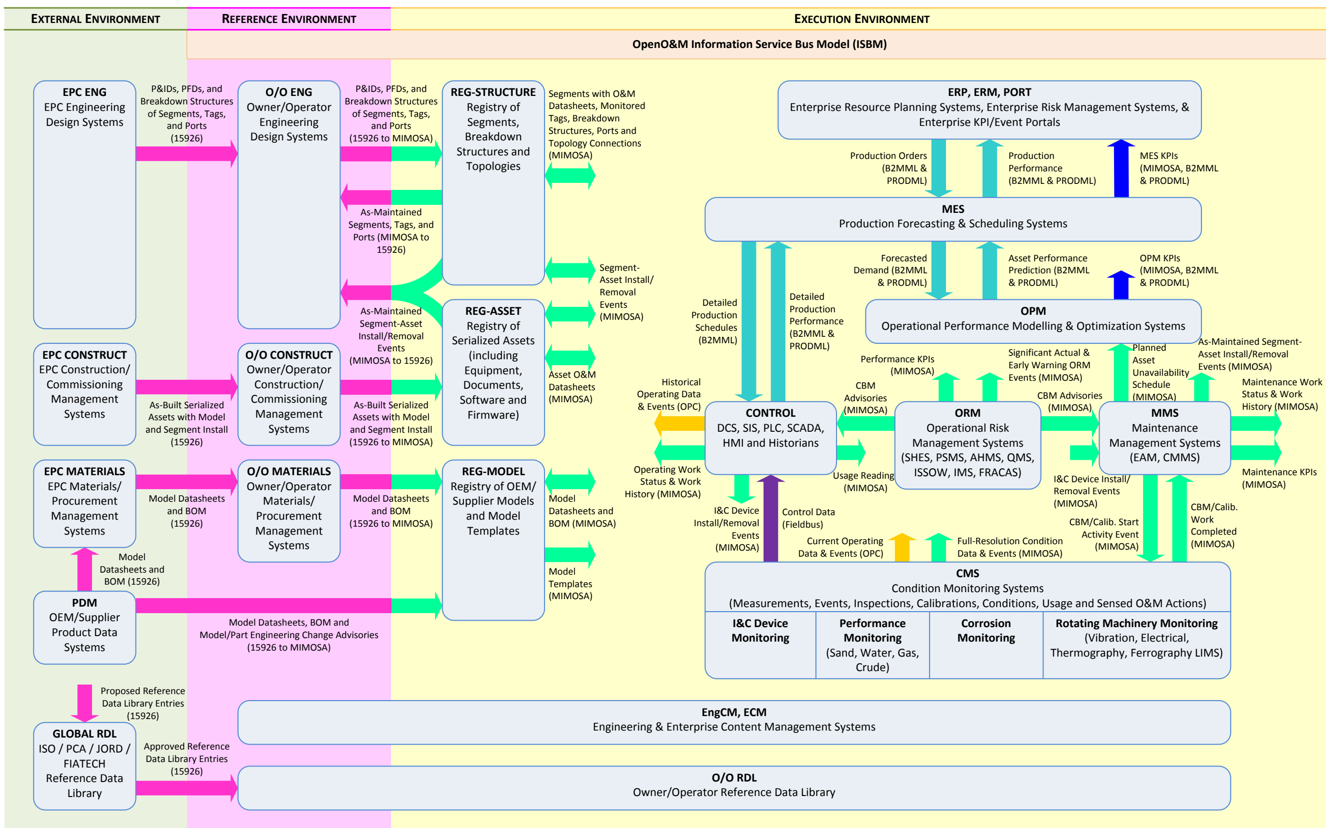

Figure 2 – OpenO&M System Landscape Data Flow Diagram

2 OpenO&M System Best Practices

2.1 OpenO&M Information Service Bus Model (ISBM)

The typical IT environment is a federation of systems. The term “federation” in the IT world is applied to collections of applications from multiple vendors that work together to support business processes. A federation may include separate applications for engineering, operations, maintenance, material management, order processing, supply chain management, customer relations, and production scheduling. Even when a company has selected a primary Enterprise Resource Planning (ERP) vendor, there is often a federation of legacy systems supporting unique business processes. Federated systems are expensive and integration efforts are often a major portion of IT budgets. An increasingly common method to reduce integration costs is an Enterprise Service Bus (ESB). These are not electronic busses in the sense of an electrical backplane bus. Instead, they are specialized applications that run on redundant servers and act as concentrators and distributors of data. Manufacturing systems that shall exchange data with business systems need to connect to the company's ESB.

Enterprise Service Buses are an architectural concept that includes proprietary web service standards, message based communications, message routing capabilities, and service discovery mechanisms. All of the ESB elements are normally based on XML technologies and web services. The data transfer element handles transporting XML messages from one application to another through the common server. This eliminates point-to-point interfaces and provides a centralized mechanism to manage and view inter-application communication.

Many enterprise IT suppliers offer ESBs; however, a few companies have also built their own ESB systems focused on their unique integration problems. Once a company has selected an ESB system, the IT department will attempt to have all applications that exchange data (including manufacturing applications) use the ESB instead of implementing point-to-point connections. Unfortunately, there is little interoperability between different ESB systems, so each application interface shall be customized for the chosen ESB.

The OpenO&M Information Service Bus Model specification provides a standard interface to any ESB or to any other message or file exchange system that offers guaranteed message and storage or caching of exchanged messages. Provider applications and consumer applications have a standard set of on-ramp and off-ramp SOA services to invoke that hide the specific ESB implementation as shown in Figure 3.

An OpenO&M-compliant ISBM system shall conform to the OpenO&M Information Service Bus Model 1.0 specification, including support for the SOAP web services defined in the associated WSDL. The bus is responsible to guarantee the delivery of messages to active subscribers and report any undeliverable messages to non-active subscribers.

Each ISBM-compliant system shall also define the level of support for security, reliability, guaranteed delivery, quality of service, and transformation capability. Message topics should follow the definitions found in the OpenO&M Use Case Specifications. Message content should comply with the published OpenO&M standard XML schema, such as MIMOSA CCOM-ML.

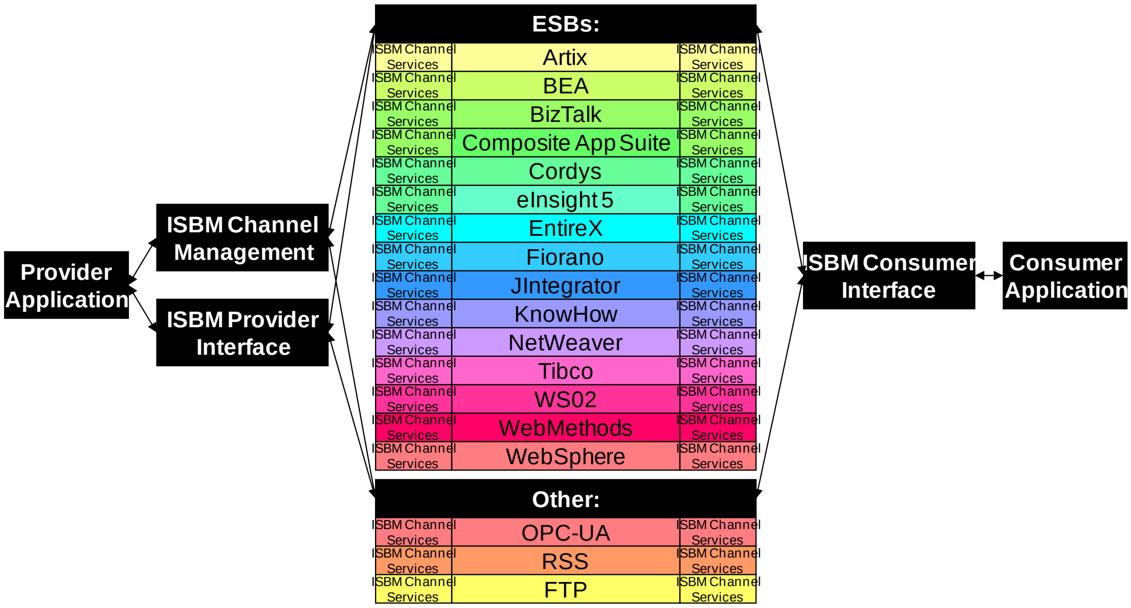

Figure 3 – ISBM Interfaces to Multiple ESBs and Other Message Bus Providers

2.2 OpenO&M Common Interoperability Register (CIR)

The purpose of the OpenO&M Common Interoperability Register specification is to provide a standards-based, vendor-neutral specification for a Web Service interface for interactions with an object identification registry. This supports the harmonization and standardized lookup of locally-unique identifiers for an identical object (including data dictionary classifications and attributes) used in multiple information systems. Each system typically maintains its own set of identifiers for its objects. For example, System A may use a set of auto-incrementing integers; System B may use strings; System C may use GUIDs. As the objects in each of these systems may be the same business object (albeit instantiated in three different systems), in order to link the three objects, the CIR is used to define an overarching identifier.

The specification details an XML language and a set of Web Services that OpenO&M systems shall support so that systems throughout an enterprise can harmonize and cross-reference their internal system objects. The server supports the harmonization of distinct, semantically-meaningful identifiers for the same tangible objects across multiple systems by generating a non-semantically meaningful 128-bit OpenO&M Common Interoperability Registry ID (CIRID). The CIRID shall be generated in compliance with the time-based generation mechanism of the Universal Unique IDentifier (UUID) definition found in ISO/IEC 9834-8:2005.

Each OpenO&M-compliant system shall utilize the CIR when creating new objects in their local system, associating their locally-unique identifier with the CIRID. Once all systems have registered their objects with the CIR and an equivalency matching process has been conducted, the CIR can be used to translate between identifiers. The OpenO&M-ISO 15926 Transform Engine uses the CIR to map identifiers to/from ISO 15926 to the CIRID. The best practice for MIMOSA CCOM-compliant registry systems is to natively utilize the CIRID GUID as the identification of MIMOSA CCOM objects.

2.3 OpenO&M – ISO 15926 Transform Engine

The OpenO&M System Landscape Data Flow Diagram defines the approved OpenO&M language to be used in a specific data interoperability scenario on the ISBM for the O&M domain (e.g., MIMOSA CCOM, OPC, WBF B2MML, Energistics PRODML) and ISO 15926 for the Engineering, Construction, and OEM Product Data domains. Rather than requiring all O&M systems to contain logic regarding the mapping between the different standards, the best practice is to utilize an OpenO&M-ISO 15926 Transform Engine that connects to the ISBM and converts from one language to another. This approach is used instead of enforcing one canonical data model on the service bus; however, only approved formats are allowed. This enables a vendor to choose a paradigm and format that aligns well to their native model. For example, an Engineering P&ID system could speak ISO 15926; an EAM system could speak MIMOSA CCOM; and a control system could speak OPC UA. This does not preclude a P&ID system from using MIMOSA CCOM for example, if it satisfies all the requirements.

2.4 Active O&M Registry Systems

2.4.1 General

This section defines the best practice for Active O&M Registry systems. These systems shall support the SOA on-ramps and off-ramps to at least one ISBM system which involve registry transactions of which it is the owner, as defined in the Use Case requirement documents. Each system shall provide to a potential O/O the scenarios the system supports.

The systems shall communicate on the ISBM utilizing the MIMOSA CCOM formats for the following registry components (as applicable):

- REG-DICTIONARY (Data dictionary of type classes)
- REG-TAXONOMY (Taxonomical classification structures composed of REG-DICTIONARY data dictionary entries)
- REG-STRUCTURE (Registry of Segments with Associated Data Sheets, Monitored Parameters, and Port Connections with Associated Breakdown Structures and Topology Configurations)
- REG-ASSET (Registry of Serialized Assets and Associated Data Sheets)
- REG-PRODUCT (Registry of Product Templates and Product Models with Associated Data Sheets)

This document defines the best practices for all of the above with the exception of the REG-PRODUCT component.

2.4.2 MIMOSA CCOM O&M Reference Data Dictionary (REG-DICTIONARY) Component

2.4.2.1 System Requirements

The MIMOSA CCOM O&M Reference Data Dictionary (REG-DICTIONARY) is a fundamental component of all Active O&M Registry systems. Each entry in the dictionary is assigned a unique, immutable GUID. Compliant registry systems shall support the import and export of dictionary entries for the following classification areas:

- Enterprise Types (EnterpriseType)
- Site Types (SiteType)
- Numeric Data Unit Classifications (UnitType)
- Enumerated Data Unit Classifications (UnitType with Valid Multiple EnumeratedItem)
- Segment Structural Process and Equipment Classifications (SegmentType)
- Segment Data Sheet Classifications (DataSheetType)
- Segment Port Connection Classifications (MeasurementLocationType)
- Segment Port Connection Metadata Classifications (AttributeType)
- Segment Constant Parameter Classifications (AttributeType)
- Segment I/O Variable Parameter Classifications (MeasurementLocationType)
- Segment Calculated Parameter Classifications (MeasurementLocationType)
- Asset/Product/Product Template Classifications (AssetType)
- Asset/Product/Product Template Port Connection Classifications (MeasurementLocationType)
- Asset/Product/Product Template Constant Parameter Classifications (AttributeType)
- Asset/Product/Product Template I/O Variable Parameter Classifications (AttributeType)
- Asset/Product/Product Template Calculated Parameter Classifications (MeasurementLocationType)
- Segment/Asset/Product Event Classifications (EventType)
- Breakdown Structure Classifications (BreakdownStructureType)
- Topology Classifications (TopologyType)
- Network Connection Types (NetworkConnectionType)

2.4.2.2 Best Practices

Imports and exports shall be in conformance with MIMOSA CCOM V3.2.3 schema and utilize the following CCOM Classes:

- AssetType
- AttributeType
- BreakdownStructureType
- DataSheetType
- EnterpriseType

- EnumeratedItem
- EventType
- MeasurementLocationType
- NetworkConnectionType
- SegmentType
- SiteType
- TopologyType
- UnitType

2.4.3 MIMOSA CCOM O&M Reference Taxonomies (REG-TAXONOMY) Component

2.4.3.1 System Requirements

The MIMOSA CCOM O&M Reference Taxonomies (REG-TAXONOMY) is the Active O&M Registry component that supports multiple taxonomies (each with a GUID) defined from entries defined in the MIMOSA CCOM O&M Reference Dictionary (REG-DICTIONARY). Compliant registry systems shall support the import and export of multiple taxonomies which referenced pre-defined entries from REG-DICTIONARY for the following classification areas:

- Numeric Data Unit Classifications (UnitType)
- Enumerated Data Unit Classifications (UnitType with Valid Multiple EnumeratedItem)
- Segment Structural Process and Equipment Classifications (SegmentType). Examples are:
  - ISA-95 or MIMOSA Equipment Class (Valve, Storage Tank, Process Separator, Tower, Heat Exchanger, Pump, Motor, Turbine, etc.)
  - ISA-95 Equipment Level (Enterprise Level, Site Level, Area Level, Process Cell Level, Work Unit Level, Unit Level, Production Unit Level, Production Line Level, Storage Zone Level, Storage Unit Level)
  - P&ID Structural Element (Valve Tag, Instrument Tag, Piping Tag)
  - Maintenance Work Breakdown “Functional Location” Classifications
  - Process Flow Diagram Node Classifications
- Segment Port Connection Classifications (MeasurementLocationType)
- Segment Port Connection Metadata Classifications (AttributeType)
- Segment Constant Parameter Classifications (AttributeType)
- Segment I/O Variable Parameter Classifications (MeasurementLocationType)
- Segment Calculated Parameter Classifications (MeasurementLocationType)
- Segment Parameter Operating Envelope / Alarm Region Classification (RegionType)

- Asset/Product/Product Template Classifications (AssetType)
- Asset/Product/Product Template Port Connection Classifications (MeasurementLocationType)
- Asset/Product/Product Template Constant Parameter Classifications (AttributeType)
- Asset/Product/Product Template I/O Variable Parameter Classifications (MeasurementLocationType)
- Asset/Product/Product Template Calculated Parameter Classifications (MeasurementLocationType)
- Segment/Asset/Product Event Classifications (EventType)

Imports and exports shall be in conformance with MIMOSA CCOM V3.2.3 schema and utilize the following CCOM Classes:

- Taxonomy class (subclass of Network)
- TypeConnection with reference to:
    - AssetType
    - AttributeType
    - BreakdownStructureType
    - DataSheetType
    - EnterpriseType
    - EnumeratedItem
    - EventType
    - MeasurementLocationType
    - NetworkConnectionType
    - SegmentType
    - SiteType
    - TopologyType
    - UnitType

2.4.3.2 Best Practices

Best practices for this taxonomy component of the Active O&M Registry include:

- Pre-load the system with all taxonomies provide by MIMOSA CCOM
- Support for CRUD (Create, Read, Update, and Delete) of the taxonomy entries
- Support for the ability to “copy and paste” taxonomy sections from one taxonomy to another

- Provide for the review and incorporation of multiple classification taxonomies from international and industry standards bodies such as ISO 15926, ISO 14224, POSC, PIP, API, ISO TR-20, ISA-95, NEMA, PPDM, OREDA, NOREK, and PRODML
- Support ISA-95 Equipment Level and Equipment Class segment classifications
- Provide configuration management as proposed changes to this taxonomy are made, reviewed, approved, activated, and distributed

2.4.4 REG-STRUCTURE Component

The REG-STRUCTURE component of the Active O&M Registry supports Segment instances for structural units, areas, systems, and equipment which are found on logical P&IDs, PFDs, and Breakdown Structures. Each Segment is assigned an immutable GUID and also the O/O assigned mnemonic identifier “tag”.

This component also supports the creation of multiple “data sheets” which utilize the MIMOSA CCOM DataSheet class (subclass of Network) to describe an unlimited number of segment parameters that are applicable to O&M systems. These include:

- Segment Constant Parameters and Values (Attribute). Examples of attributes includes:
  - Technical Attributes Relevant to O&M from an Engineering Specification Sheet
  - As-Designed/As-Refurbished Base Performance Characteristics
  - Defined Calibration Settings
  - Defined Configuration Settings
  - Values can be one of the following MIMOSA CCOM ValueContent types:
    - BinaryData
    - BinaryObject
    - Boolean
    - CDF
    - Coordinate
    - Enumeration
    - HDF5
    - MathML3
    - Measure
    - MonetaryAmount
    - NumericType
    - OCL
    - Percentage
    - Probability

  - SVG
  - TextType
  - TextWithUnit
  - URILink
  - UTCDateTime
  - UUID
  - XHTML
  - XMLAny

- Segment I/O Variable Parameter Classifications (MeasurementLocationType)
- Segment Calculated Parameter Classifications (MeasurementLocationType)

Each I/O variable and calculated parameter can also contain metadata, such as the associated unit of measure (UoM), valid min/max range, default value, monitored frequency rate, etc. These parameters can also contain parameter operating envelopes or state regions.

Segments also have contain structural Input/Output Port Connections which can later be hooked together to represent inputs/outputs in a network. The port connections can also contain metadata, such as the location of a port on a segment, a graphic representation, process flow contents, etc.

Breakdown structures are supported as CCOM BreakdownStructure entities (subclass of Network) with parent/child segment connections (SegmentConnection). Logical P&ID topologies are supported as CCOM Topology entities (subclass of Network) with input/output port connections (PortConnection) between segments. The same segment can be referenced in multiple topologies and multiple breakdown structures. This allows a segment to be organized in an engineering Plant Breakdown Structure, in an Operations ISA-95 Equipment Structure, and in a Maintenance Breakdown Structure.

Imports and exports shall be in conformance with MIMOSA CCOM V3.2.3 schema and utilize the following CCOM Classes:

- Enterprise
- Site
- InfoSource
- BreakdownStructure
- Topology
- SegmentConnection
- PortConnection
- Segment
- MeasurementLocation (Physical Port on a Segment referenced as a “from” or “to on a PortConnection)

- DataSheet (subclass of Network)
- SegmentConnection (for DataSheet)
- Segment (Group on a DataSheet)
- Attribute (Static Parameter with ValueContent associated with a DataSheet Group)
- MeasurementLocation (I/O Variable and Calculated Parameter on a Group on a DataSheet)
- Attribute (I/O Variable and Calculated Parameter Metadata)
- Attribute (Physical Port Metadata including PFD process input/outputs)

2.4.5 REG-ASSET Component

The REG-ASSET component of the Active O&M Registry supports serialized Asset instances of equipment. Each Asset is assigned an immutable GUID and also the O/O assigned mnemonic identifier “tag”.

This component also supports the creation of multiple “data sheets” which utilize the MIMOSA CCOM DataSheet class (subclass of Network) to describe an unlimited number of asset parameters that are applicable to O&M systems. These include:

- Asset Constant Parameters and Values (Attribute). Examples of attributes includes:
    - Technical Attributes Relevant to O&M from an OEM Specification Sheet
    - As-Installed Performance Characteristics
    - Calibration Settings
    - Configuration Settings
    - Values can be one of the following MIMOSA CCOM ValueContent types:
        - BinaryData
        - BinaryObject
        - Boolean
        - CDF
        - Coordinate
        - Enumeration
        - HDF5
        - MathML3
        - Measure
        - MonetaryAmount
        - NumericType
        - OCL

    - Percentage
    - Probability
    - SVG
    - TextType
    - TextWithUnit
    - URILink
    - UTCDateTime
    - UUID
    - XHTML
    - XMLAny
- Asset I/O Variable Parameter Classifications (MeasurementLocationType)
- Asset Calculated Parameter Classifications (MeasurementLocationType)

Each I/O variable and calculated parameter can also contain metadata, such as the associated unit of measure (UoM), valid min/max range, default value, monitored frequency rate, etc. These parameters can also contain parameter operating envelopes or state regions.

Assets are referenced in “install” and “removal” events (CCOM entity AssetOnSegmentEvent as a subclass of ActualEvent) associated with a Segment. Best practice is that a “remove” event for an Asset should have a corresponding earlier “install” event. The most recent AssetOnSegmentEvent, if an “install” event, will reference the Segment where an Asset is currently installed. The most recent AssetOnSegmentEvent, if a “removal” event, represents an uninstalled Asset.

Imports and exports shall be in conformance with MIMOSA CCOM V3.2.3 schema and utilize the following CCOM Classes:

- InfoSource
- Asset
- DataSheet (subclass of Network)
- SegmentConnection (for DataSheet)
- Segment (Group on a DataSheet)
- Attribute (Static Parameter with ValueContent associated with a DataSheet Group)
- MeasurementLocation (I/O Variable and Calculated Parameter on a Group on a DataSheet)
- Attribute (I/O Variable and Calculated Parameter Metadata)

2.5 Engineering Systems

For handover information related to plant breakdown structures, logical P&IDs and PFDs, engineering systems shall use ISO 15926 formats that conform to Red-level ISO 15926 compliance[1] for Semantic Precision, Standardization Level and Implementation Schema Type and Blue-level compliance for Implementation Interface Type. Only Blue-level compliance is required for Implementation Interface Type as the ISBM is prescribed as a transfer mechanism and an ISO 15926 Part 9 Façade is optional. The reference data and templates used for the exchange shall leverage ISO 15926 standardized templates and reference data. The Joint MIMOSA / PCA O&M SIG will work to properly incorporate MIMOSA CCOM concepts in ISO 15926 so that key O&M information can be unambiguously exchanged based on existing O&M information models.

The data required by the O&M Register must conform to MIMOSA CCOM using the CCOM Reference Data Dictionary (REG-DICTIONARY) and Taxonomy (REG-TAXONOMY).

2.6 Construction System

For turnover information related to serialized assets installed in segment structures, construction systems shall use ISO 15926 formats which conform to Red-level ISO 15926 compliance for Semantic Precision, Standardization Level and Implementation Schema Type and Blue-level compliance for Implementation Interface Type. Only Blue-level compliance is required for Implementation Interface Type as the ISBM is prescribed as a transfer mechanism and an ISO 15926 Part 9 Façade is optional. The reference data and templates used for the exchange shall leverage ISO 15926 standardized templates and reference data. The Joint MIMOSA / PCA O&M SIG will work to properly incorporate MIMOSA CCOM concepts in ISO 15926 so that key O&M information can be unambiguously exchanged based on existing O&M information models. The data required by the O&M Register must conform to MIMOSA CCOM using the CCOM Reference Data Dictionary (REG-DICTIONARY) and Taxonomy (REG-TAXONOMY).

2.7 Document Management System (DOC)

The Document Management System shall support URI references to specific documents in is repository. This allows Data Sheets to contain references to associated documents through attributes with URILink value types.

2.8 O&M Systems

All O&M systems that require breakdown structures or topologies shall support its population in a CCOM REG-STRUCTURE information package with associated CCOM REG-DICTIONARY and CCOM REG-TAXONOMY entries. Each system shall subscribe to the ISBM as a transfer mechanism as specified in OpenO&M Use Case specifications.

All O&M systems that require serialized asset information shall support its population in a CCOM REG-ASSET information package with associated CCOM REG-DICTIONARY and CCOM REG-TAXONOMY entries. Each system shall subscribe to the ISBM as a transfer mechanism as specified in OpenO&M Use Case specifications.

[1] https://www.posccaesar.org/wiki/ISO15926Primer_HowItWorks_ComplianceColors