

OpenO&M/MIMOSA and PCA Forum
Chevron, Houston, 24 Feb 2011

Information Integration in the Oil & Gas Industry

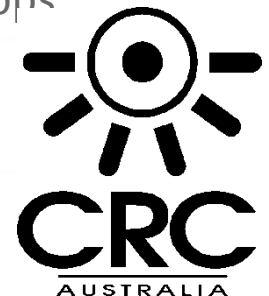
Markus Stumptner, Georg Grossmann



Overview



- CIEAM is a Collaborative Research Centre (CRC) that has been defining and shaping Engineering Asset Management (EAM) not only in Australia but globally since 2003.
- AU\$40M federal funding 2003-2009, extended by AU\$13M for 2010-2013 (CIEAM II)
- ~15 organisations actively participate in CIEAM, 12 core, several “third party”
- ~ 30 research projects, ~60 postgraduate students
- Links to US (IMS), China, Korea, Greece, Finland, Netherlands,
- CIEAM has developed an EAM Technology Roadmap
- CIEAM Education: professional development & training workshops
- CIEAM developed an integrated asset management strategic framework and with an accompanying point body of knowledge – CIEAM Wiki



CIEAM Participants



University of
South Australia



Rio Tinto Alcan



mainpac

CIEAM – Program Overview

- 5 Programs
 - Organisational Performance and Human
 - Integration and Interoperability
 - Capability Optimisation
 - Infrastructure Integrity
 - Sustainability and Climate Change
- Program 2 led by Prof. Andy Koronios
- 3 Themes
 - **Integration**
 - **Information Management**
 - **Knowledge Portal**



University of
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Interoperability-related CIEAM Projects

- SI301 “Integrated Reliability Management” 2003-2007
Service Oriented “Data Bridge”



- SI302 “Improved OPAL Monitoring and Management System” 2008-2010



- MD201 “CIEAM Integration Project” 2008-2010



- SI2100 “Standards-Based Interoperability for Asset Management Information Systems” 2010-2013



Integration Strategy



Unstructured Data Sources

Data Analysis Data Conversion & Transformation

Source Data
Hardcopy Native Files
2D & 3D Diagrams

Data Preparation
Data Analysis

Unstructured to Structured Data Transformation

XML

XML

Enterprise Content Management

Condition Monitoring

Asset Information Repository (AIR)

Enterprise Asset Management

MIMOSA Adapters

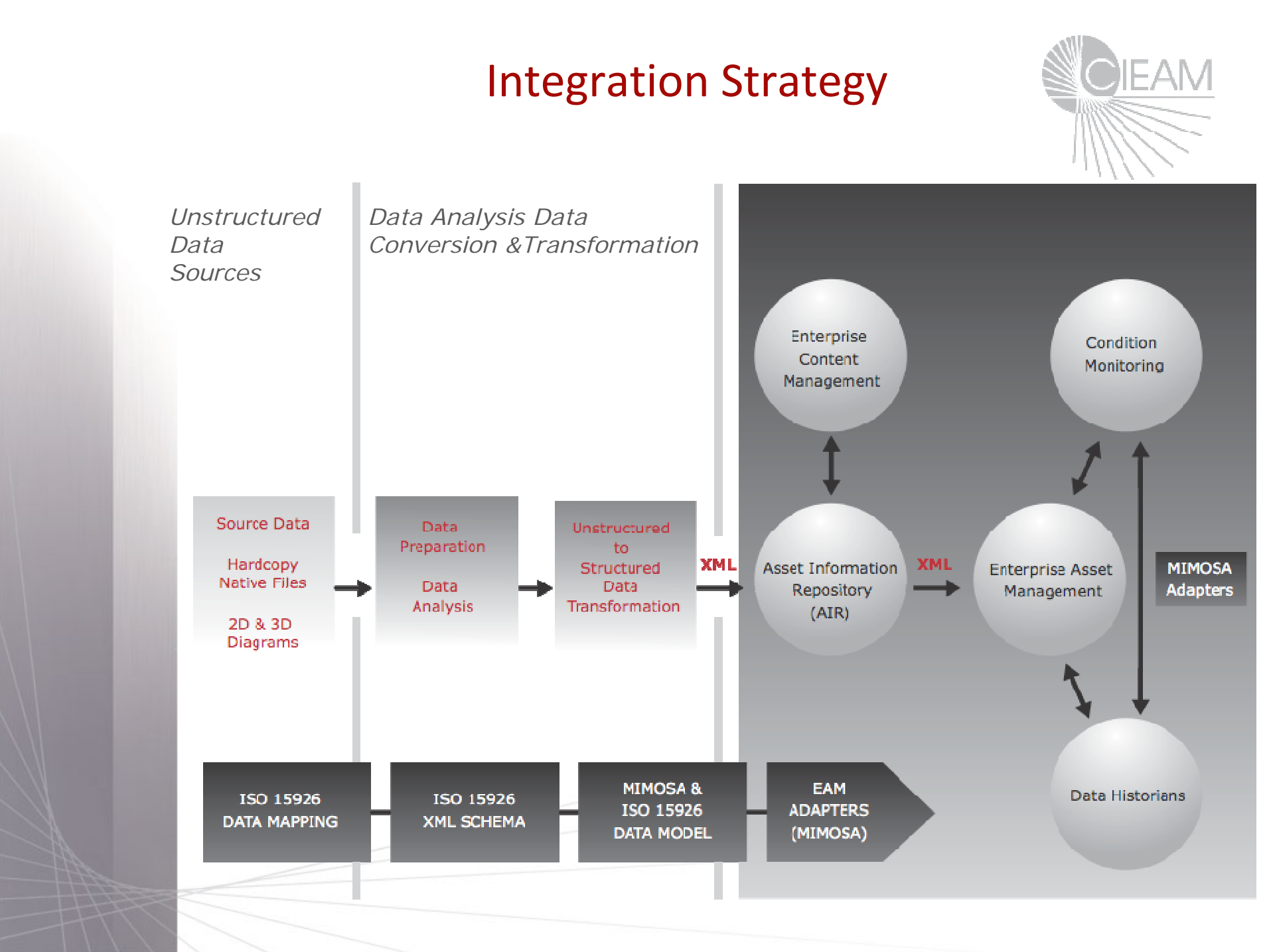
ISO 15926 DATA MAPPING

ISO 15926 XML SCHEMA

MIMOSA & ISO 15926 DATA MODEL

EAM ADAPTERS (MIMOSA)

Data Historians

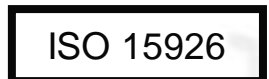


bp data model map

plant lifecycle



	engineering	procurement	construction	operation	capability
materials model	Material Specifications	Piping Specs. Material Master Catalog	Tool Catalog	Crude Assays MSDS	Spare Parts Lists Stores Inventory Reliability Data
equipment model	Vendor Catalogs	Bill of Material	As-installed Equipment Data	Operations Procedures Equipment & Alarm Configuration Operating Envelopes	Maintenance Procedures Job plans As maintained eqpt. data As operated reliability data
personnel model	Vendor & Engineering Contracts	Service Contracts	Contracted Service Contracts	Operator Unit knowledge	Trade skills register Root Cause Analysis Data
plant model	Design Requirements	Purchase Requests	Construction Schedule	Shift roster Daily plans Stock progression Price sets	Work requests TAR plans PM program Inspection schedule Maintenance roster Eqpt. Calibration Eqpt. Capability Forecast
actuals model	Calculations Project P&ID's	Purchase Orders Invoices	As-built P&ID's HAZOP minutes	Tug Monitoring Locations Data Tank inventories Lab results Bill of Lading Transfer Advices Operator Logs	TAR reports Fault data w Op Params Component tracking Inspection records Work Order History Work Permits



Problems

- Data exchange between different asset management tools
- Heterogeneities
 - Different interfaces (API)
 - Different data structures
 - Different standards

Problems cont'd

- Version control
 - Rapid development of new versions
- Data transformation
 - Laborious
 - Traditionally restarts from scratch for each tool
 - Transformation is hidden in code
 - Applicable only between two tools

Data Transformation Engine

- Open Data Transformation
- Model Driven Architecture™
(Model Driven Engineering)
- Model Driven Integration
 - Lifting data structures and transformation to conceptual level (object models)
 - Visual representation
 - Simulation
 - Monitoring data transformation

Transform Engine cont'd

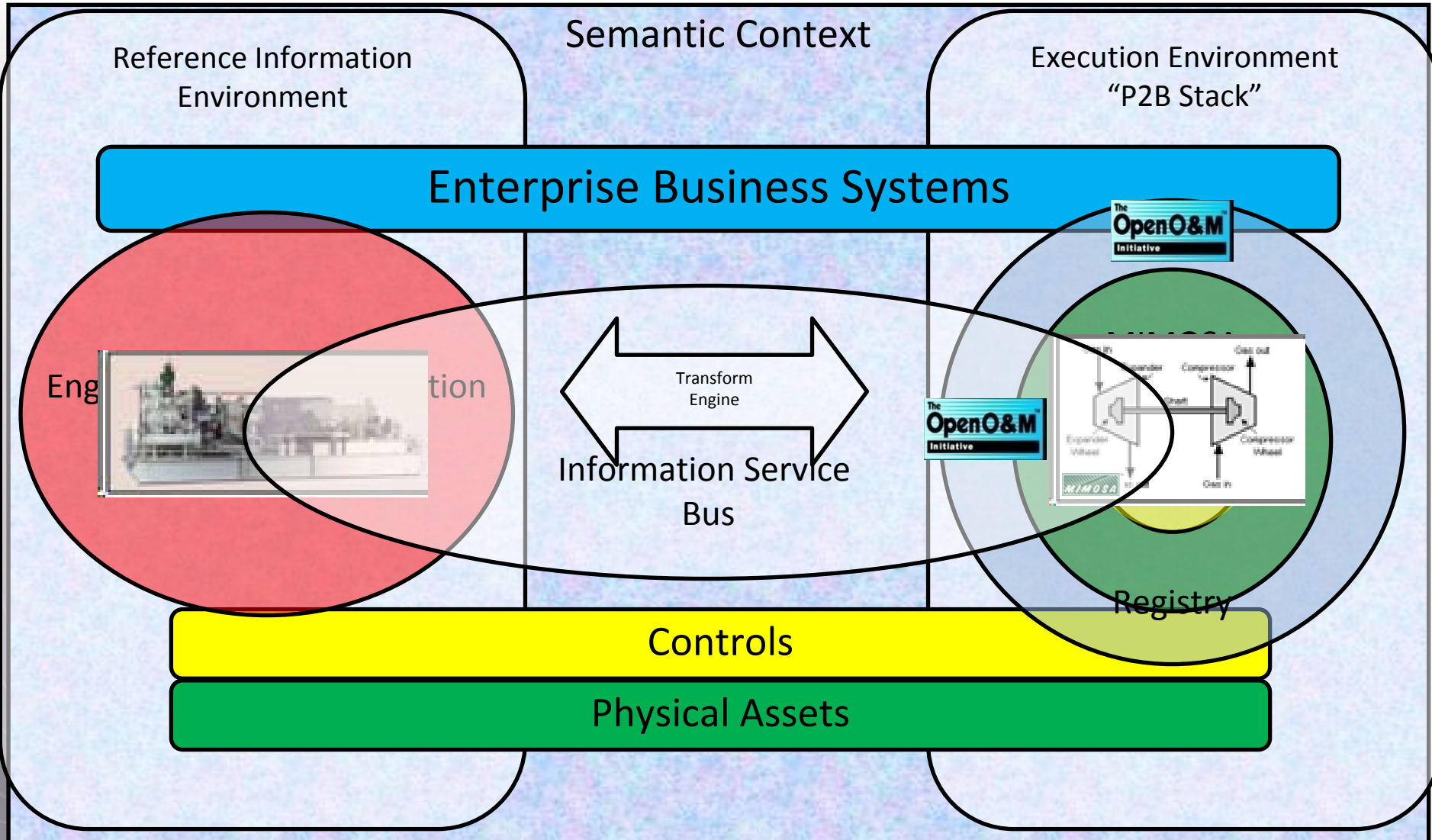
- Re-use of integration techniques through integration patterns and operators
- Support of various data formats
 - XML, RDF, WSDL, CSV, ...
- Support of various APIs
 - Web services, SAP, relational databases, ...

Motivation

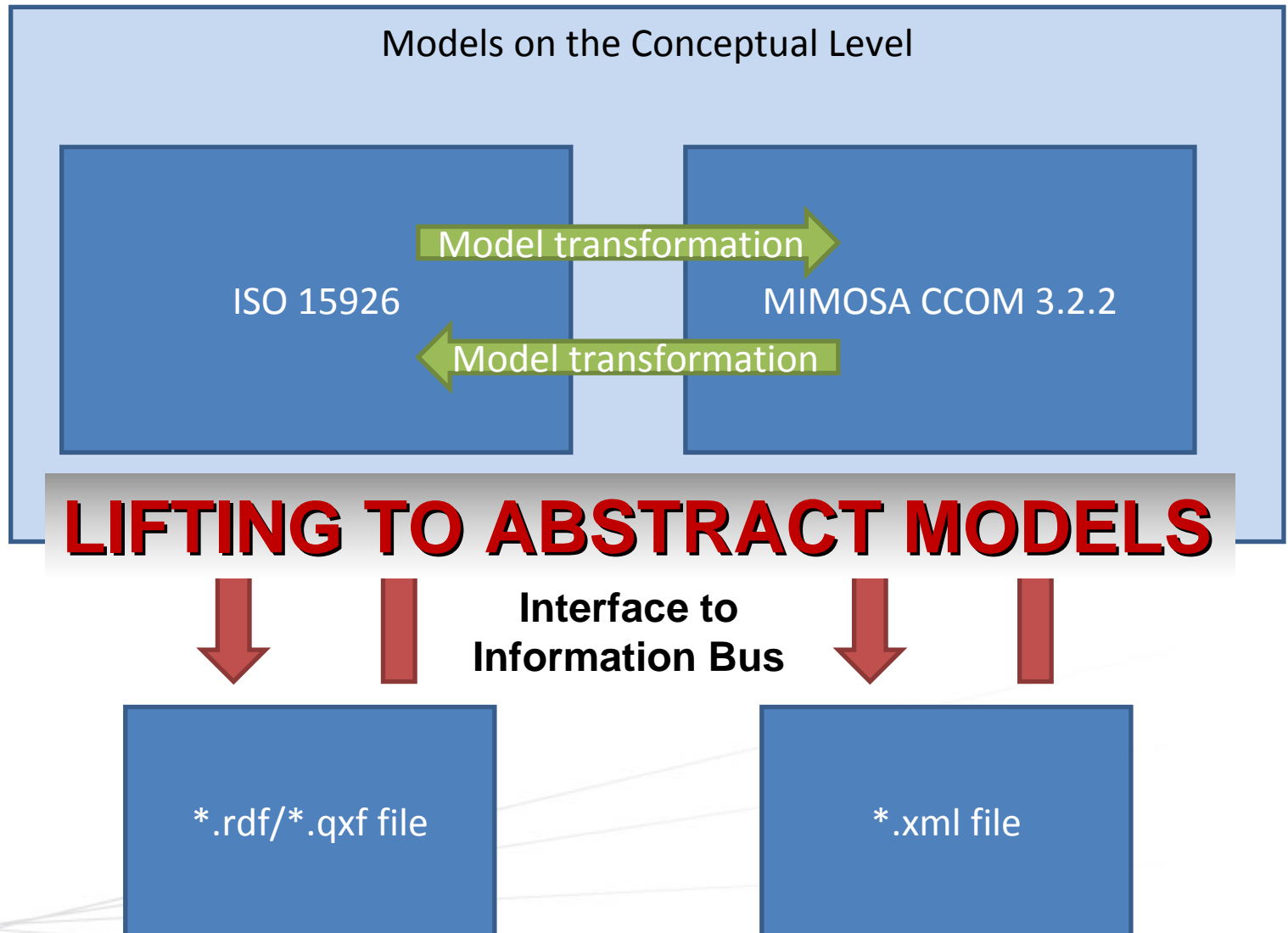
- Asset Management Use Case
 - Hand-over design documents to operational side (different ecosystems)
 - Bi-directional transformation required
 - Very complex data structures
- Challenges
 - Flexible data integration
 - Support for whole asset life-cycle
 - Light weight approach
 - Evolution of Asset Management Technology
 - Assets often live (far) longer than IT systems
 - New version of standards

Use Case

Based on The Safe Technology Roadmap™ for Interoperability



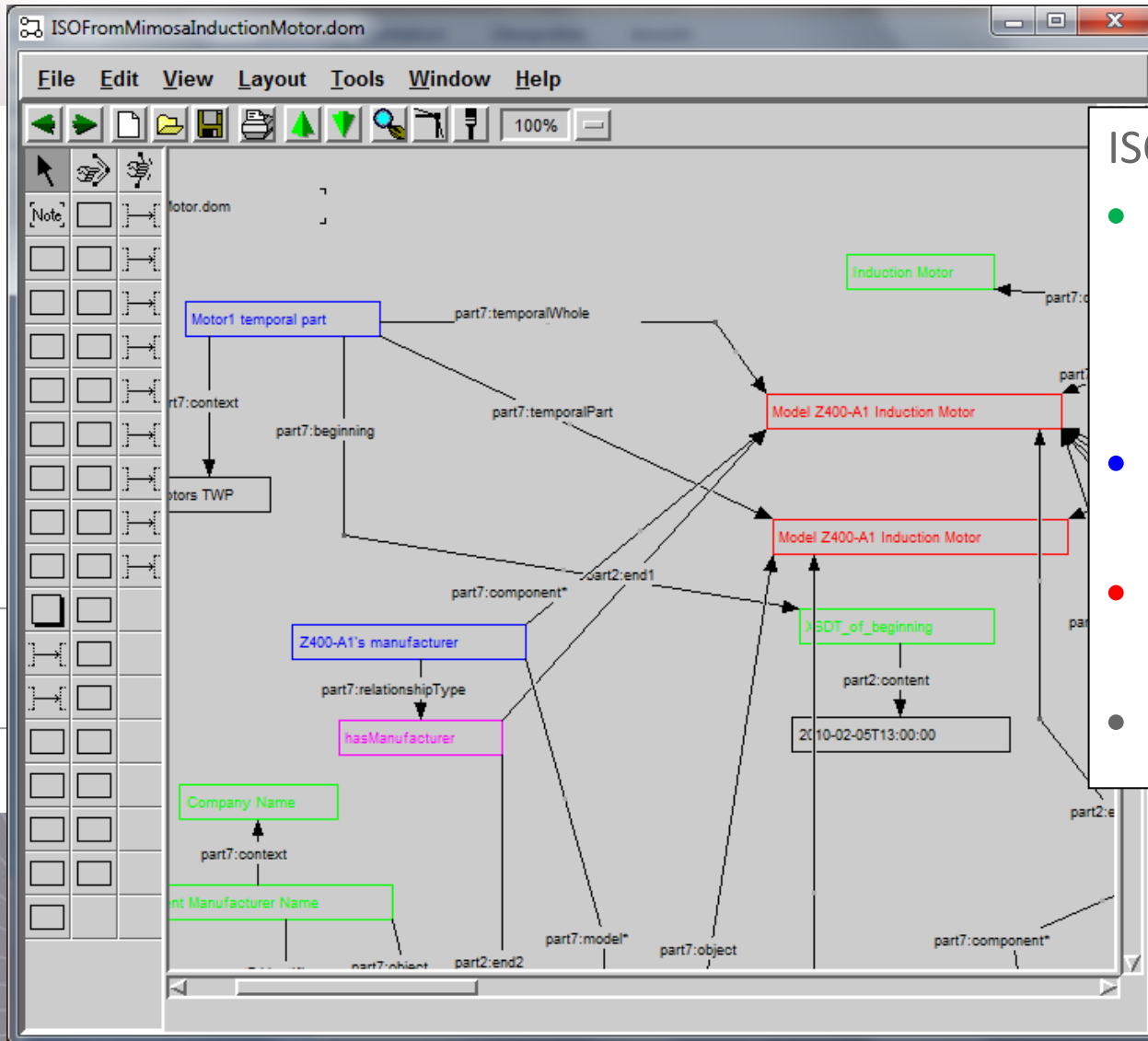
Transformation Concept



Use Case: Handover EPC to O&M



Use Case: Handover EPC to O&M

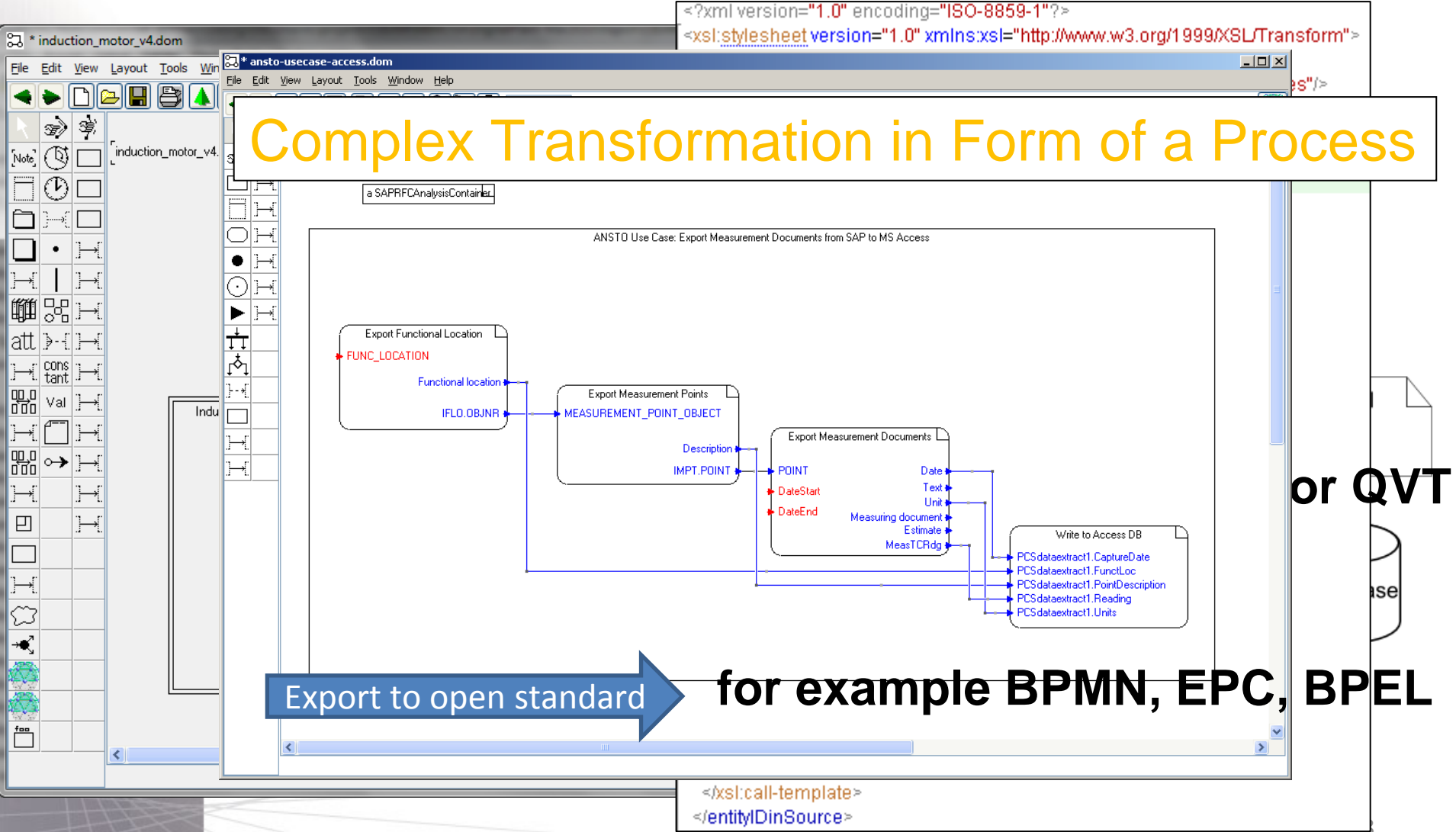


ISO 15926 Representation

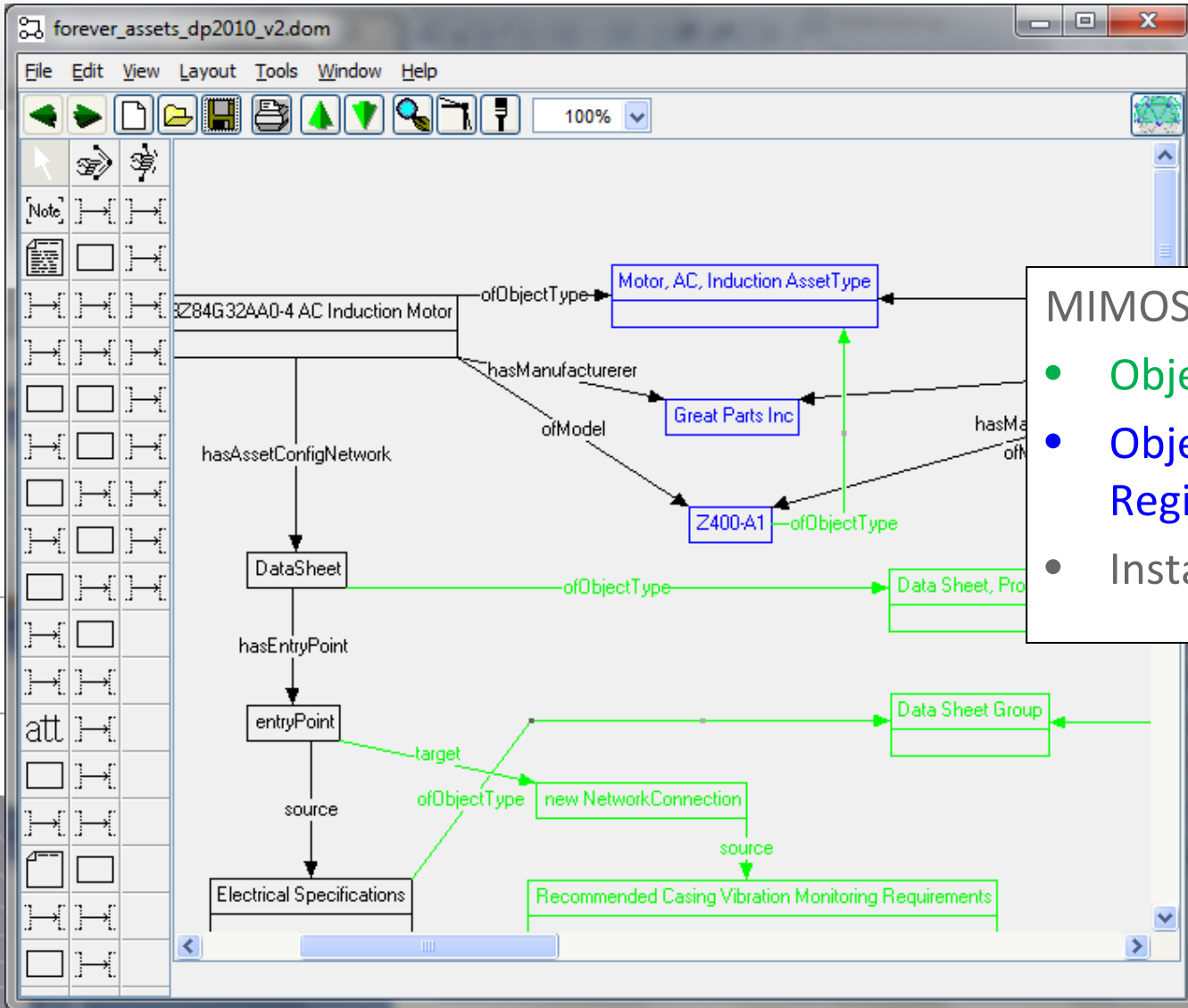
- Templates in Reference Data Library (RDL): Specialized Templates from ISO 15927-7
- Templates defined in ISO 15926-7
- Concepts defined in ISO 15926-2
- Values

Use Case: Handover EPC to O&M

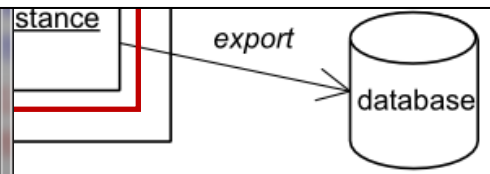
Complex Transformation in Form of a Process



Use Case: Handover EPC to O&M



- MIMOSA Representation
- Object Types in Topology
 - Object Types from Asset Registry
 - Instance Values



Use Case: Handover EPC to O&M

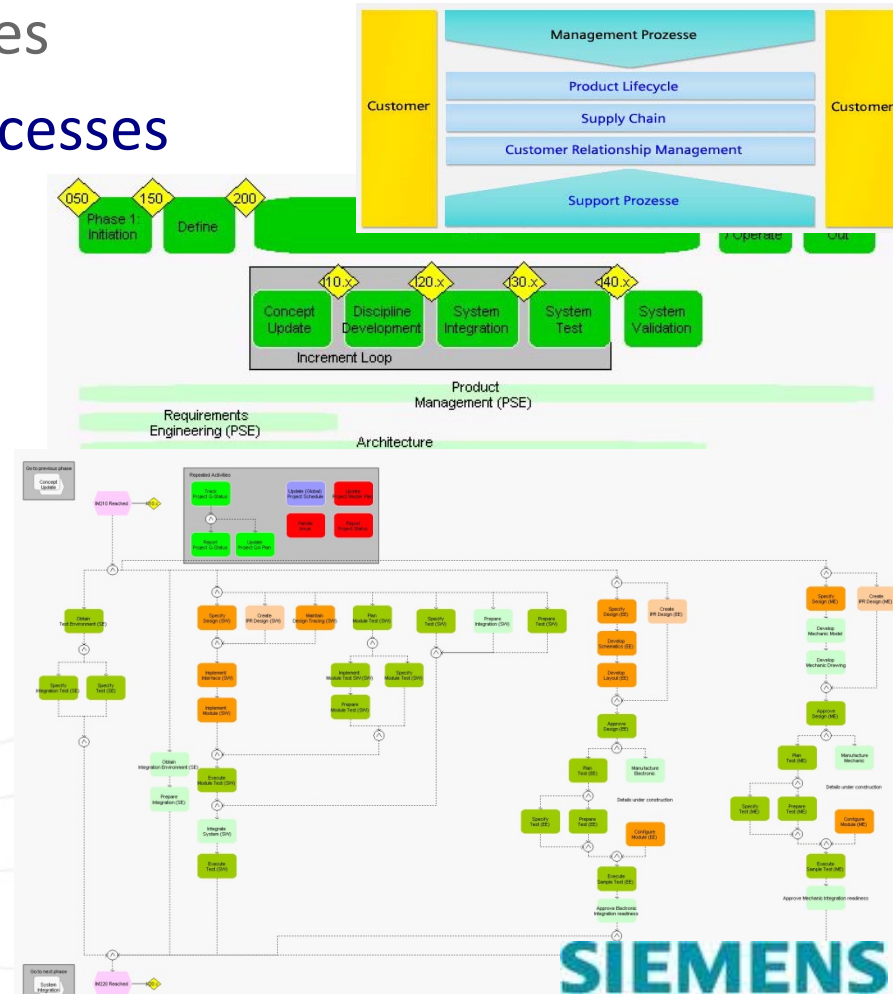
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<?xml version="1.0" encoding="UTF-8"?>
- <CCOMData xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://www.mimosa.org/osa-eai/v3-3/xml/CCOM-ML">
  - <Event>
    <guid>251ff520-e40e-11de-8a39-0800200c9a36</guid>
    <userTag>[2010-02-10 13:21:00] Motor installed on 01G-7A</userTag>
    <userName languageID="en-us">[2010-02-10 13:21:00] Asset: Model Z400-A1 S/N 3Z84G32AA0-4 AC Induction Motor installed on Functional Location:
      01G-7A Motor </userName>
    <utcLastUpdated>2009-07-03T13:30:00</utcLastUpdated>
    <statusCode>1</statusCode>
  - <ofObjectType>
    <guid>cd0e974d-7f11-4f3d-91a5-903138e75c76</guid>
    <idInSource>0000040500000001.1.1</idInSource>
    <sourceId>www.mimosa.org/CRIS/V3-3/sg_as_event_type</sourceId>
    <crisEntityTypeId>29</crisEntityTypeId>
    <userTag>Install Event</userTag>
    <userName>Install Event</userName>
    <utcLastUpdated>2006-10-15T18:00:00.00000000</utcLastUpdated>
    <statusCode>1</statusCode>
  - <registrationInfoCollection xsi:type="InfoCollection">
    <guid>cd0e974d-7f11-4f3d-91a5-903138e75c76</guid>
    <idInSource>0000040500000001.1</idInSource>
    <sourceId>site_database</sourceId>
  </registrationInfoCollection>
</ofObjectType>
- <forCCOMObjectWithEvents xsi:type="Segment">
  <guid>abcf6703-4d26-4f0b-8f0e-c4d704da514a</guid>
  <userTag>01G-7A Motor</userTag>
  <userName>01G-7A Motor</userName>
</forCCOMObjectWithEvents>
- <hasMonitoredObject xsi:type="Asset">
```

Aims and Benefits

- **Automation** of semantic integration
- **Flexibility** through **open transformation** across ecosystems
- **Standards-based** transformation
- **Reusable transformation** through library of mapping operators
- **Transformation process** for complex transformations
- **Extensibility** allows dynamic changes
- **End-user friendly** tool guidance with abstract visual notations for non-IT-experts

Business Process Engineering

- Analysis and configuration of large-scale business processes
- Tailoring of generic (sub)processes to specific projects
- Instantiation of processes for execution
- Artefact tracking, execution monitoring, adaptation and validation



Library of Integration Operators

