IT Architecture SIG

Stavanger 2013-05-27

Frode Myren, DE, Executive Architect, IBM

Tore Christiansen, Technical Advisor, POSC Caesar Association

POSC Caesar Association

MIMOSA

Agenda

- **Background for the SIG**
- **The architecture**
  - framework
  - dimensions
  - reference models
  - application examples
- **Summary and next steps**

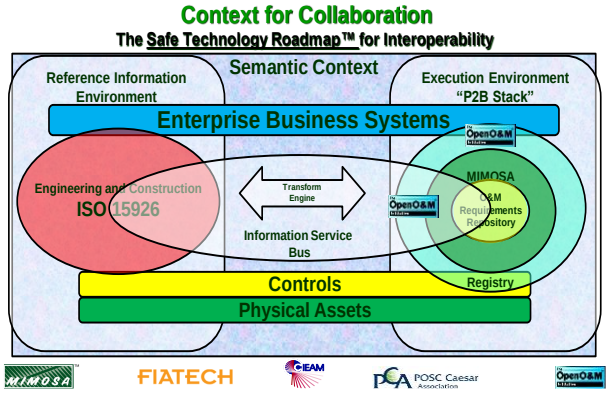
Background for the SIG

- Joint SIG between MIMOSA and POSC Caesar
- Key stakeholders:
- Alan Johnston, MIMOSA
- Cliff Pedersen, MIMOSA
- Nils Sandsmark, PCA
- Thore Langeland, PCA

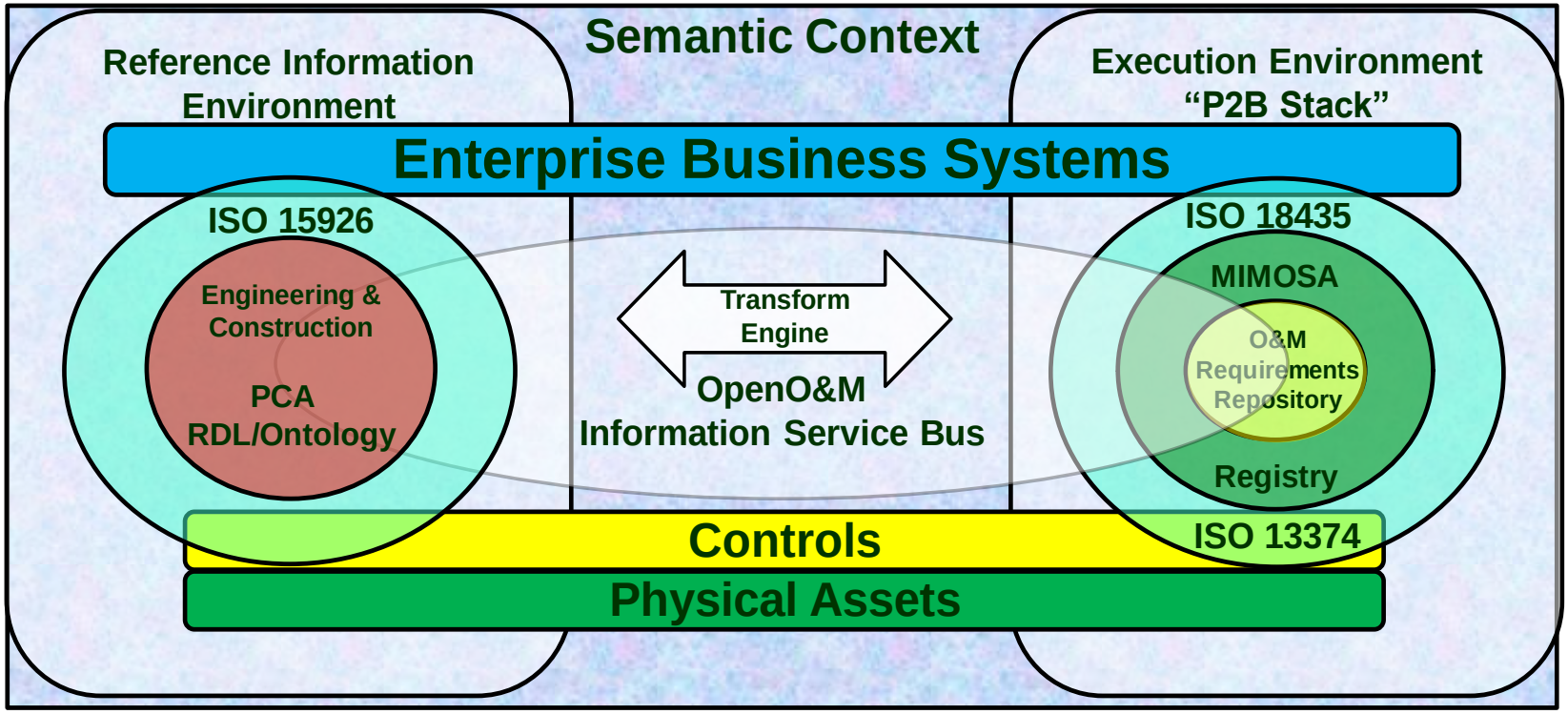
- Aim to complete and issue a first version this year

Mandate Purpose

- Harvest IT architecture
- At logical level, with examples of possible implementation architectures
- Including information access
- In alignment with jointly developed top-level architecture →
- In collaboration with Joint O&M SIG and other appropriate parties
- Communicate how PCA Ontology/PCA RDL, MIMOSA, OpenO&M and other standards are being used and interlinked
- Ensure industry relevance



Context for Collaboration



ISO TC 184/WG 6

POSC Caesar Association

MIMOSA

Relationship to other SIGs and broader community

- **Operations and Maintenance SIG –**
  Chair: Markus Stumptner, University of South Australia
- **Instrument and equipment SIG –**
  Chair: Ravindra Grampurohit, Emerson
- **MMT - Models, Methods and Tools SIG –**
  Chair: Lillian Hella, PCA
- **Relevant best practice patterns in the broader community**

Deliverables

Link up to projects where more detailed work is done
Contribute based on shared interests

Past ITA patterns

Future ITA patterns

NWR?

Statoil?

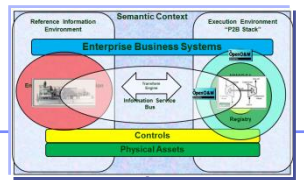
EPIM?

PCA SIGs?

OpenO&M SIGs?

Joint O&M SIG

Joint ITA SIG



time

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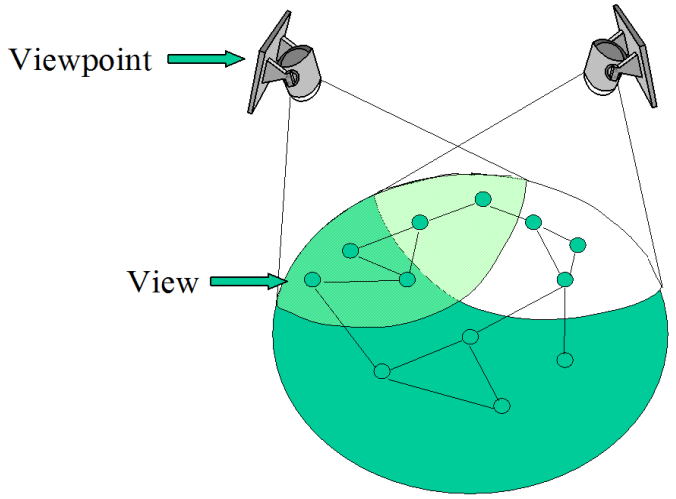
ARCHITECTURE

Architecture: The purpose and motivation

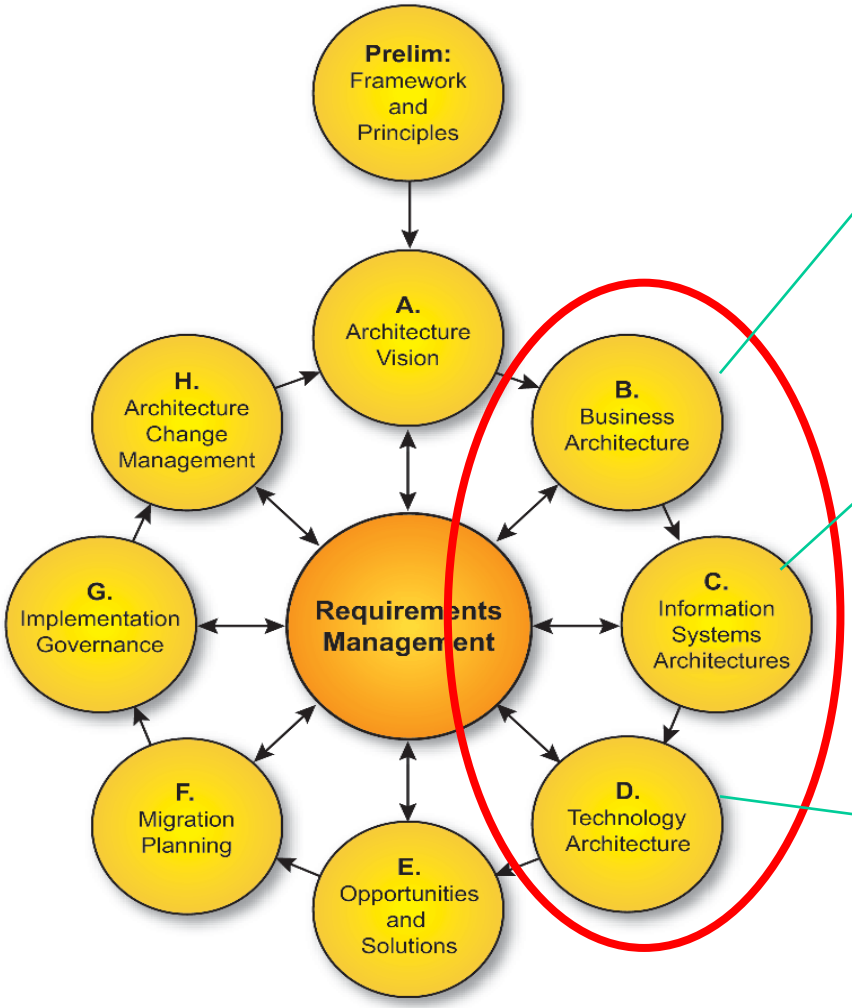
- **Enterprise systems have to meet requirements of many different types**
- **Business Context**
- **People – process – organization**
- **User stories/Use cases**
- **System Context**
- **Data Architecture**
- **Application Architecture**
- **Component Models**
- **Operational Models**
- **Physical Architecture**

It is difficult to keep everything in focus, and too many system architectures are only about technology

How can architecture help create systems that better meet their requirements throughout the life-cycle?



The Open Group Architecture Framework
Architecture Development Method - TOGAF ADM



- **Business Context**
- People – process – organization
- User stories/Use cases
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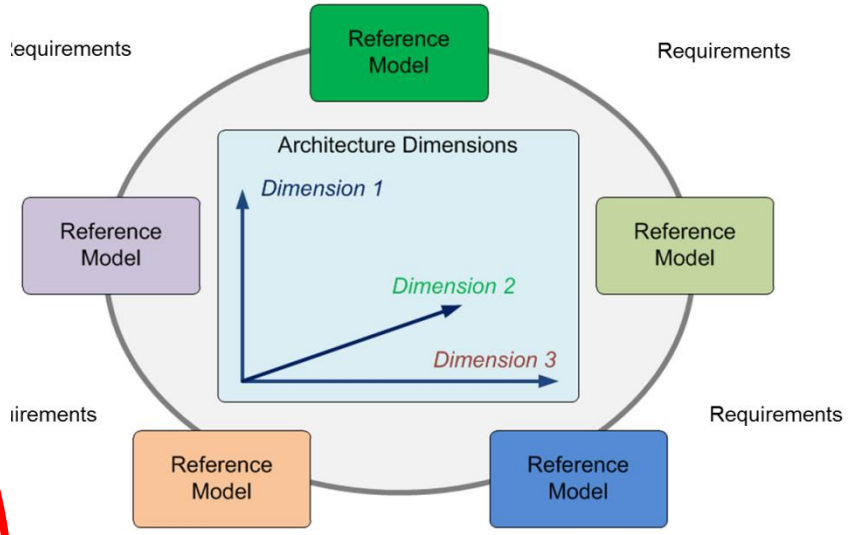
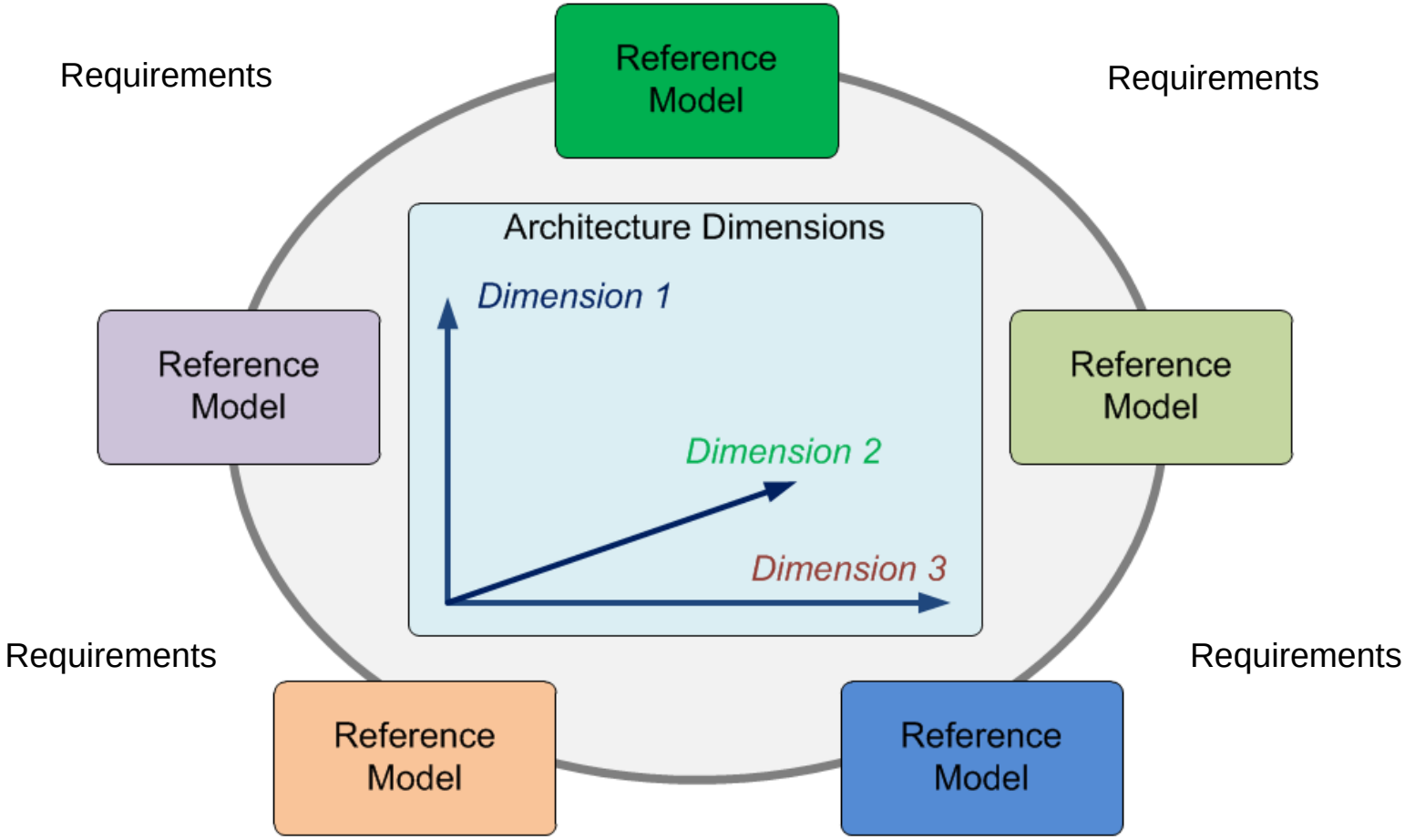
- Data Architecture
- Application Architecture
- Component Models
- **Operational Models**
- Physical Architecture

TOGAF ADM

PCA-MIMOSA Architecture Framework

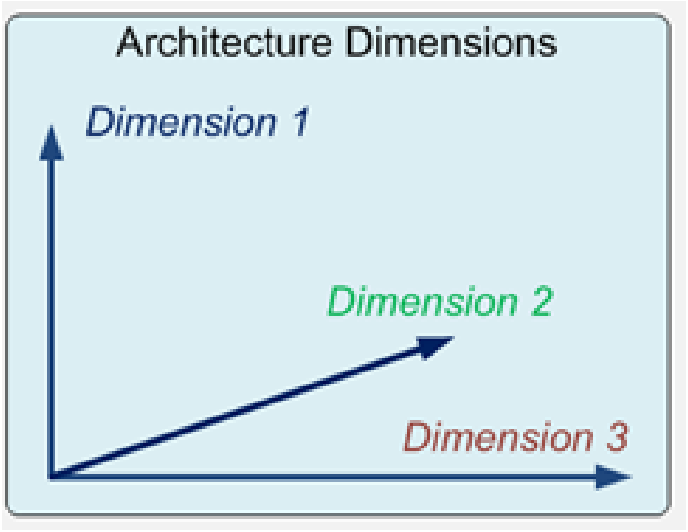


PCA-MIMOSA Architecture Framework



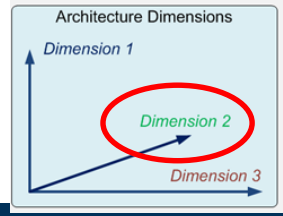
Architecture: The dimensions

- The Business Context Dimension
- The Technology Configuration Dimension
- The Knowledge Content Dimension

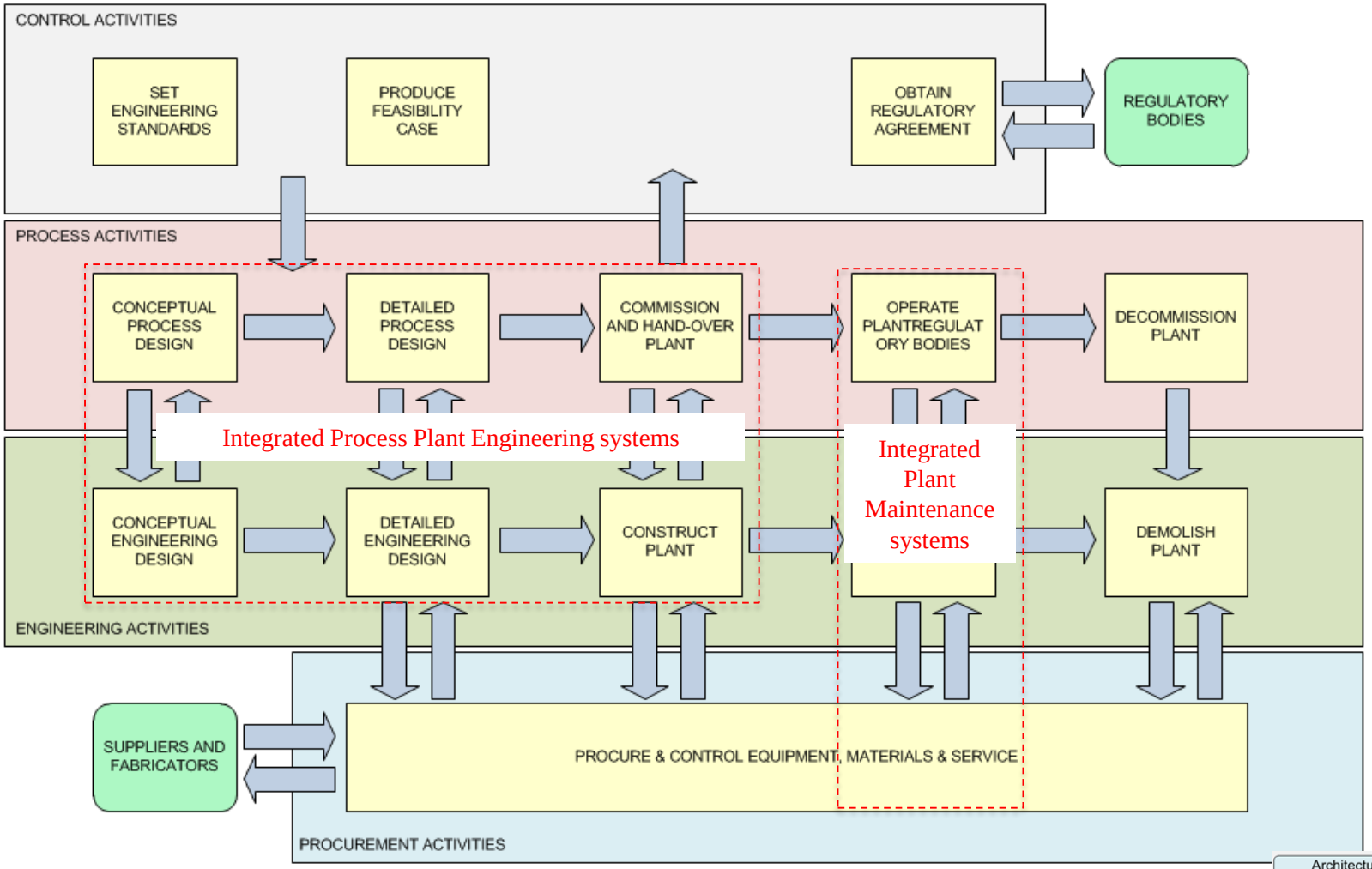


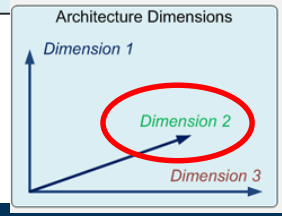
Architecture: The Business Context Dimension

- "Why is the system there in the first place"
- A lifecycle view of system operation
- PISTEP lifecycle model
- Engineering and Process value chain
- Control and Procurement supply chain
- Scoping of information lifecycle management



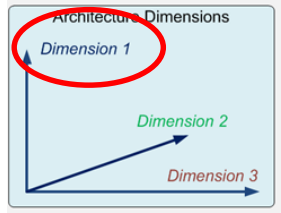
PCA-MIMOSA Business Context Dimensio



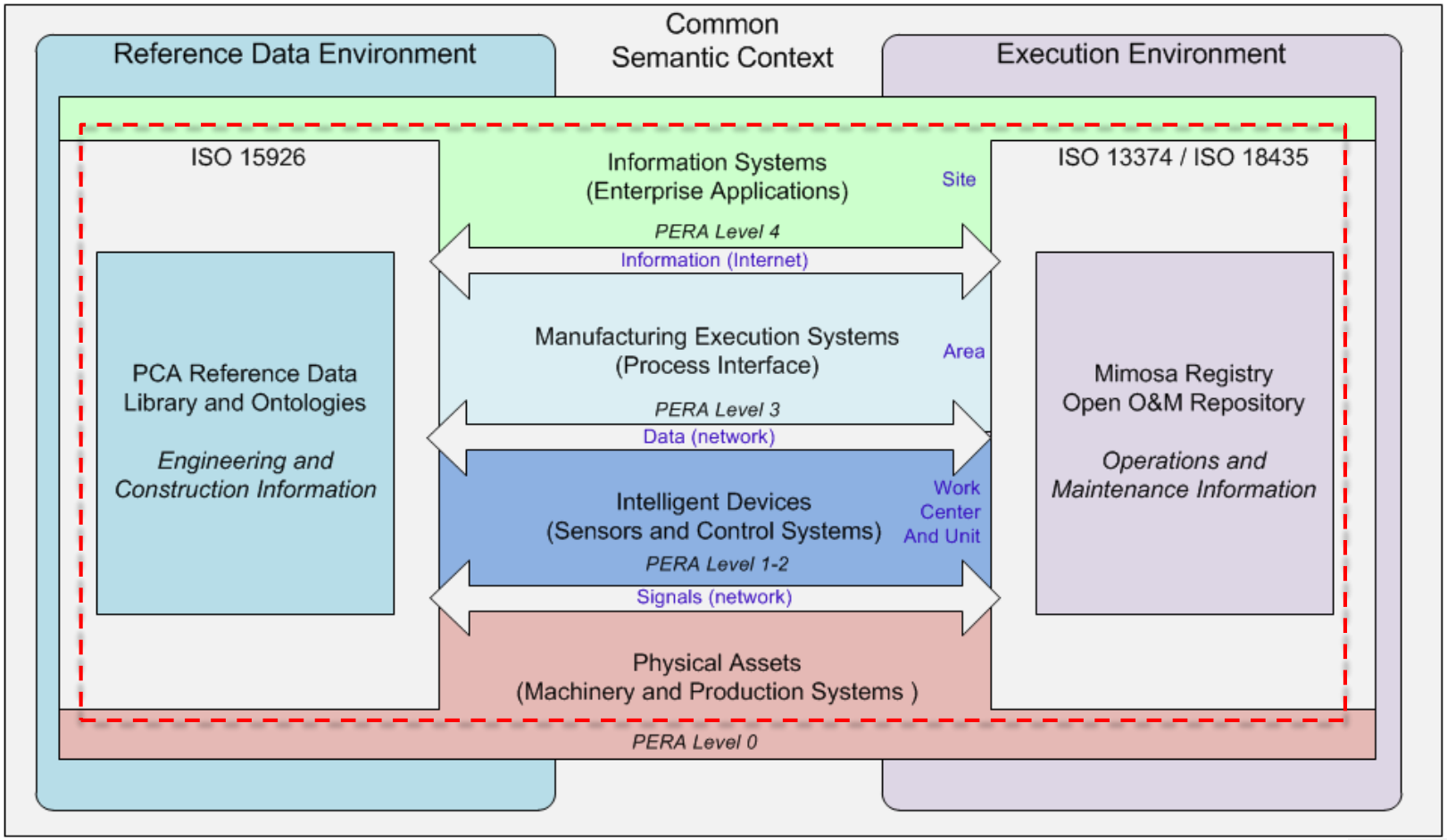


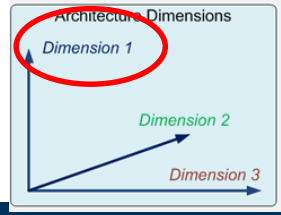
Architecture: The Technology Configuration Dimension

- "How is the system layered and populated"
- A topological view of system structure
- Purdue Enterprise Reference Architecture
- Physical environment and production system
- Intelligent devices, manufacturing control
- Enterprise applications



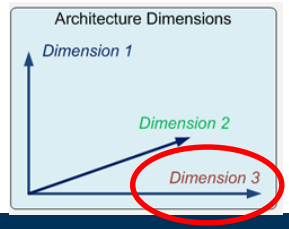
PCA-MIMOSA Technology Configuration Dime





Architecture: The Knowledge Content Dimension

- "What does the system know"
- A topical view of domain knowledge
- Application domain specific terms
- ISO 15926 Data Model
- PCA Reference Data Classes
- MIMOSA Reference Terms and Models



PCA-MIMOSA Knowledge Content Dimensio

Domain Specific Nomenclatures

Health, Safety & Environment

Seismic

Reference Data for Oil & Gas applications

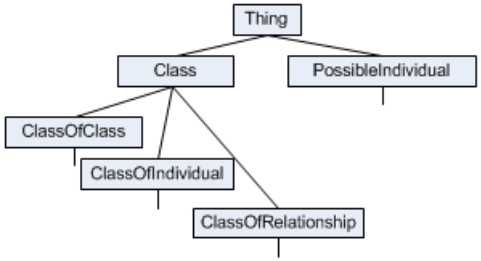
Drilling & Completion

Reservoir & Production

Operations & Maintenance

Logistics & Transportation

ISO 15926 Data Model

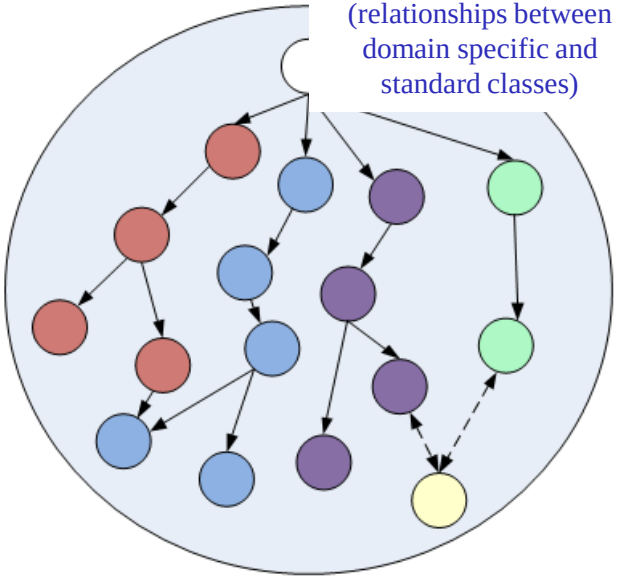


Structure and add to PCA Reference Data Library (RDL)

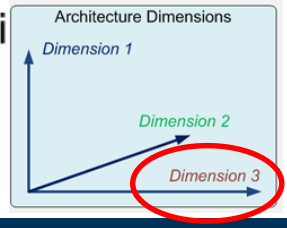
Determine entity type

PCA (Oil & Gas & Process Industry Ontologies and Reference Data)

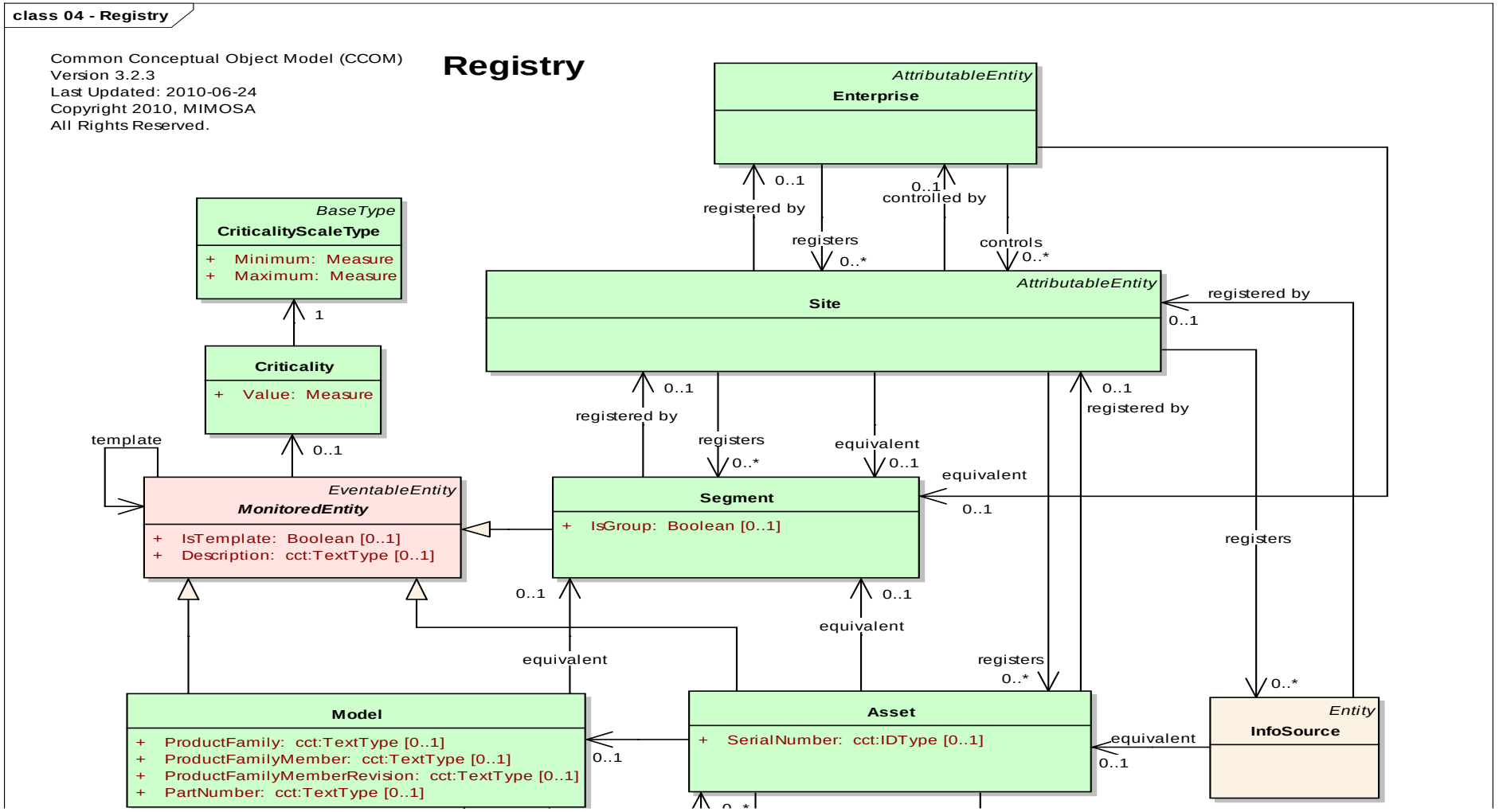
Production Control Ontology (relationships between domain specific and standard classes)



Determine specialization and other relationshi

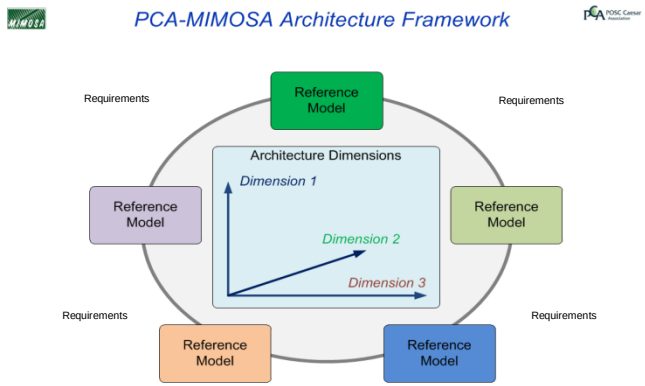


MIMOSA Common Conceptual Object Model (CCOM)

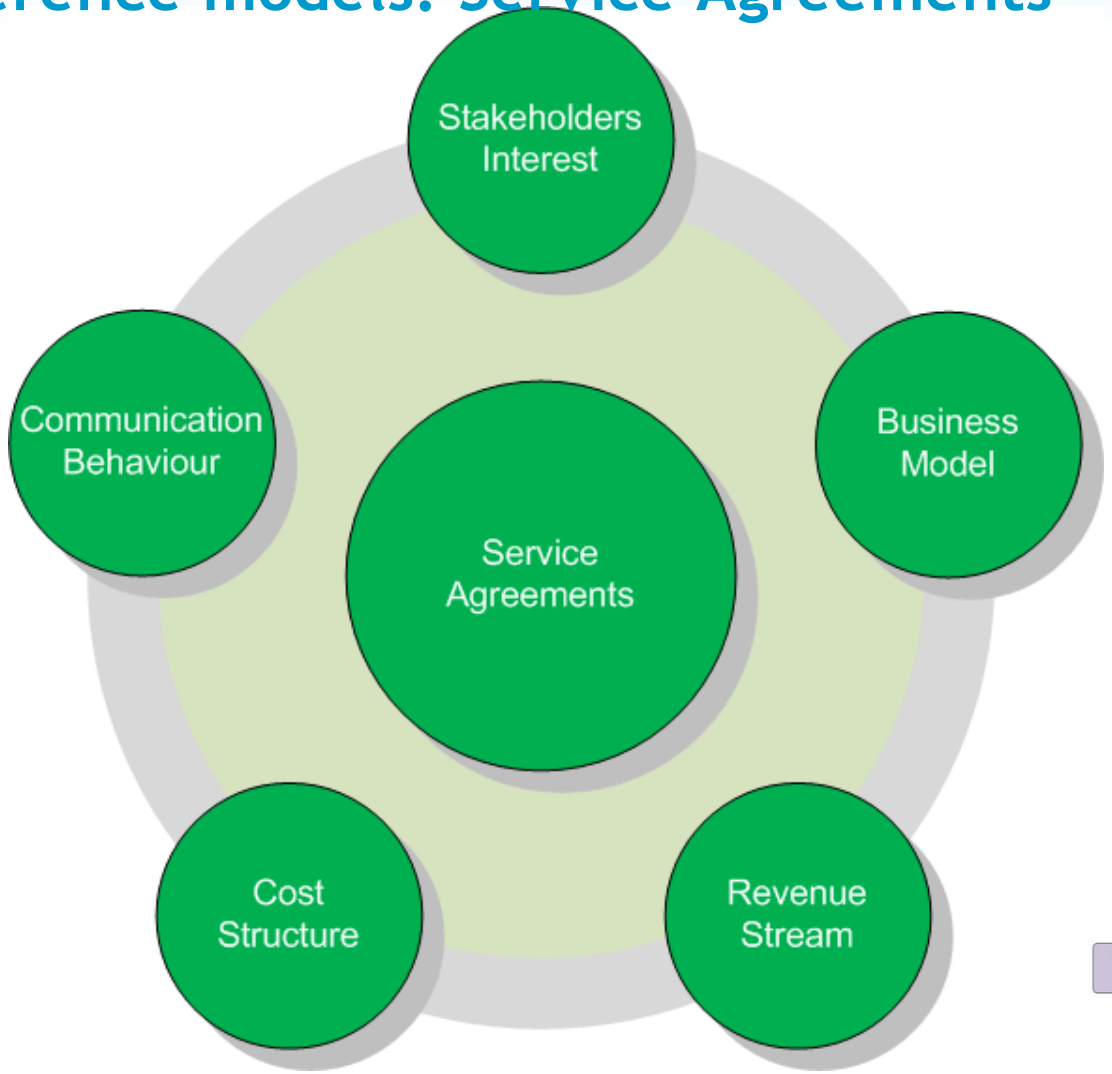


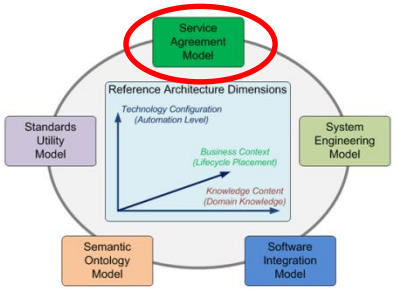
The reference models

- **Stakeholder Agreements**
  Business Model, revenue & cost, interests, behavior
- **Systems Engineering**
  Control, manufacturing and information system configuration
- **Software Integration**
  Platform, programming paradigm, integration, storage
- **Semantic Ontology**
  Domain and scope, model paradigm and constructs
- **Standards Usage**
  Representation, meta-data, data quality and security, ref. data

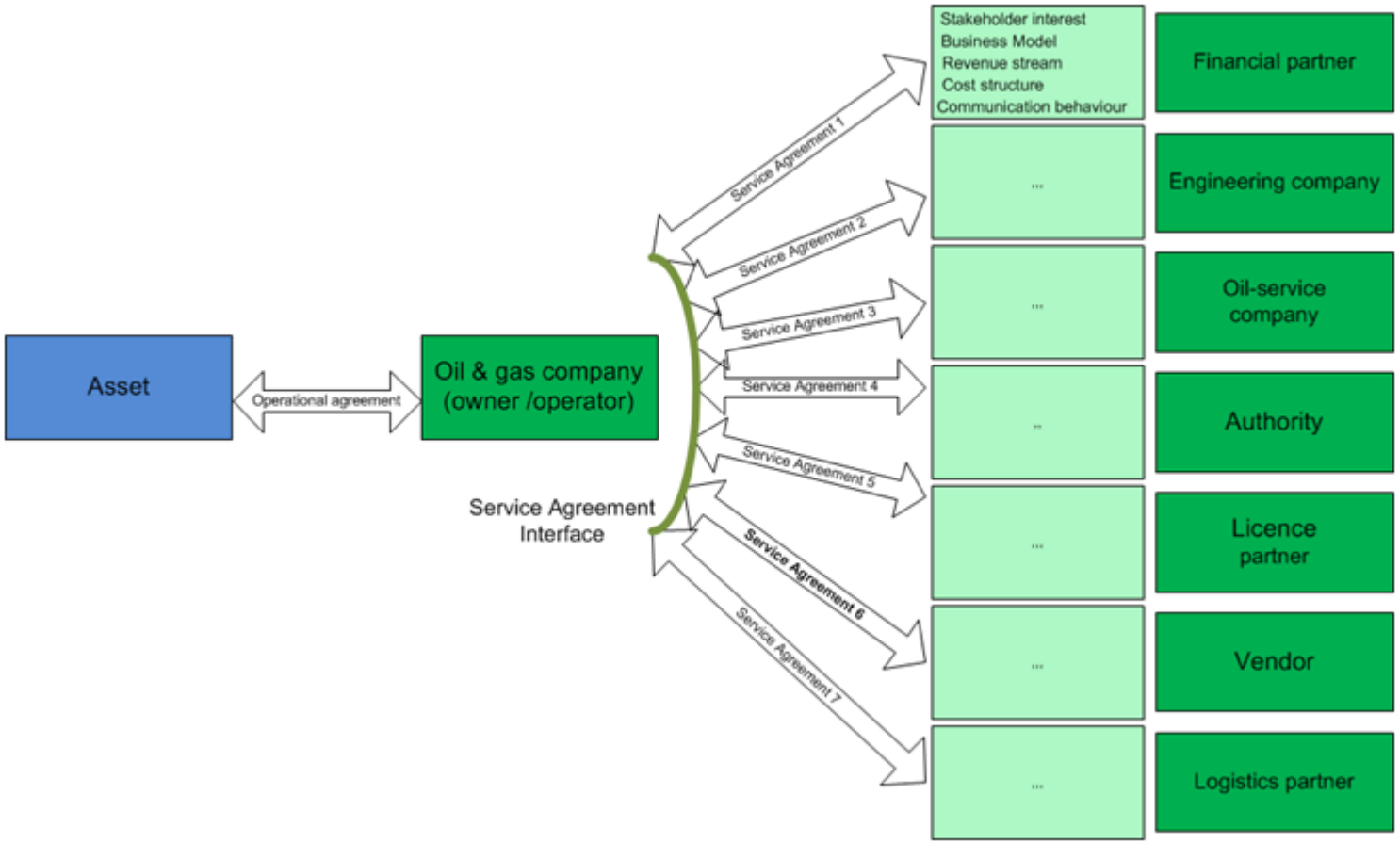


The reference models: Service Agreements

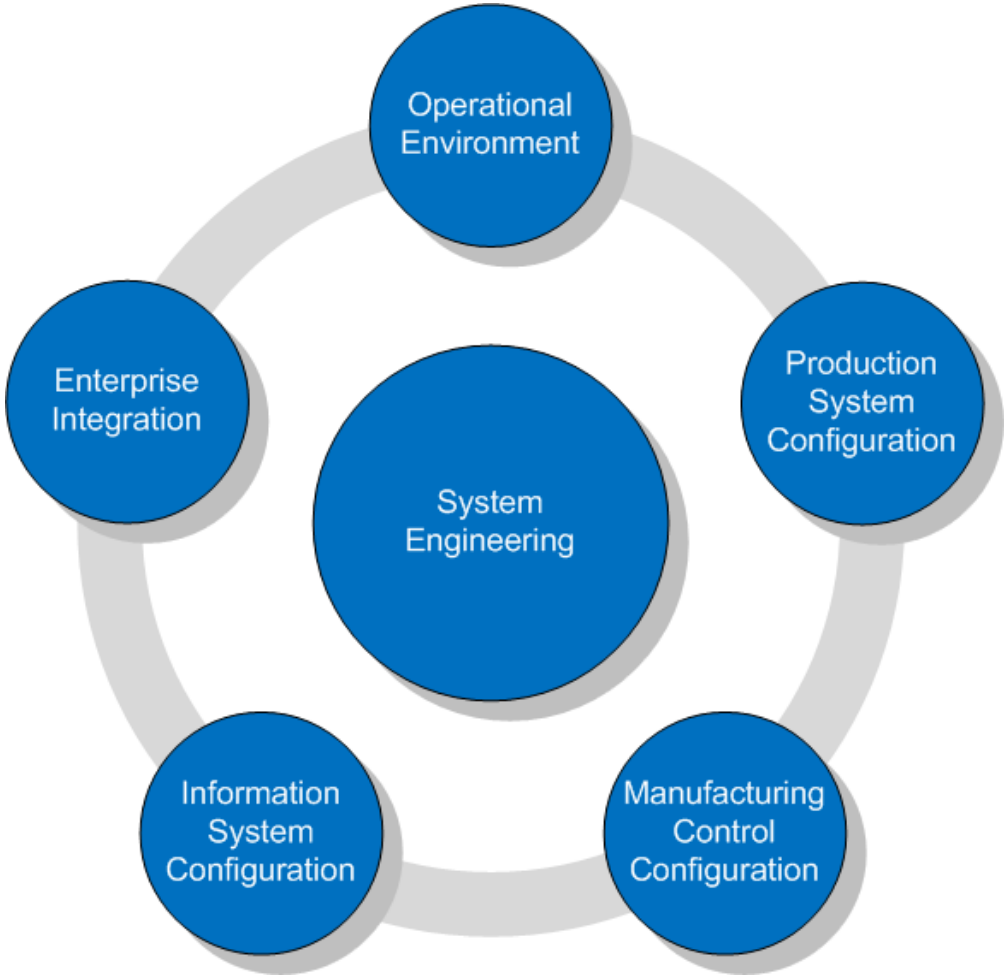


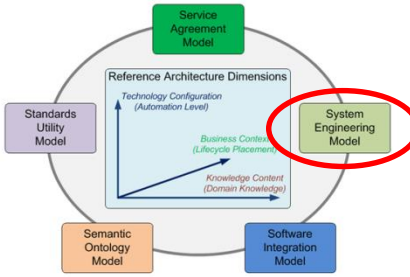


The reference models: Service Agreements – example: Stakeholders interest - example

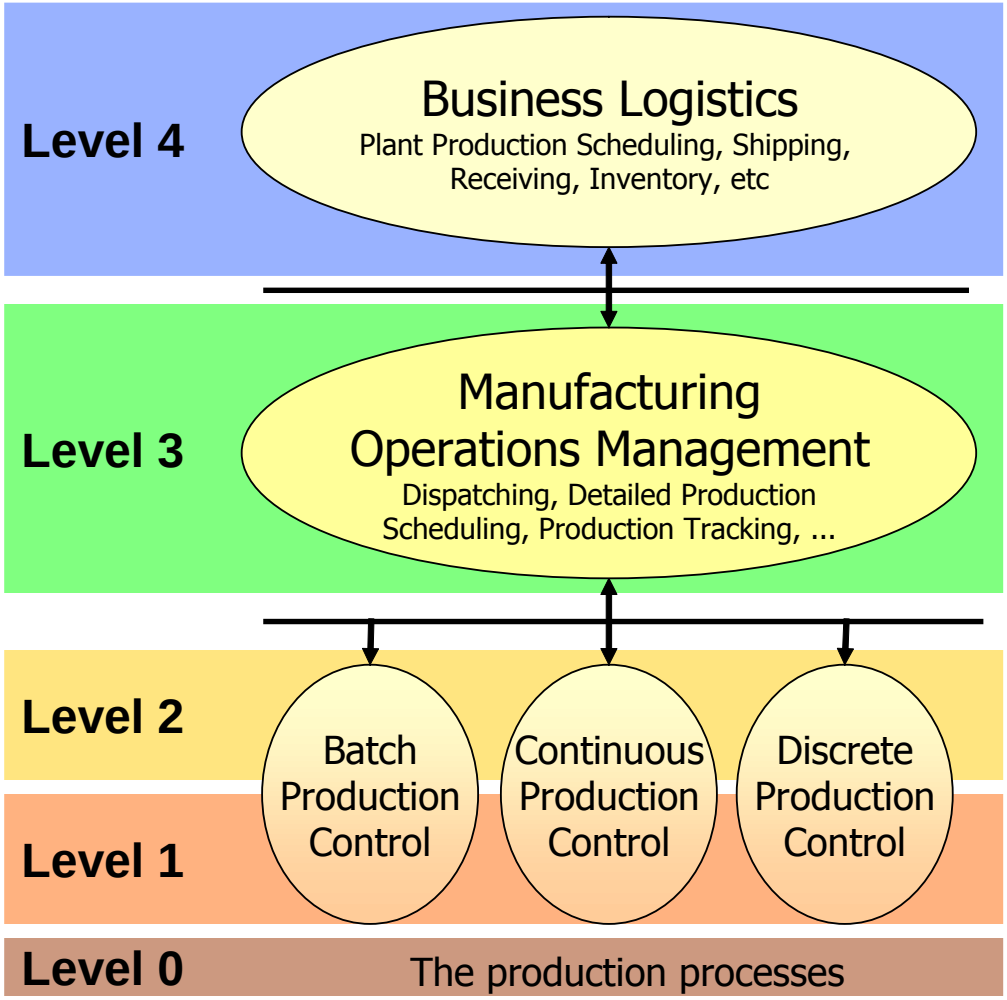


The reference models: Systems Engineering





The reference models: Systems Engineering - example



MES, MRP: Scheduling, Recipe,Material Flow, Work Flow

Temperature model, Shape Control, Mill Set-Up Control, Coil Tracking,

Speed Regulator, Sequence Control, Position Control, Temperature Control,

Pressure, Temperature, Speed, Accelerometer, Force, Position, Shape, Thickness

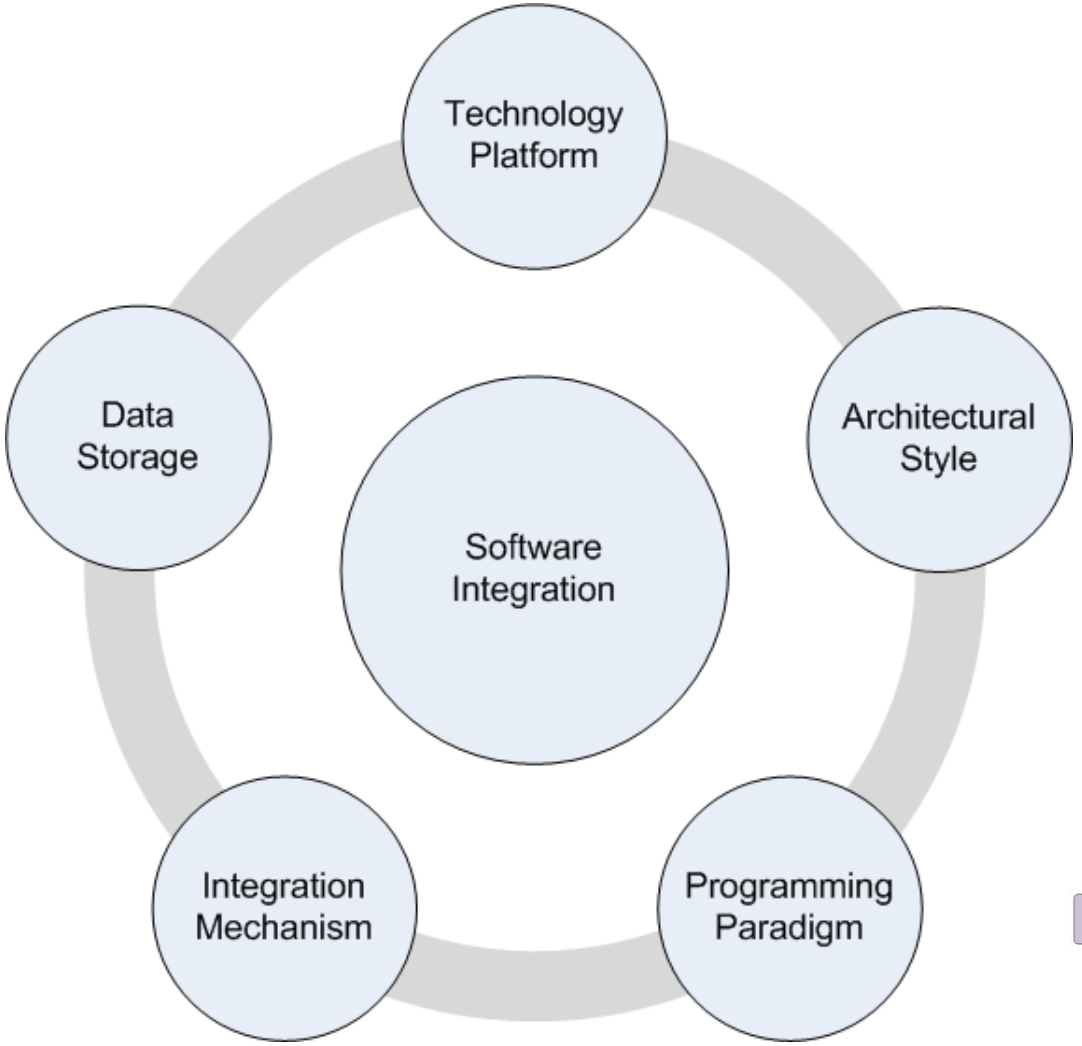
Enterprise Business Systems, Supply Chain Management, Enterprise Resource Planning

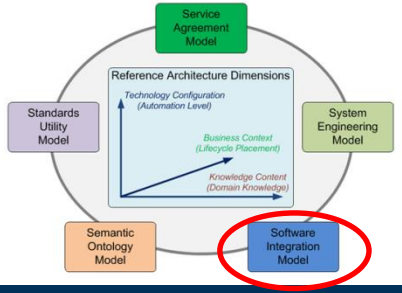
Facilities, Plant Systems, MES - Manufacturing Execution Systems, SCADA - Supervisory Control and Data Acquisition systems

Control Systems, Controller Level (Feed back closed loop control) Sensor level, Measuring devices, Programmable Logic Controllers, Actuators

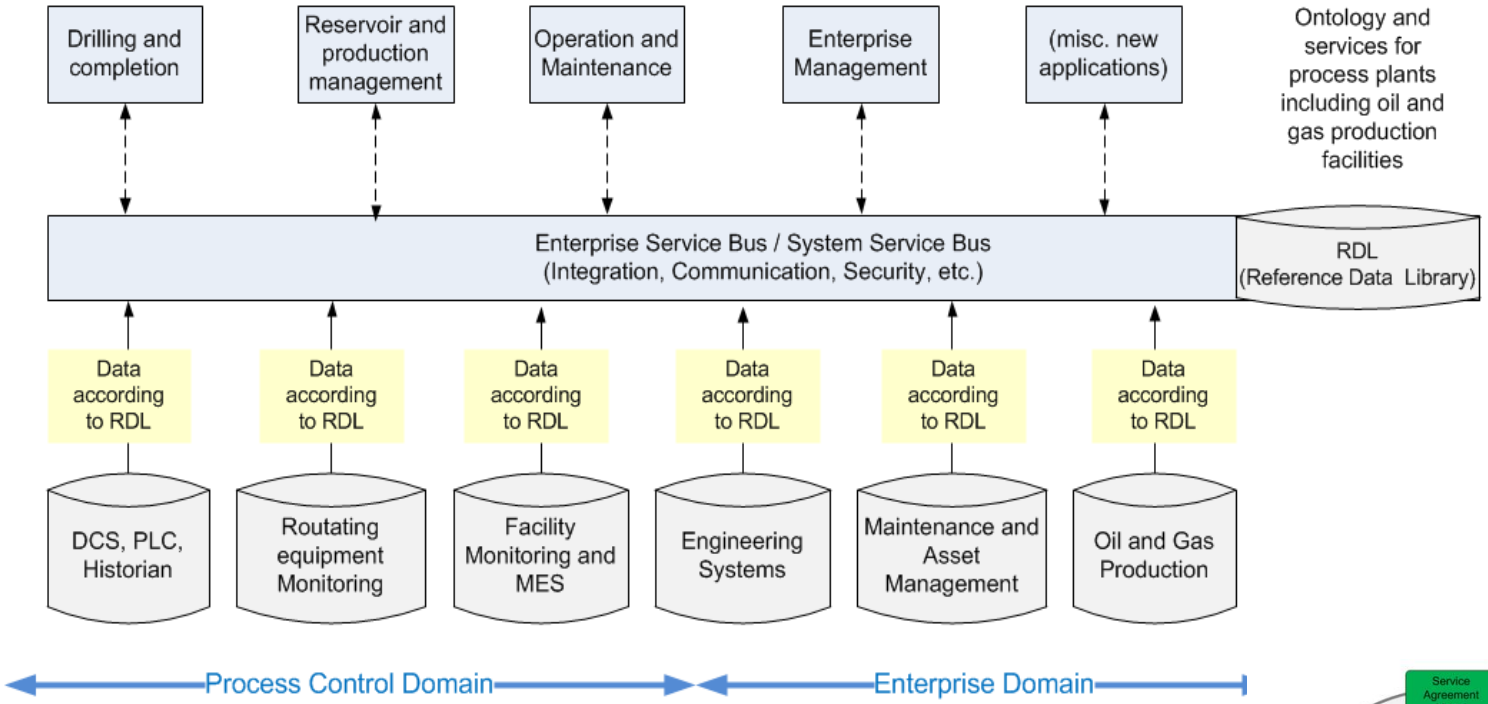
*** ISA-95 Level Definition**

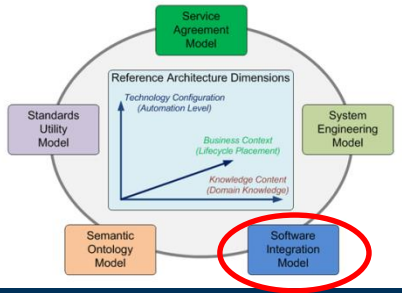
The reference models: Software Integration



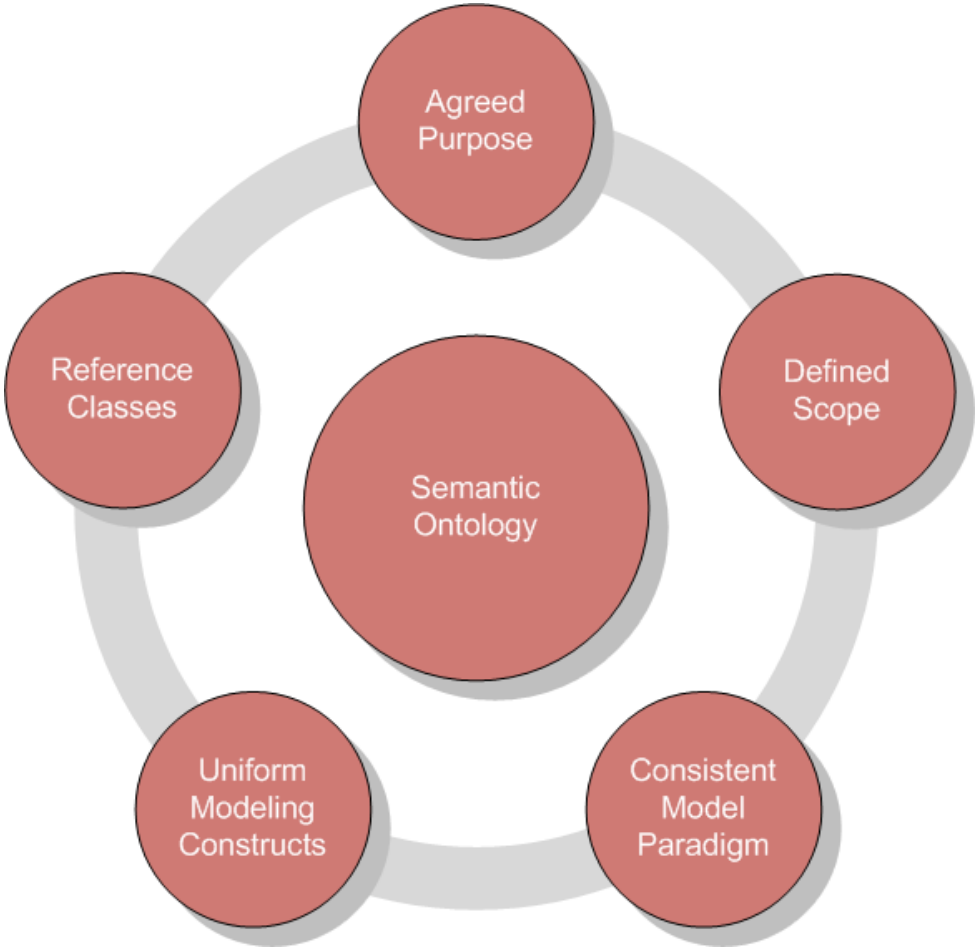


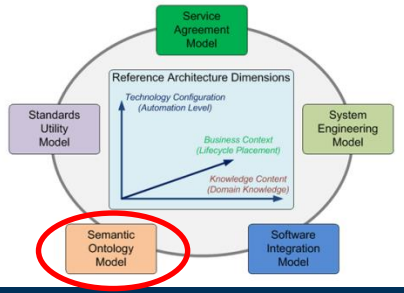
The reference models: Software Integration - example





The reference models: Semantic Ontology



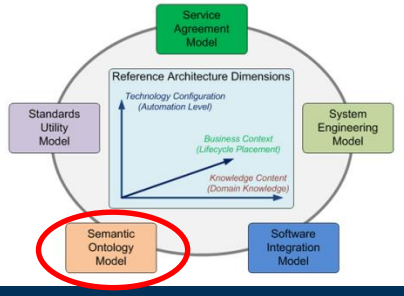


The reference models: Semantic Ontology - example

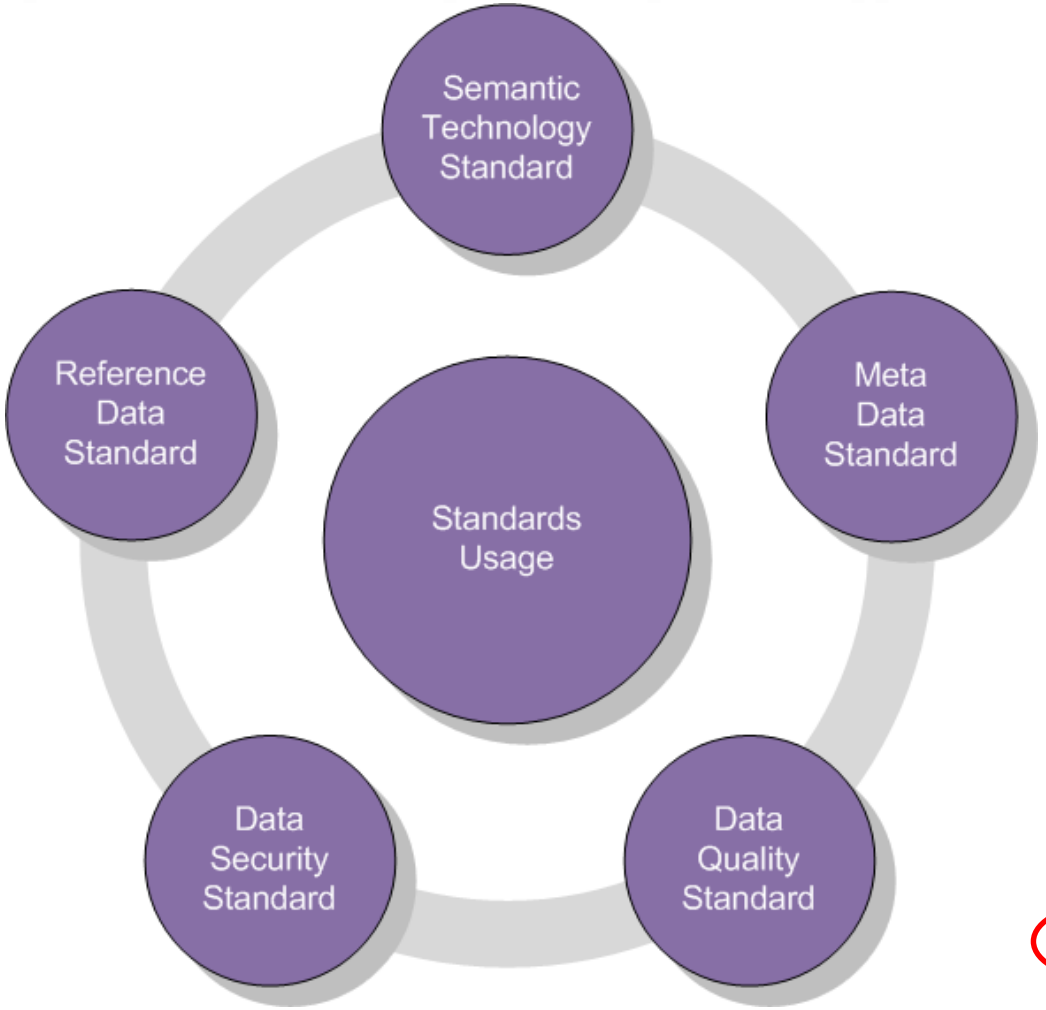
- Ontology = Class + Relations + Constraints

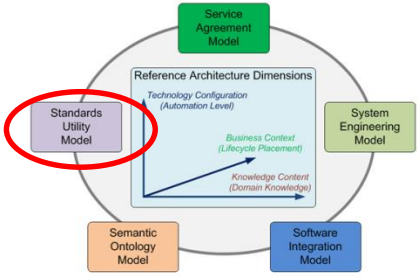
- Using ontologies, applications can be “intelligent”, - more accurately work at the human conceptual level.

- Knowledge Base = Ontology + instances + (Standard) Inferences and rules



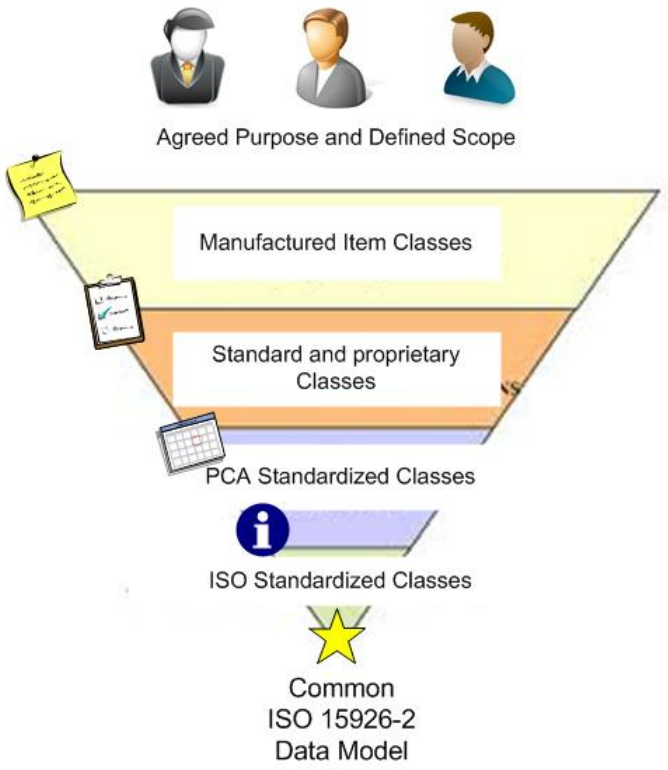
The reference models: Standards Usage



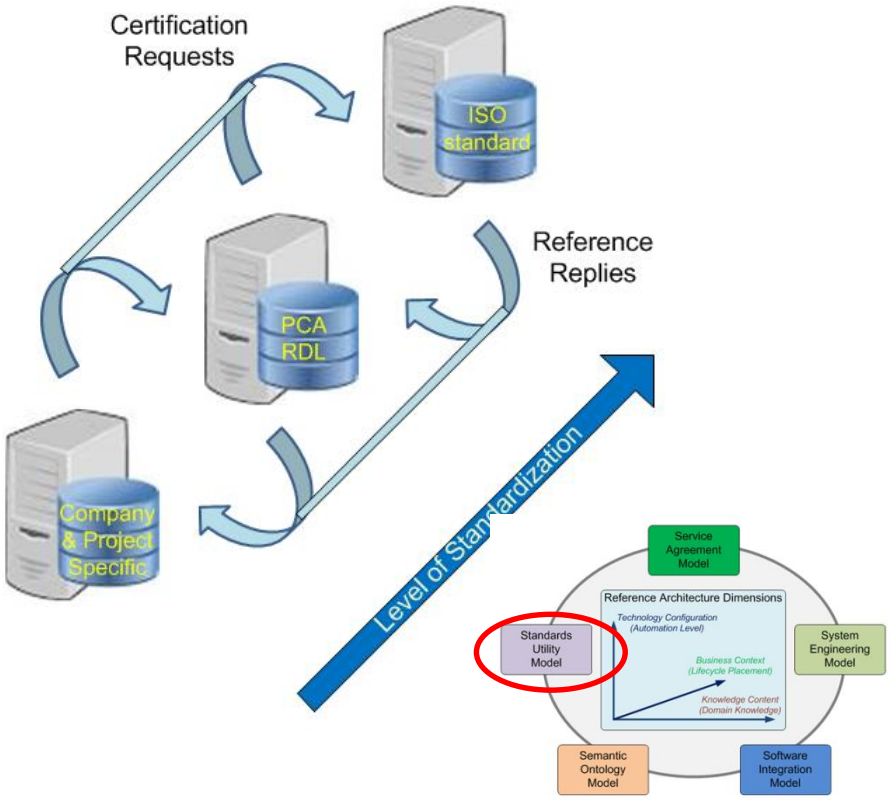


The reference models: Standards usage - example

Logical organization of reference data

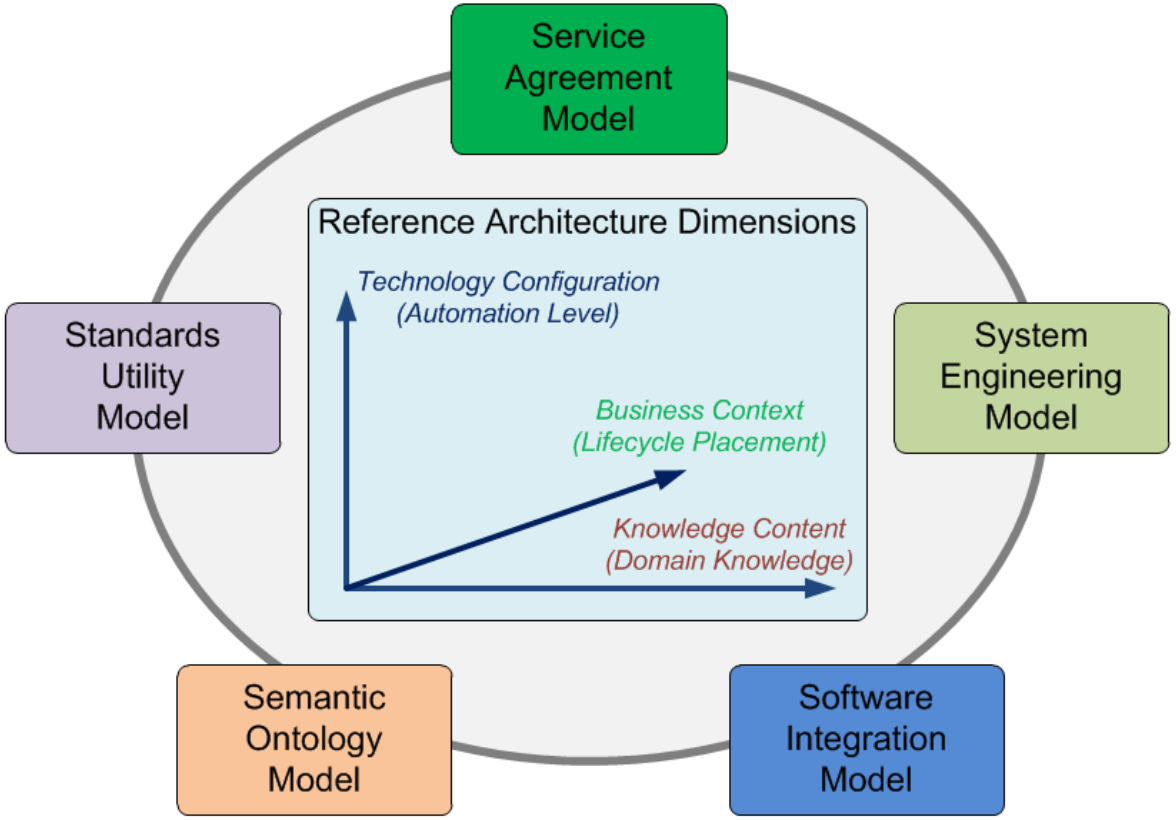


Federated arrangement of many web connected libraries



The Reference Models: Summary

PCA-MIMOSA Reference Architecture Framework



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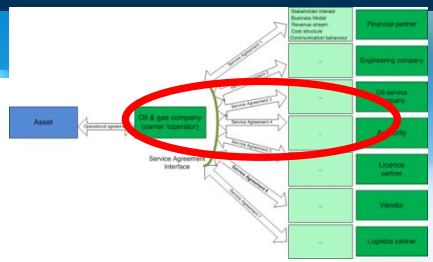
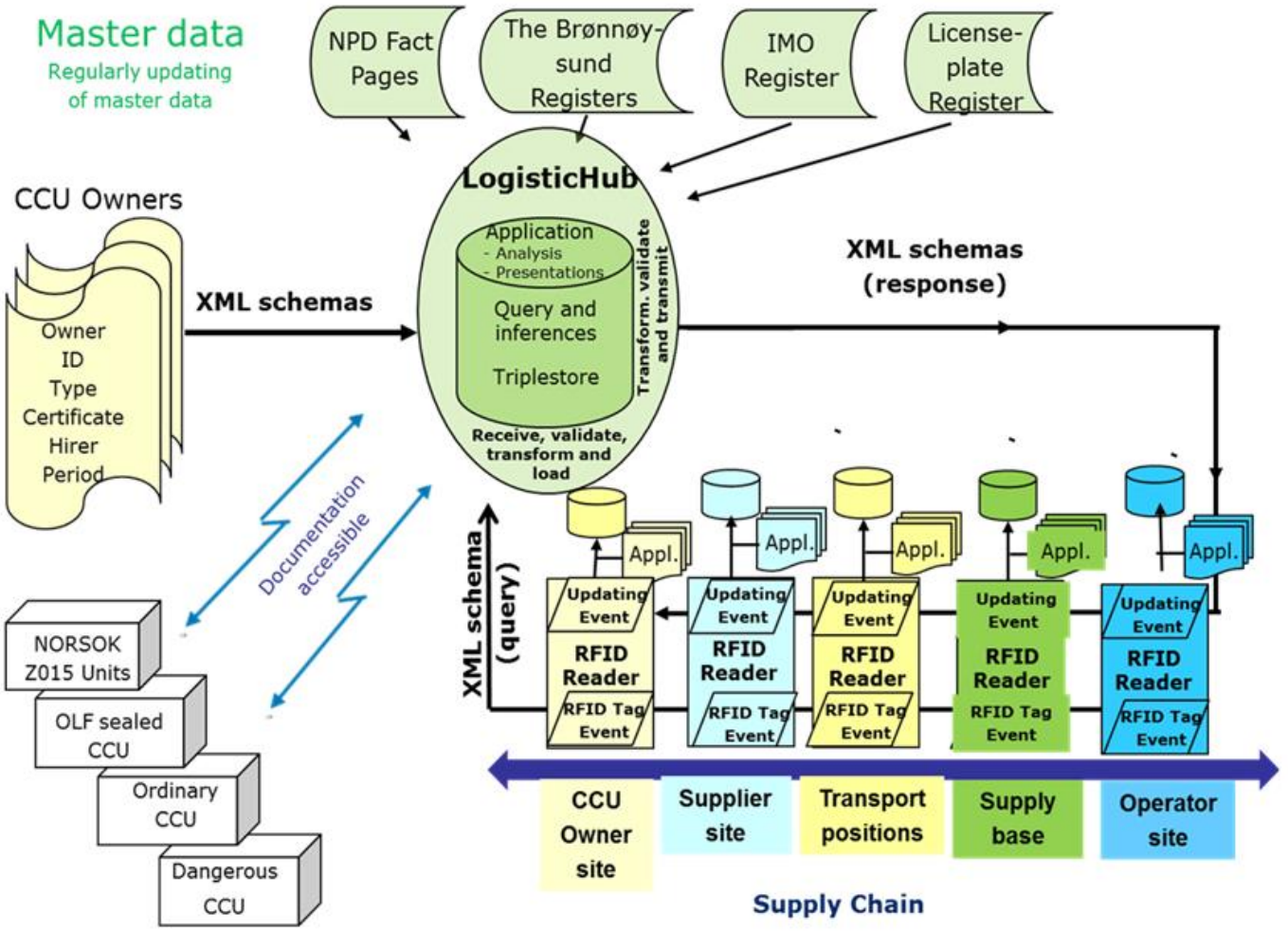
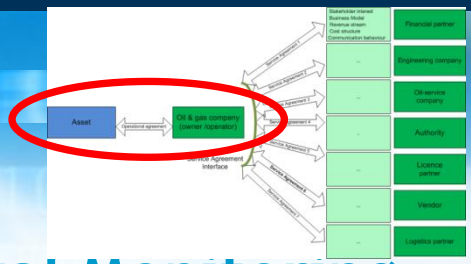
THE ARCHITECTURE APPLICATION EXAMPLES

EPIM Logistics Tracking



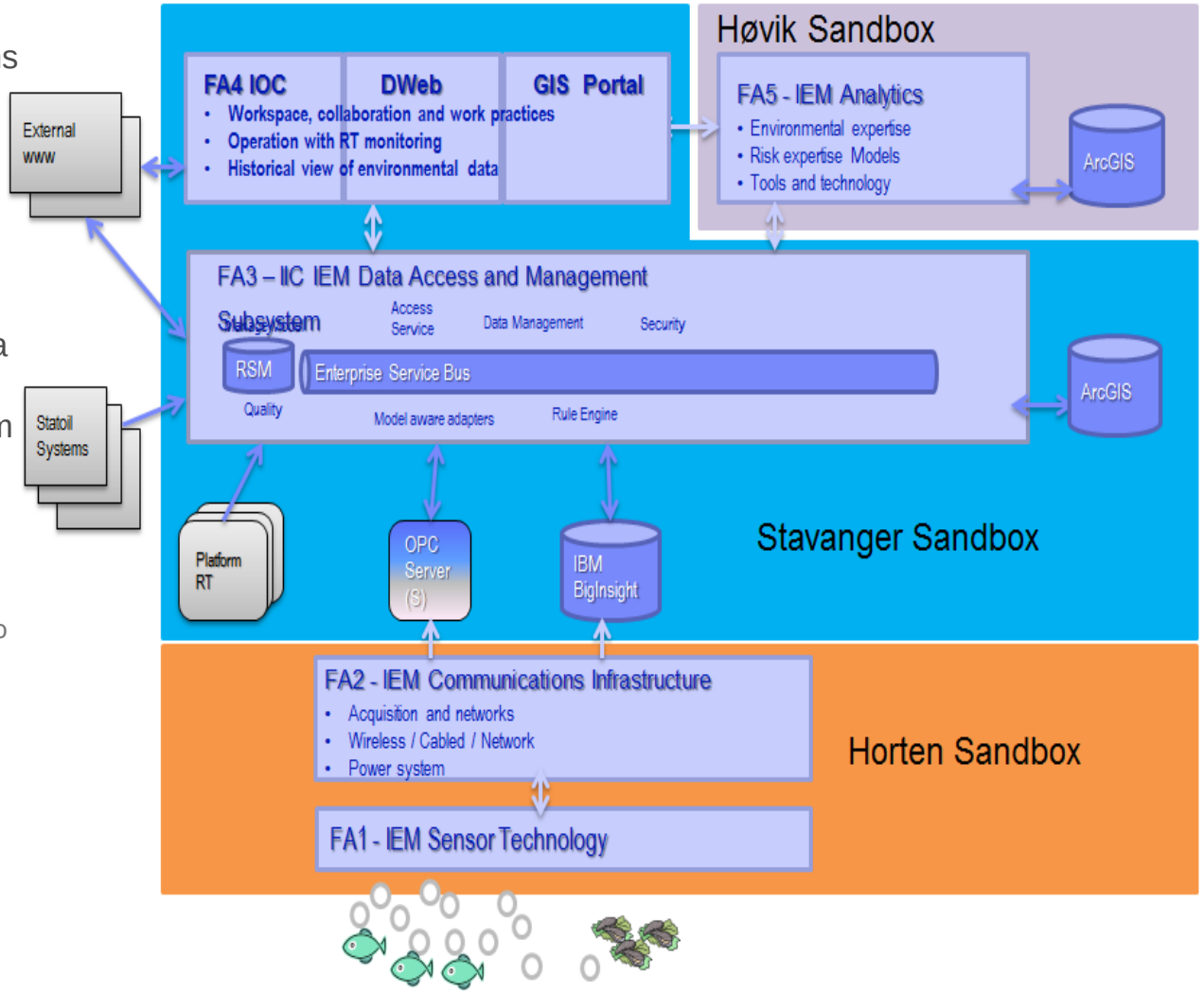


POSC Caesar Association

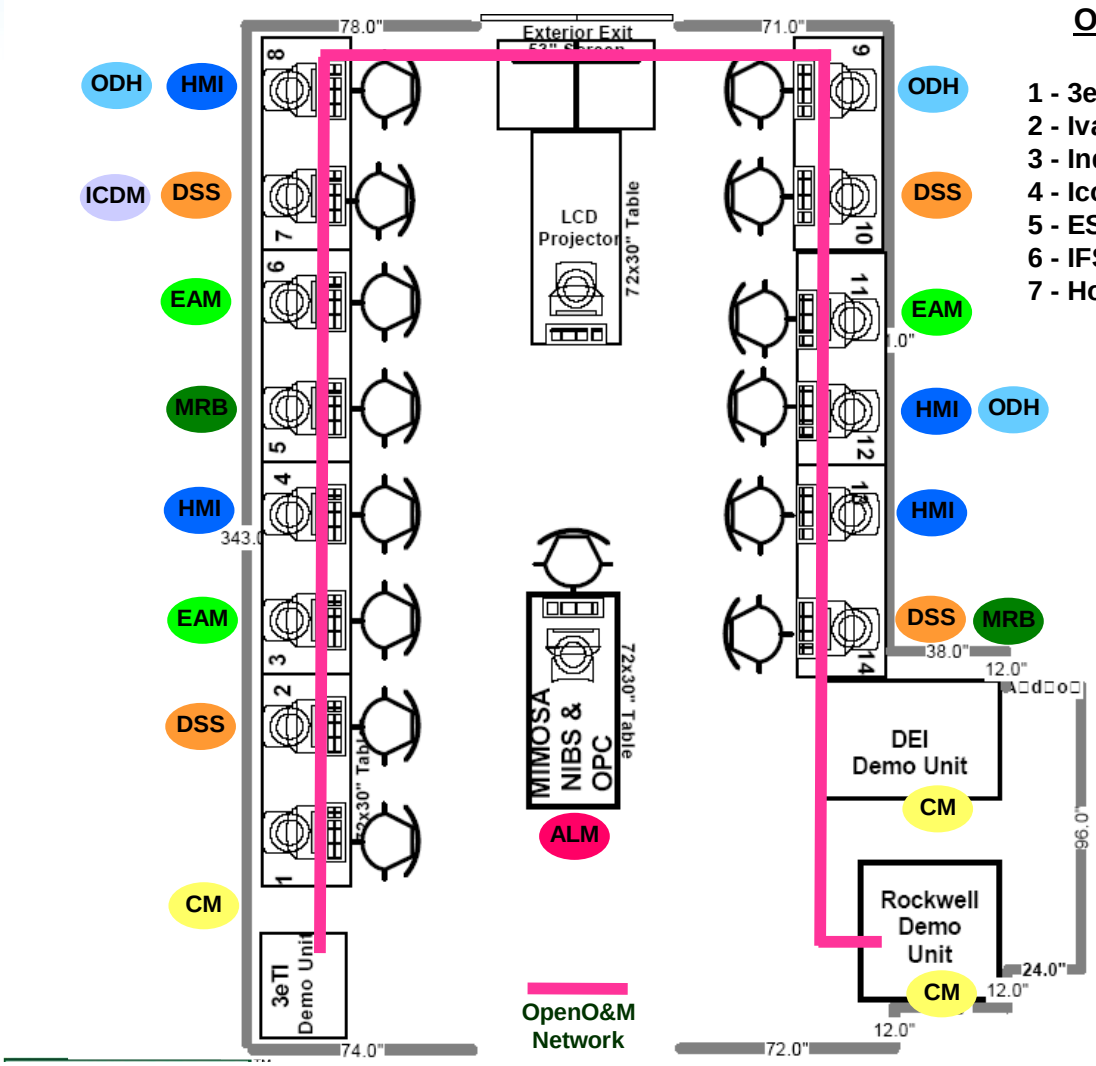


Application examples: Integrated Environmental Monitoring

- Statoil: Prudent operations in fragile environments
- An environmental monitoring system
- 1)subsea monitoring system for measurement of key environmental data
- 2)decision support system for analysis and visualization, monitoring and controlling
  - 1)Discharges to the sea
  - 2)Natural resources ,
  - 3)Combinations of the two
- Consortium: Kongsberg(lead), DNV, IBM



Int. Maintenance Conference IO&M Interoperability Demo



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

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

MIMOSA Information Network (MIN)

June 21, 2000

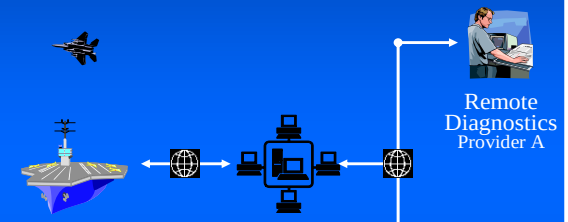
MIN-Viewer

OSA-CBM Presentation

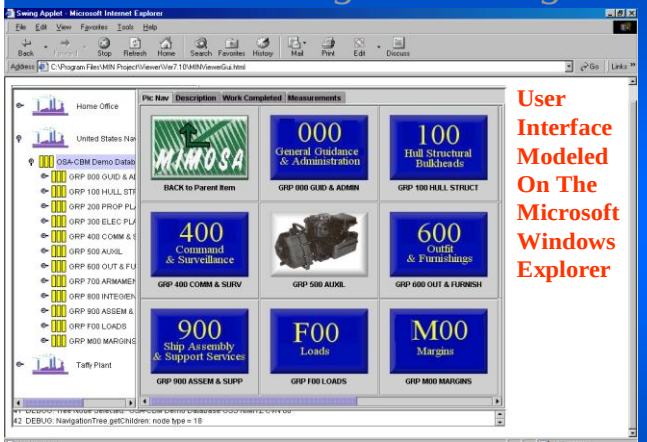
Alan T. Johnston

MIN Project Director

The OSA-CBM MIN Demonstration Concept

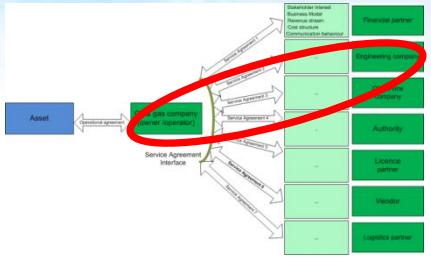


MIN-Viewer Segment Navigation 1



User Interface Modeled On The Microsoft Windows Explorer

Application example: Digital Handover



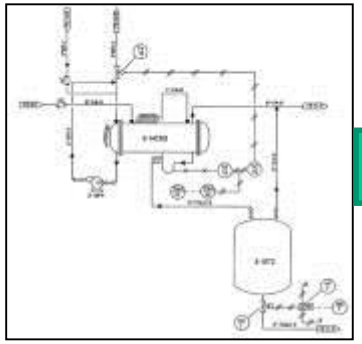
- North West Upgrading / North West Redwater Partnership

- Handover - the process of exchanging engineering specifications between the engineering, construction, and manufacturing companies and the operator of an asset or facility

- Digital Handover - automatically provision O&M systems from an EPC, - synchronize the physical and digital asset

- Standards Based EPC Handover – owner/operator's are specifying a common specification for handing over data

- Standards bodies actively participating in real world projects. In conjunction and supported by ISO15926, PCA, and MIMOSA joint SIGs



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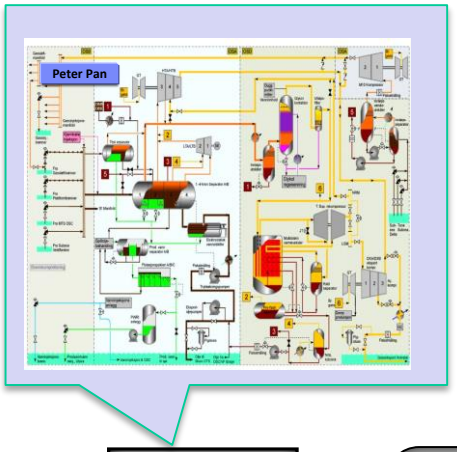
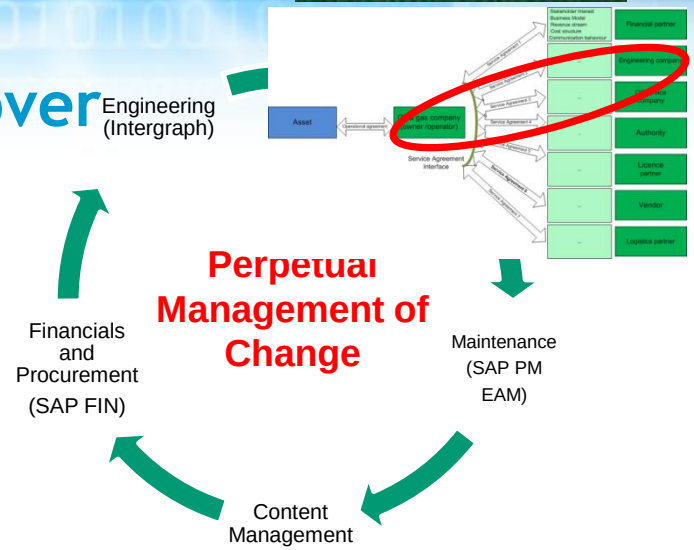
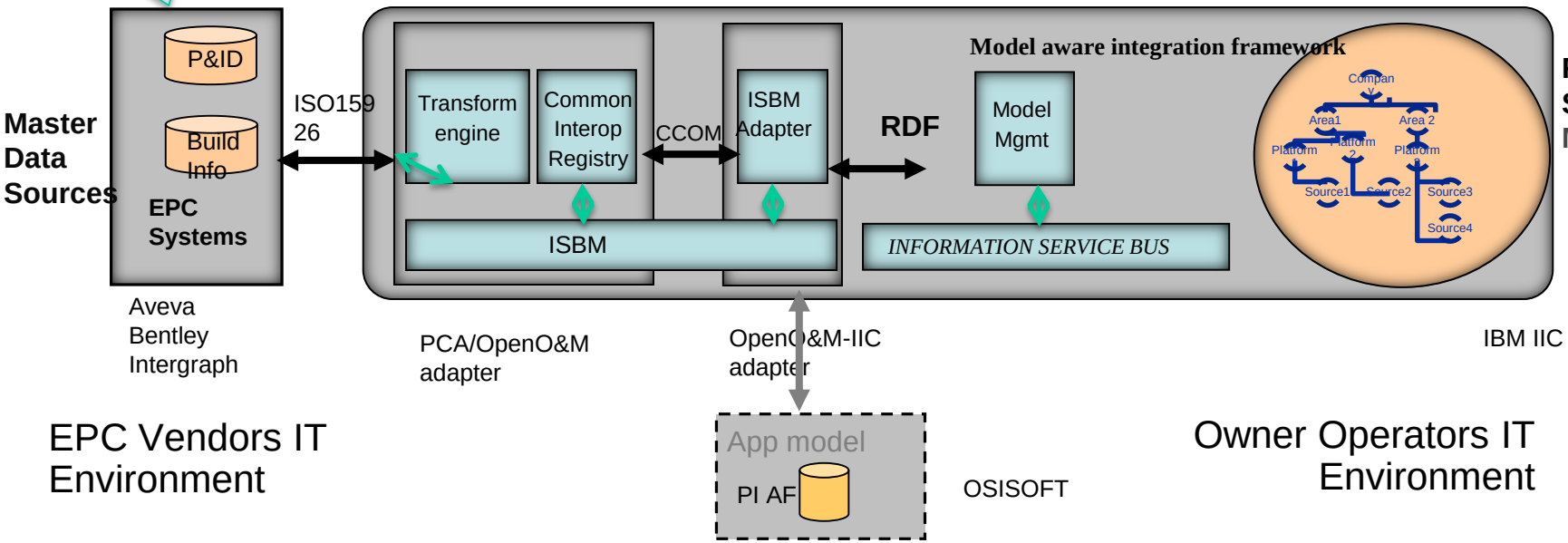
Application example: Digital Handover







Summary and next steps

- Complete the description of architecture and systems in an ITA SIG report
- Balance the architecture description language complexity with ease of reading to gain a sufficiently wide audience
- Harmonize terms between MIMOSA and PCA (integrate and interoperate between CCOM and PCA RDL)
- *For more information please contact:*
  - tore.christiansen@posccaesar.org
  - myren@no.ibm.com
  - atjohn@comcast.net

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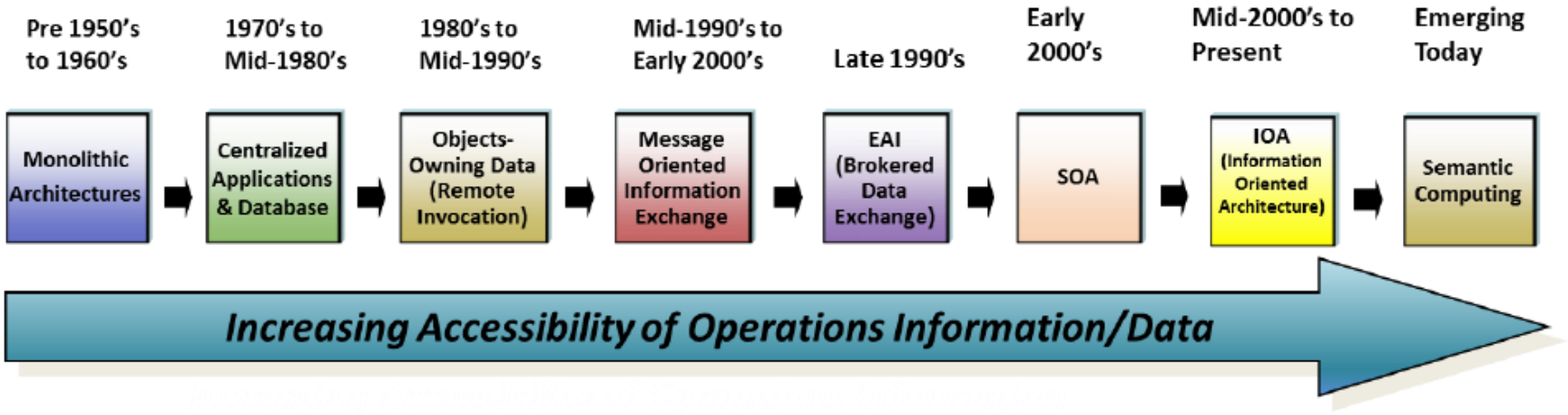
QUESTIONS AND COMMENTS?

BACKUP

The reference models: Software Integration – *Operations Systems Integration Evolution*



MESA WHITE PAPER #42: The Role of Semantic Models in Smarter Industrial Operations (Noller, Hanis, Feldman, Gifford)