



Semantically aware integration architecture for oil & gas solutions

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"ISO 15926 and Semantic Technologies 2009"

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Further context

Draft Reference Architecture for Integrated Operations Generation 2

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Presentation at DI and ICF meeting
 OLF, 2008-02-12



StatoilHydro ABB SKF AkerSolutions



Model driven Integration Architecture for IO G2

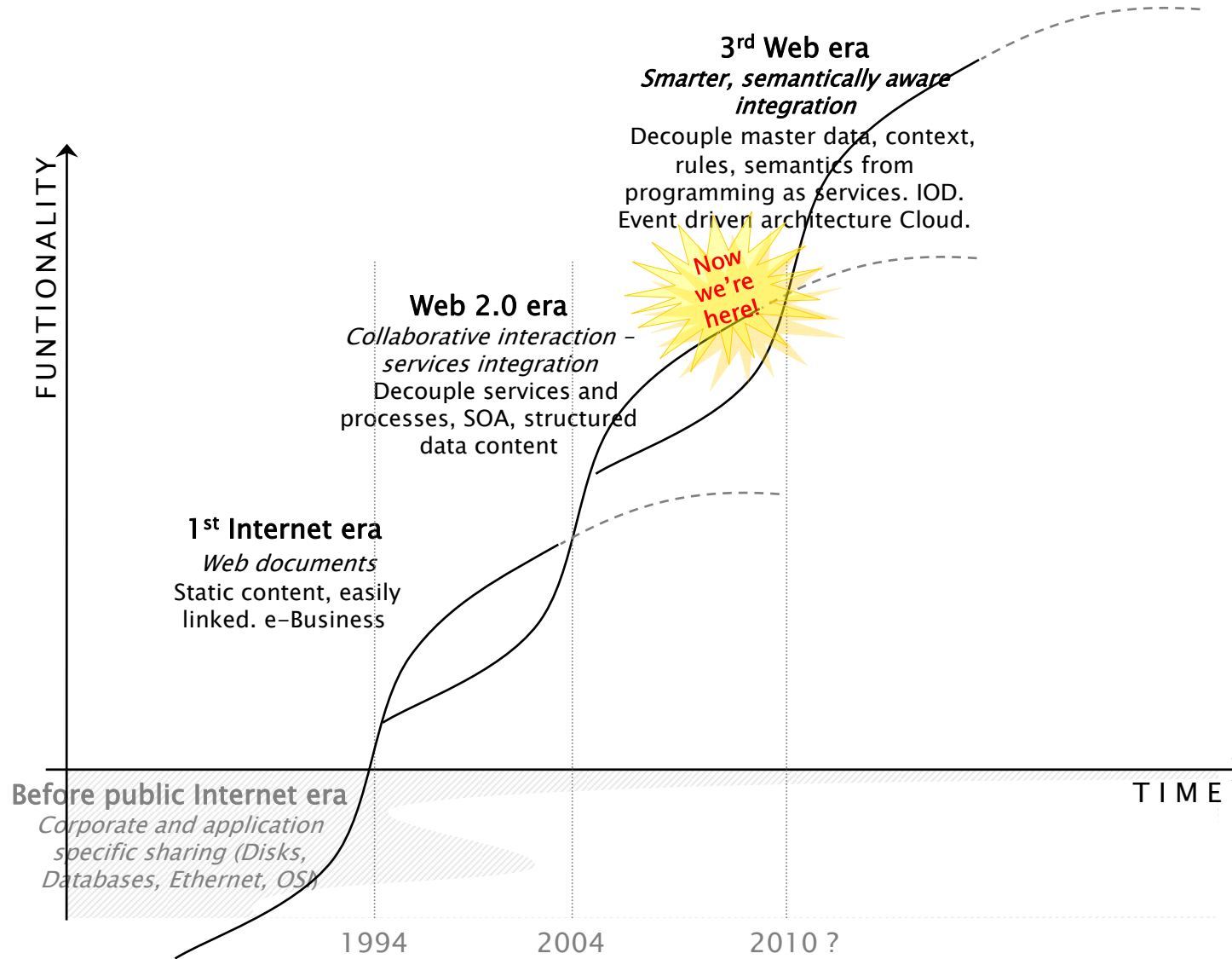
Reference Semantic Model for IO G2 to ISO 15926

Semantic Days, May 20, Stavanger, Norway

Integrated Operations in the High North – Joint Industry Project

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The technical evolution continues: the 3rd Web Era



Overview



- **Background**
 - **Integrated Operations, High North challenges, Integrated Operations in the High North project**
- Architectural challenges
- Model Transformation
- Summary



The context

- Integrated Operations Generation 2 (IO G2)

Integrated Operations in the High North – Joint Industry Project



Integrated Operations (IO)

- IO is more information in real time offshore and onshore
- IO is safer, faster and better decisions
- IO has a potential of NOK 300 billions on the NCS

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OLF's Information Management Strategy

An efficient pipeline for real-time data transferal and analysis

Field data

- Health, safety, environment
- Seismic
- Drilling & Completion
- Reservoir & production
- Operation & maintenance

Smarter solutions

- Web portals
- Web services

Common XML schemas

Smarter data

- Semantic Web
- Infrastructure for web services
- Oil & Gas Ontology

*Ontology = A hierarchical data structure containing concepts, relationships, properties and rules for a specific domain

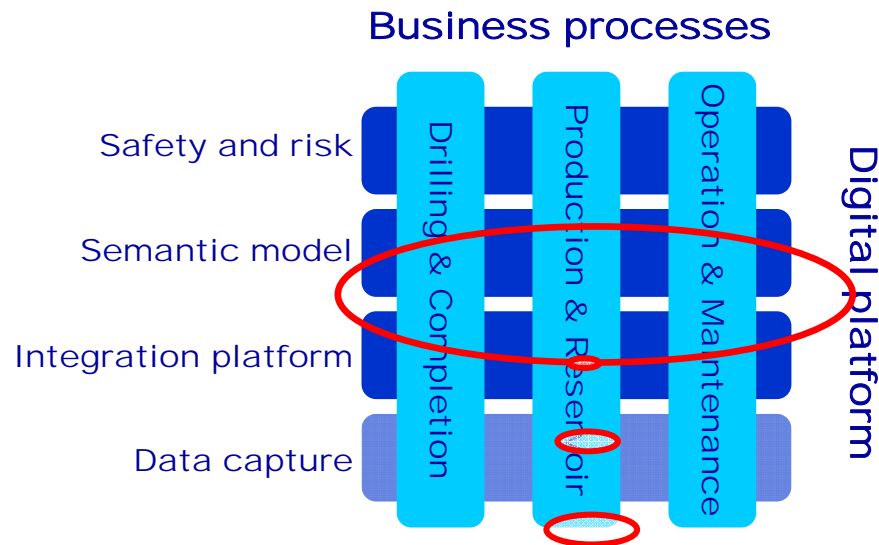


Integrated Operations in the High North (IOHN) project

- demonstrating a reliable digital platform for IO G2 in the High North



Integrated Operations in the High North – Joint Industry Project

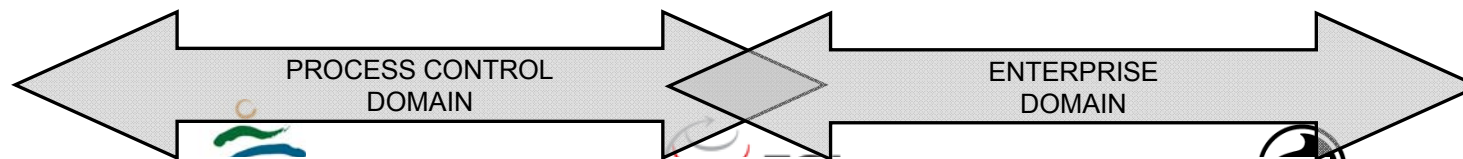
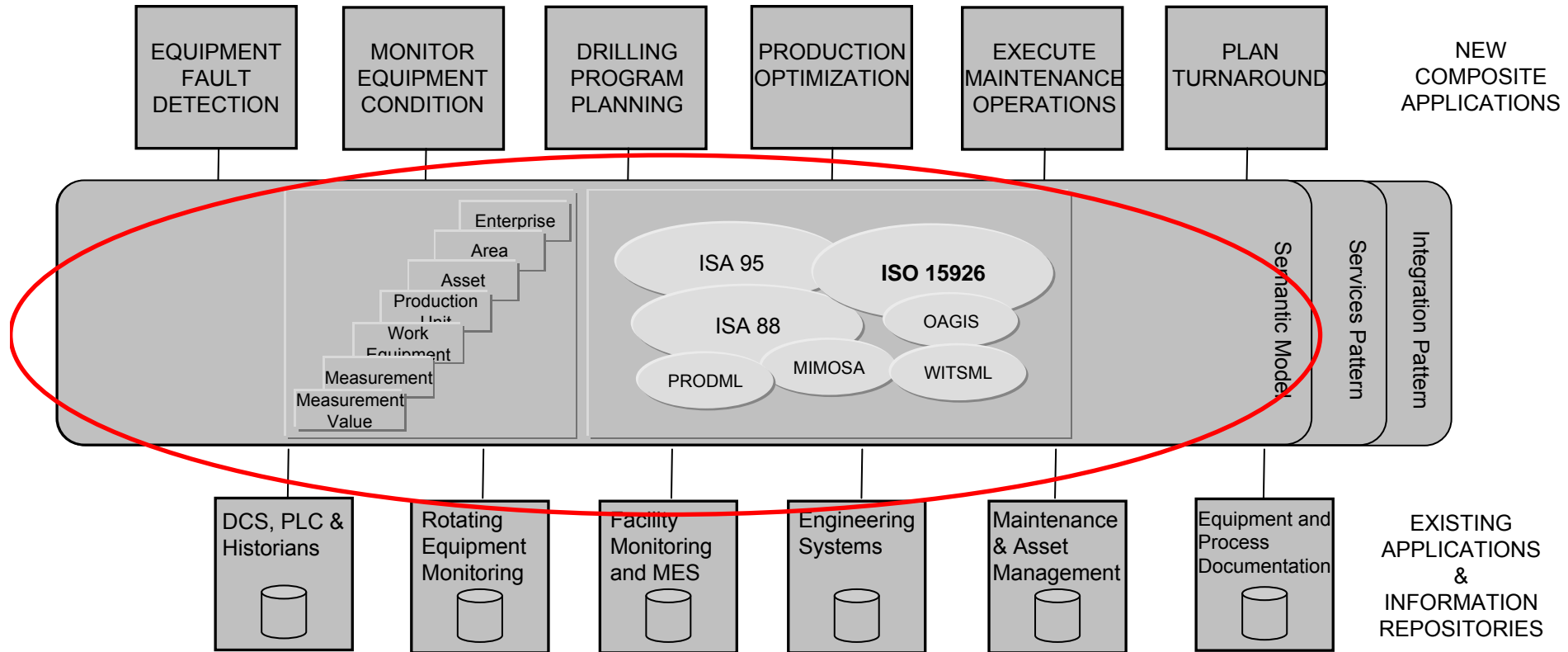


Focus of this presentation



Information models embedded in the integration layer are of high importance

Integrated Operations in the High North – Joint Industry Project

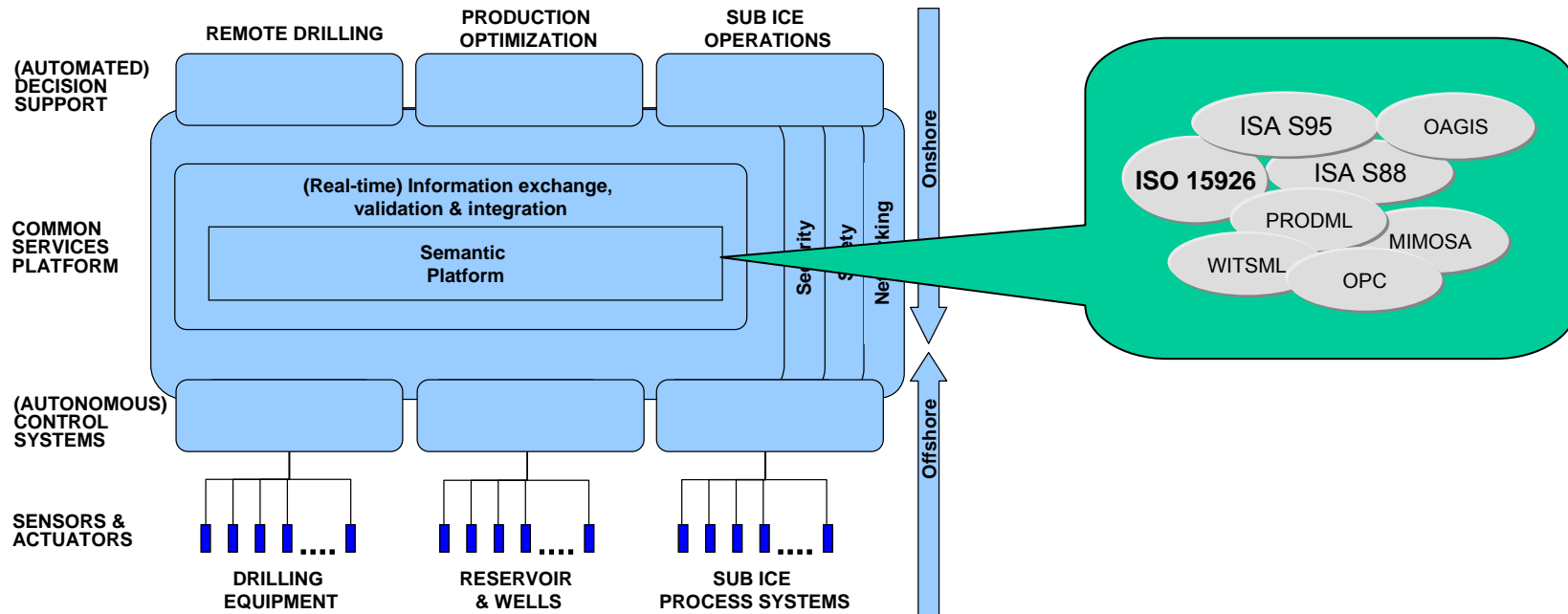


“Draft Reference Architecture for OLF Integrated Operations Generation 2”



Information models embedded in the integration layer are of high importance

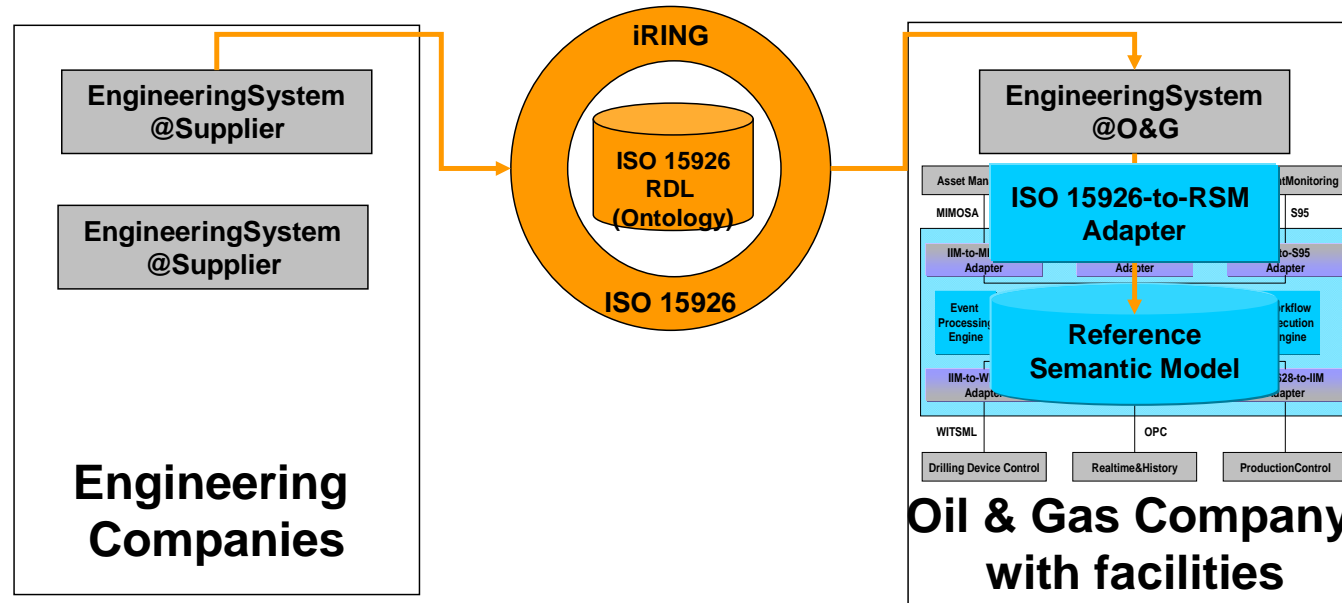
Integrated Operations in the High North – Joint Industry Project



Architecture based on Reference Architecture for OLF Integrated Operations Generation 2 and NTNU IO Center Architectures”



Application integration requires agreement about the meaning of information to exchange



- Engineering Company – Owner/Operator integration requires agreement about the meaning of information to exchange
 → **Integration Information Model**
 e.g., **ISO 15926 with Reference Data Libraries as the basis of iRING**
- Oil and Gas Enterprise – Facility Integration approaches recommend a neutral information model in the middle between applications
 → **Integration Information Model**
 e.g., **Reference Semantic Model as the basis for IO integration infrastructures**



Overview



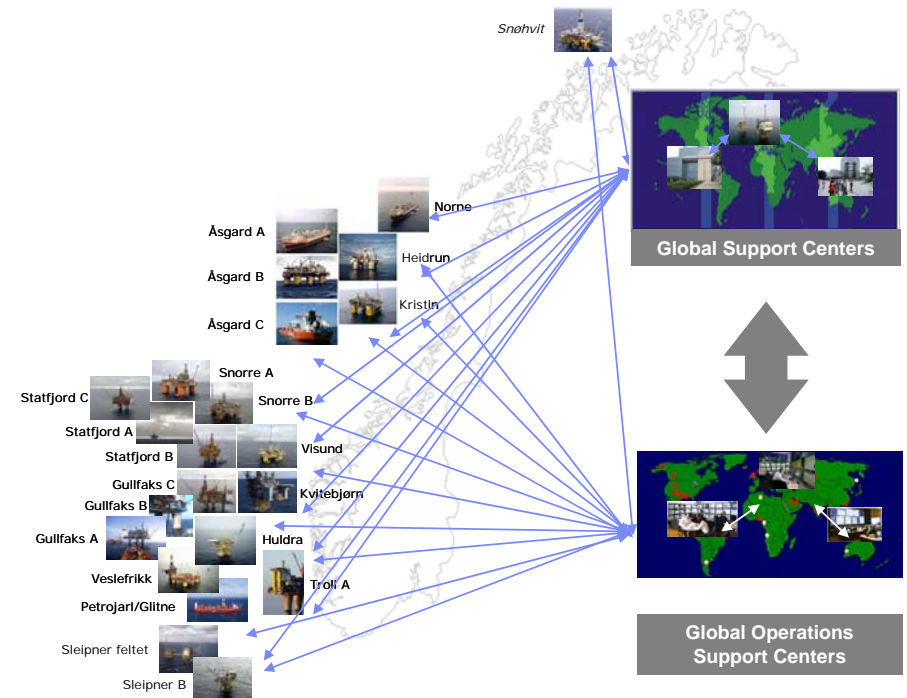
- Background
- **Architectural challenges in cross-facility and vertical application integration**
- Model Transformation
- Summary



The complexity of the technical infrastructure in the oil & gas industry requires highly integrated IT system support.

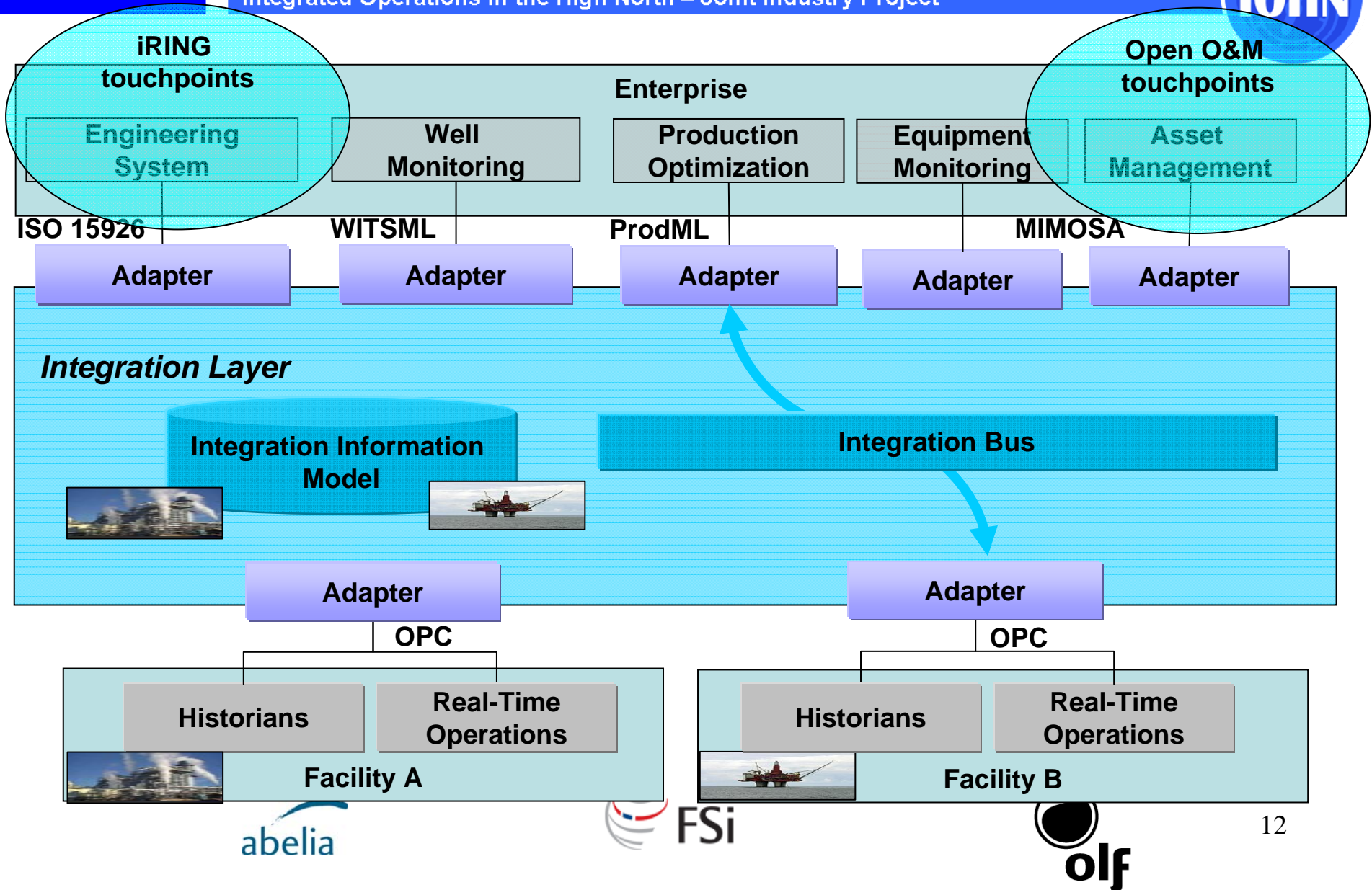


- Excellence in Integrated Operations requires deep insight into the state & condition of production facilities
- Monitoring and controlling production facilities individually will no longer be sufficient
- There is need for enterprise-wide Integrated Operations solutions
- IT solutions in the area of Integrated Operations must access various enterprise-wide information sources
- Vertical integration of IT solutions has to be coupled with horizontal integration



IOHN Architecture - integration architecture for Integrated Operations

Integrated Operations in the High North – Joint Industry Project



Requirements fulfilled by IOHN architecture

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- Applications relevant for Integrated Operations operates on different standardized information models
 - One standardized information model is not enough for integrated operations use cases
- A comprehensive application integration platform has to mediate between different industry standards
 - An Integration Information Model is needed, plus adapters translating to and from the IIM



Applications to be integrated often operate on different information models/industry standards.



- To facilitate different aspects of monitoring and control applications, different information models have been standardized within different domains of the O&G industry, e.g.
 - S95, S88, MIMOSA, ISO 15926, PRODML, WITSML, ...
- For application integration this requires translations between standardized information models
- In order to avoid point-to-point bilateral translations, an Integration Information Model should be identified as a ,model-in-the-middle‘

An Integration Information Model connects applications with different information needs

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- Classical Horizontal EAI (topfloor-to-topfloor integration)
 - Connect enterprise applications which operate at the **same levels of information**
 - Integration typically requires rewriting of similar information
- Vertical (E)AI (shopfloor-to-topfloor integration)
 - Connect plant control and enterprise applications operating at ***different levels of information***
 - Integration typically requires enrichment/reduction of different information

An IIM enables compensating the ‘semantic information slope’ between applications – especially on the vertical integration path

Overview



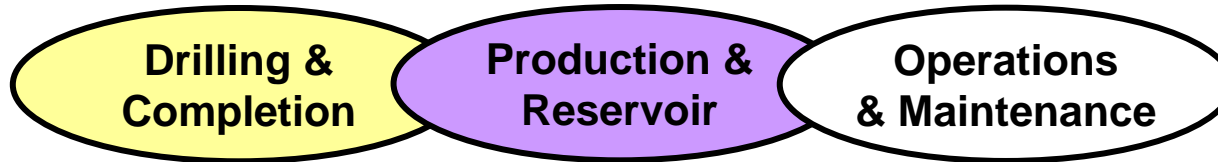
- Background
- Architectural challenges
- **Model Transformation between ISO 15926 and Reference semantic Model**
- Summary



IOHN provides ISO 15926 semantics to the Reference Semantic Model



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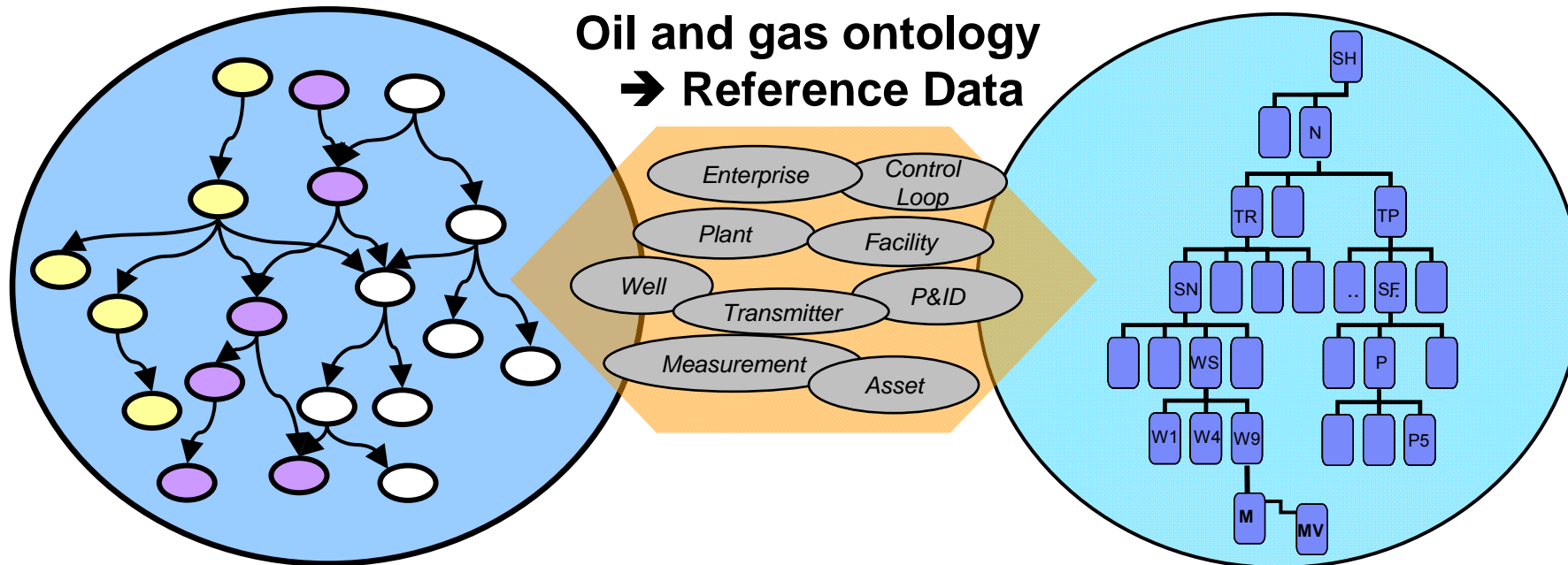


ISO 15926

- Integration of life-cycle data for process plants including oil and gas production facilities
- **Get the terminology right!**

Reference Semantic Model

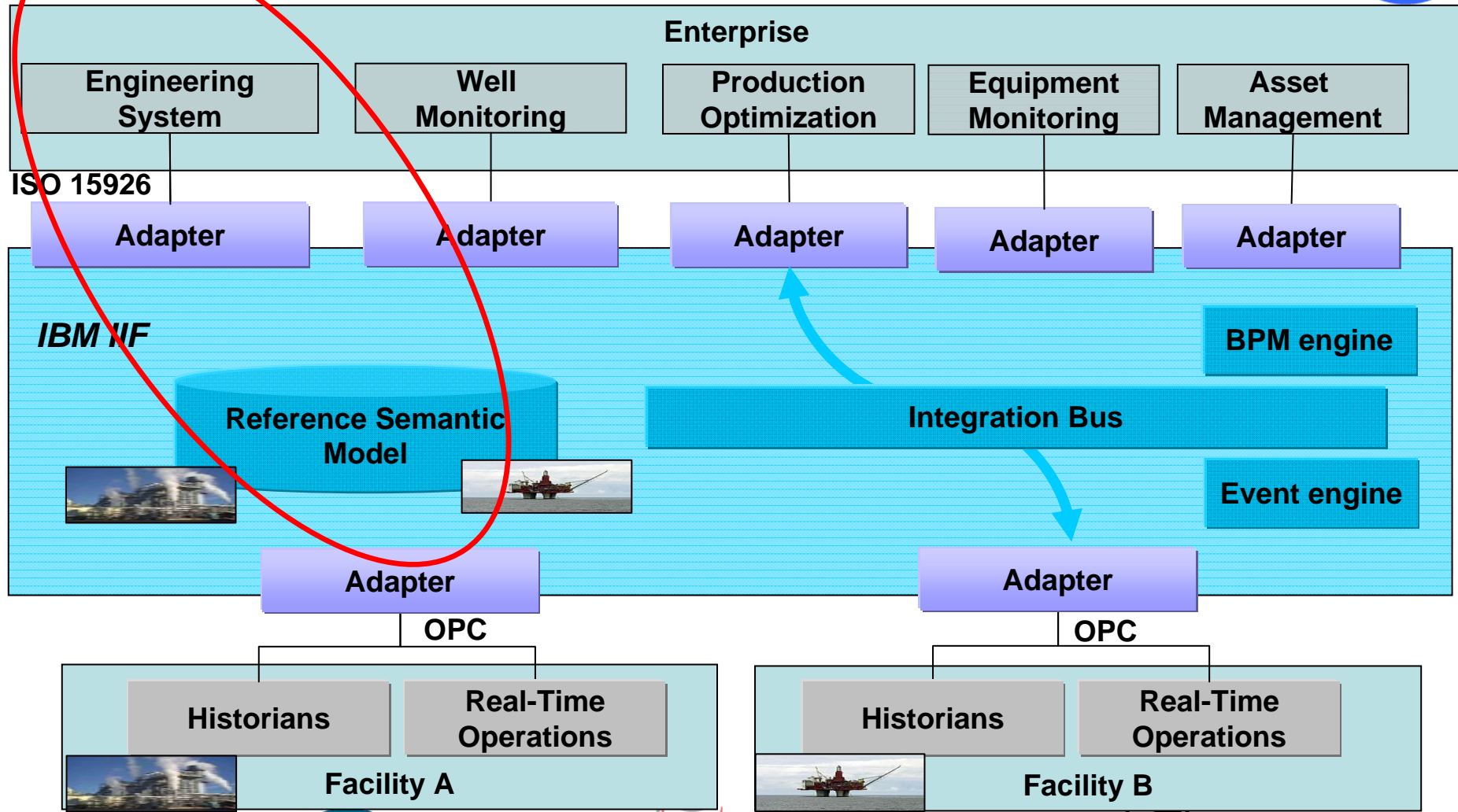
- An information model unifying industry standards for vertical integration of IO applications
- **Implement based on the right terminology!**



Towards implementing the IOHN architecture using runtime frameworks with the IBM C&P Integrated Information Framework

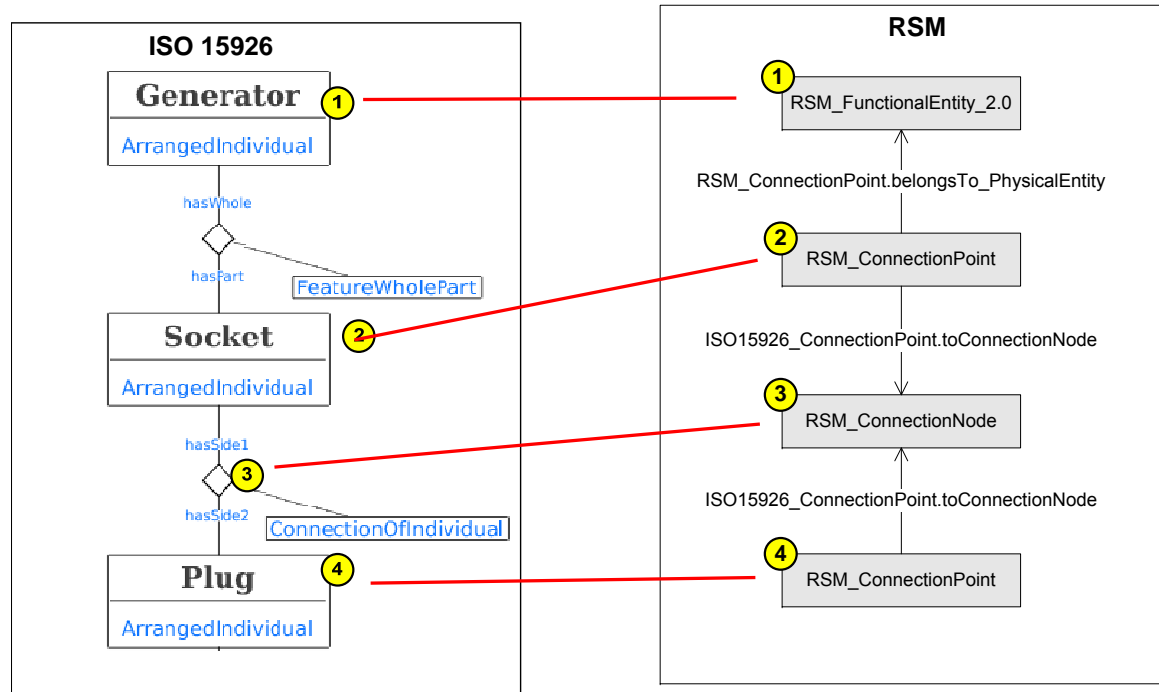
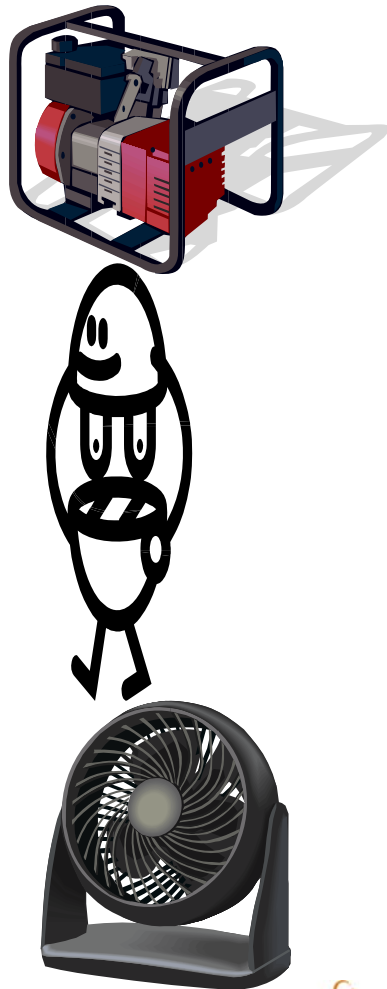


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ISO 15926 – RSM alignment

- the principles of the ISO15926 – RSM adapter



- Typical information in an RSM database: A generator is connected to power a fan.
- The general case is: Pieces of equipment are connected.
- We want to present such connection information in the ISO 15926 space as well.

Alignment of semantic content between ISO 15926 and RSM is a key driver towards application integration within IOHN

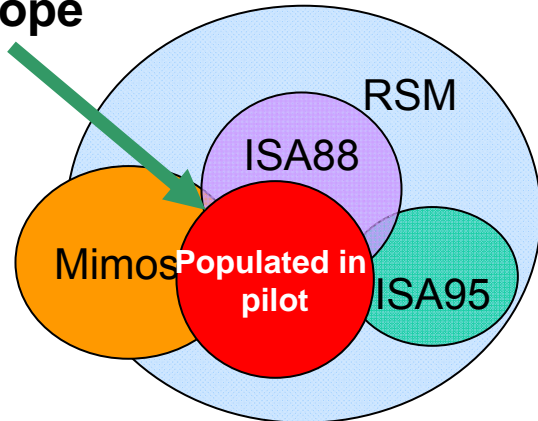


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IOHN assignment: Represent the Reference Semantic Model (RSM) in ISO15926

Scoping statement: Represent in ISO15926 the scope of the Reference Semantic Model exploited in pilots at two StatoilHydro facilities

Scope



Status:

- Approximately 100 classes and relations added to PCA RDL
- RSM model v2.0 proposed
 - Aligned with ISO15926 model
 - Opens up for use of rich information structures contained in RDLs
- Ready for next step
 - Review and standardization through PCA
 - Making RSM publicly available

Participants

StatoilHydro

- Requirements

IBM

- Provider of RSM
- RSM and UML modeling expertise
- Application integration know-how
- Business scenario insight

DNV

- Vendor independent advisor
- Expertise in semantic technology
- Expertise in ISO15926
- Project management

Epsis

- Expertise in semantic technology

Mimosa

- Expertise in relevant domain standards



Overview



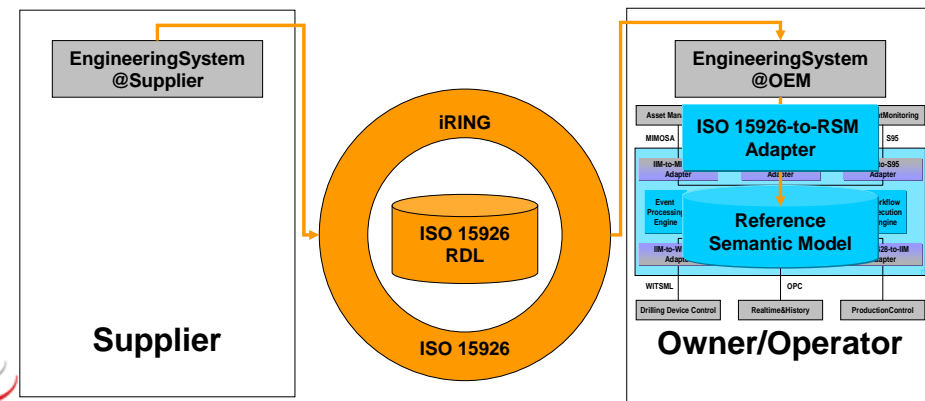
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 - Integrated Operations
 - High North challenges
 - Integrated Operations in the High North project
- Architectural challenges in cross-facility and vertical application integration
- Model Transformation between ISO 15926 and Reference semantic Model
- **Summary**



Summary 1/2



- Vertical integration faces an 'information slope' regarding semantic richness between facility, e.g. DCS, and enterprise applications, e.g. ERP
 - information enrichment/reduction becomes a very important aspect for the Integration Layer
- Integration Information Models like ISO 15926 and RSM and adapters between them can balance this 'information slope'
 - bi-directional translations between ISO 15926 and RSM
- iRING and IIF are integration layer platforms which can benefit from ISO 15926 and RSM alignment
 - for exchange of master and transactional data



Summary 2/2



- The alignment work
 - Driven by StatoilHydro
 - Performed (mainly) between DNV and IBM
 - a good example of cooperation between standards custodians, technology providers and business

- Alignment between ISO 15926 and RSM:
 - Opens up for using the best from two worlds
 - Rich information structures from ISO 15926 → Standardized classification provides a prescriptive buildtime approach
 - Model instance data integrated with real time data through scalable runtime frameworks
 - Driving towards an ISO15926 oil and gas O&M ontology

- DNV and IBM are ready to bring the results sketched here forward for validation & review through POSC Caesar standards bodies

