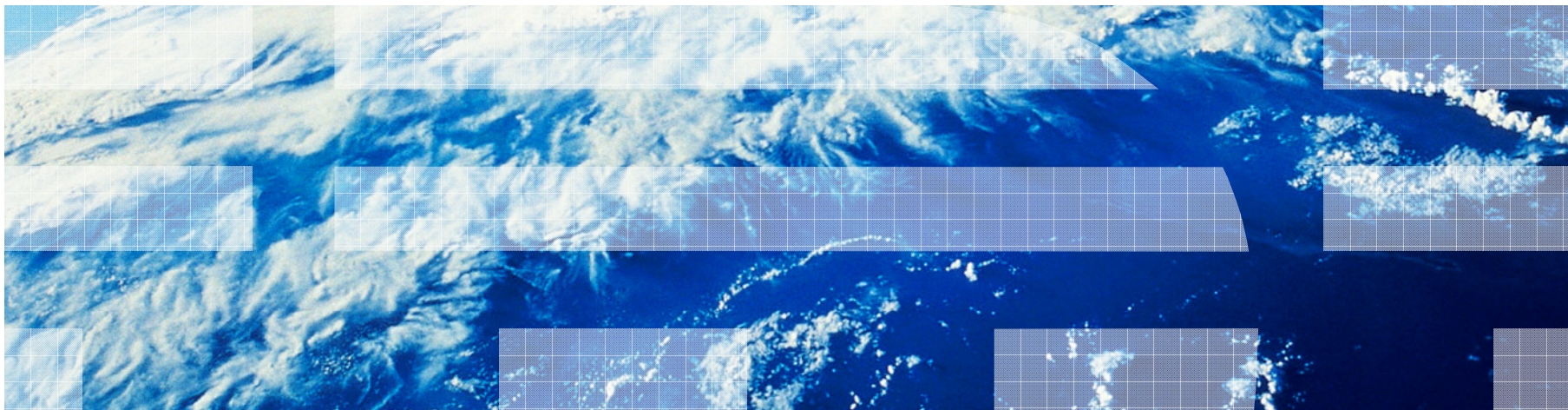


## Semantic Days 2010 Tutorial

# The role of ISO 15926 for applying enterprise service bus technologies in oil & gas industry solutions

**Dr. Udo Pletat**  
**IBM Germany, Boeblingen**



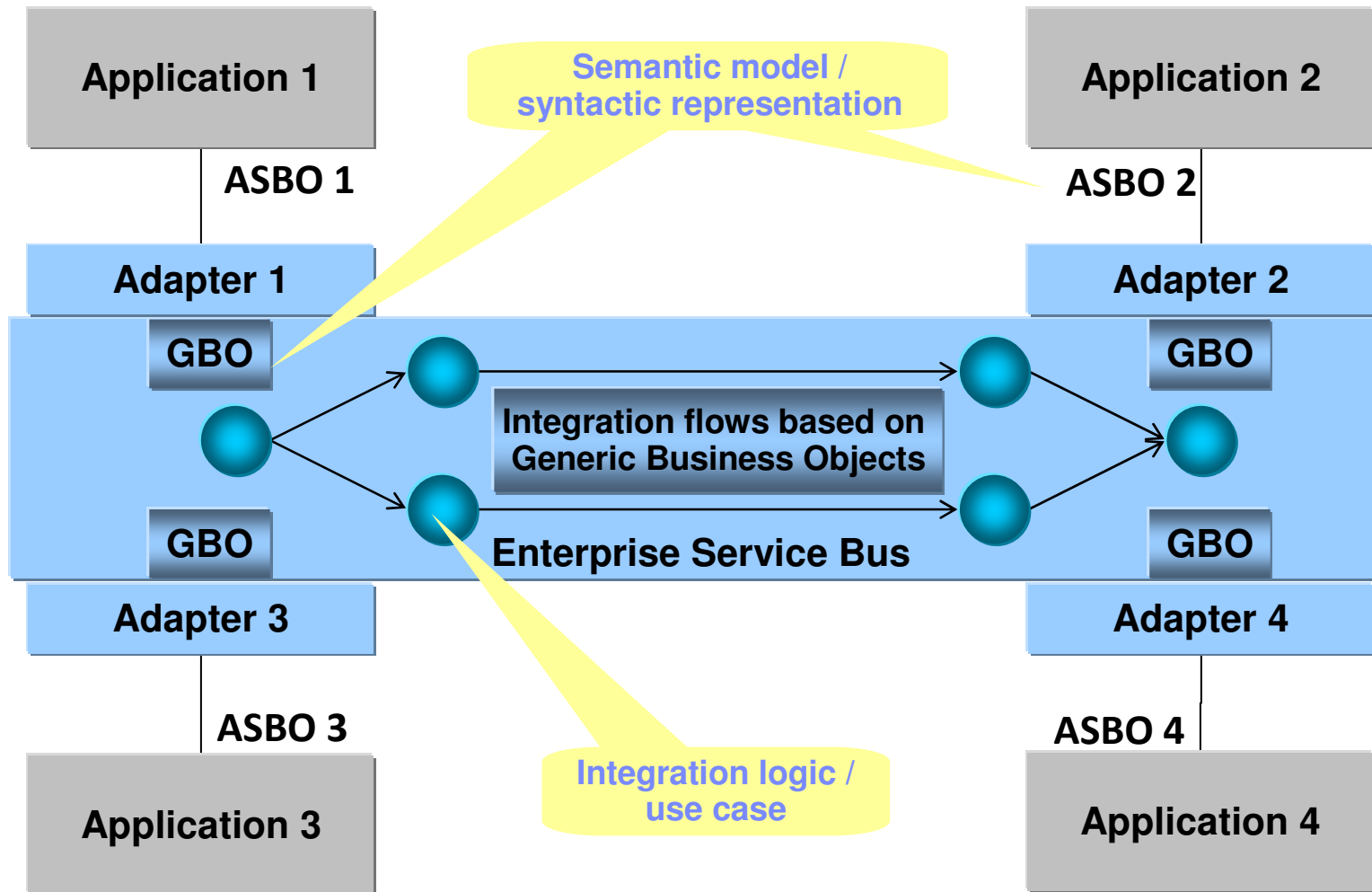
## Topic areas

- **Enterprise Application Integration flashback**
- Industry standard information models and EAI
  - ISO 15926 and Reference Semantic Model
- ISO 15926 and Reference Semantic Model alignment revisited
- Relating iRING and IIF from an EAI bus perspective
- Summary

## Motivation

- Observe existence of different application integration infrastructures & technologies
  - **Enterprise application level:**
    - ➔ Enterprise Service Bus approach to connect ERP, EAM, CRM systems
  - **Production Control Level:**
    - ➔ Open Process Control (OPC) to integrate DCS and MES systems
  
- Integrate integration infrastructures
  - ➔ vertical application integration

## Enterprise Application Integration flashback to year 2000



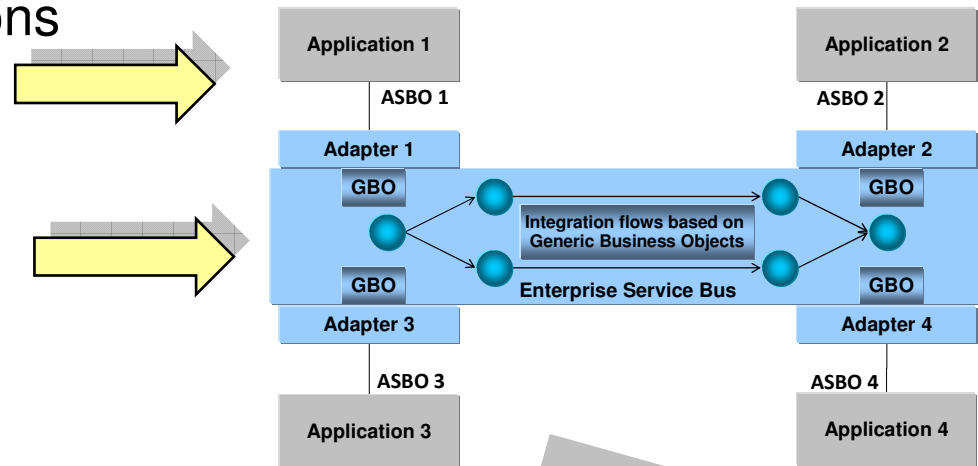
## EAI ,rules of the game‘

- **Applications** to be integrated are
  - More established & harder to change
  - Based on their *application specific business objects*
- **Integration bus** (Enterprise Service Bus)
  - Host integration logic based on a ,common ground‘
  - Operate on *generic business objects*
- **Adapters**
  - Translate between application specific and generic business objects
  - Trigger the *integration logic* (workflows)

# The role of industry standard information models in EAI scenarios

Where can industry standard information models be found?

- Application specific business objects  
→ standards based applications
- Generic business objects  
→ standards based application integration
- Mapping between/to/from industry standards  
→ becomes part of the EAI discipline



for example  
ASBO 1 = ISO 15926  
ASBO 2 = ISA S95  
ASBO 3 = MIMOSA  
ASBO 4 = CIM

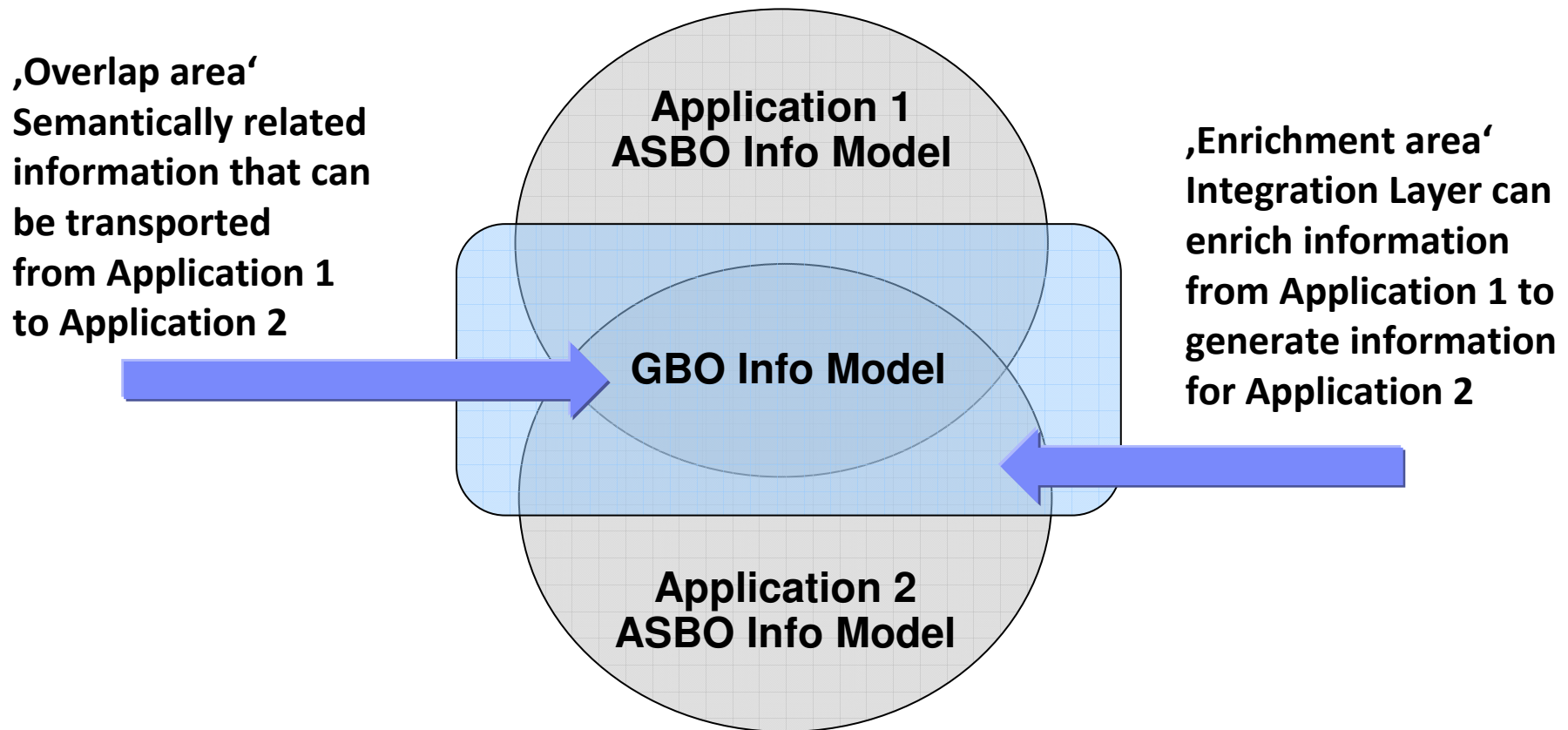
for example  
GBO = ISO 15926  
GBO = ISA S95  
GBO = MIMOSA  
GBO = CIM

## ,Classical' Horizontal EAI (topfloor-to-topfloor integration)

- Connects enterprise applications which operate at **similar levels of semantic information**
- Couples systems which **operate at the same processing speed** (order of magnitude)
- Overlap between business objects is required  
 **$ASBO\ App1 \cap GBO \cap ASBO\ App2$**

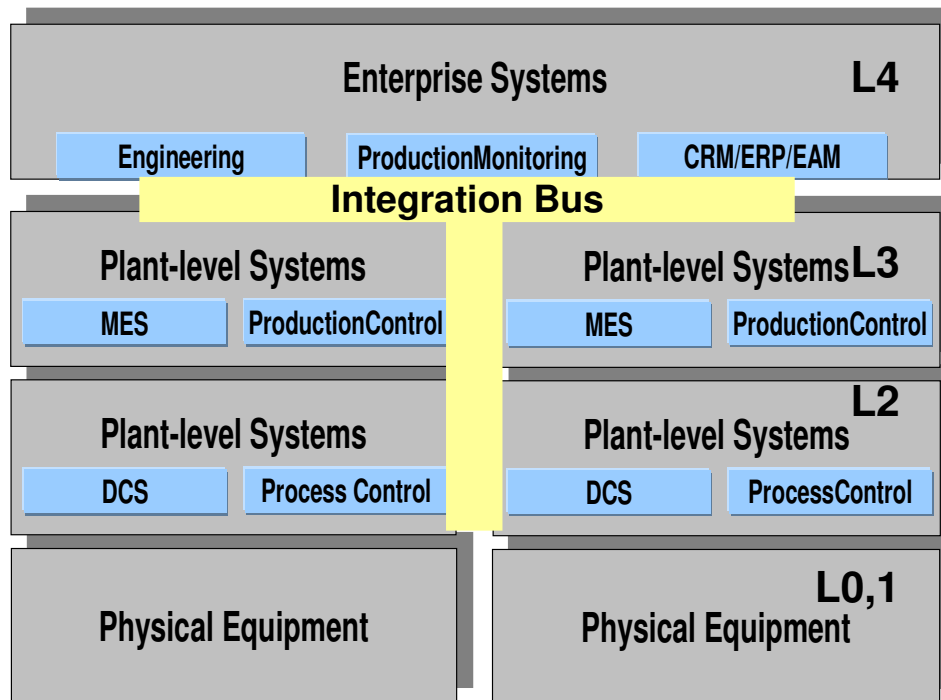
The ASBOs carry enough information to populate the GBO

## Relationship between ASBO and GBO information models



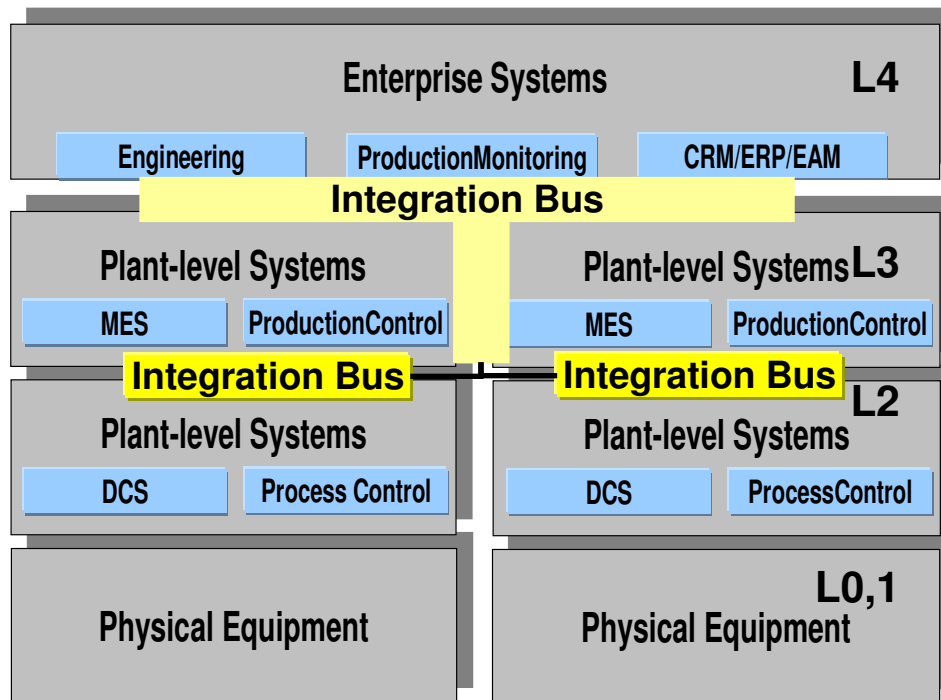


## Simplified view on ISA S95 layers (Purdue Reference Model)



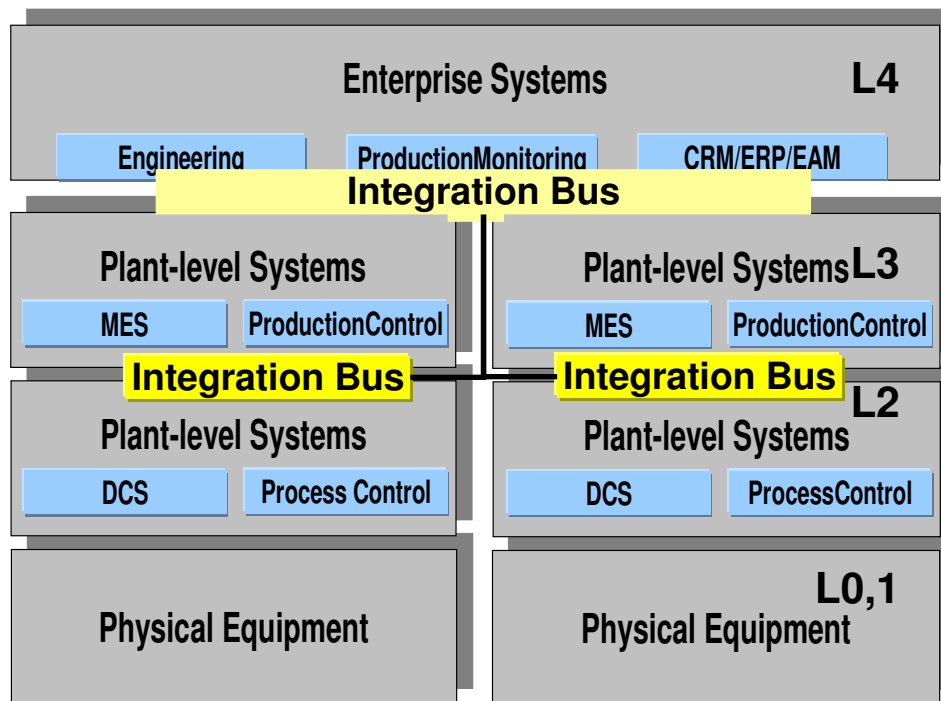
- Application layers
  - Enterprise wide business applications
  - Plant-level manufacturing execution
  - Plant-level process control
- Production equipment

## Simplified view on ISA S95 layers (Purdue Reference Model)



- Application layers
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## Simplified view on ISA S95 layers (Purdue Reference Model)



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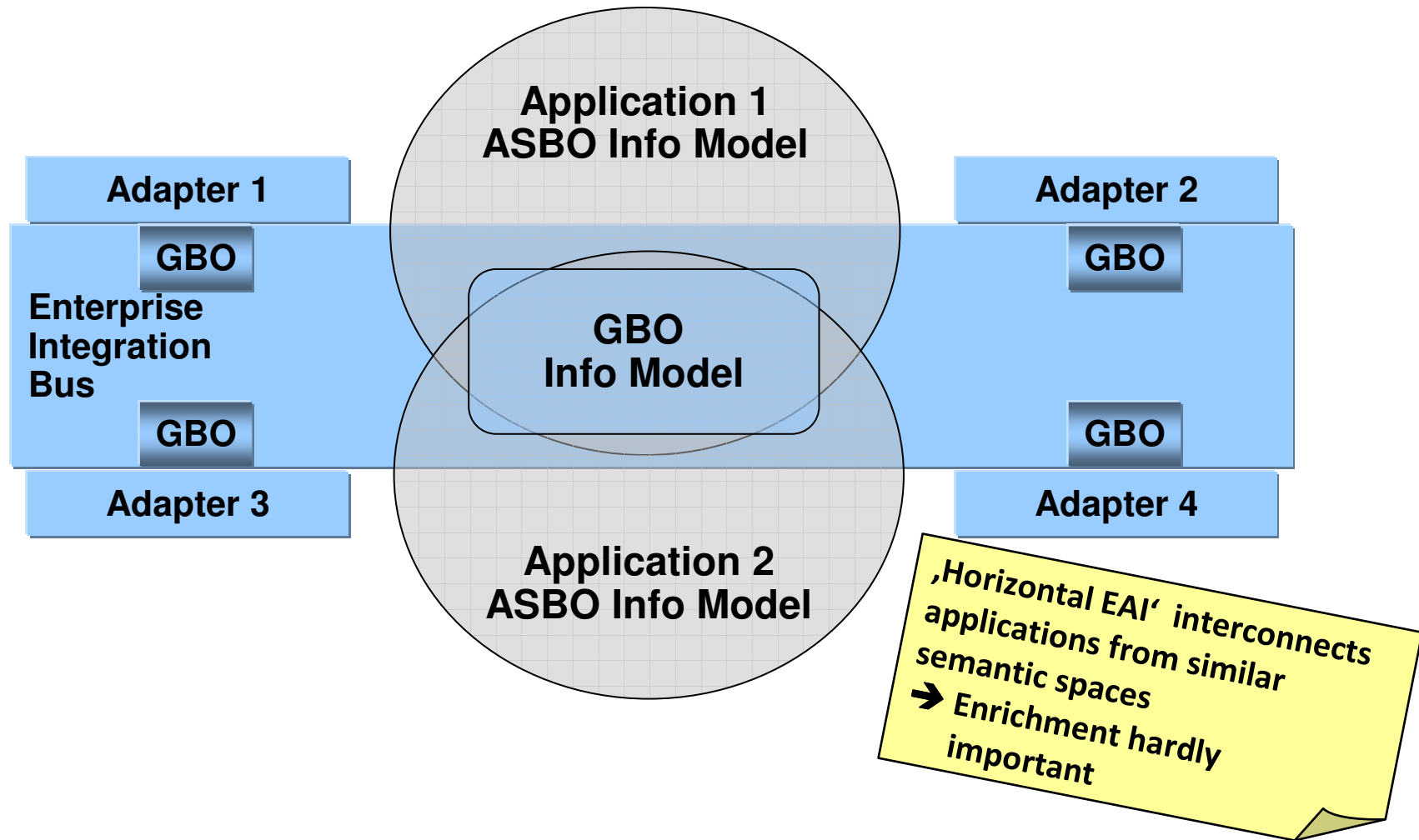
## Advanced Vertical (E)AI (shopfloor-to-topfloor integration)

- Connects plant control and enterprise applications operating at ***different levels of semantic information***
- Integration typically requires enrichment/reduction of different information
- Couples systems which **operate at different processing speeds** (order of magnitude)
- Overlap between business objects is required  
 **$ASBO\ App1 \cap GBO \cap ASBO\ App2$**

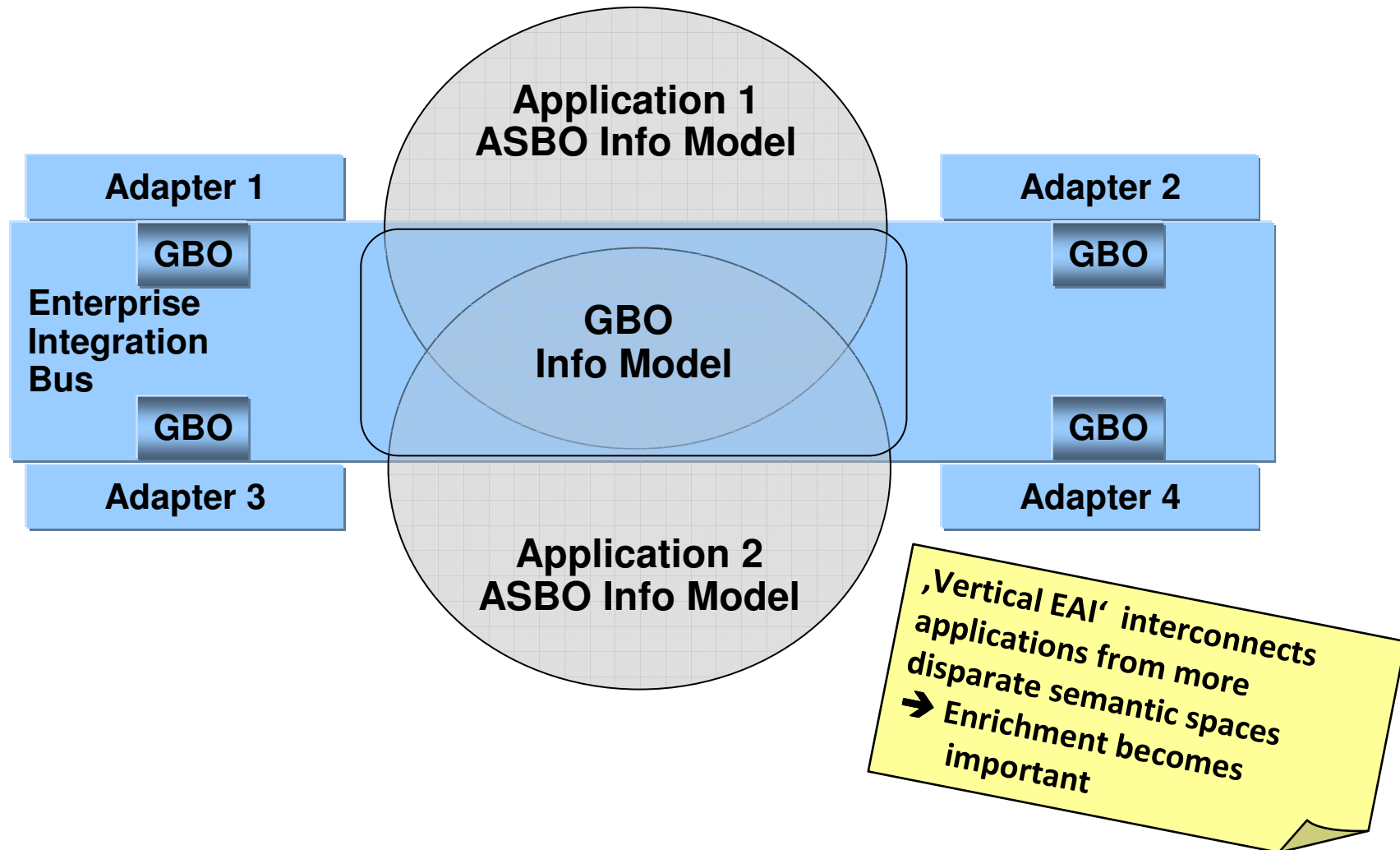


**ASBOs from the plantfloor (L1, L2) do not carry enough information to populate the GBO!**

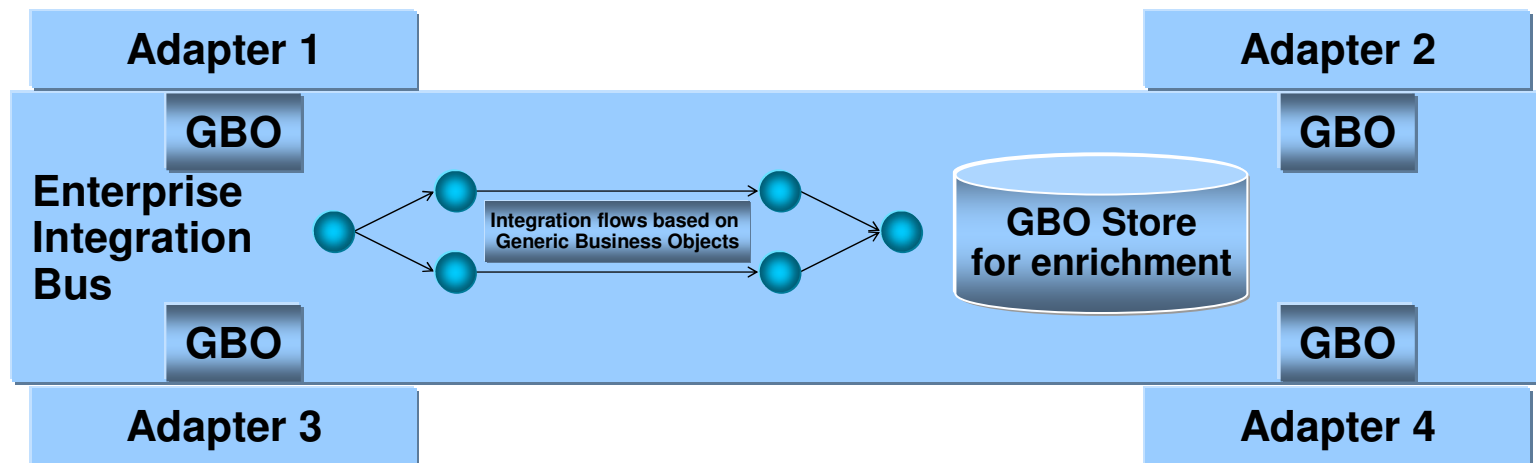
## „Classical‘ GBO models for horizontal application integration



## „Modern“ GBO models for vertical application integration



## The bus needs to get smarter – add a GBO store



In the classical horizontal bus GBOs exist mainly transiently

In the modern vertical bus GBOs exist also persistently

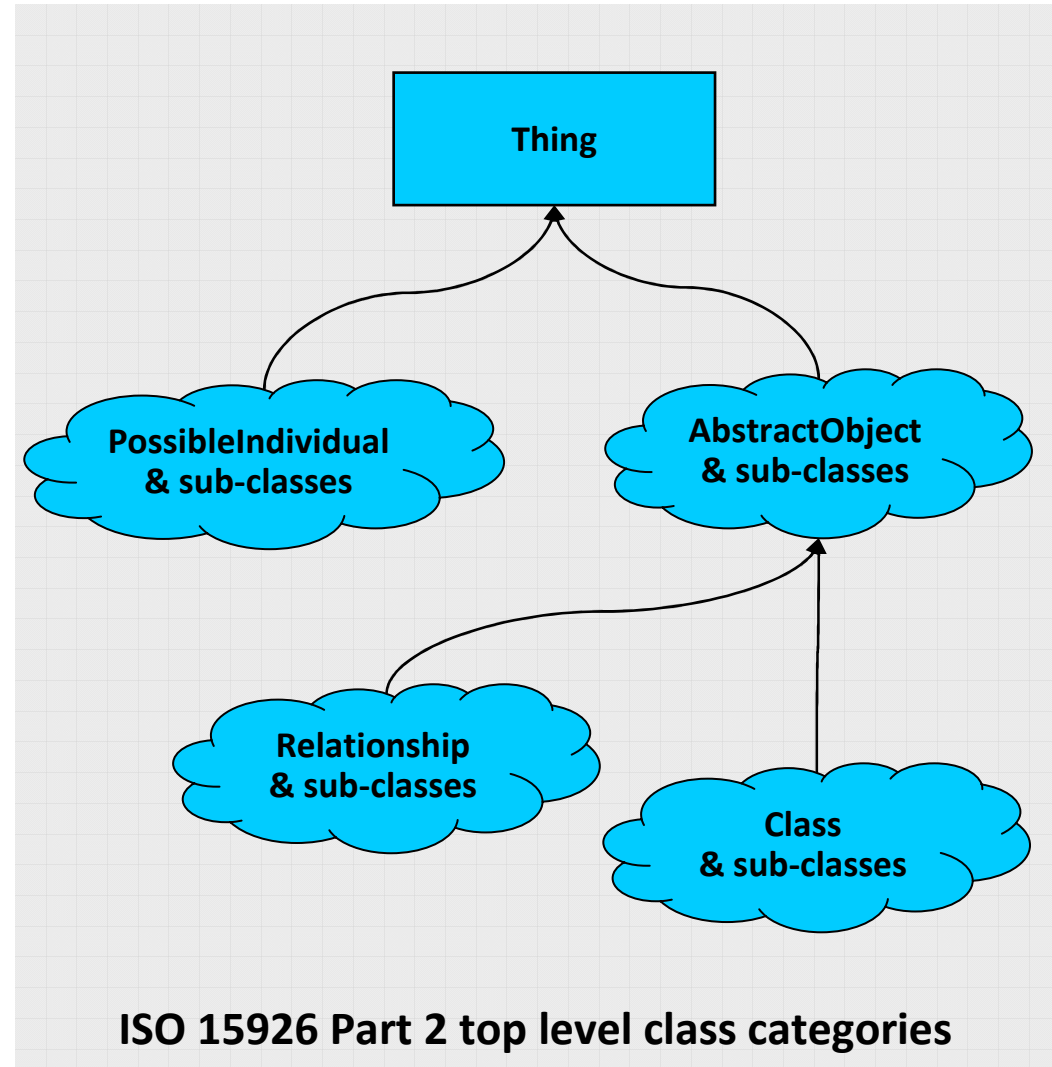
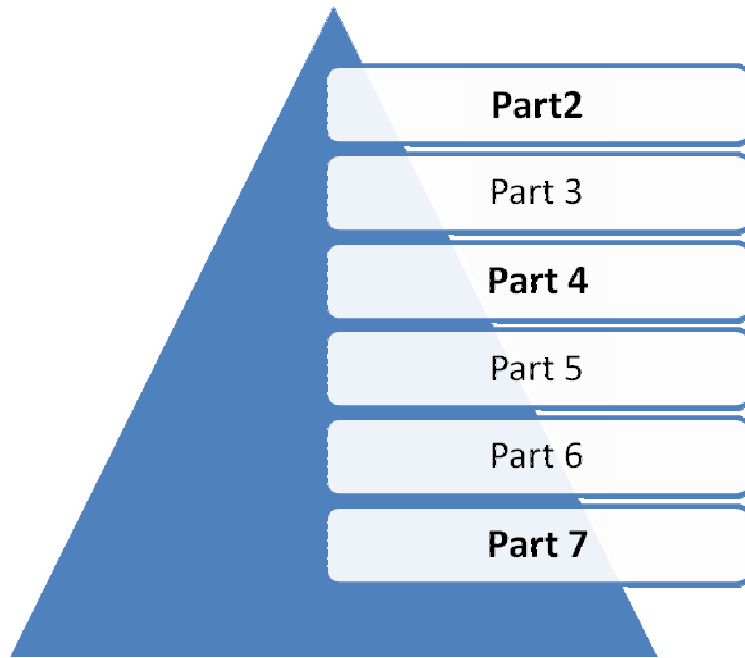
**Importance of GBO information model grows for vertical EAI**

## Topic areas

- Enterprise Application Integration flashback
- **Industry standard information models and EAI**  
– **ISO 15926 and Reference Semantic Model**
- ISO 15926 and Reference Semantic Model alignment revisited
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# The ISO 15926 Pyramid



## The roles of Part 2, 4, and 7 from an EAI perspective

- Part 2 is the master GBO schema
  - All ISO 15926 data to be transported is – in the end – instance data of the Part 2 meta-model
  
- Part 4 is ‚just‘ instance data according to Part 2
  - Would a Part 4 Oil & Gas ontology defining an O & G meta-model also serve as the GBO meta-model?  
→ **NO!**
  - Do interaction partners have to agree on the same Part 4 O&G ontology?  
→ **YES!**
  
- Part 7 template definitions allow
  - To define the translations to be performed in the adapters  
**model X → ISO 15926 → model Y**



## Observations using ISO 15926 as the GBO information model

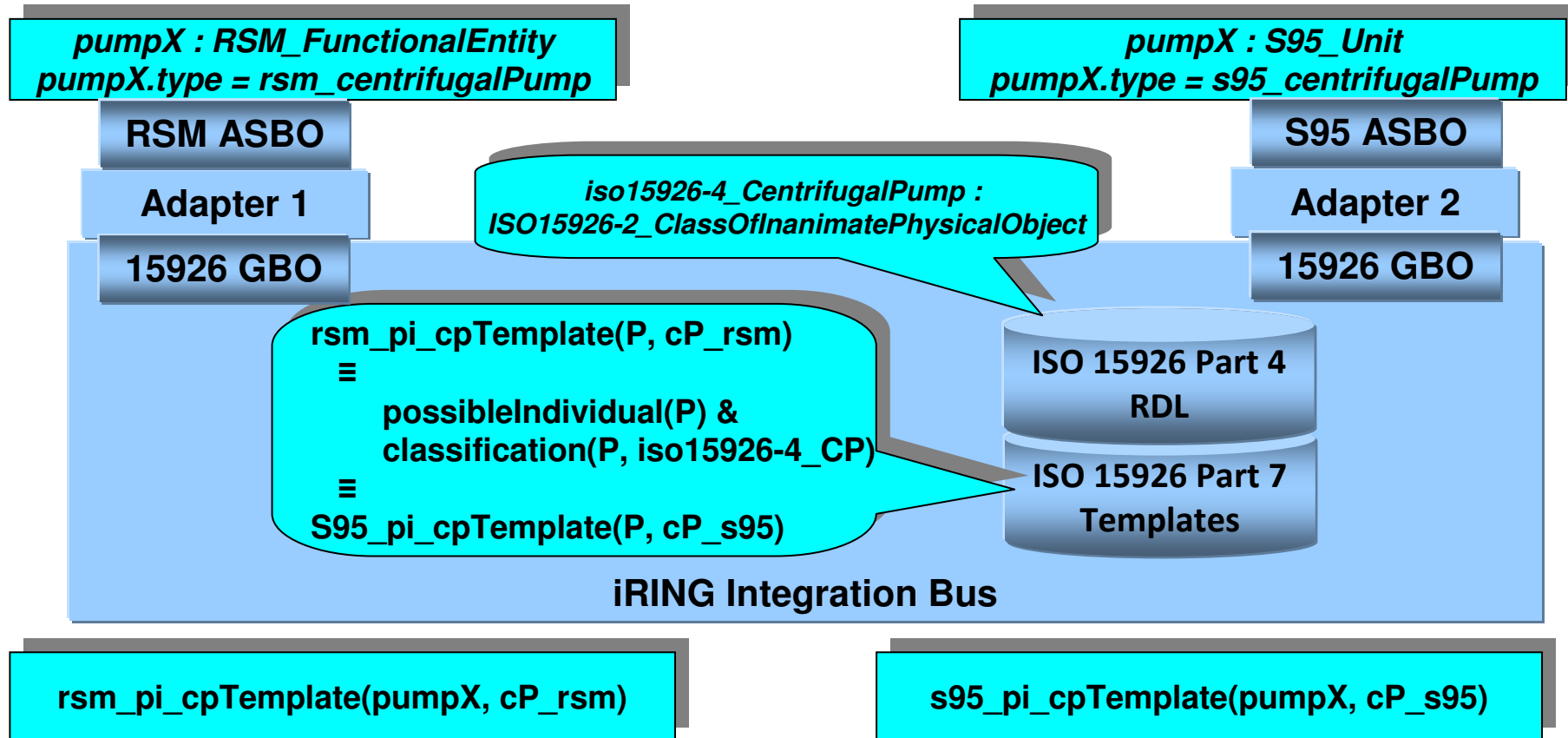
- ISO 15926 Part 2 is fairly generic
  - pro → easy to map into
  - con → hard to map out of

```
pumpX : ISO15926-2_PossibleIndividual
```

- Relate the transported content to an RDL
  - pro → know the terms that are transported
  - con → both parties have to agree on the same RDL

```
pumpX : ISO15926-2_PossibleIndividual  
classification(pumpX, iso15926-4_CentrifugalPump)  
iso15926-4_CentrifugalPump : ISO15926-2_ClassOfInanimatePhysicalObject
```

## Some thoughts on iRING from an EAI perspective



GBO's are ISO 15926 ,sentences', i.e., multiple Part 2 statements  
 → compress these sentences into a Part 7 Template

## Reference Semantic Model by IBM

- Blend of different industry standards
  - S88, S95, CIM (IEC 61970), MIMOSA, ISO 15926, UNCEFACT, ...
  
- Fulfills requirements for a GBO model for vertical application integration
  
- Is the GBO information model for IBM's Integrated Information Framework

# The Reference Semantic Model

Chemical and Petroleum Solutions

## The Conceptual Reference Semantic Model

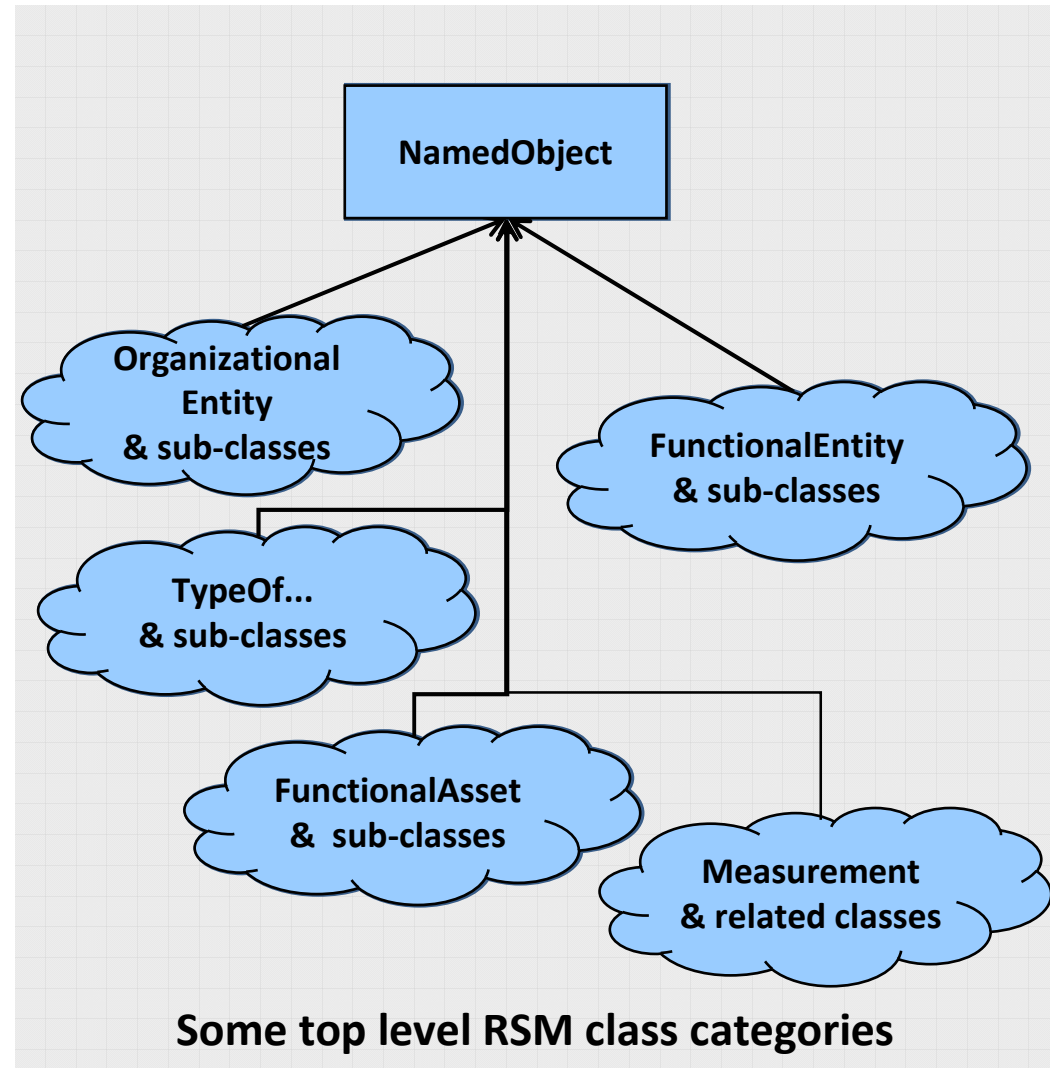
- RSM Team**
  - PCA / POSC Caesar Association – Thore Langeland, Nils Sandsmark, Magne Valen-Sendstad
  - ISA 95 – Keith Unger
  - ISA 88 – Dennis Brandl
  - OAGI – Dave Connelly
  - WBF – Dave Emerson
  - Energistics – Jerry Hubbard
  - MIMOSA – Alan Johnson, Ken Beaver
  - OSisoft – Jack Aude
  - StatOilHydro - Olav Lerflaten
  - DOW – Russ Dickinson
  - SISCO – Herb Falk, Lorenzo Childress
  - IBM - Russ Lambert, Udo Pletat

**RSM Team Objectives/Milestones**

- Objectives
  - Advance the modeling work
  - Ensure compliance with the participating standards
- Standardisation
  - Working with ISO 15926 through their IO HN project initiative to standardise RSM in ISO 15926

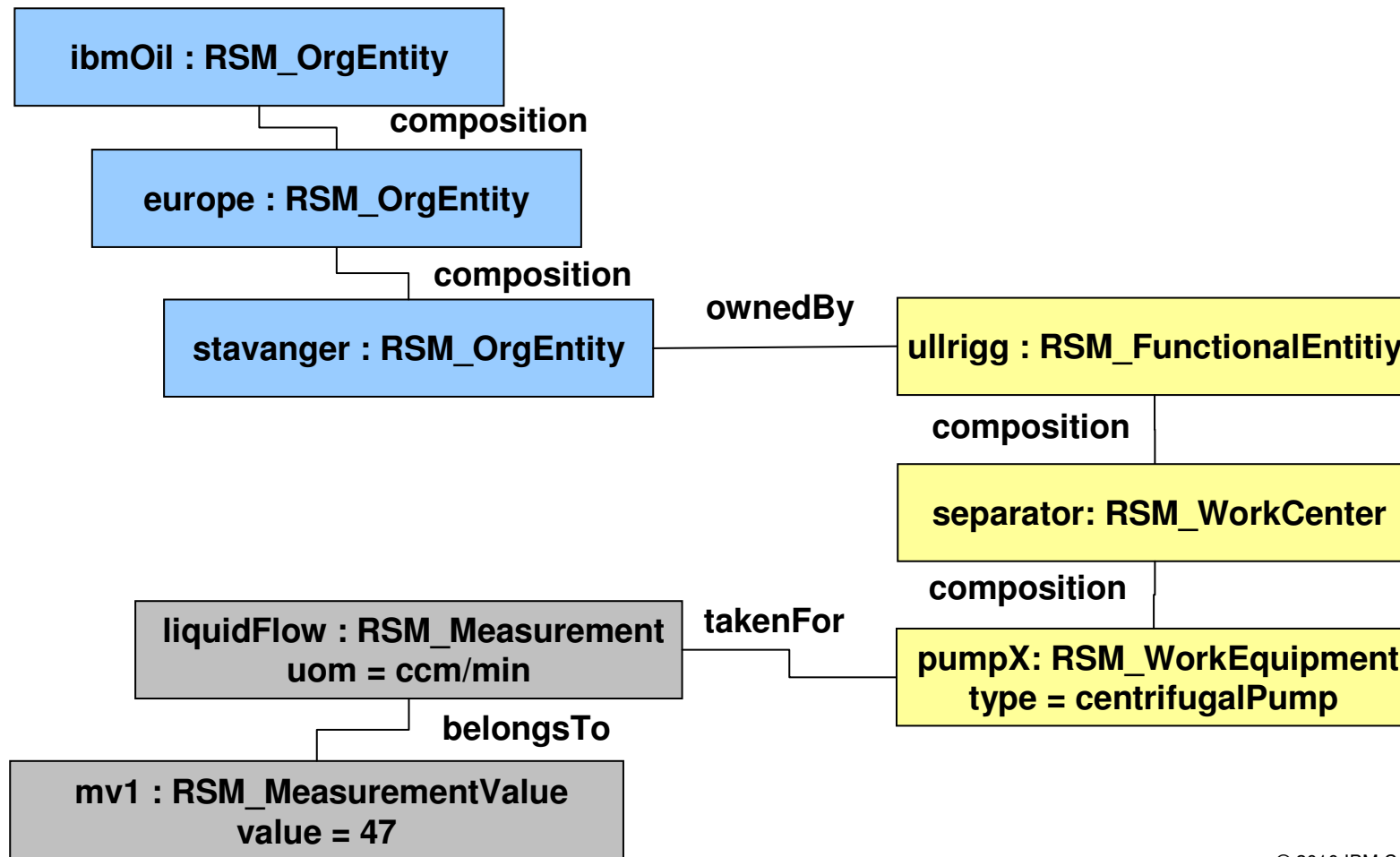
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## RSM Ancestry chart

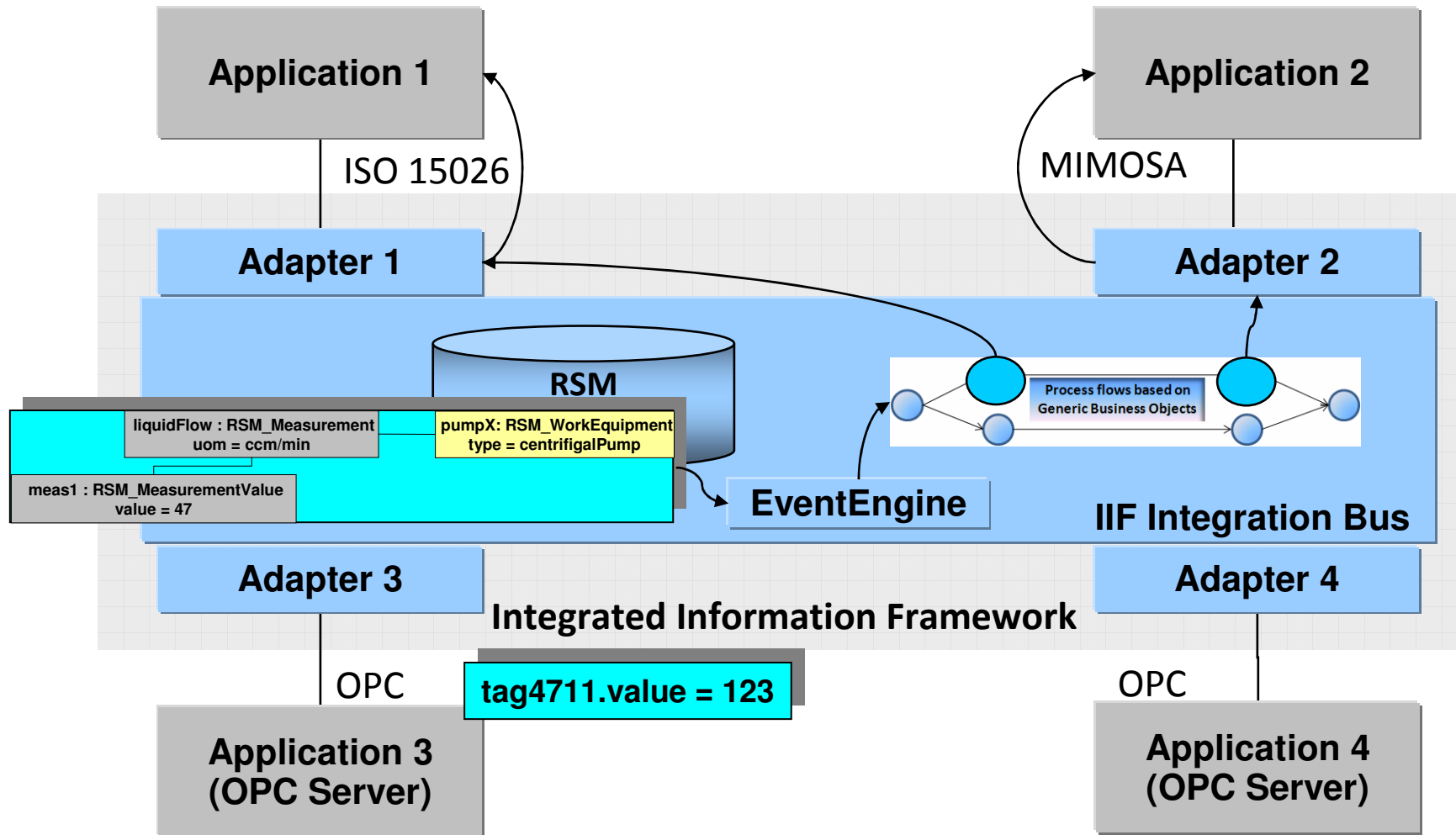


# RSM used for representing enterprise structure

Hierarchies of organizational units      Hierarchies of functional units  
& much much more

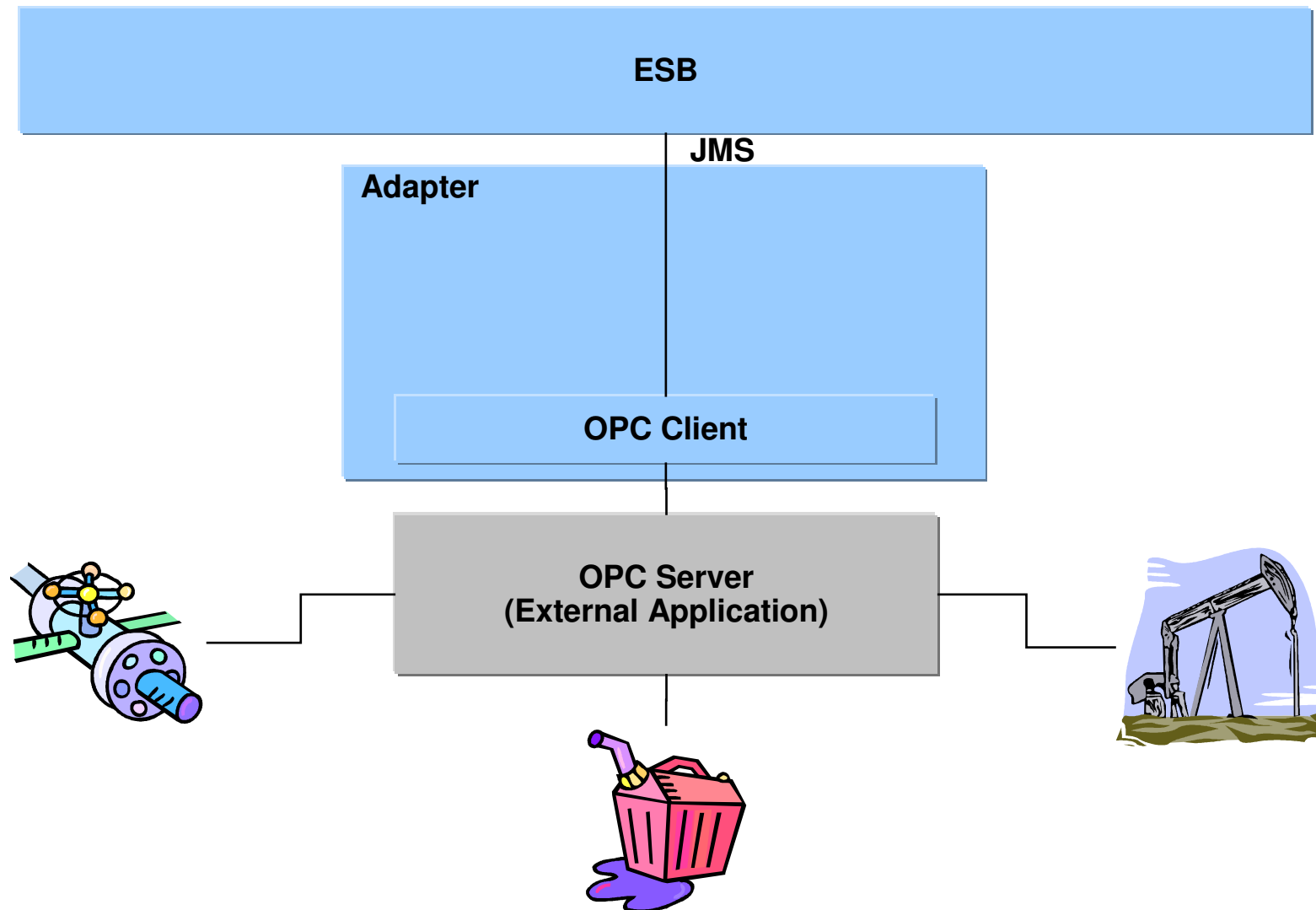


# Typical vertical EAI use case pattern for IIF: - lift OPC tag reads to RSM GBOs and trigger work flows

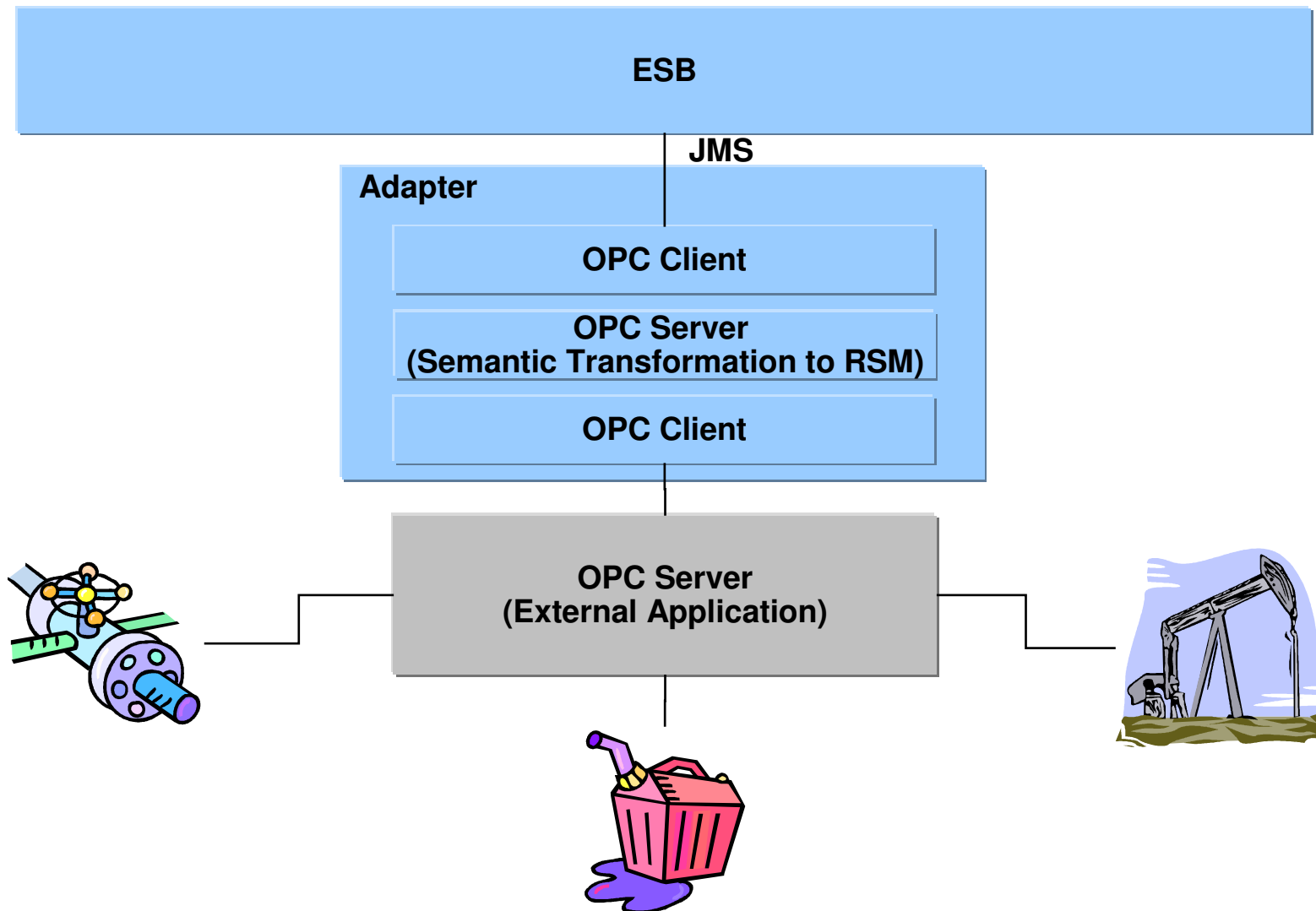




# Typical structure of adapter to hook up OPC to ESB - lightweight



# Structure of IIF adapter to hook up OPC to ESB - heavyweight



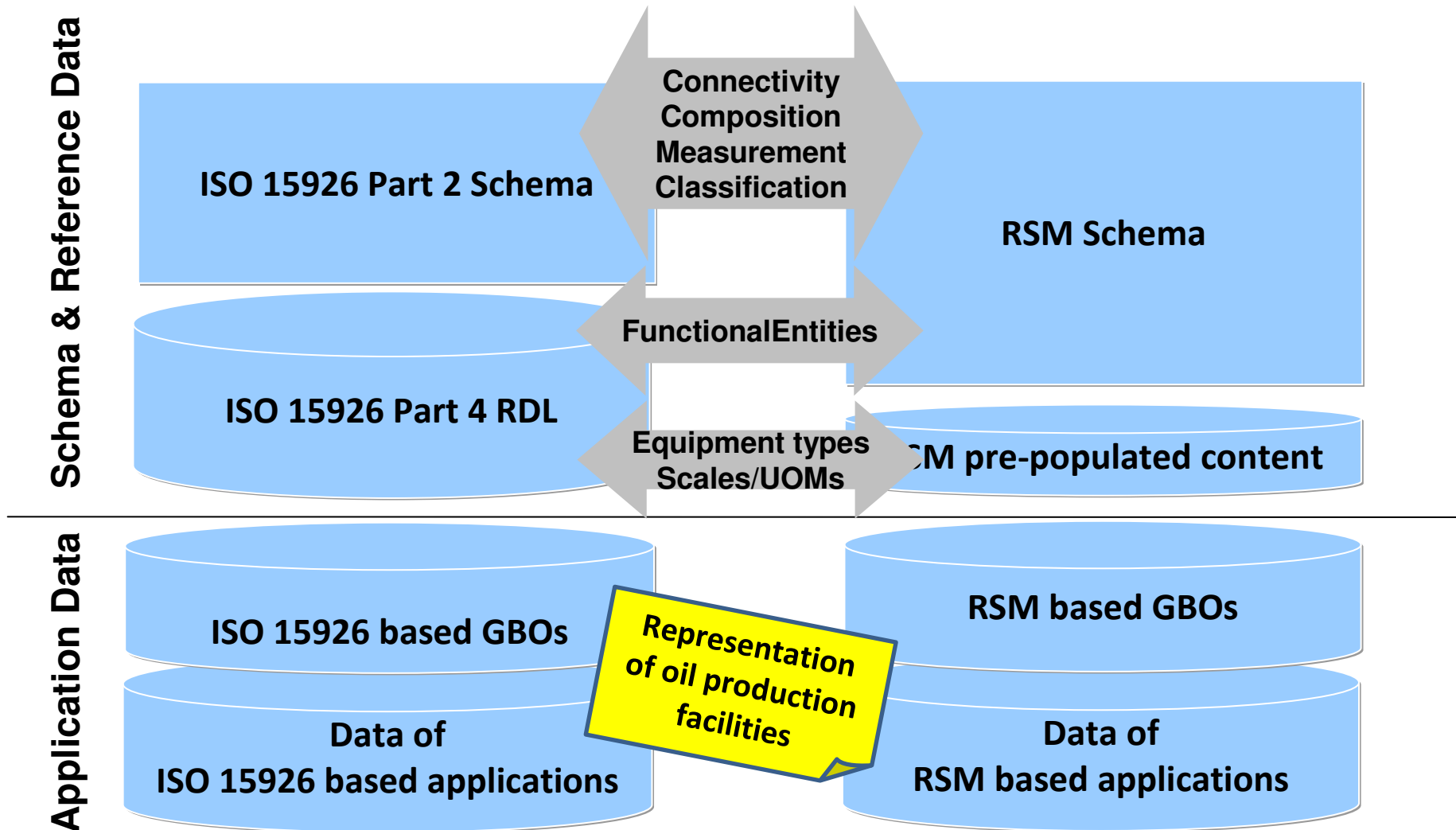
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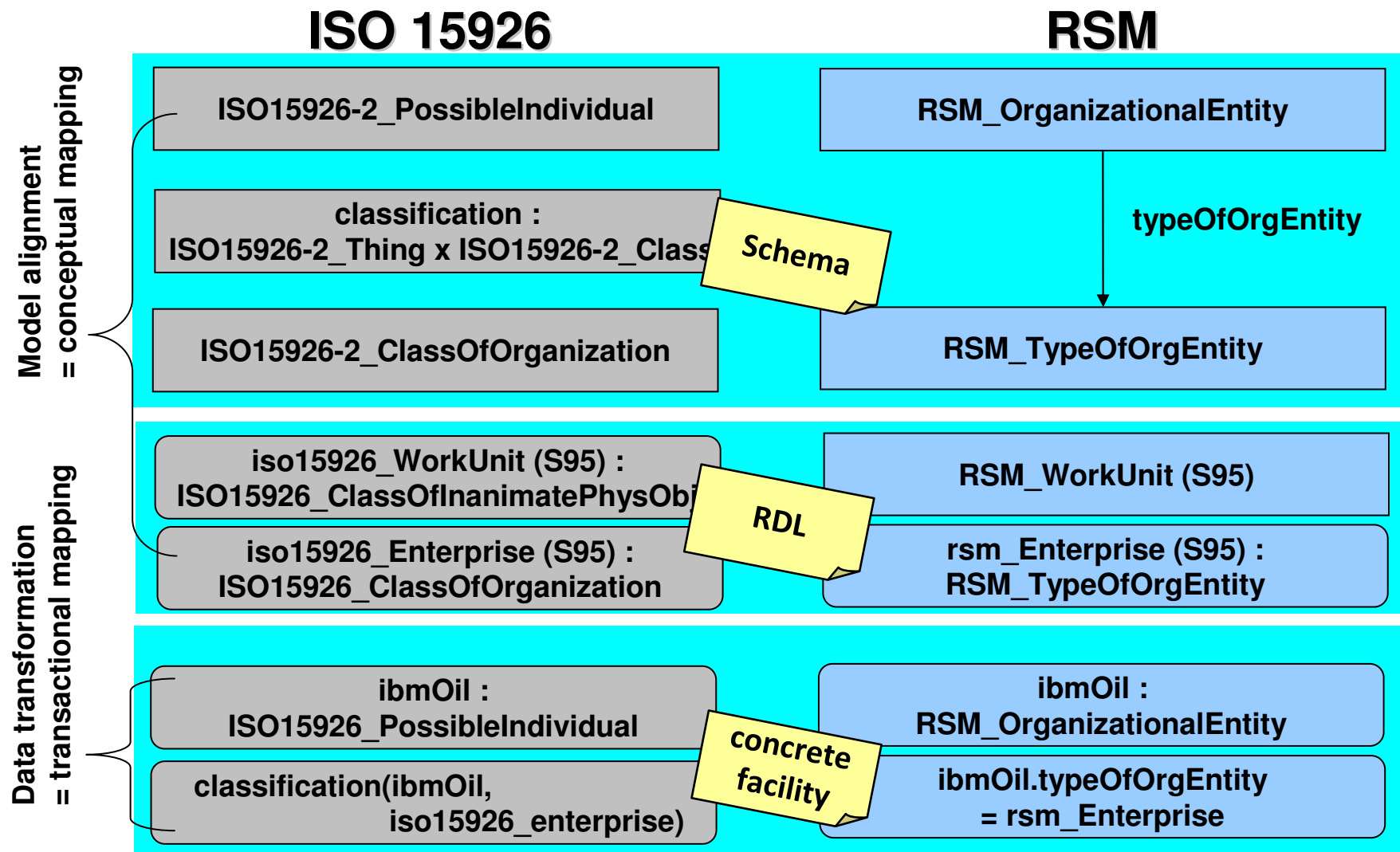
## Conceptual overlaps between ISO 15926 and RSM

- **Schema level**
  - ISO 15926 - Part 2 ↔ RSM classes
  
- **Instance level → reference data**
  - ISO 15926 – Part 4 (RDL) ↔ RSM classes
  - ISO 15926 – Part 4 (RDL) ↔ RSM class instances  
(pre-populated)
  
- **Instance level → facility representation**
  - Instances of part 2 classes  
classified by part 4 terms ↔ RSM instances  
tagged with pre-populated  
terms

## Take a closer look at the overlap areas between ISO 15926 and RSM

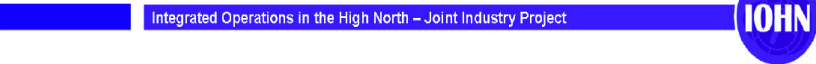


## Class and instance level correspondances

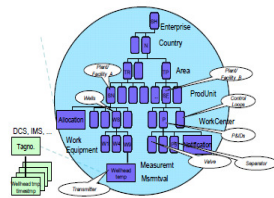


# Protoype implementation of ISO 15926 – RSM conversion demonstrated at ISA Expo 2009

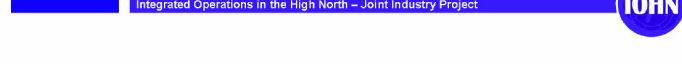
## ModelQuery input



- <http://172.20.5.101:9082/QueryTestWeb/ModelQueryHTTP/GetXML>
- `rsmQuery.enterprise('name' eq 'IBM Oil')`
  - `country('name' eq 'Europe')`,
  - `field('name' eq 'Stavanger')`,
  - `productionUnit('name' eq 'Ullrigg')`,
  - `workCenter('name' eq 'Separators')`,
  - `workCenter('name' eq 'CD7101-X').equipment()`,
  - `equipment().equipmentCategory()`
  - `equipmentPropertyDefinition()`
  - `equipmentProperty()`;

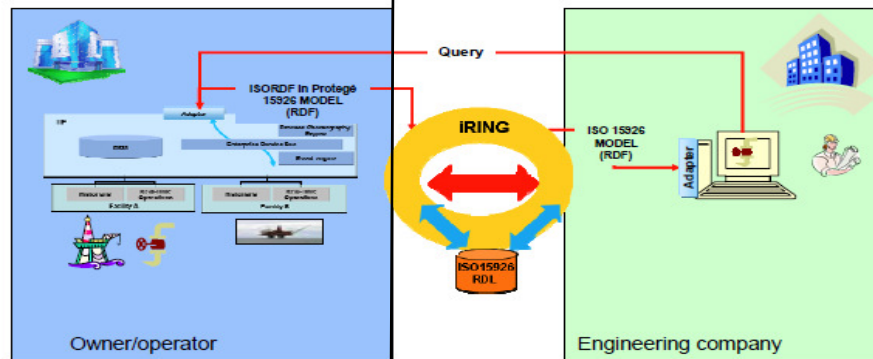


## Valve data in in Inspec, the Bechtel engineering application



Tag	Work Center	Area	Unit	Equipment	Min Flow Rate	Max Flow Rate	Flow Rate UOM	Min Oper Temp	Max Oper Temp	Oper Temp UOM
EV7101	CD7101-X	Stavanger	Ullrigg	CD7101	32	172	Asc3/h	-30	165	DegC
EV7126	CD7101-X	Stavanger	Ullrigg	CD7101	25	126	Asc3/h	-45	197	DegC

(private instance) IIF ← → iRING (public or private instance)



## Topic areas

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## IIF versus iRING

### - some commonalities & differences

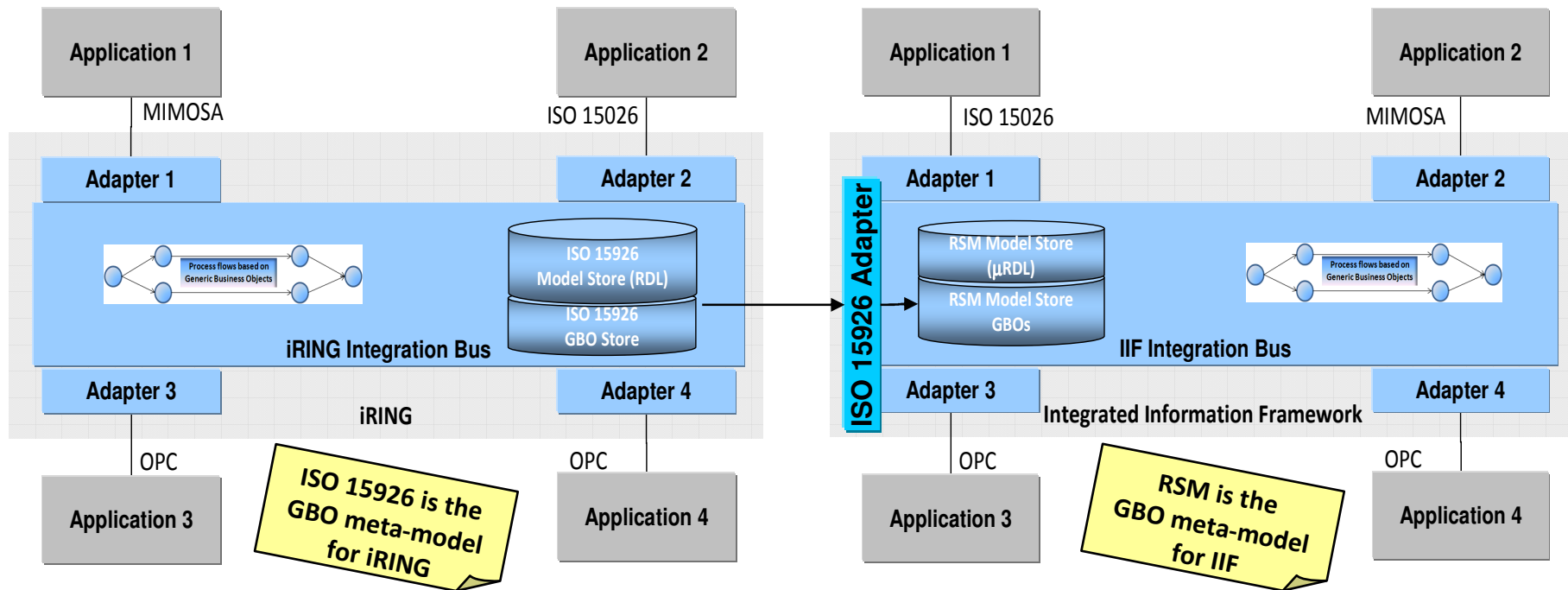
	<b>iRING</b>	<b>IIF</b>
<b>Base information model</b> → GBO info model	▪ <i>ISO 15926</i>	▪ <i>Reference Semantic Model</i>
<b>Use of information model</b>	<ul style="list-style-type: none"> <li>▪ Reference Data Library <i>definition</i></li> <li>▪ Representation of enterprise GBO data (-)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reference Data Library <i>consumption</i></li> <li>▪ Representation of enterprise GBO data (++)</li> </ul>
<b>Preferred use</b>	<ul style="list-style-type: none"> <li>▪ intra-enterprise</li> <li>▪ inter-enterprise (private)</li> <li>▪ <i>inter-enterprise (public)</i></li> </ul>	<ul style="list-style-type: none"> <li>▪ intra-enterprise</li> <li>▪ inter-enterprise (private)</li> </ul>
<b>Implementation technology</b>	▪ <i>.NET architecture</i>	▪ <i>JEE ESB architecture</i>

# Establishing iRING and IIF interoperability

## → GBO & RDL synchronization in integration buses

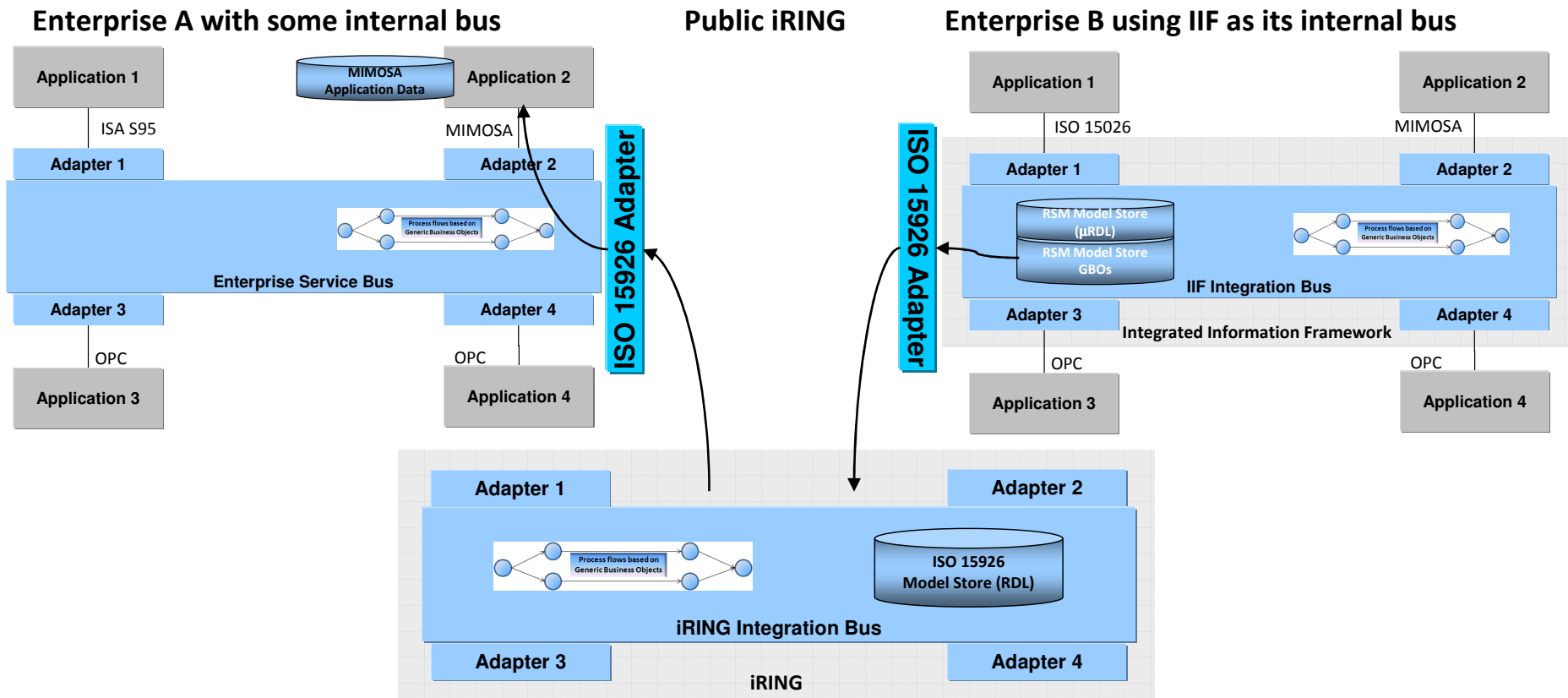
### Enterprise A using iRING as its internal bus

### Enterprise B using IIF as its internal bus



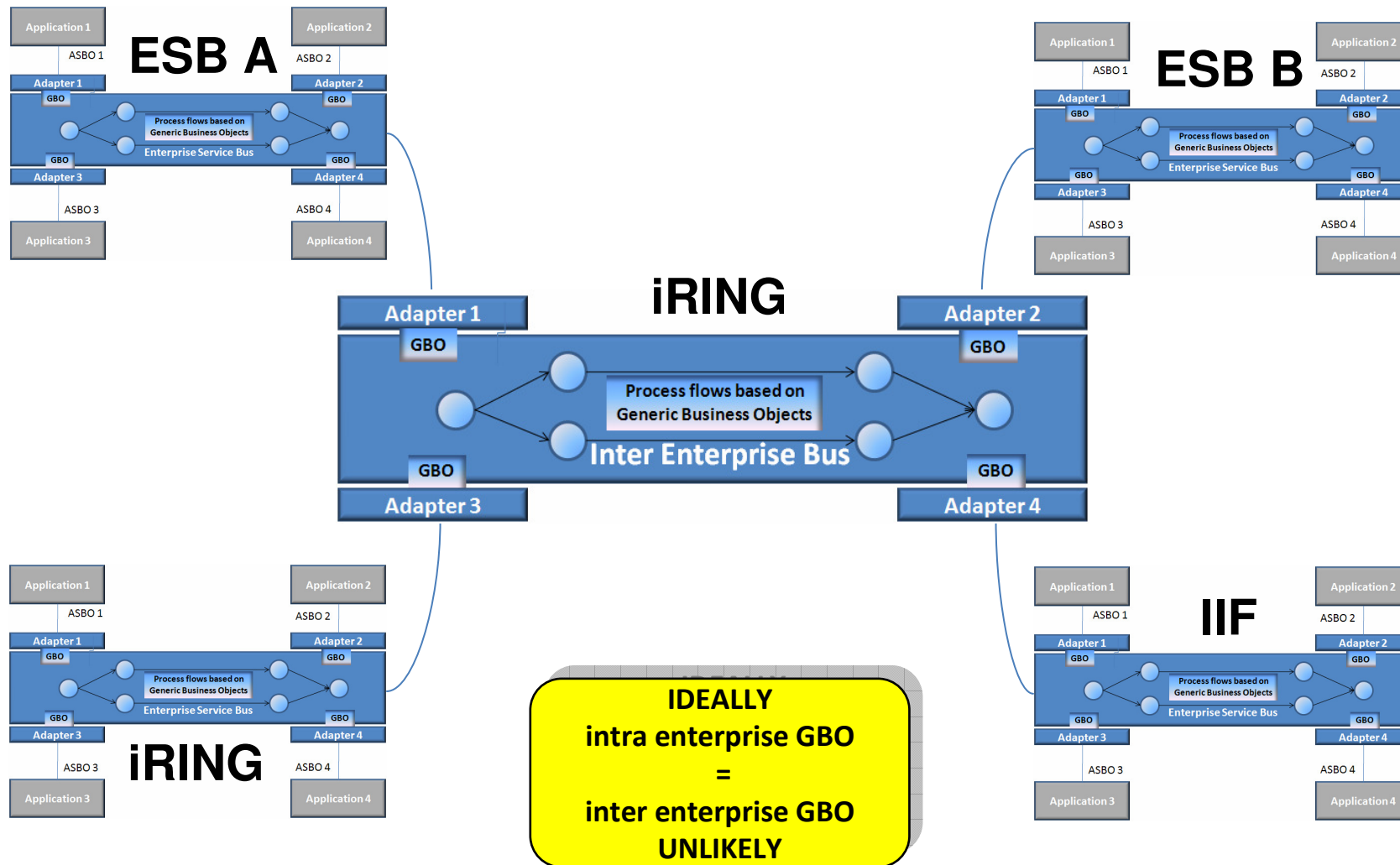
**iRING RDL is local at enterprise A**  
**Scenario: use the RDL store for maintaining GBOs**

# Establishing interoperability between IIF and other bus infrastructure through a public iRING

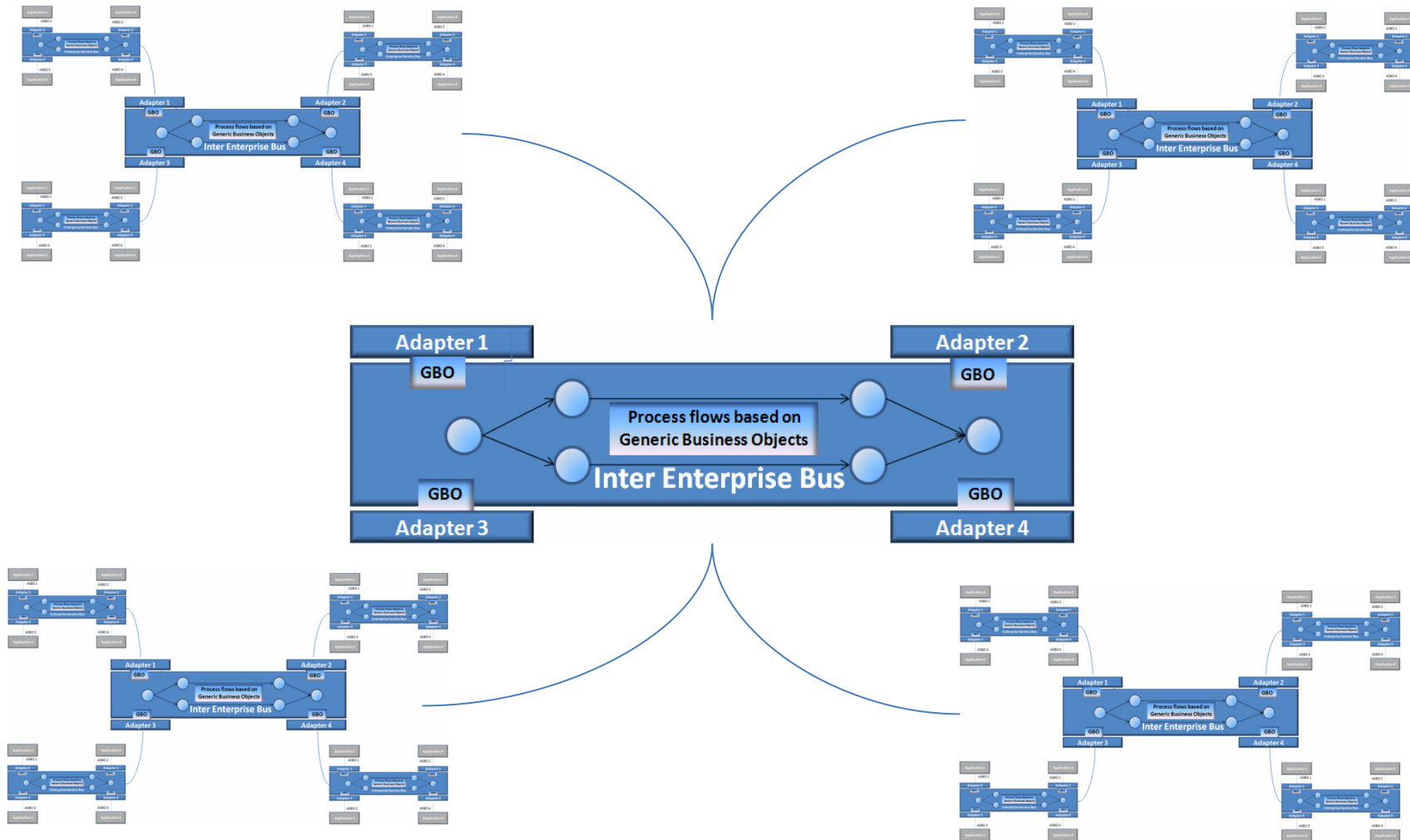


**ISA Expo 2009 demo use case: retrieve RSM model store content  
 RSM Model Store content → ISO 15926 Data → Application Data**

# Similar problem – similar solution when going cross-enterprise



# For those who liked Gödel, Escher, Bach – An Eternal Golden Braid



## Topic areas

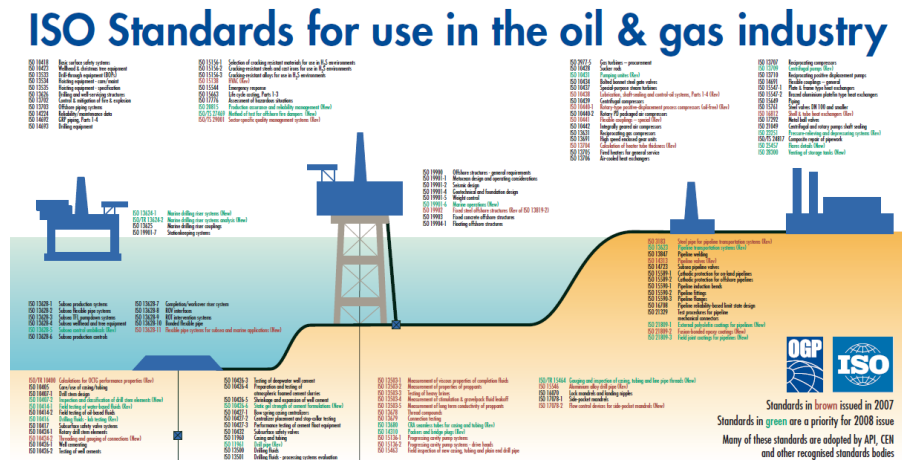
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## Vertical EAI – a next step evolving from horizontal EAI

- **Horizontal Enterprise Application Integration**
  - contributed the basis of modern enterprise service bus architecture pattern
    - terms like ASBO, GBO, Adapter (mediation), integration flows
  - used for coupling primarily applications on S95 layers 4 and 3
  
- **Vertical Enterprise Application Integration**
  - should adopt the established terminology and approaches from horizontal EAI
  - includes S95 layer 2 (with its connections into layer 1) into the integration scope
  - Has to deal with
    - ‚information slope‘ between S95 layer 2 and S95 layer 3 & 4 information
    - higher performance requirements due to layer 2 runtime characteristics

# The role of industry standard information models for vertical EAI

- There quite a lot of standards addressing different subject areas relevant for the oil & gas industry
- Some are (want to be) by nature
  - Topic specific → WITSML
  - Topic independent → ISO 15926
  - ASBO models → WITSML
  - GBO models → ISO 15926, RSM
- Standard-to-Standard conversions highly appreciated
  - use for intra-enterprise data exchange
  - use for inter-enterprise data exchange
- Enterprise Application Integration is an adequate conceptual framework for this





**This is it!**

***Questions?***

***Thanks for listening!***

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