

# RFID and ISO 15926

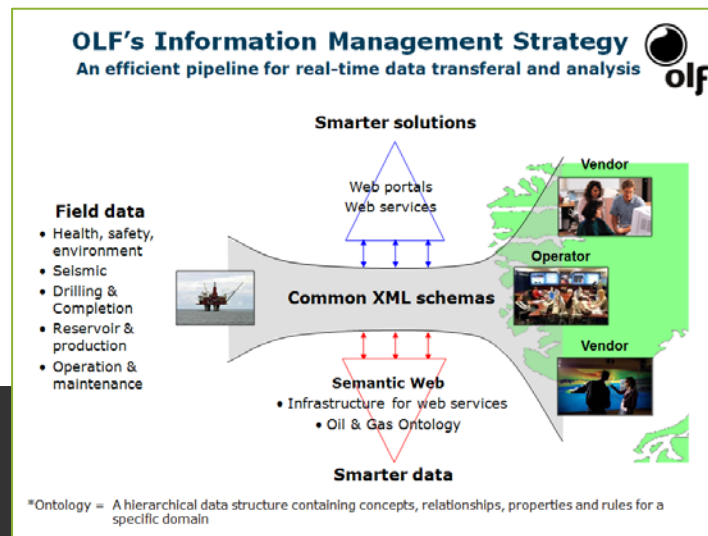
Jennifer Sampson

# Introduction - RFID project

- OLF together with BG, BP, ConocoPhillips, GDF SUEZ, Shell and Statoil financed a project outlining the use of RFID technology in the offshore oil and gas industry. (2007-2009, Project leader: Ovidiu Vermesan, SINTEF)
- Produced [OLF RFID guidelines Parts 1-9](#)
- The goal was to define the requirements and needs of the oil and gas industry for the deployment of RFID technology to successfully undertake the adoption and evaluation of the technology for:
  - petroleum personnel monitoring in critical situations,
  - cargo carrying unit tracking,
  - drill string components and tools tracking,
  - monitor and manage mobile and fixed equipment.

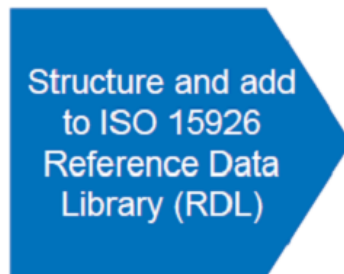
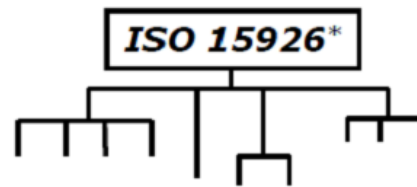
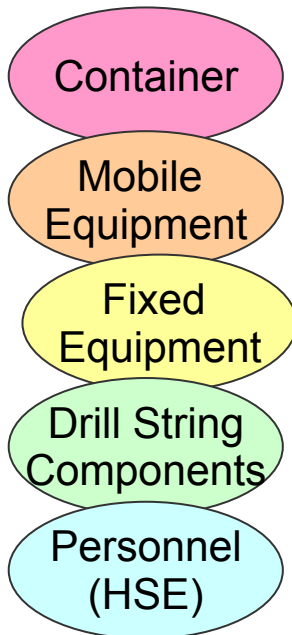
# Background

- Implementation of OLF's Integrated Operations (IO) Generation 2,
  - i.e. integration between operators and suppliers in real time requires a common communication platform based on international standards.
- Key elements of this platform are a common terminology and a reference IT architecture.
  - RFID data should be well defined to enable efficient data sharing across disciplines and organizations.
  - Within each RFID system all data concepts should be aligned with the terminology in use in the offshore industry.

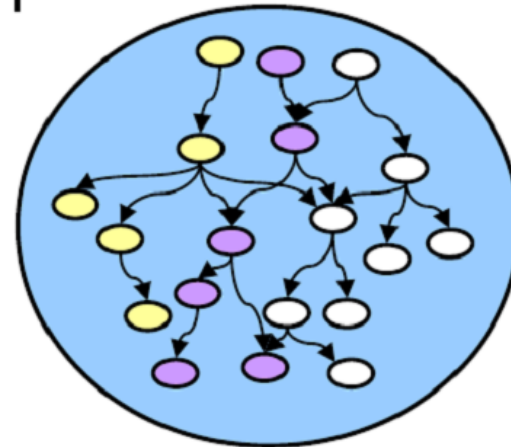


# Deployment Areas of RFID Reference Data

Domain Specific  
Nomenclatures



Oil and gas  
ontology  
(Reference Data)



\* ISO 15926 – *Integration of life-cycle data for process plants including oil and gas production facilities.*

# Architecture - Logical View

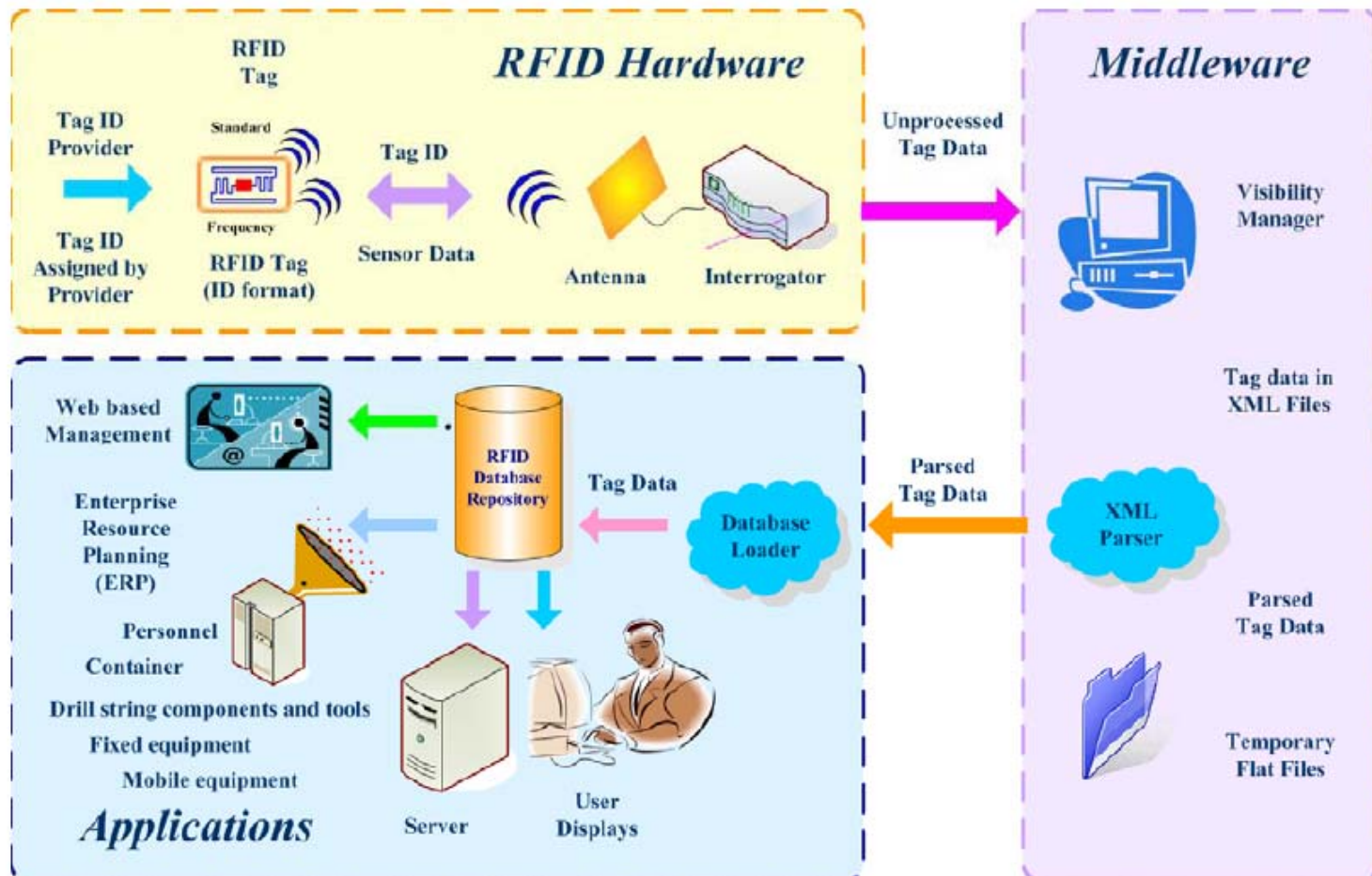


Fig. 5: RFID Architecture logical view.

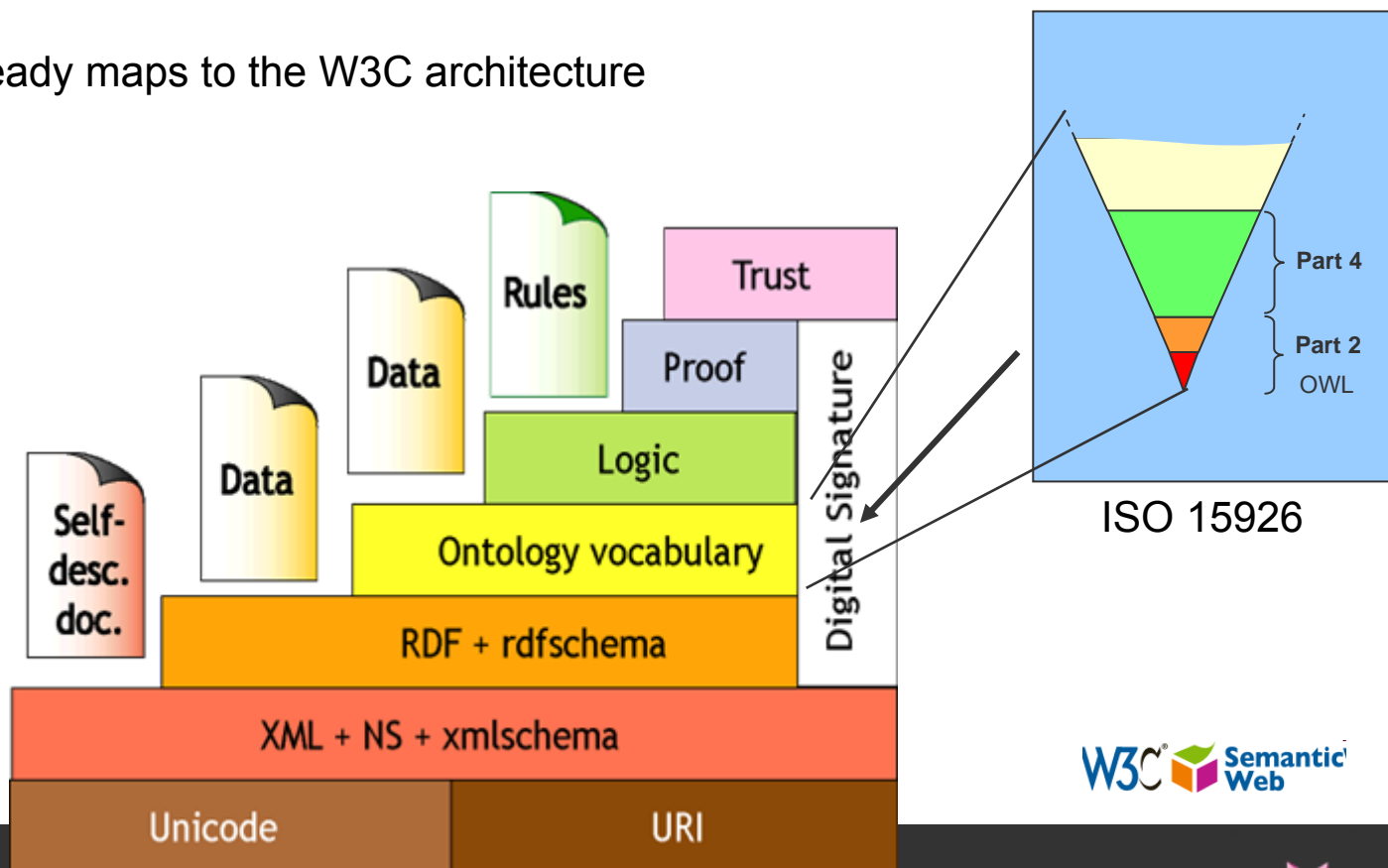
# Semantic Web Stack

Architecture for the Semantic Web

The basic principles can be used to help solve enterprise interoperability

Open Standards of the World Wide Web Consortium – W3C

ISO 15926\* already maps to the W3C architecture



# Ontology

- An ontology is an artefact consisting of:
  - a **vocabulary** used to describe a particular view of some domain
  - a set of **explicit assumptions** regarding the intended meaning of the vocabulary.
    - Usually includes **classification** based information
  - Constraints capturing **background knowledge** about the domain
- Thus, an ontology describes a formal specification of a certain domain:
  - Shared understanding of a domain of interest
  - Formal and machine manipulable model of a domain of interest

# Reference Data Complexity

Decrease of ambiguity

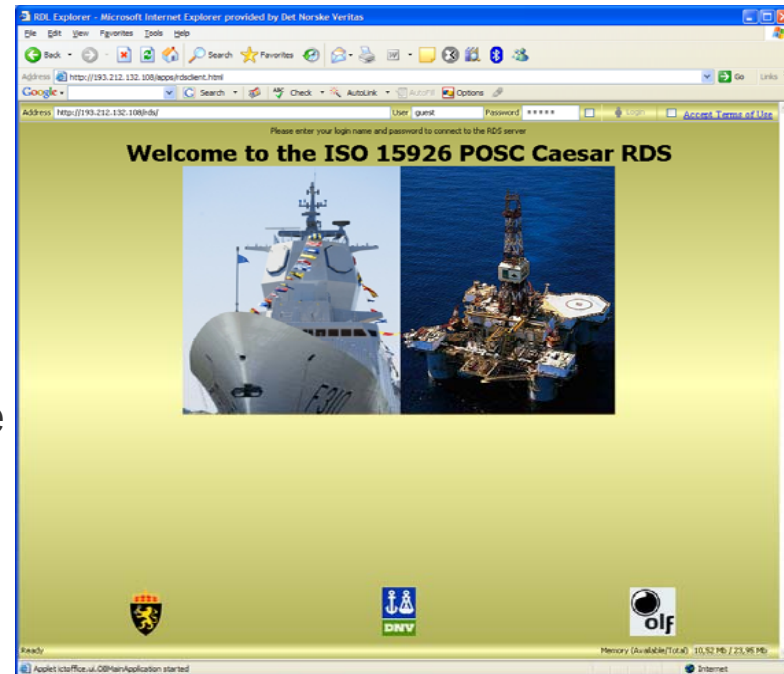
- Dictionary
  - Terms and definitions
- Taxonomy
  - Classes in sub-/superclass hierarchy
- Ontology
  - Constraints
  - Connections



# PCA's RDS

-where the RFID reference data will end up

- The reference data (ontology) is available free of charge at PCA's Reference Data System (RDS)
- RDS consists of 3 parts – ISO, WIP and submission area
- The RDS is linked up to Internet and all technologies and services of the Web are available.
- Special Interest Groups maintain and enhance the different domains of the ontology
- [www.posccaesar.org](http://www.posccaesar.org)



# RFID Ontology phase 1 status

- So far 65 concepts with definitions
- classification and specialization relations
- other relations and roles
- Containers, mobile equipment & drill string components
  - fixed equipment and personnel for phase 2.
- OWL ontology in progress

# Container XML working example

- XML for Containers (Statoil)

- NORSOK standard Z-015 Temporary Equipment

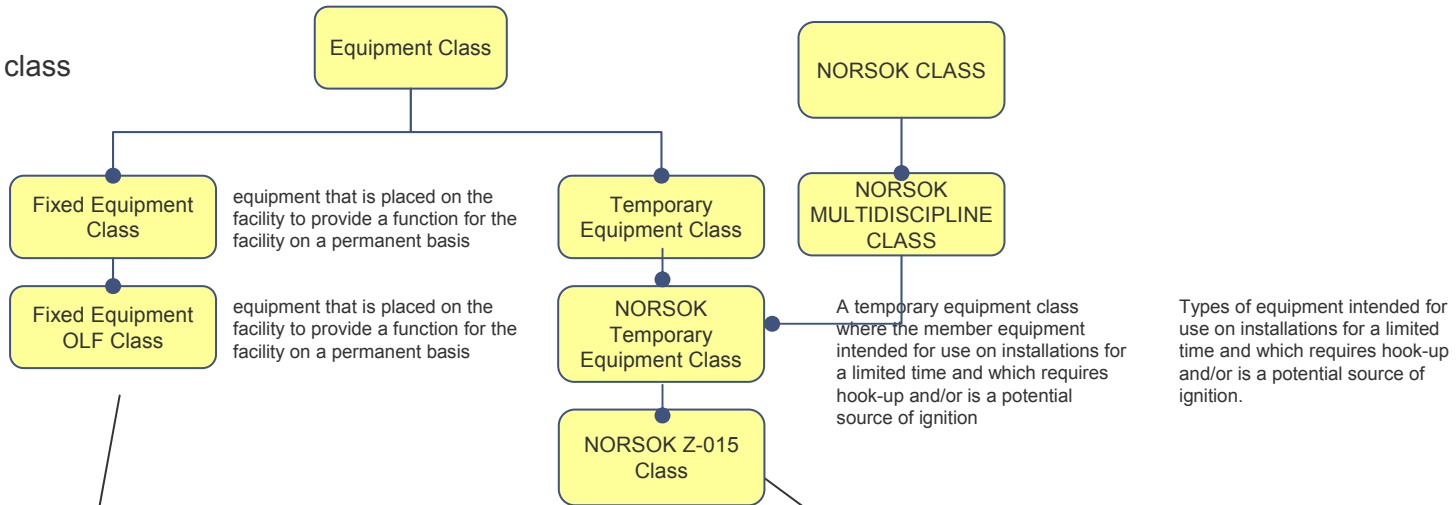
**e.g Type U07: Well service equipment**

**Description of equipment:**

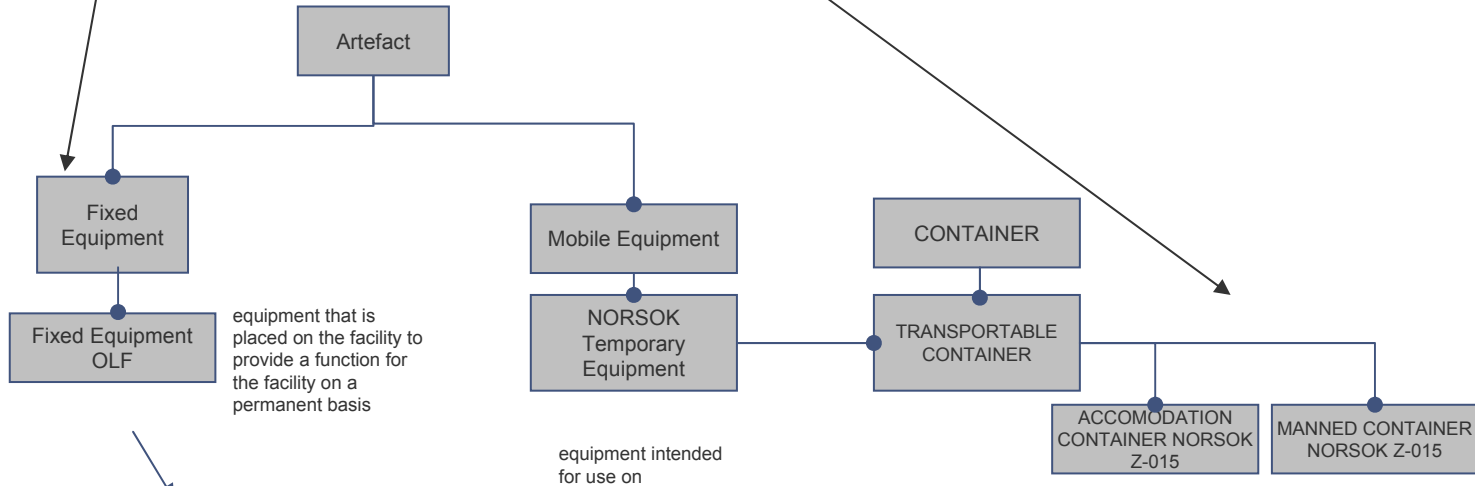
All equipment used in connection with preparations for and performance of well interventions (wireline, coiled tubing, snubbing, well testing etc.).

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
- <OffshoreInd>
- <ContainerInfo>
  <ClassID>3</ClassID>
  <Container_ownerID>100254</Container_ownerID>
  <Container_owner_name>SWIRE</Container_owner_name>
  <Product_numberID>1455567</Product_numberID>
  <Container_desc>MUD Container</Container_desc>
  <Container_serial_number>FSM1724</Container_serial_number>
  <Certificate_number>74907</Certificate_number>
  <Certificate_exp_date>2008-11-04</Certificate_exp_date>
  <Container_manufacture_date>2004</Container_manufacture_date>
  <Payload>5250 kg</Payload>
  <Max_gross_weight>7100 kg</Max_gross_weight>
  <RentingCompany>Kongsberg Offshore</RentingCompany>
  <ContainerTypeZ015>U07</ContainerTypeZ015>
  <ProcessEventDateTime>2008-02-11T13:23:55</ProcessEventDateTime>
  <ProcessEvent>Loading ship</ProcessEvent>
- <Location>
  <locationLat>60.412327</locationLat>
  <locationLong>5.011482</locationLong>
  <locationName>CCB Ågotnes Plan 1</locationName>
</Location>
</ContainerInfo>
</OffshoreInd>
```

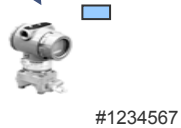
Class of class



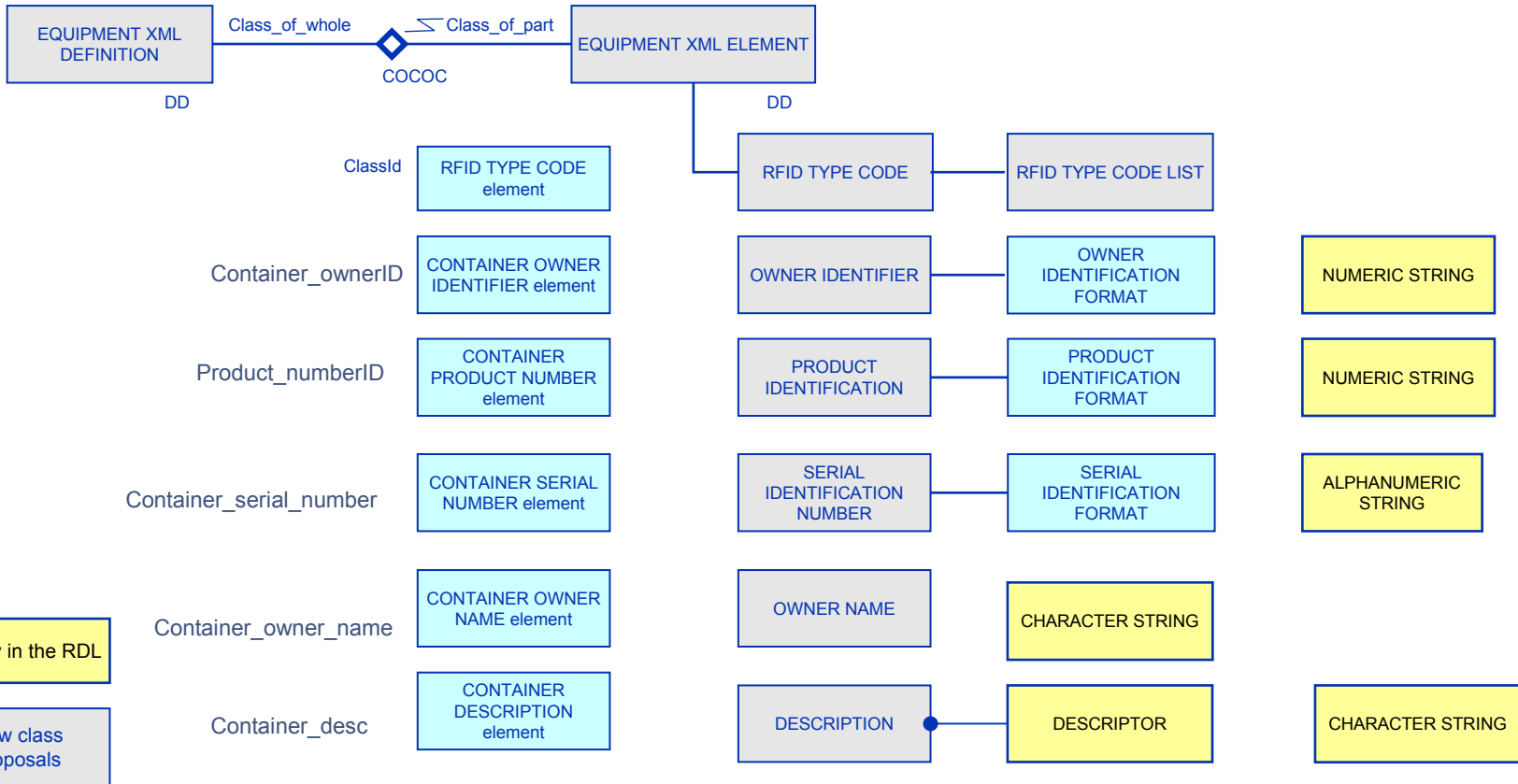
Class



Individual



# XML data elements



Already in the RDL

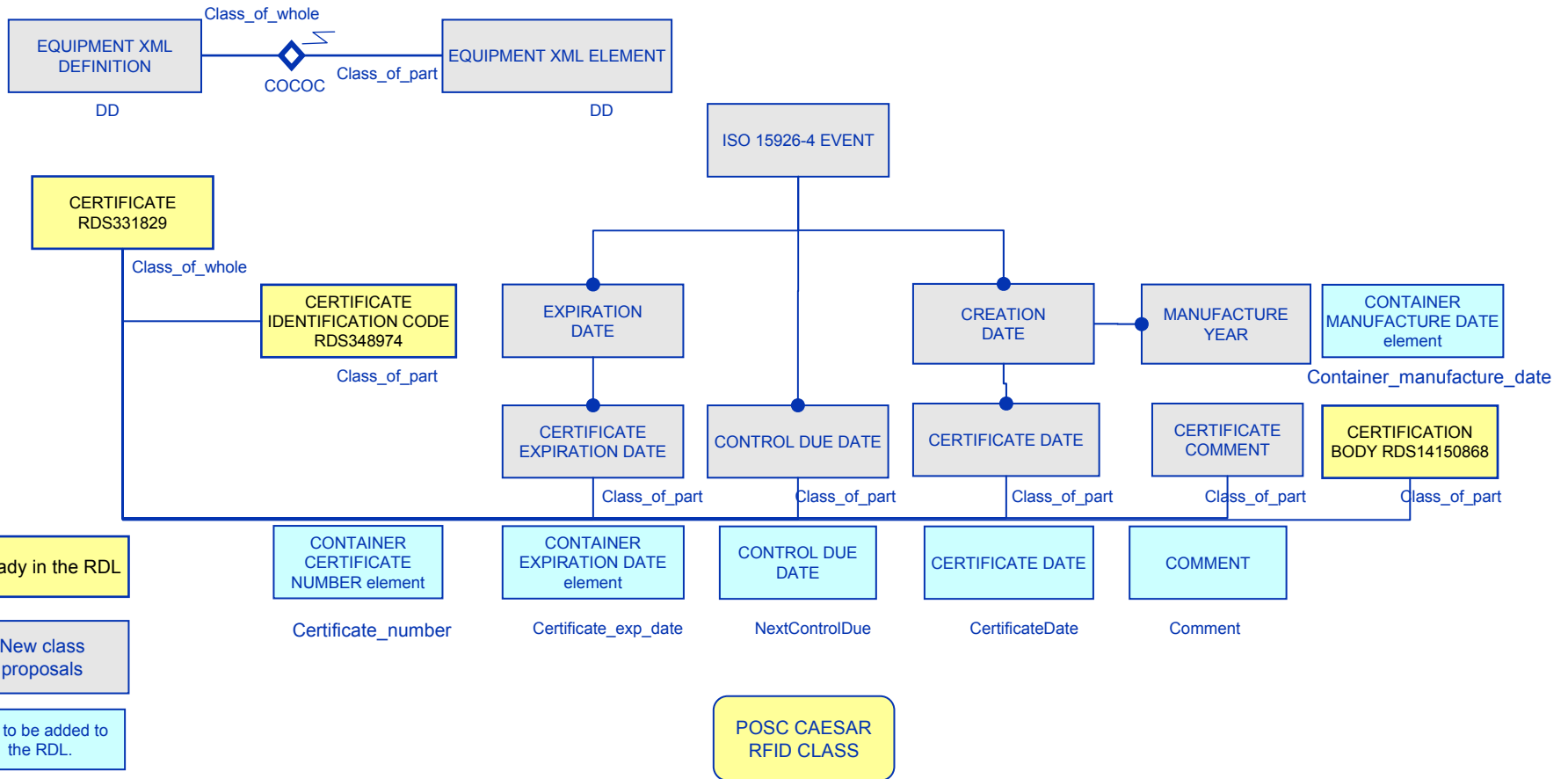
New class proposals

Not to be added to the RDL.

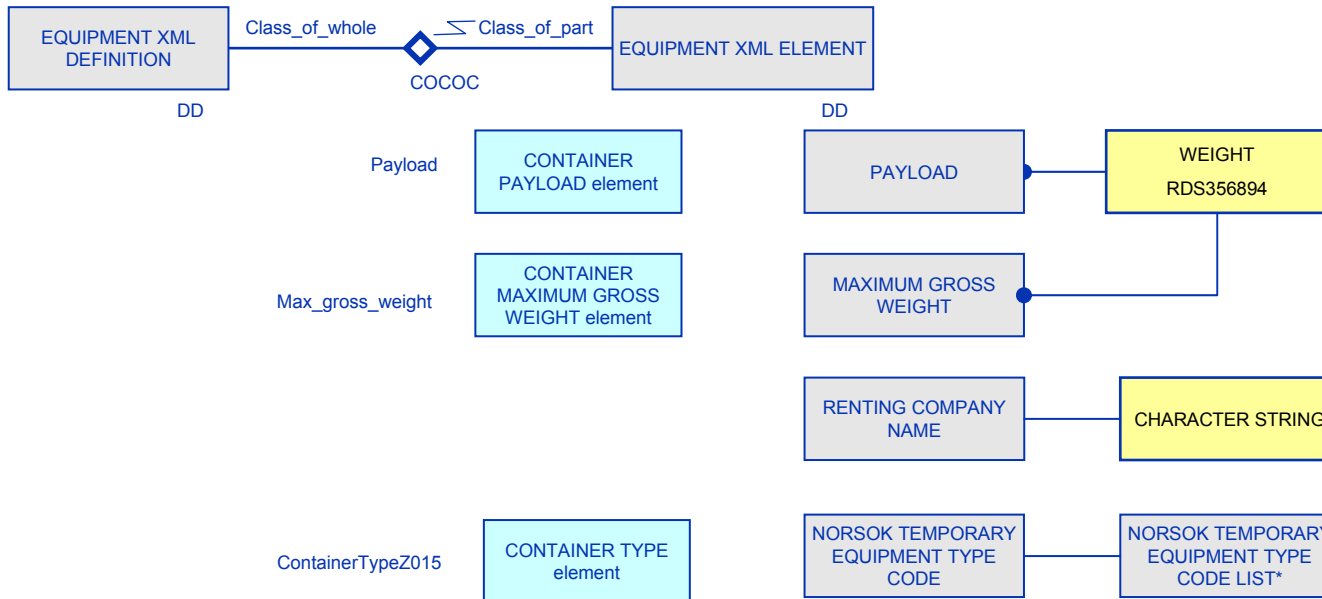
A container serial number is an alpha numeric number (36 bit, 11 digit) for Containers on the NCS. The serial number is one part of the RFID-tag information.

DD – document definition

# XML data elements



# XML data elements



See next slide

\* Codes are specified in the NORSOK Z-015 documents

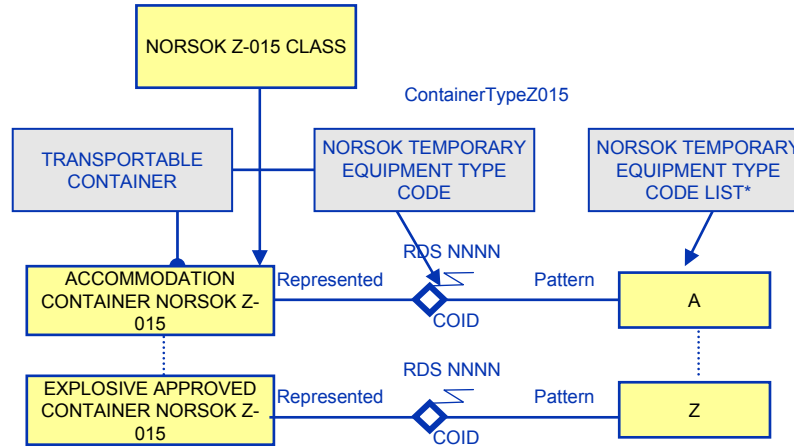
Already in the RDL

New class proposals

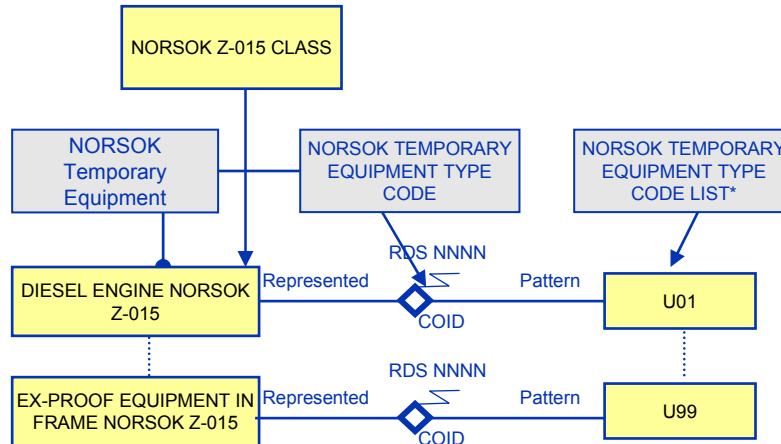
Not to be added to the RDL

# Norsok temporary equipment type code

Types of Containers with Code (see table 4.1.2 page 6) Norsok Z-05



Types of Equipment with Code (see table 4.1.2 page 7) Norsok Z-05



Already in the RDL

New class proposals



# Protégé Ontology Work Bench

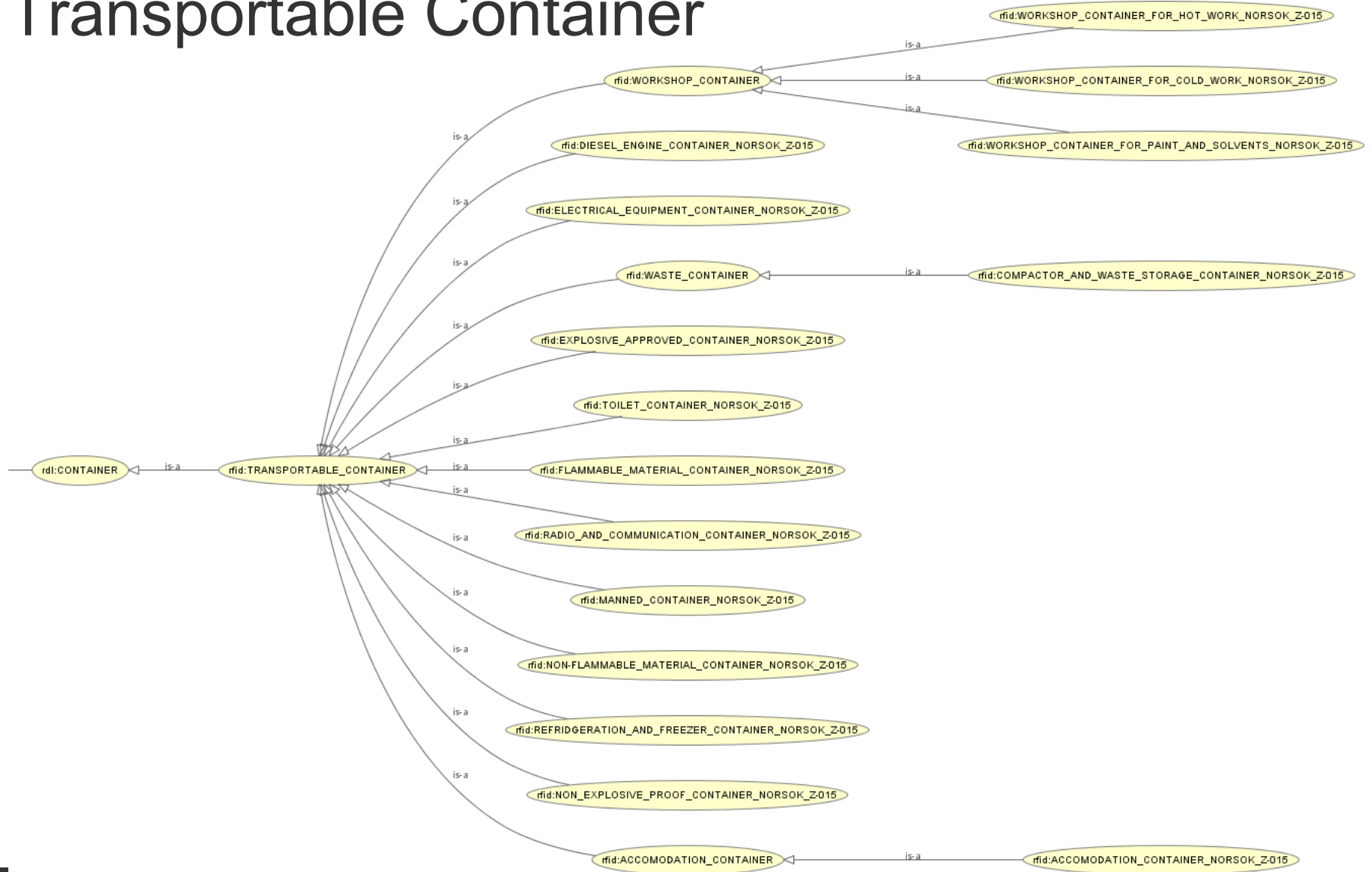
The screenshot displays the Protégé Ontology Work Bench interface. The main window shows the ontology editor with the following elements:

- Menu Bar:** File, Edit, Ontologies, Reasoner, Tools, Refactor, Tabs, View, Window, Help.
- Toolbar:** Includes buttons for navigation and a dropdown menu for the Reasoner, currently set to FaCT++.
- Active Ontology:** rfid.owl (http://RFID\_in\_ISO15925/rfid.owl) - [C:\rfid\_ontolog\rfid.owl]
- Class List:** A list of classes including rfid:WELL\_SERVICE\_EQUIPMENT\_CLASS, rfid:WORKSHOP\_CONTAINER, rfid:WORKSHOP\_CONTAINER\_FOR\_HOT\_WORK\_NORSOK\_Z-015, rfid:WORKSHOP\_CONTAINER\_FOR\_PAINT\_AND\_SOLVENTS\_NORSOK\_Z-015, rdl:ARTEFACT\_CLASS, rdl:DIESEL\_ENGINE, rdl:EQUIPMENT\_CLASS, and rdl:INDUSTRY\_ASSOCIATION\_CLASS.
- Class Hierarchy:** A tree view showing the hierarchy starting from owl:Thing, with sub-classes like rdl:ISO\_15926-4\_THING, rdl:ISO\_15926-4\_ORGANIZATION, and rdl:ARTEFACT.
- Class Annotations:** A panel for the selected class (rdl:DRILL\_STRING) showing annotations such as hasExplanatoryComment, hasDefinition, and hasIdPCA.
- Description:** A panel for the selected class (rdl:DRILL\_STRING) showing equivalent classes (rdl:ARTEFACT) and other properties.

**Acknowledgements** This work was conducted using the Protégé resource, which is supported by grant LM007885 from the United States National Library of Medicine.  
<http://protege.stanford.edu/>



# Transportable Container



# Mobile Equipment

User Vocabulary Item	Definition
<b>Equipment (Mobile Equipment)</b>	Heading, not for use in semantics
UniquelDentificationNumber (UIN)	Text/number
SerialNumber	Text/number
Description	Text
EquipmentType	Text
Model	Text
Producer	Text
ProducedYear	Year
Payload	Kg
Max_gross_weight	Kg
<b>Certificate</b>	Heading, not for use in semantics
CertificateNo (PK)	Number
CertificateDate	Date
CertificateExpiry	Date
CertifiedBy	Signature (electronic)
NextControlDue	Date
Comment	Text
<b>Document</b>	Heading, not for use in semantics
Document (PK)	Document number
Description	Text
Revision	Revision number
<b>Mobile Equipment Events</b>	Heading, not for use in semantics
Project	Project number
Purchase Order No	Text/number

# Events

- Preliminary structure defined
  - Set of events to be proposed by the industry
- In ISO 15926 RFID ontology there will be an abstraction/model which can be mapped to different implementations e.g. EPC.
- GS1 / RFID Innovasjonsenter AS
  - EPCIS events
- TRAC ID - Drilling
- Statoil - Containers
- Aker Solutions – mobile equipment

# Events – basic structure



## Proposed Events (Trac ID):

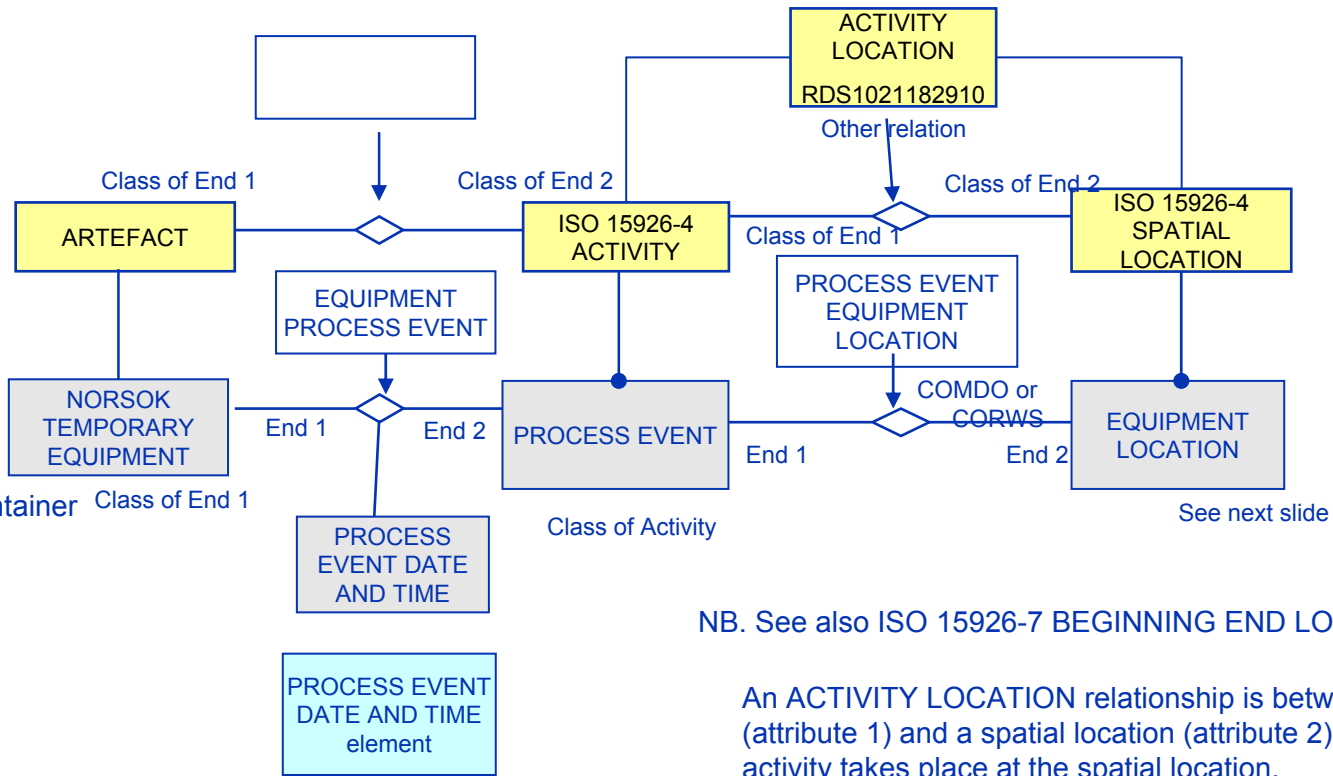
- Stock Yard
  - New Tubular received
  - Received from Inspection
  - Received from offshore
  - Sent to Inspection
  - Sent to offshore
- Inspection
  - Received from storage
  - Received from repair
  - Sent to storage
  - Sent to repair
  - Sent to scrap
- Repair
  - Received from inspection
  - Sent to stock yard
- Rig
  - Received from carrier
  - Loaded onto carrier
  - Sent to location
  - Received from location
- Drilling
  - Tally changed

Already in the RDL

New class proposals

Not to be added to the RDL.

# Equipment Event Location WIP



- Personnel
- Transportable Container
- Mobile Equipment
- Fixed Equipment
- Drill string, Pipe

See next slide

NB. See also ISO 15926-7 BEGINNING END LOCATION OF ACTIVITY

An ACTIVITY LOCATION relationship is between an activity (attribute 1) and a spatial location (attribute 2), stating that the activity takes place at the spatial location. This relation was introduced in the defining axiom for template ISO 15926-7 LOCATION OF ACTIVITY. Its entity type should really be CLASS OF RELATIONSHIP WITH SIGNATURE. It is recorded here as OTHER RELATIONSHIP due to technical restrictions in the reference data database.

Already in the RDL

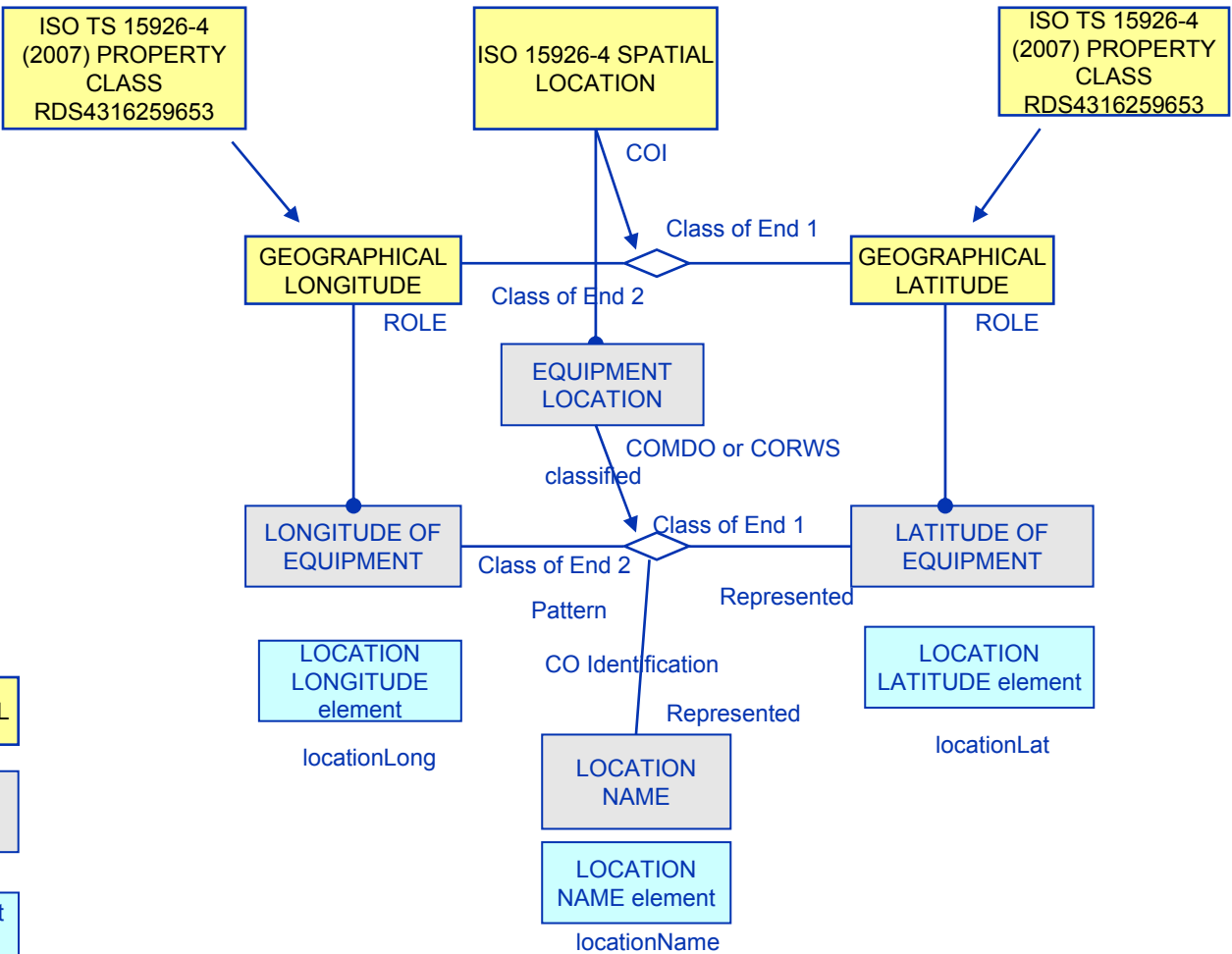
New class proposals

WIP

xml elements (not to be added)

ProcessEventDateTime

# Location WIP



# Open issues

Issue	Description	Possible resolution
1	RFID identifier and the components to be agreed on and then modelled in the ontology.	Solution forth coming.
2	XML documents agreed and defined on for the other four business areas namely: drill string components, mobile equipment, fixed equipment and personnel.	Input required from industry groups to define XML schemas for each business area.
3	Agree on the level of abstraction for equipment and attributes that are relevant for each business area.	Review meetings for each business area to establish commonalities between XML elements.
4	Reviewing of the concepts, definitions and RDL taxonomy (hook classes) to be carried out.	To be able to identify the correct location in the taxonomy, good definitions need to be in place. Improvements to some definitions will be necessary to more precisely capture the meaning.
5	Drill string components - more specific definitions are required regarding the actual information to be used in RFID applications for drill string component tracking.	Drill string components working group could be established. Maersk Drilling together with Trac ID and other industry parties interested in collaborating here to specify the concepts and definitions.
6	Use of templates, development of signatures and multidimensional objects to be defined. e.g. equipment event, process event location, 'thing'-ownership, equipment rental etc.	To precisely model more complex concepts and relations than already exists it is recommended that ISO 15926-7 templates be utilised.



# Summary

- OLF RFID project produced 9 guidelines for the deployment of Radio Frequency Identification (RFID) in the oil and gas industry through a common understanding, practice, and technology platform adoption to achieve data interoperability between RFID and corporate systems.

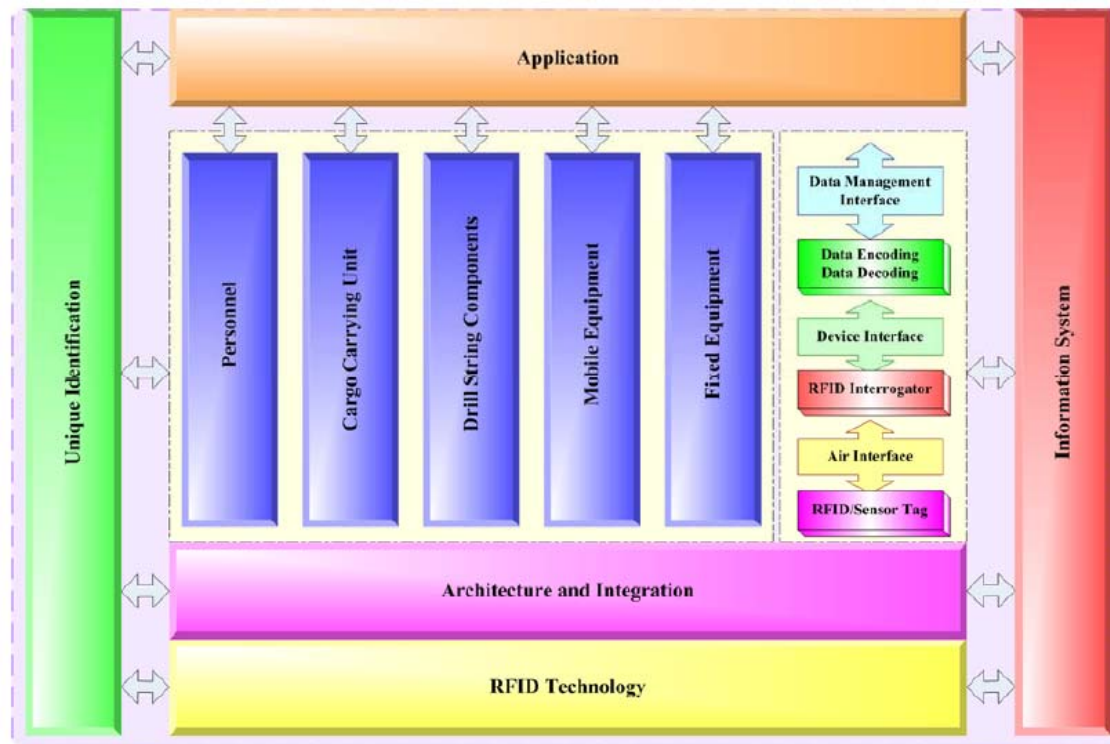


Fig. 1: RFID guideline documents organization.

# Thank you

## RFID and ISO 15926

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