PLCS reference data

Peter Bergström 2015-02-18

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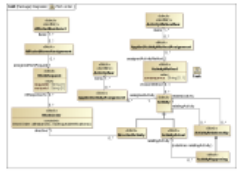
PLCS Reference Data Architecture

All PLCS OWL classes and individuals are derived from PLCS PSM EXPRESS/SysML model



PLCS PSM
SysML model

SysML XMI to OWL transform

Industry Standardized in OASIS PLCS TC

PLCS (English)
File URI: *http://docs.oasis-open.org/plcs/plcslib/v1.0/data/plcs/plcs-psm/refdata/plcs-psm-en.owl*
OWL ontology IRI: *http://docs.oasis-open.org/plcs/ns/plcslib/v1.0/data/plcs/plcs-psm/refdata/plcs-psm-en*
Namespace prefix: *plcs-psm*
OWL File: *plcslib/data/PLCS/psm_model/refdata/plcs-psm-en.owl*

OWL classes derived from PLCS PSM English annotation of the OWL classes derived from PLCS

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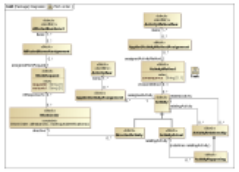
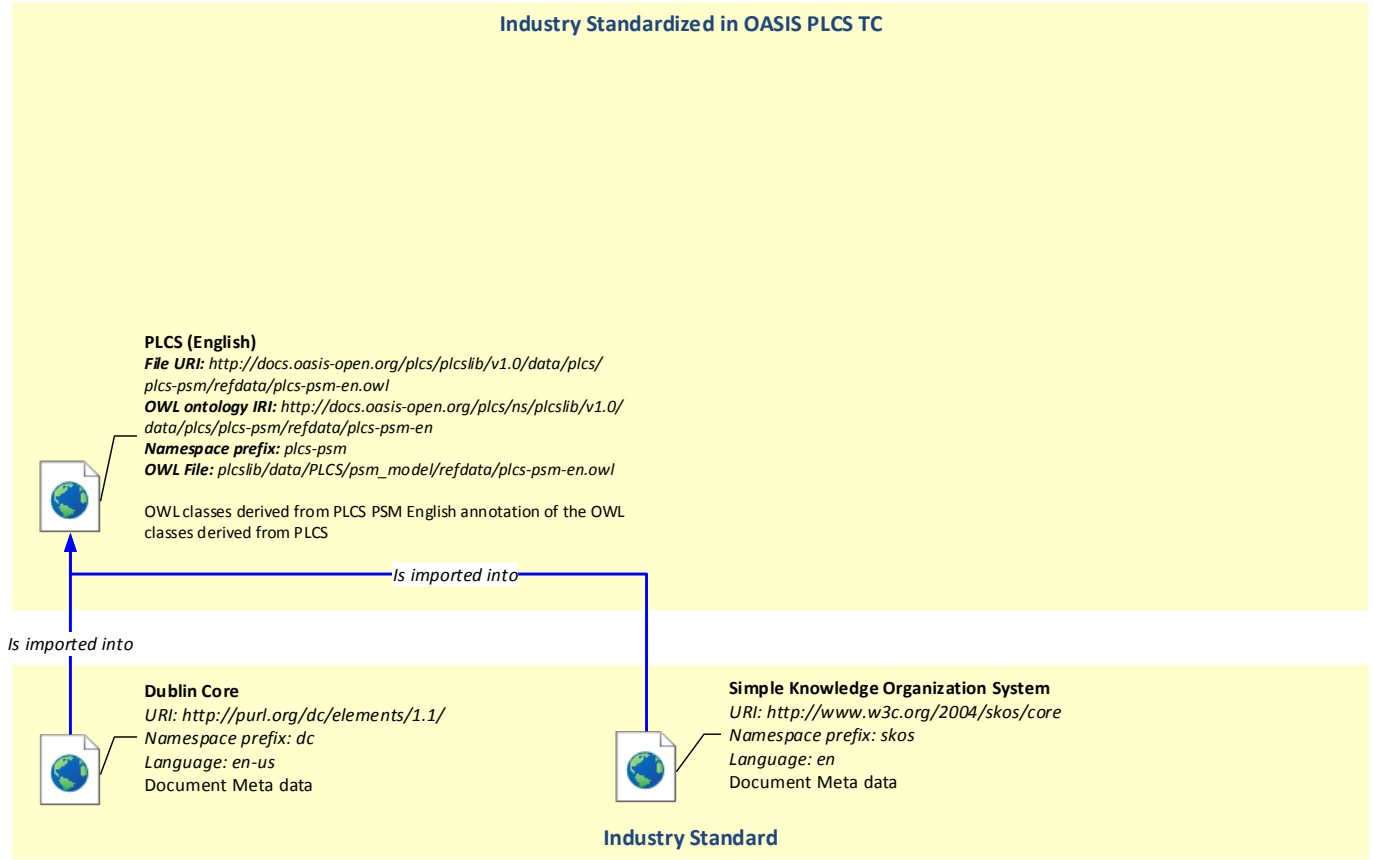
PLCS Reference Data Architecture

All PLCS OWL classes and individuals are derived from PLCS



PLCS PSM
SysML model

SysML XMI to OWL transform



Annotations based on Dublin Core metadata elements and Simple Knowledge Organization System

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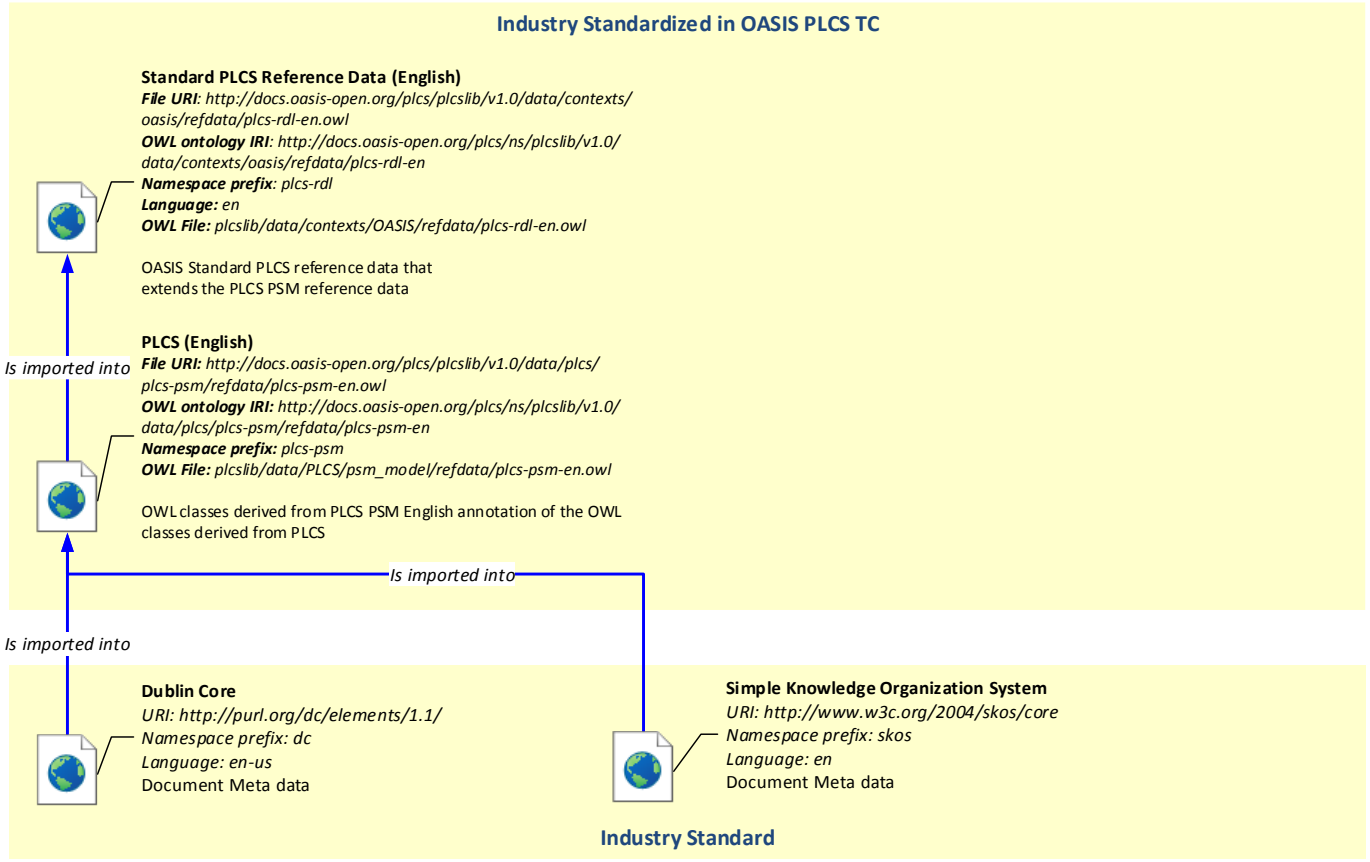
PLCS Reference Data Architecture

OASIS standard PLCS reference data extensions:

- Assignment types
- Date types
- ID-types
- Relationship types
- SI units
- etc

This is the basis RDL for any industry or domain extension



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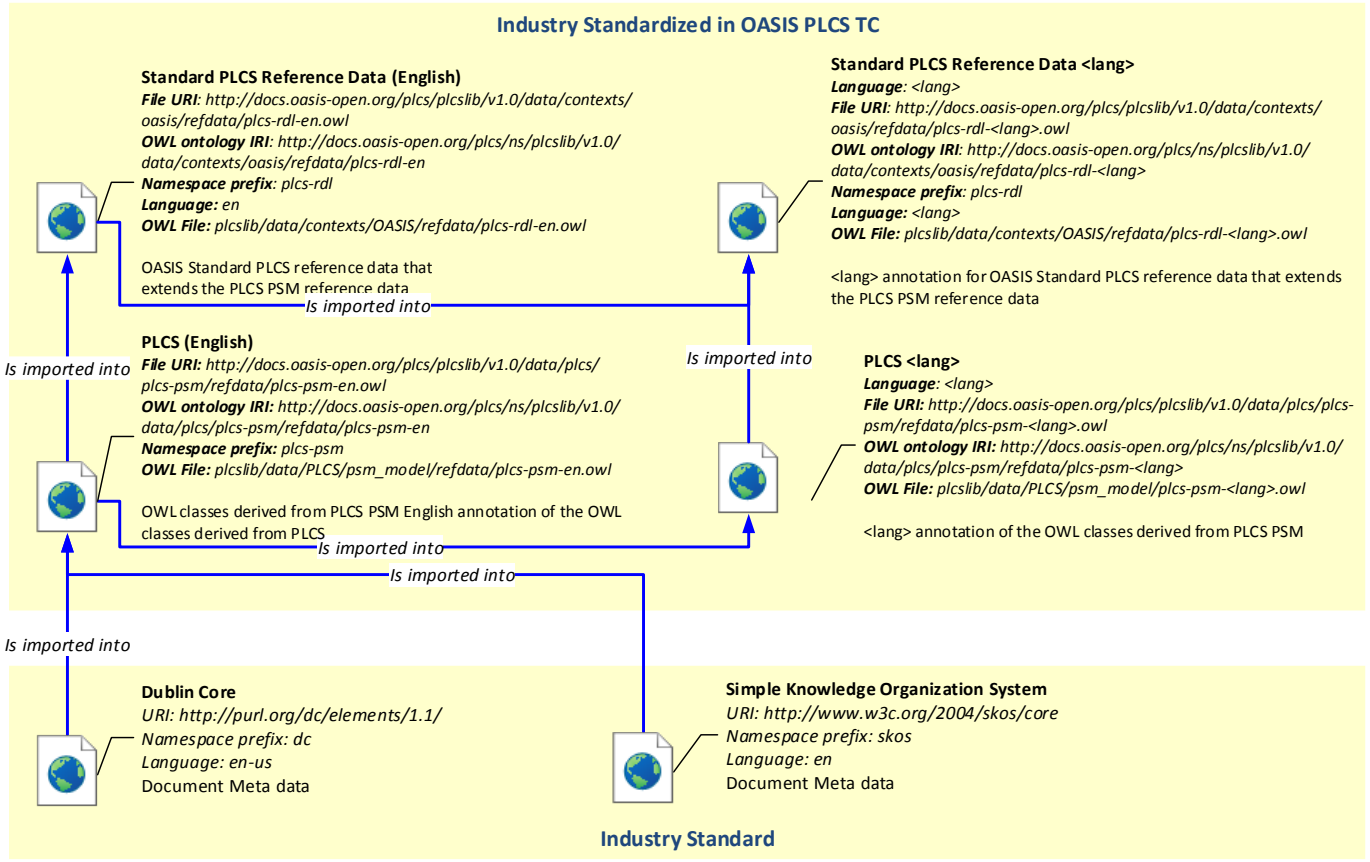
PLCS Reference Data Architecture

Language variants may be provided for each RDL in the hierarchy



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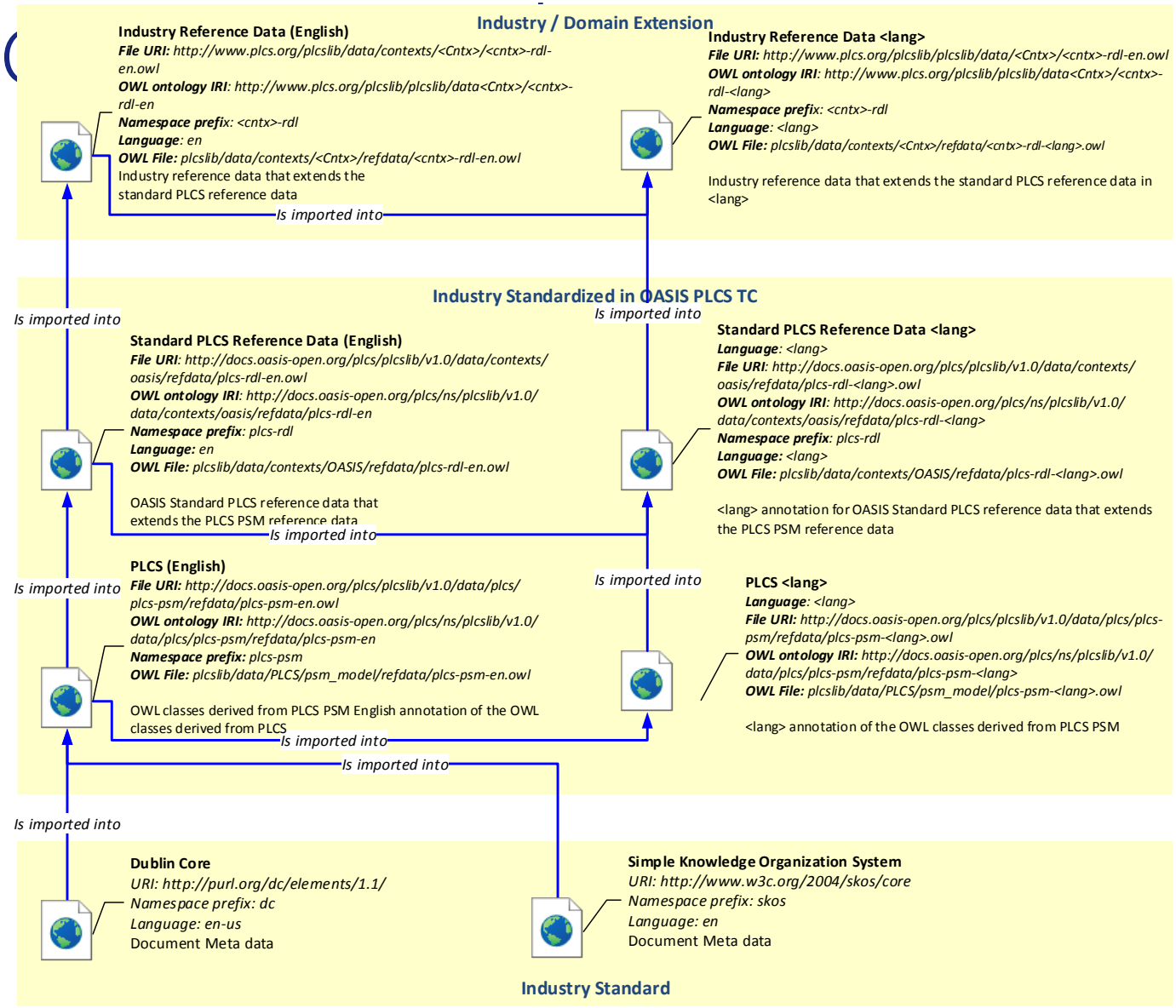
PLCS Referenc

Industry or domain extensions may be developed outside of OASIS.

These may be shared, and perhaps standardized, across an industry sector, or may be project-, contract-, country-, or company-specific.



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OWL (Web Ontology Language)

```
<!-- http://docs.oasis-open.org/plcs/ns/plcslib/v1.0/data/contexts/OASIS/refdata/plcs-rdl#Activity_identification_code -->

  <owl:Class rdf:about="&plcs-rdl;Activity_identification_code">
     <rdfs:subClassOf rdf:resource="&plcs-psm;Identifier"/>
     <dc:date xml:lang="en">2012-10-05</dc:date>
     <dc:creator xml:lang="en">Mike Ward, Eurostep</dc:creator>
     <dc:contributor xml:lang="en">Mike Ward, Eurostep</dc:contributor>
     <dc:source xml:lang="en">PLCS OASIS</dc:source>
     <dc:contributor xml:lang="en">Rob Bodington, Eurostep</dc:contributor>
     <skos:changeNote xml:lang="en">[2012-01-26] Steve Yates, Eurostep: Initial definition. Transferred to PLCS PSM ref data from DEXlib</skos:chan
     <skos:changeNote xml:lang="en">[2012-10-05] Mike Ward, Eurostep: rdfs:comment and skos:prefLabel edited</skos:changeNote>
     <skos:prefLabel xml:lang="en">activity identifier</skos:prefLabel>
     <dc:type xml:lang="en">ready_for_review</dc:type>
     <owl:versionInfo xml:lang="en">v1.00</owl:versionInfo>
     <rdfs:comment xml:lang="en">{identifier http://docs.oasis-open.org/plcs/ns/plcslib/v1.0/data/plcs/plcs-psm/refdata/plcs-psm#Identifier} that ider
{activity http://docs.oasis-open.org/plcs/ns/plcslib/v1.0/data/plcs/plcs-psm/refdata/plcs-psm#Activity}</rdfs:comment>
  </owl:Class>
```

In RDF/XML

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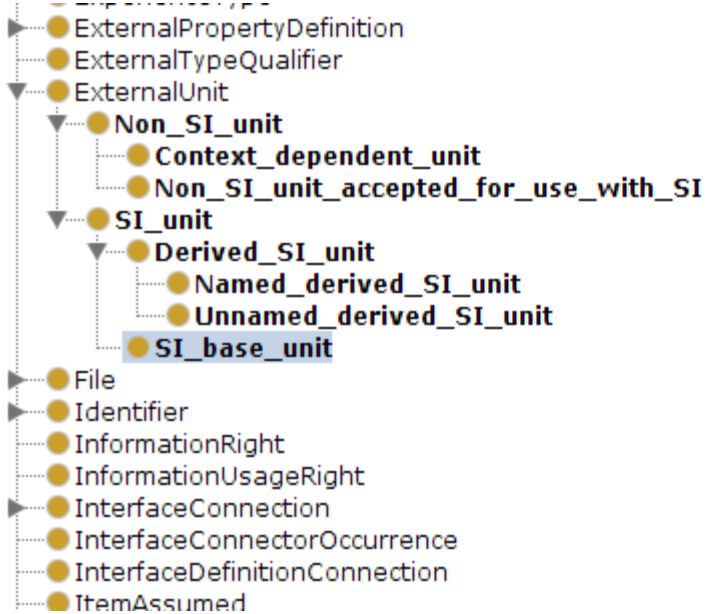
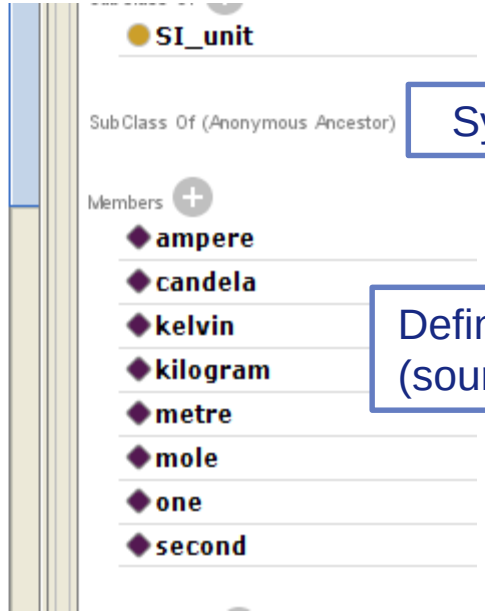
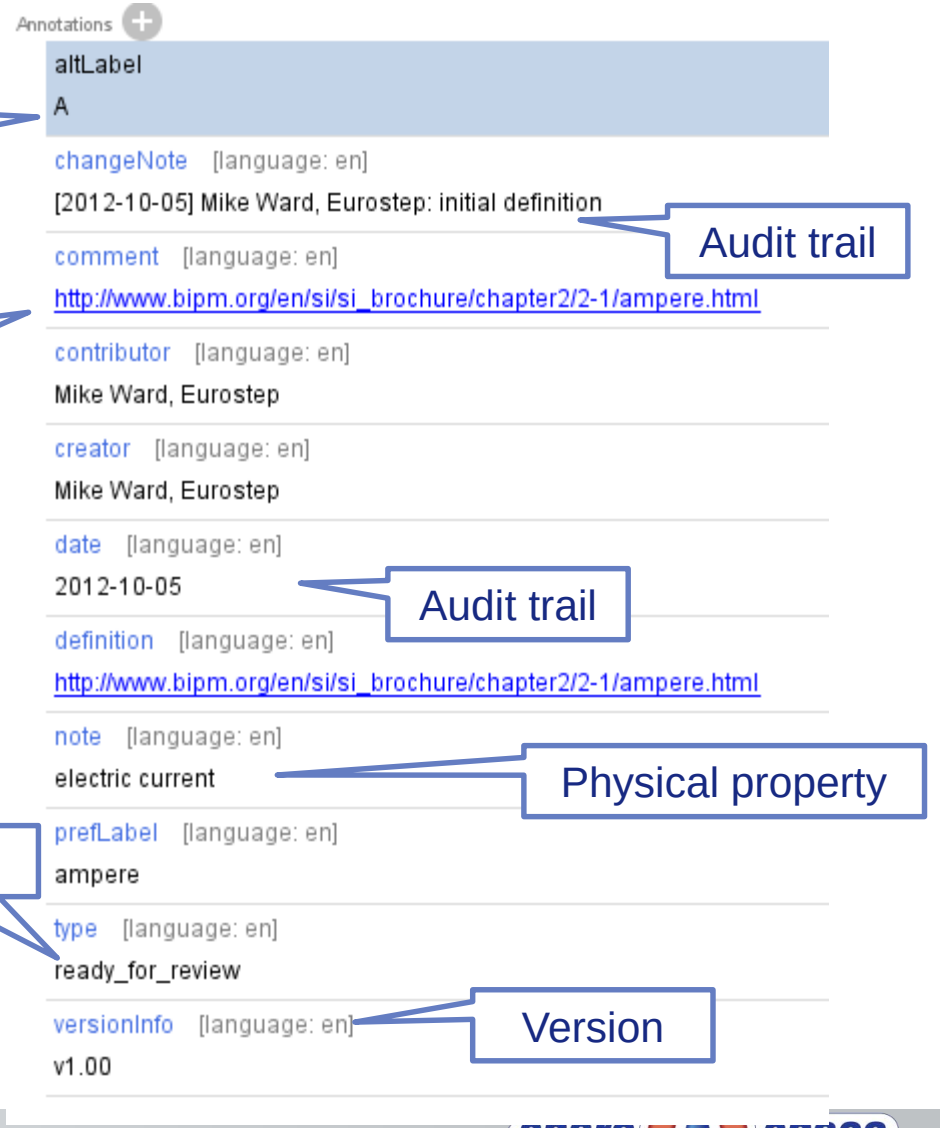
OWL (Web Ontology Language)



Classes



Individuals



Symbol

Audit trail

Definition (source)

Audit trail

Physical property

Status

Version

In Protégé

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PLCS use of reference data

- Current usage includes:
  - Specializing entities in PLCS
    - E.g. entities with attributes "type" or "role"
    - Document types, types of parts, type of dates, relationship roles
  - Extending the vocabulary of the model
    - Properties, units of measure, defined states

- Future usage may also include:
  - Standardized definitions for use in requirements and specifications
    - E.g. material specifications, electrical components
  - Catalogue parts used in design/maintenance
    - E.g. generically identified commodity items and vender specific items

Potential use of ISO15926 reference data and similar RDLs

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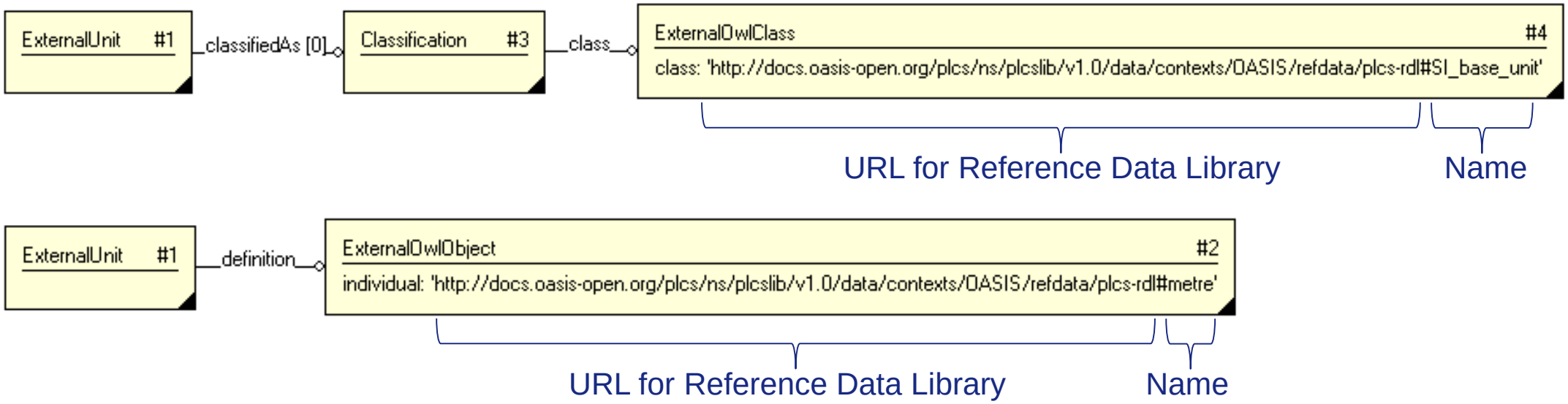
How is it used?

- The link is established by using
  - a URL to identify the Reference Data Library, with a
  - name (identifier) of the class or individual inside the RDL



Further explanation of PLCS reference data can be found in
http://docs.oasis-open.org/plcs/plcslib/v1.0/cs01/data/contexts/OASIS/model_usage_guides/ReferenceData/mguide.html

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Status of PLCS reference data

- OASIS PLCS TC has published the OASIS PLCS RDL as part of their PLCS committee specification version 1.0 in 2013:
  - http://docs.oasis-open.org/plcs/plcslib/v1.0/cs01/plcslib-v1.0-cs01.html
- It is used as a basis for extensions by industry and other organizations in several countries
- Mechanisms also already exists in PLCS to reference other Reference Data Libraries, although with less control
  - Such references are made by the user's, and the mapping to a PLCS superclass and the meaning of the class referenced is not formally controlled
- With a proper mapping between RDLs, the standard PLCS reference data mechanisms can be used

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Plans for PLCS reference data

- PLCS reference data is being used and extended in many projects world wide
- Recommendation: Use current techniques to reference other RDLs today!

- With a SC4 common reference data methodology, any SC4 reference data would be equal to and in practice considered as PLCS reference data. This "integrated" reference data would provide a higher level of control.

- However, with the first mechanism PLCS already have one way of referencing external, non-PLCS reference data. It is unclear what extra benefits we would get from "integrating" the RDLs, and how important that is to existing PLCS users.

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Using PCA RDL (15926) with PLCS

Peter Bergström 2015-02-17

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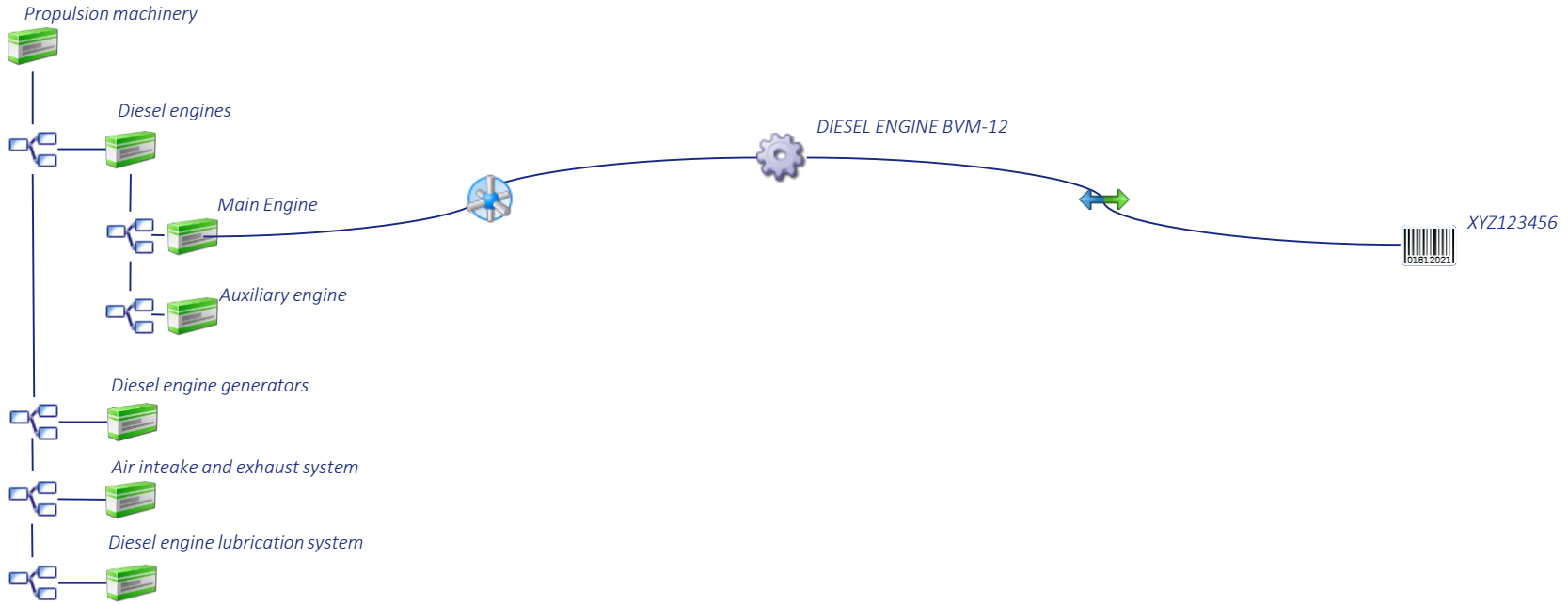
Development of PLCS data for engine

Breakdown of a type of ship

Part Assembly of a type of ship

Individual Products in a ship



This is a typical instantiation of PLCS data for a ship

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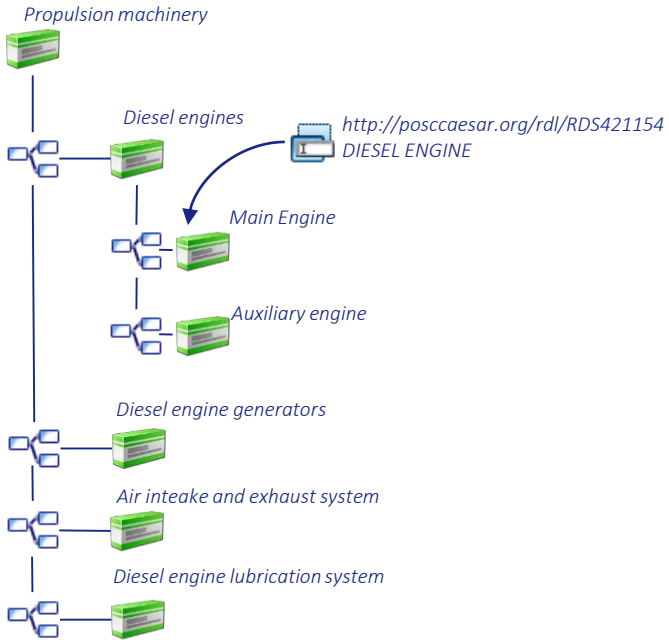
Using PCA RDL (15926) with PLCS



DIESEL ENGINE

rdl:defaultRdsId	"R87348972627"
rdl:hasCreationDate	"2002.11.06"
rdl:hasCreator	"u20683"
rdl:hasDefinition	"An internal combustion engine in which ignition of the fuel injected into the cylinder is performed by the heat of compression of the air charge."
rdl:hasDesignation	"DIESEL ENGINE"
rdl:hasIdPCA	"RDS421154"
rdl:hasNote	"derived from Chalmers Science and Technology Dictionary - compression-ignition engine"
rdl:hasStatus	"Recorded"
rdf:type	p2:ClassOfInanimatePhysicalObject
rdfs:label	"DIESEL ENGINE"
owl:sameAs	http://posccaesar.org/rdl/RDS421154

Specialization

Superclass

- INTERNAL COMBUSTION ENGINE
- RECIPROCATING PISTON ENGINE

Subclass

- DIESEL ENGINE CATERPILLAR 3512
- GAS OIL DIESEL ENGINE
- HEAD RECOVERY DIESEL ENGINE
- HEAVY OIL DIESEL ENGINE
- HIGH-SPEED DIESEL ENGINE
- IDI DIESEL ENGINE
- LOW-SPEED DIESEL ENGINE
- MARINE DIESEL ENGINE
- MDO DIESEL ENGINE
- MEDIUM-SPEED DIESEL ENGINE

Some of the 15926 ref data is applicable on breakdown elements, or even requirements

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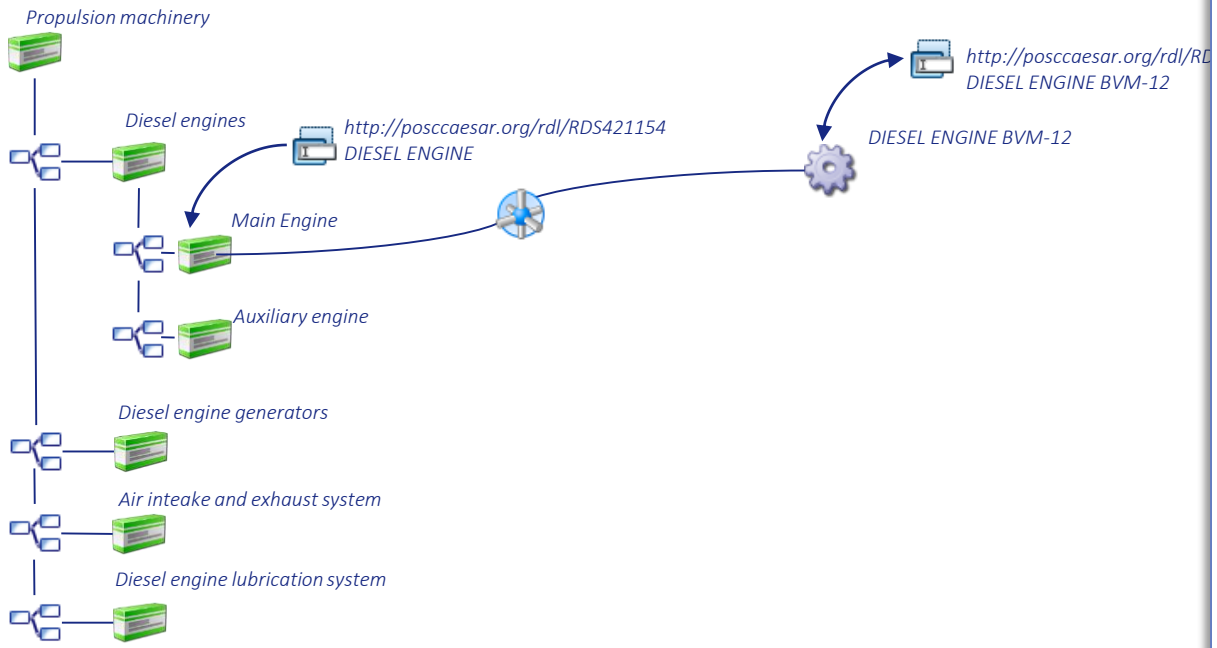
Using PCA RDL (15926) with PLCS



DIESEL ENGINE BVM-12

rdl:defaultRdsId	"R30407507217"
rdl:hasCreationDate	"2003.04.25"
rdl:hasCreator	"u20683"
rdl:hasDefinition	"A Bergen Diesel BVM-12 type diesel engine built by Rolls-Royce AS Engines - Bergen."
rdl:hasDesignation	"DIESEL ENGINE BVM-12"
rdl:hasIdPCA	"RDS13701902"
rdl:hasStatus	"Incomplete"
rdf:type	p2:ClassOfInanimatePhysicalObject
rdfs:label	"DIESEL ENGINE BVM-12"
owl:sameAs	http://posccaesar.org/rdl/RDS13701902

Specialization

Superclass

- 12 CYLINDER ENGINE
- 4-STROKE TRUNK ENGINE
- HIGH-SPEED DIESEL ENGINE
- MAIN ENGINE
- V-ENGINE

ClassOfIndirectProperty

Property Space

- 167.5 kg
- BRAKE MEAN EFFECTIVE PRESSURE: 24.4 barg
- CHARGE AIR PRESSURE: 2.7 barg
- COMPRESSION PRESSURE: 120 barg
- COMPRESSION RATIO: 12.5 1
- CONNECTION ROD RATIO: .2209 1
- MAXIMUM FIRING PRESSURE: 190 barg
- MEAN INDICATED PRESSURE: 26.6 barg

Most benefit will be given when selecting vendor parts that are already encoded with 15926 reference data

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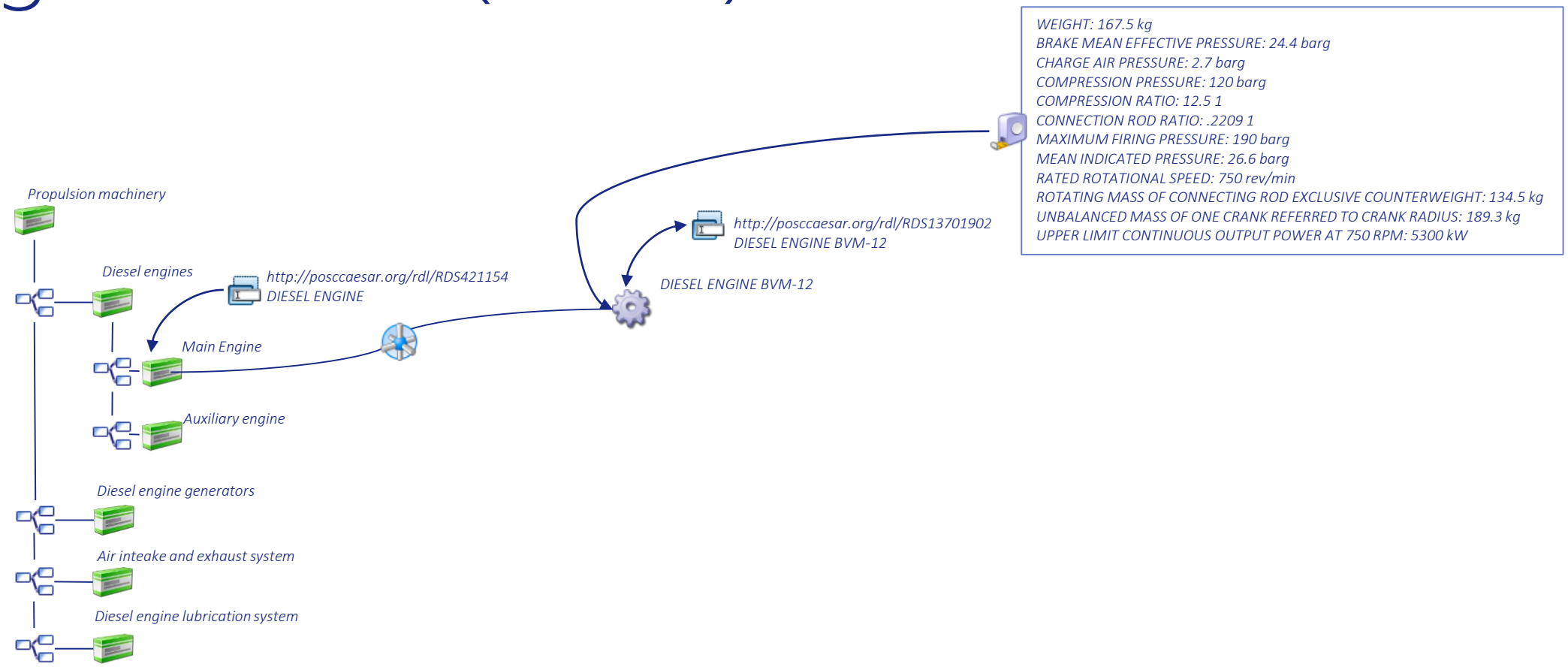
Using PCA RDL (15926) with PLCS



If properties are encoded using 15926, these may be mapped to PLCS properties, if desired

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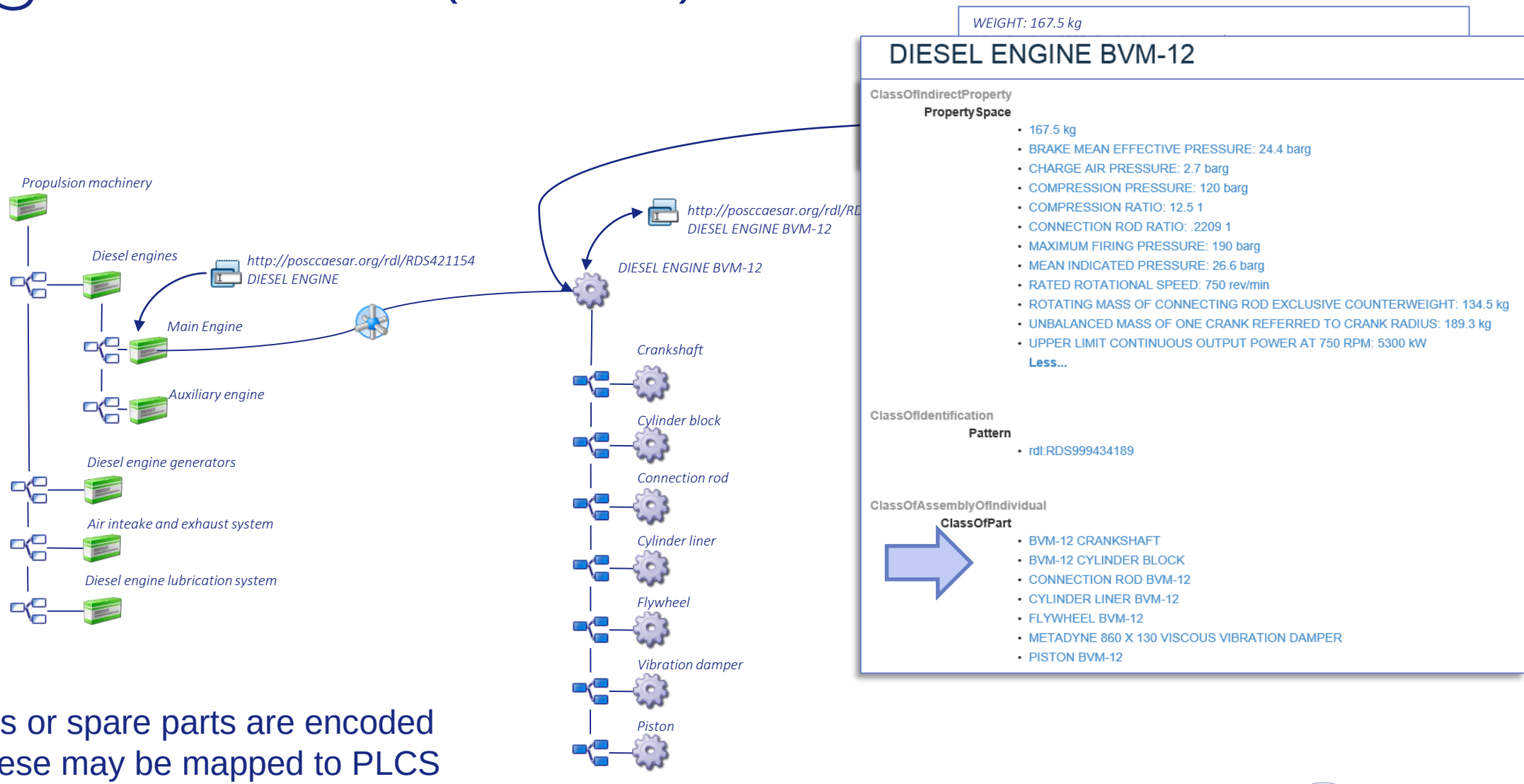
Using PCA RDL (15926) with PLCS



If subassemblies or spare parts are encoded using 15926, these may be mapped to PLCS

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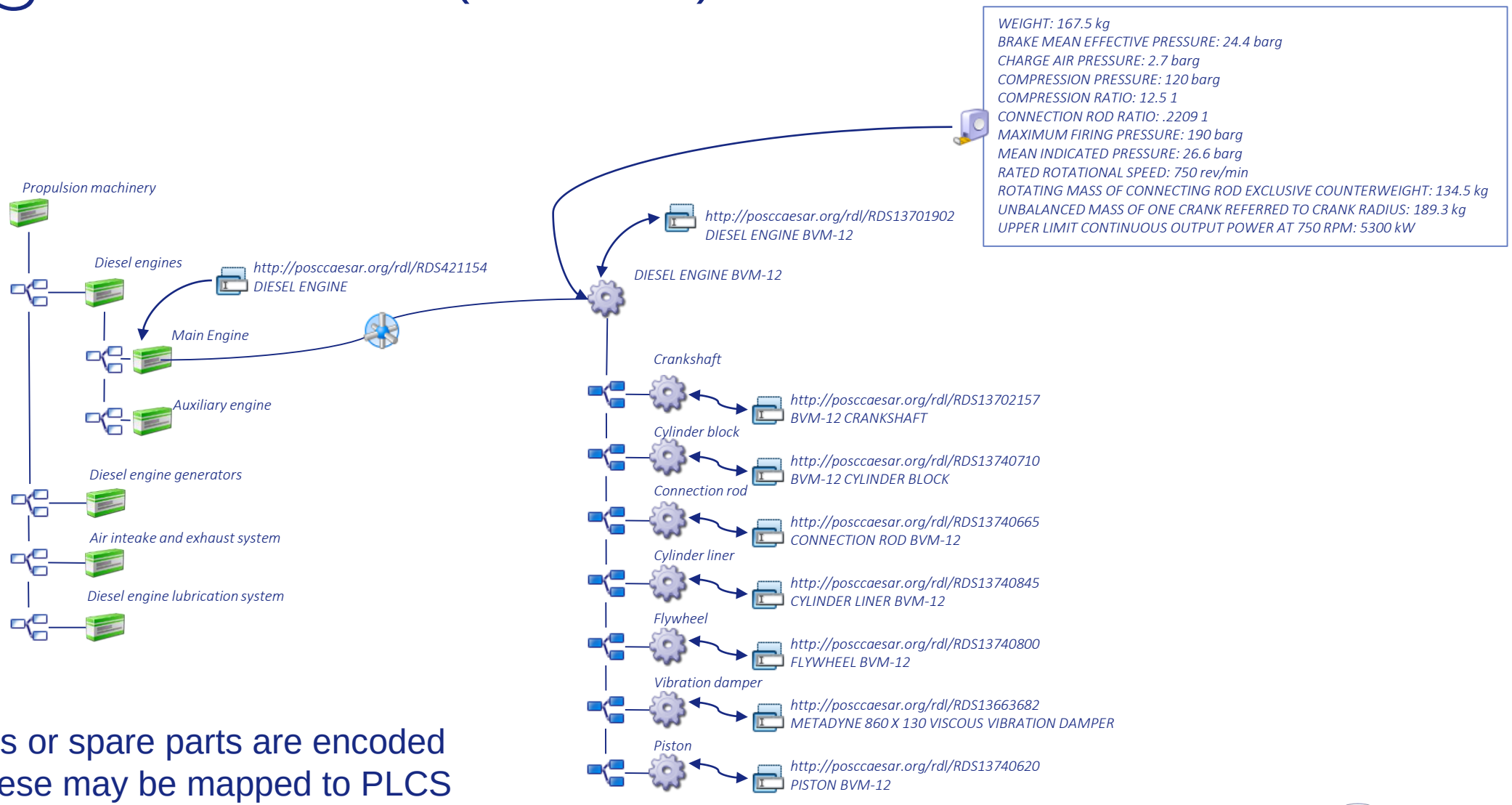
Using PCA RDL (15926) with PLCS



If subassemblies or spare parts are encoded using 15926, these may be mapped to PLCS

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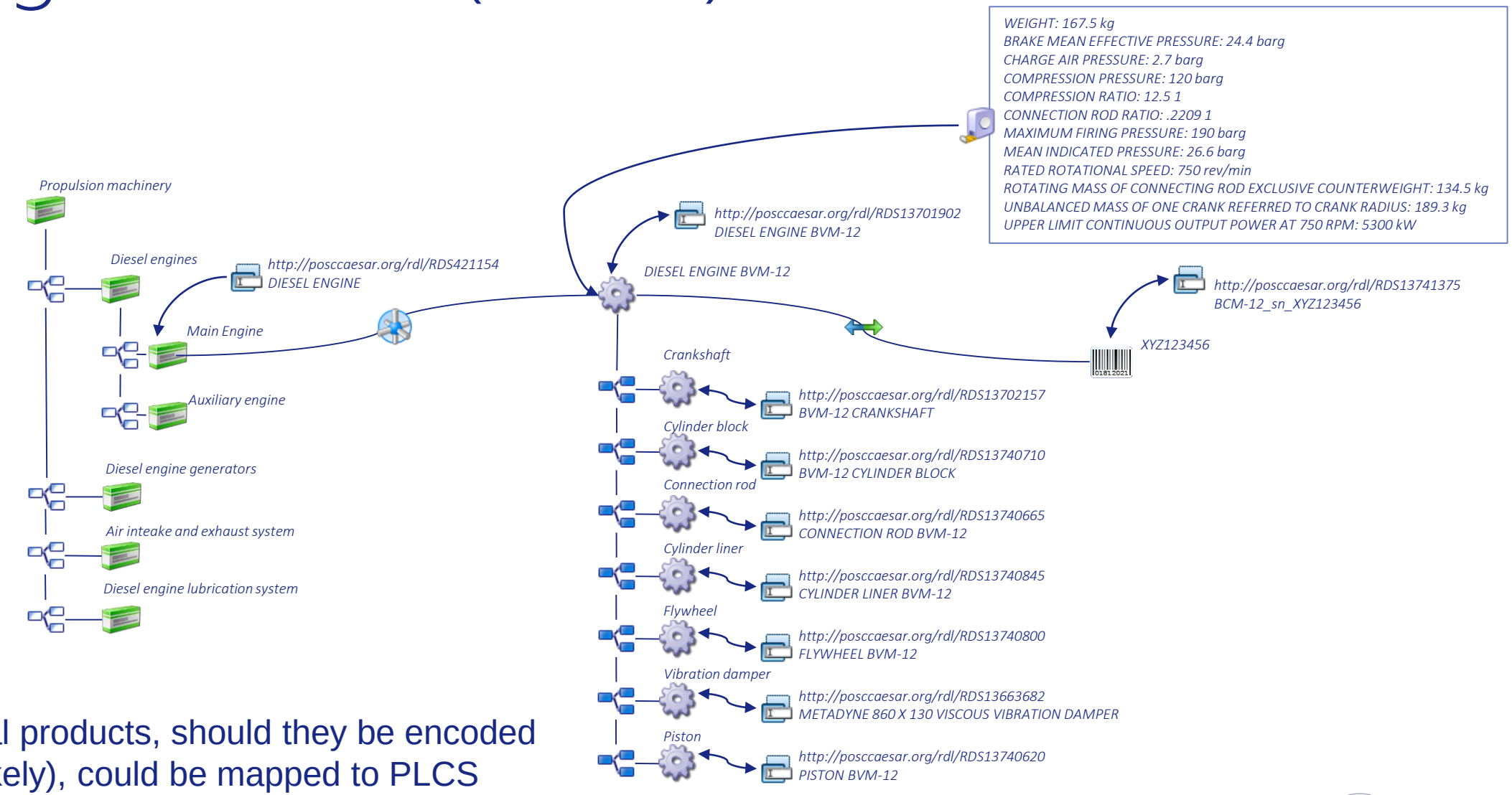
Using PCA RDL (15926) with PLCS



Even individual products, should they be encoded in 15926 (unlikely), could be mapped to PLCS

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Two ways to achieve this

1. Treat 15926 reference data as PLCS OASIS Template ClassCode (and IndividualCode)
   - Makes use of ExternalClass, little intelligence in PLCS data (just superclass)
   - 15926 reference data becomes an external class in PLCS, systems that manage 15926 may make use of the classes using other mechanisms
   - **This method can be used now**!

2. Map and import 15926 reference data into PLCS reference data library
   - Makes it possible to use 15926 reference data as PLCS reference data (external owl class)
   - Same mechanism required to resolve reference data as with other PLCS reference data
   - Provides a higher level of control, e.g. standardisation of reference data classes, but also requires a higher level of maintenance

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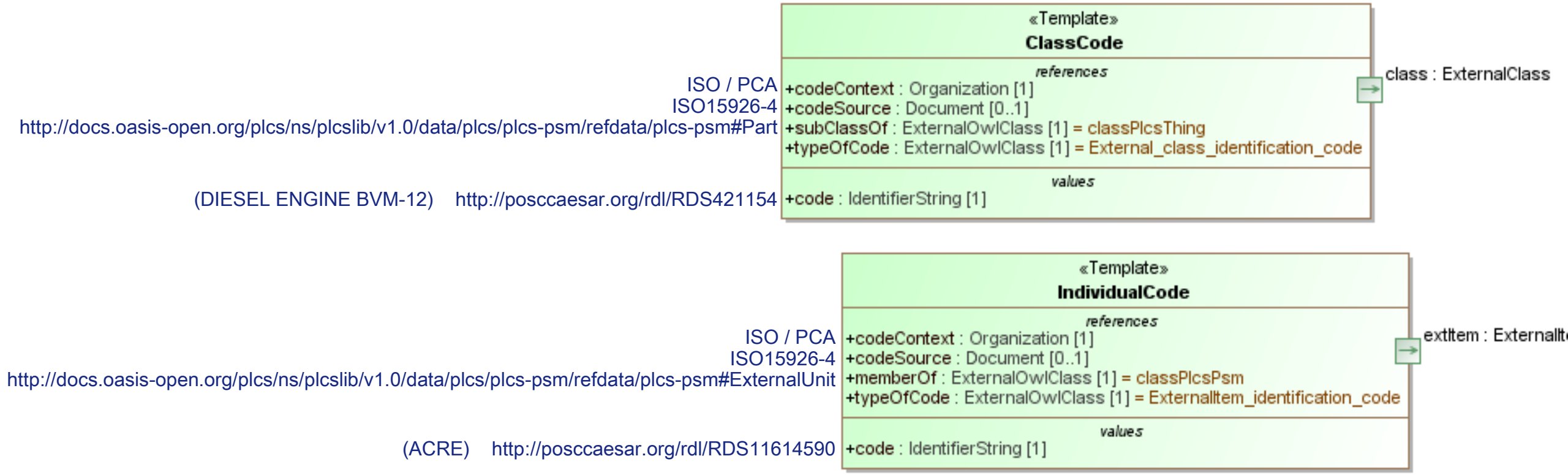
Using template ClassCode for 15926 ref data



The mechanism to refer to external reference data is already implemented in PLCS.

However, this mechanism doesn't make the 15926 reference data checked as part of the normal PLCS reference data, validation is up to software systems (= no control).

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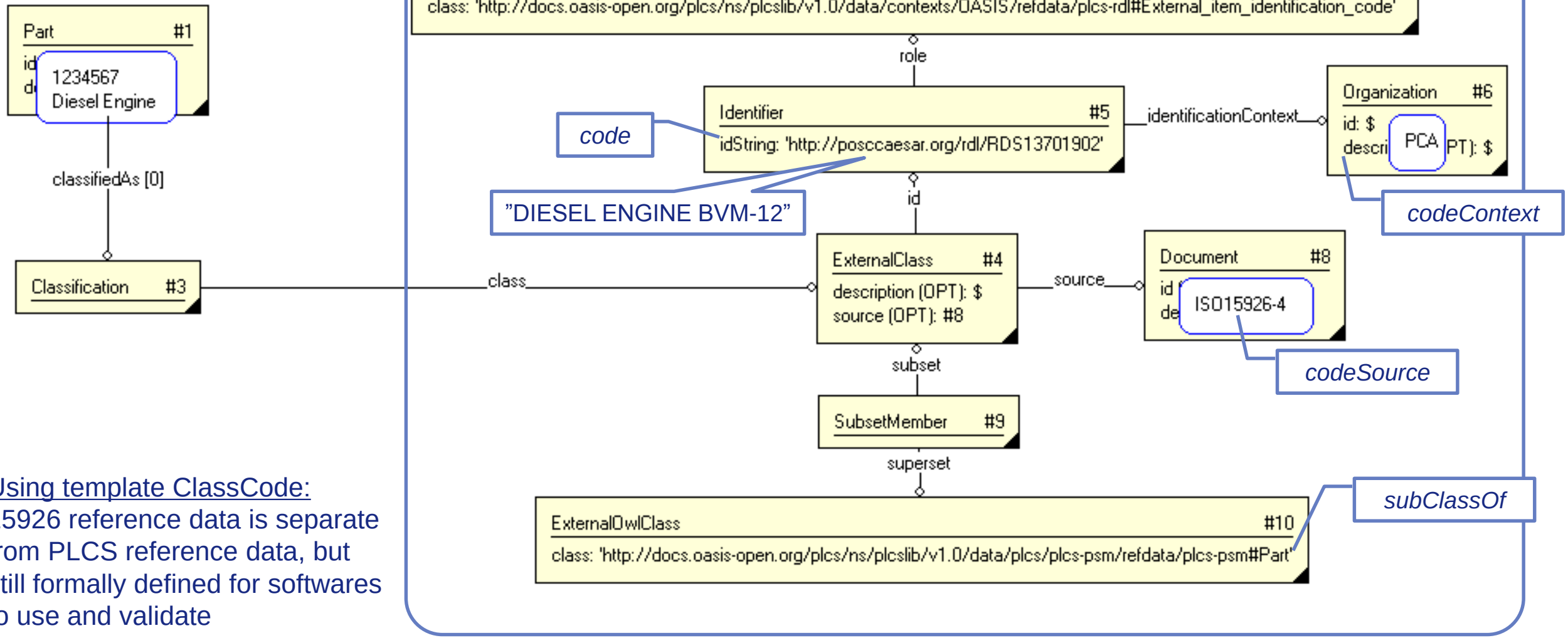
Developed using Graphical Instance from eurostep



Using template ClassCode:
15926 reference data is separate from PLCS reference data, but still formally defined for softwares to use and validate

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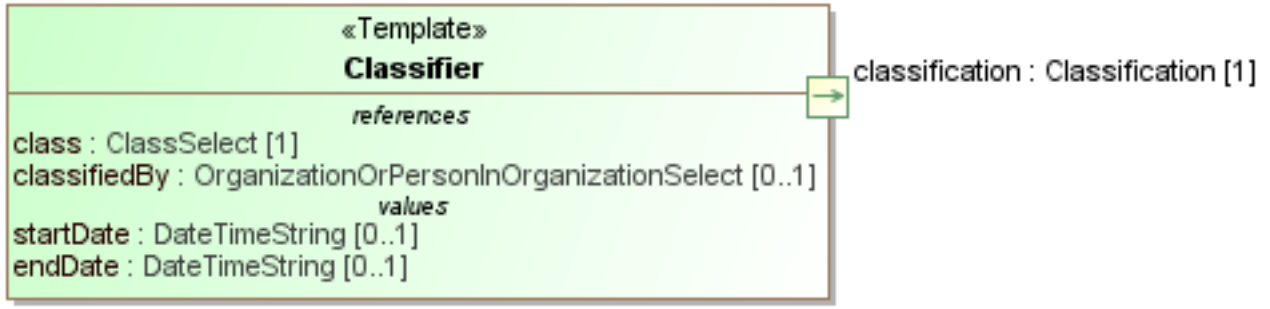
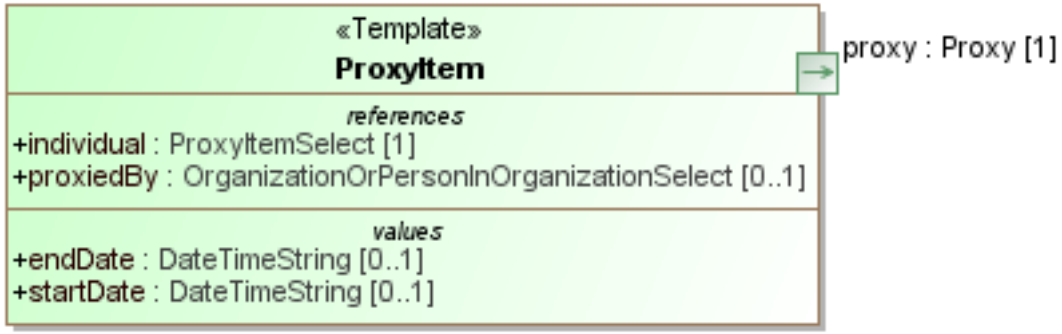
Integrating 15926 ref data with PLCS ref data

(DIESEL ENGINE BVM-12) http://www.myorg.com/plcs-rdl#PCA_RDS421154



(ACRE) http://www.myorg.com/plcs-rdl#PCA_RDS11614590



The mechanism to refer to PLCS reference data is less complex, because inheritance etc is already known (in RDL).

It also provides a means to validate the use of ref data according to OWL (one exchange context RDL).

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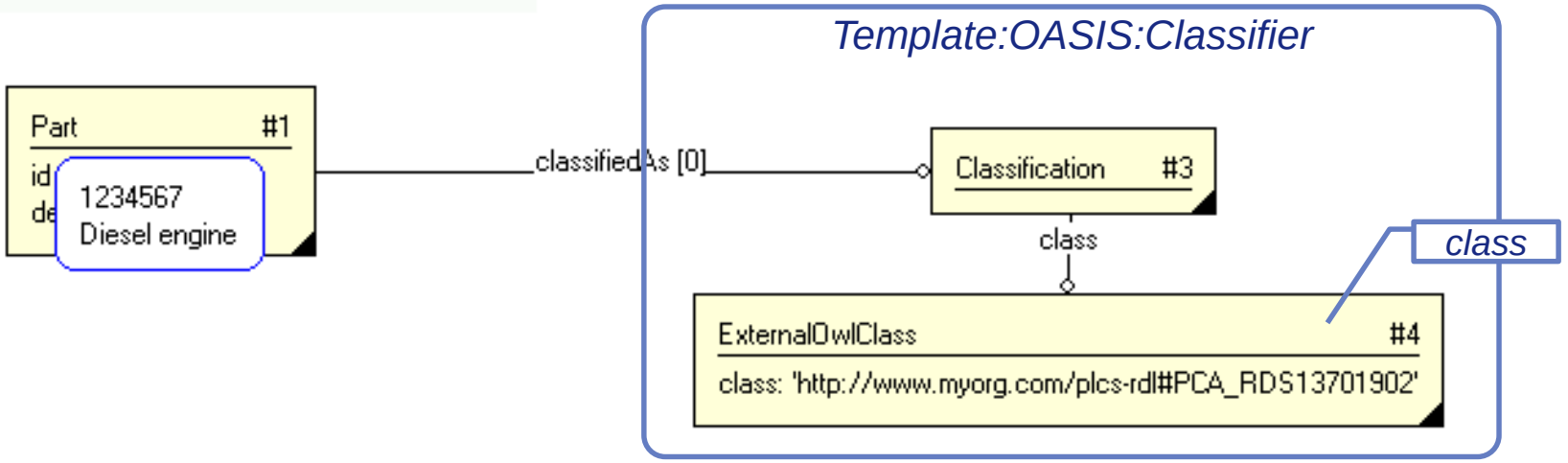
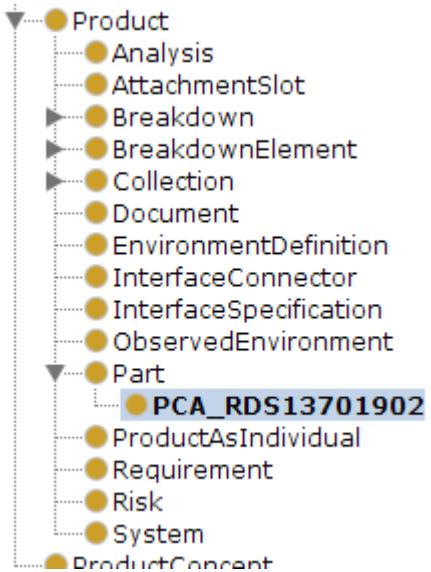


http://www.myorg.com/plcs-rdl



Using PLCS ref data as proxy:
15926 reference data is included in PLCS reference data, and is in all aspects equal to any other PLCS ref data

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