OntologySummit2009: Toward Ontology-based Standards

EADS inputs based on Inputs from research activities performed by EADS and LIRIS
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Potential usage of ontology for standard

- **Annotate schemas with information not modeled in APs**

  such as modules, UoF, CC, Conformance Option, definition, AP/Module structure

  ⇒ Application protocols becoming knowledge based that can be "queried", validated from a logical point of view, displayed with visualization tools, enriched and annotated, etc

  ⇒ Modules and usage recommendations (e.g. DEXs, RDL, Services) that can be "cross-checked" (federated models through annotation)

- **Distributed semantic Store available for intelligent agent**

- **Mapping rules formalized using DL**
  - most of the time OK going from ARM to AIM

- **Insuring semantic preservation and coherency for different formalization of the same manufacturing concepts** (extended hyper models)
  - e.g. EXPRESS, UML, OWL, XML Schema, Programming languages, service description language…

- **Basis for producing frame to insure coherency of formal description of family of standards**
  - e.g. AP214, PDT.net, PLM services, VDA Ecr…

- **Formal validation and improvement of existing protocols**
  - E.g. rationalize the way xAssignment and xyRelationship entities are produced

Issues on developed semantic web technologies

- Limitation of Descriptive Logic – extensions required for
  - Computation
  - Equivalence of constructions
  - Semantic service missing
  - Breakdown constructs not available while required for product engineering

- Improvement and extension of formal explicit visual representation languages
  - Important to make the link between representation for people, and representation for machines, with good alignment
  - E.g: BPMN us XPDL/BPEL, starting from different conceptual models and difficult to align, while describing the same things.

- Better inter-relation between languages
  - Extending and reusing standards and not recreating with huge inconsistent overlaps.

Drawback slides

More information on previous projects and thinking relating ontology and standards

Knowledge base as semantic graph (ATHENA)

- Formalized information within AP which are not within the EXPRESS model
- Reasoning not required, just relate heterogonous distributed source of knowledge
- Should allow usage of SparQL to “query” Application Protocol document

ATHENA:

- *opportunity to work on:*
  - *STEP binding to produce Semantic Graphs based on OWL Full from Express and P21 files*
  - *Enriched with external knowledge (Definition, UoF, CC)*
  - *Navigated a graphical way (OWLViz, Jambalaya,etc)*

⇒ *automated transformation from EXPRESS not appropriate*

difference of expressivity between EXPRESS and OWL

- *no construct exist in EXPRESS to deal with relations/properties*
- *While relations/properties core construct of OWL*
  - *allows dealing very simply with xyRelationship, xAssignment entities defined in STEP application protocols.*
  - *Allows dealing simply with the SELECT types in EXPRESS.*

- *Choice not to use OWL DL*
  - *DL constraint (partitioning of things as individual, property or class) not appropriate for AP (coexistence of product family, product and product instance within the same model)*
  - *Establishment of a semantic graph brought a sufficient value without adding some complexity trying to produce DL models, with not yet mature open source engines.*

Logically federated models
(based on OWL2 and Large Triple stores …)

- Schemas and AP content published as OWL models for annotation of distributed resources
- Allowing SparQL querying, PLM data annotation, usage of Reasoning Engine, intelligent agents, pervasive product and standard knowledge for people and tools

WITH OWL2, new large triple store, improved reasoning engines

- *More mature modeling tools*
  - *Protégé 4*
- *More mature reasoning engines*
  - *Pellet, Fact++*
- *Emerging large RDF stores*
  - *To deal with large amount of data for Aerospace product description*
- *Some improvement*
  - *better management of import/export*
  - *annotations and subProperties*

=>reconsidering OWL DL as a target is today more relevant

Potential usage

- *formalize logical mappings in OWL*
- *take advantage of reasoning engines for transformation through inferencing*
- *logic validation of mapping between models*

Coherency of representations of a same knowledge using different formalism (languages) for different purpose and automates (software)

- EXPRESS us UML us XML Schema us RDF us OWL us DL us programming language us SQL
- Describe us Reasoning us Computing us Structure us Manage
- Classification us Decomposition us Aggregate
- Most of constructs provided by ontology insufficient for Product Design

Some open questions

- *all the rules formalized with EXPRESS can't be formalized in OWL*
- *descriptions of operations and functions on literals is not supported by OWL.*
- *How to establish equivalence of models where some set of literals is equivalent to another as it can be obtained by functions?*
- *An example is definition of a circle, which can be obtained and is fully defined by different sets of parameters and associated way to construct it.*
- *If two modeling languages are not using the same, do we consider they are not equivalent?*
- *And when willing to transform the data from one to the other, reasoning is not sufficient, as we also need to ... calculate.*

Studying OMG MDA, UML, XMI and MOF

- *both EXPRESS and OWL very poor with specialized relationships required for Product Development.*
- *Nor EXPRESS nor OWL are providing dedicated constructs for breakdowns, being aggregates or compositions*
- *while UML do*
- *Within application protocols, such constructs proposed (metamodel level) while part of modeling constructs with UML or SysML.*
- *Idem for OWL*
- *In the reverse, UML being for design so very poor to deal with individuals*
- *Way to formalize logic constraints is very complicated compared to OWL.*
- *XMI is syntactic, not semantic*
- *Why to use within Manufacturing community EXPRESS, OWL or UML to describe the same world.*
- *A response is may be "let's use together for appropriate usage".*
- *Most of the studies conclusion is: "languages are not equivalent but complementary". So why to choose?*

Impedance misMESS – semantic preservation

- Language mappings against coherent multi-formalism and multi-representation of a domain of knowledge according different viewpoints to address for enterprise technical application

- *One issue,*
  - *"impedance mismatch" (<Object Relational Mapping community)*
  - *“we loose information when translating”*
- *Over numerous languages to use => going toward "impedance misMESS"?*
- *Semantic preservation going from a representation of the same reality using one language to a second representation of the same reality using another language*
- *Semantic preservation more an more important*
  - *To avoid "formal language silos“*
  - *To produce set of representations using different languages but insuring coherency of these representations*
  - *Effective usage of the produced formal models is also expected.*
- Using more and more using COTS
- Focusing on our core activities
- Our providers are not using the same language than us
- How to deal with reconciliation of enterprise, application users, software product and developers viewpoints and make them communicate together?

Industrial context and viewpoint

- Today several initiatives are trying to define a framework to deal with numerous manufacturing eBusiness standards (ASD SSG, EADS SSC), with a difficulty due to usage of heterogeneous modeling languages based on different paradigms.
  - Encompass
    - Organization, Process, Information and ICT
  - Encompass
    - Data, Services (set of published and consumed operations), Process (behavior)
- What about set of coherent standardized languages
  - covering complete spectrum of needs and phases of application lifecycle
  - Selecting already existing and relevant languages
  - Using them together

- EXPRESS, UML and OWL are candidates to be part of such a set
  - Product Data Exchange
  - Software engineering for component and model based software engineering
  - Semantic WEB

- But should be completed by emerging SOA and BPM related languages which are not information centric, but are focusing on other aspect than information models.
- It is nevertheless a pity that SOA W3C standards are syntactic, and not semantic.
- What about W3C recommendation for semantic services?
- Can we imagine to “ontologize” existing W3C standards

Semantic sharing

1. Sharing data objects semantics between designers

⇒ STEPMOD electronic technical dictionary in English

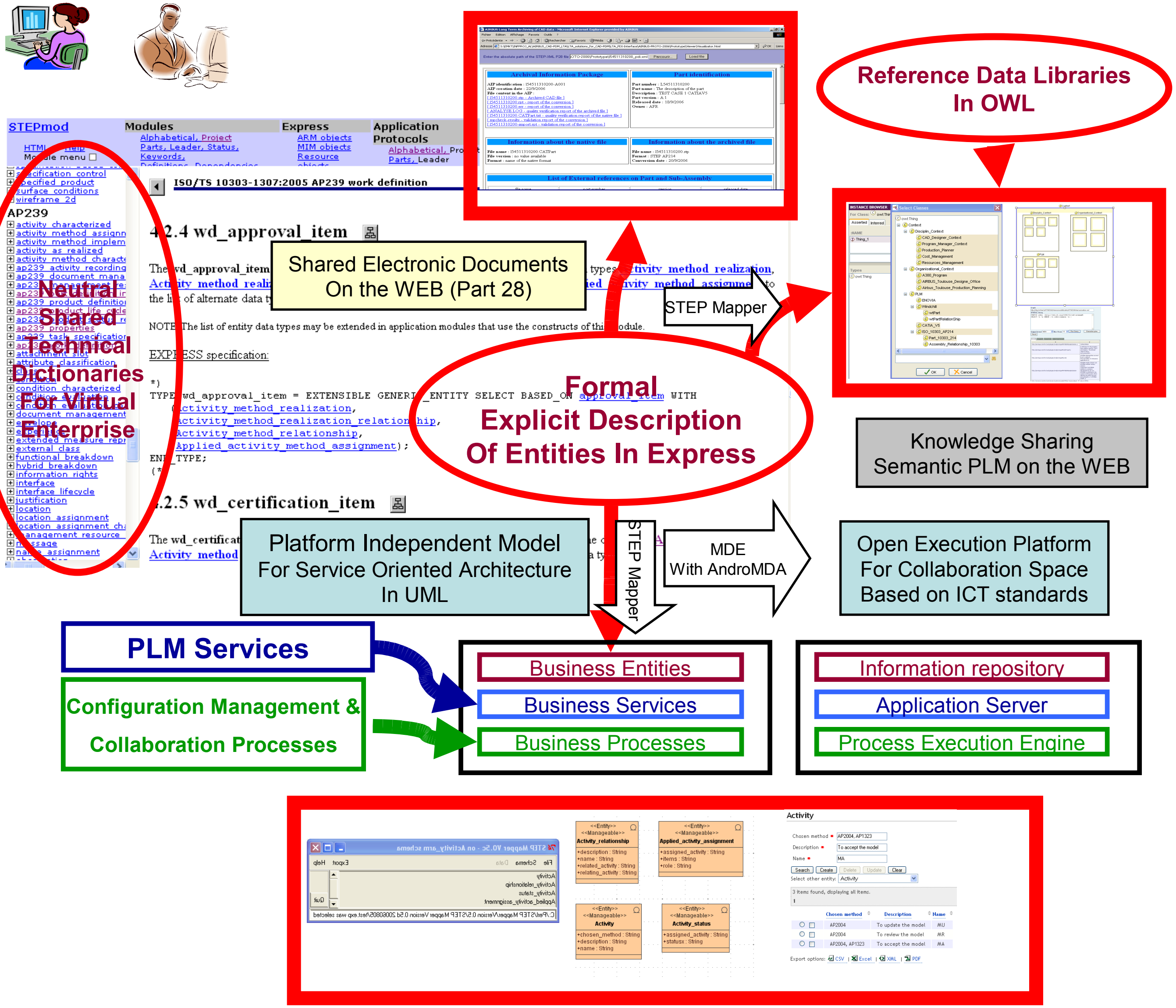
2.Sharing semantics for applications

=>transformation in XML for Shared Electronic Documents on WEB

⇒ transformation in OWL for knowledge sharing and semantic PLM on the WEB

⇒ UML transformation for application engineering

⇒ Completion with services and processes: Model Driven Approach based on PIM4SOA



Neutral Shared Technical Dictionaries For Virtual Enterprise

Shared Electronic Documents On the WEB (Part 28)

Reference Data Libraries In OWL

STEP Mapper

Formal Explicit Description Of Entities In Express

Knowledge Sharing Semantic PLM on the WEB

Platform Independent Model For Service Oriented Architecture In UML

STEP Mapper

MDE With AndroMDA

Open Execution Platform For Collaboration Space Based on ICT standards

PLM Services

Configuration Management & Collaboration Processes

Business Entities

Business Services

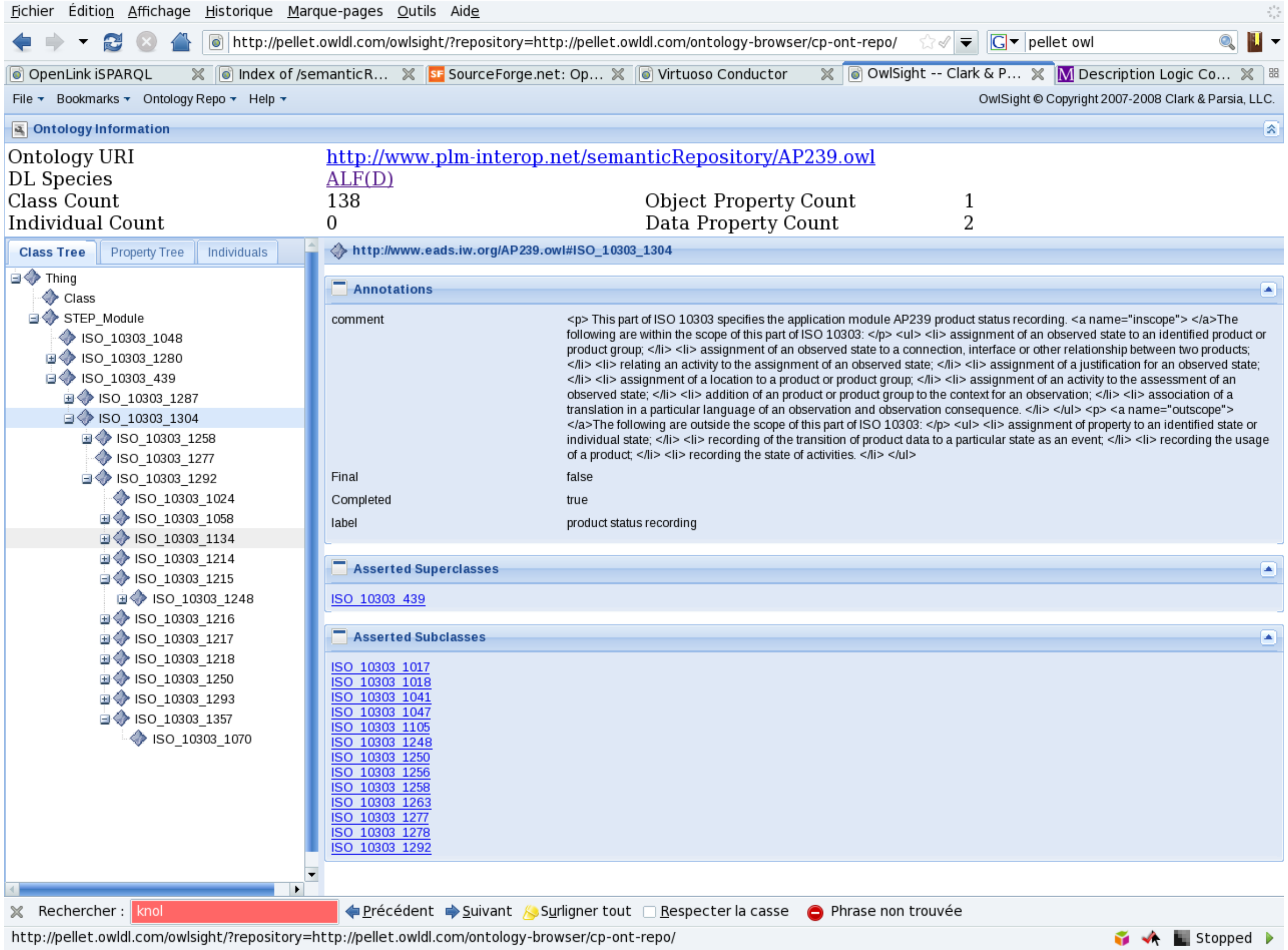
Business Processes

Information repository

Application Server

Process Execution Engine

Semantic Repository: usage of reasoning engine


Fichier Édition Affichage Historique Marque-pages Outils Aide
http://pellet.owldl.com/owlsight/?repository=http://pellet.owldl.com/ontology-browser/cp-ont-repo/
pellet owl
OpenLink iSPARQL
Index of /semanticR...
SourceForge.net: Op...
Virtuoso Conductor
OwlSight -- Clark & P...
Description Logic Co...
File Bookmarks Ontology Repo Help
OwlSight © Copyright 2007-2008 Clark & Parsia, LLC.
Ontology Information
Class Tree Property Tree Individuals

Ontology URI	http://www.plm-interop.net/semanticRepository/AP239.owl		
DL Species	ALF(D)		
Class Count	138	Object Property Count	1
Individual Count	0	Data Property Count	2

```
Thing
  Class
  STEP_Module
    ISO_10303_1048
    ISO_10303_1280
    ISO_10303_439
      ISO_10303_1287
      ISO_10303_1304
        ISO_10303_1258
        ISO_10303_1277
        ISO_10303_1292
          ISO_10303_1024
          ISO_10303_1058
          ISO_10303_1134
          ISO_10303_1214
          ISO_10303_1215
            ISO_10303_1248
          ISO_10303_1216
          ISO_10303_1217
          ISO_10303_1218
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          ISO_10303_1293
          ISO_10303_1357
            ISO_10303_1070
```

http://www.eads.iw.org/AP239.owl#ISO_10303_1304

Annotations

comment	<p> This part of ISO 10303 specifies the application module AP239 product status recording. <a name="inscope"> </a>The following are within the scope of this part of ISO 10303: </p> <ul> <li> assignment of an observed state to an identified product or product group; </li> <li> assignment of an observed state to a connection, interface or other relationship between two products; </li> <li> relating an activity to the assignment of an observed state; </li> <li> assignment of a justification for an observed state; </li> <li> assignment of a location to a product or product group; </li> <li> assignment of an activity to the assessment of an observed state; </li> <li> addition of an product or product group to the context for an observation; </li> <li> association of a translation in a particular language of an observation and observation consequence. </li> </ul> <p> <a name="outscope"> </a>The following are outside the scope of this part of ISO 10303: </p> <ul> <li> assignment of property to an identified state or individual state; </li> <li> recording of the transition of product data to a particular state as an event; </li> <li> recording the usage of a product; </li> <li> recording the state of activities. </li> </ul>
Final	false
Completed	true
label	product status recording

Asserted Superclasses

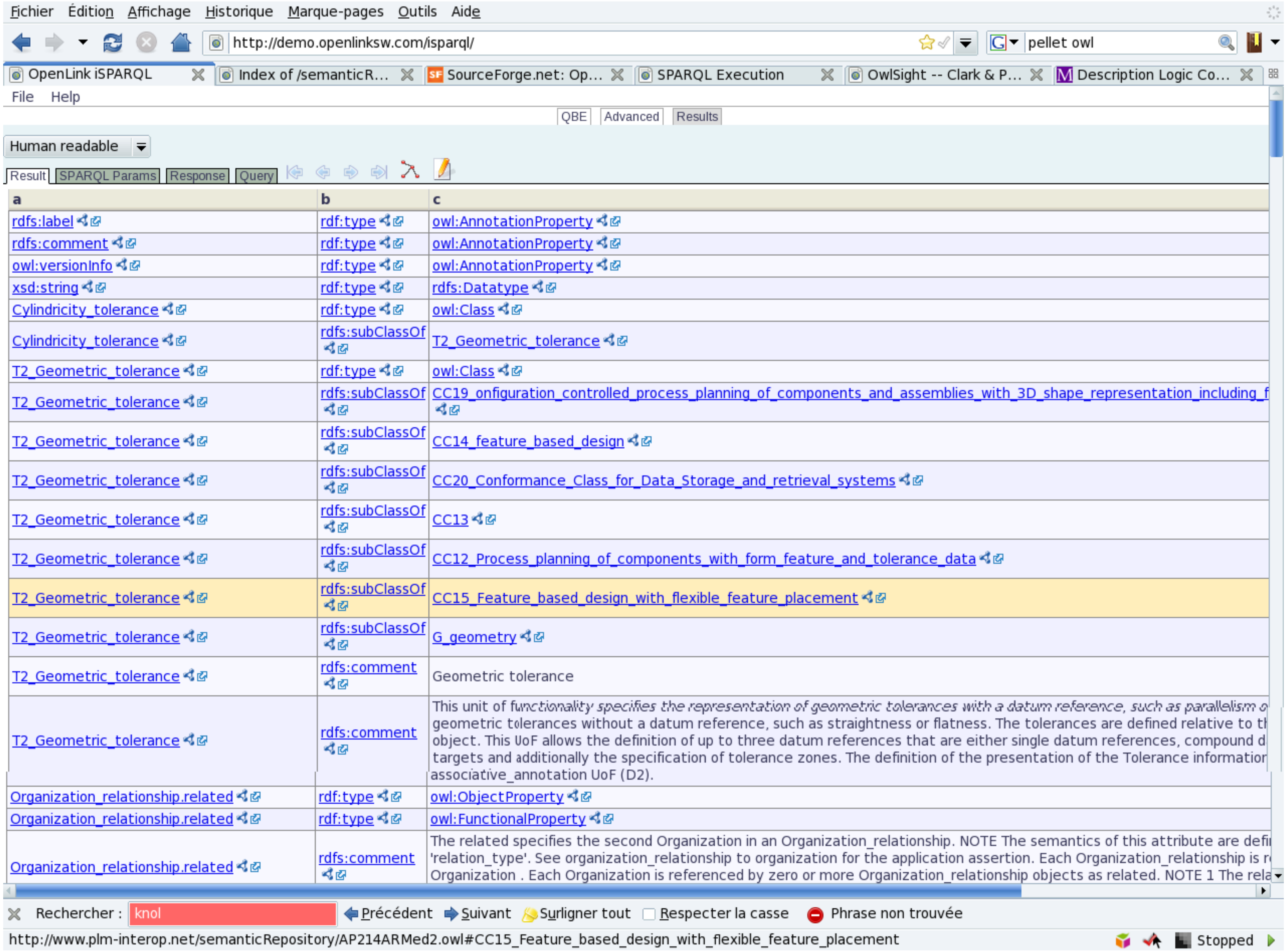
ISO_10303_439

Asserted Subclasses

ISO_10303_1017
ISO_10303_1018
ISO_10303_1041
ISO_10303_1047
ISO_10303_1105
ISO_10303_1248
ISO_10303_1250
ISO_10303_1256
ISO_10303_1258
ISO_10303_1263
ISO_10303_1277
ISO_10303_1278
ISO_10303_1292

Rechercher : knol
Précédent
Suivant
Surligner tout
□ Respecter la casse
Phrase non trouvée
http://pellet.owldl.com/owlsight/?repository=http://pellet.owldl.com/ontology-browser/cp-ont-repo/
Stopped

Semantic Repository – SparQL querying with Virtuoso



http://demo.openlinksw.com/isparql/

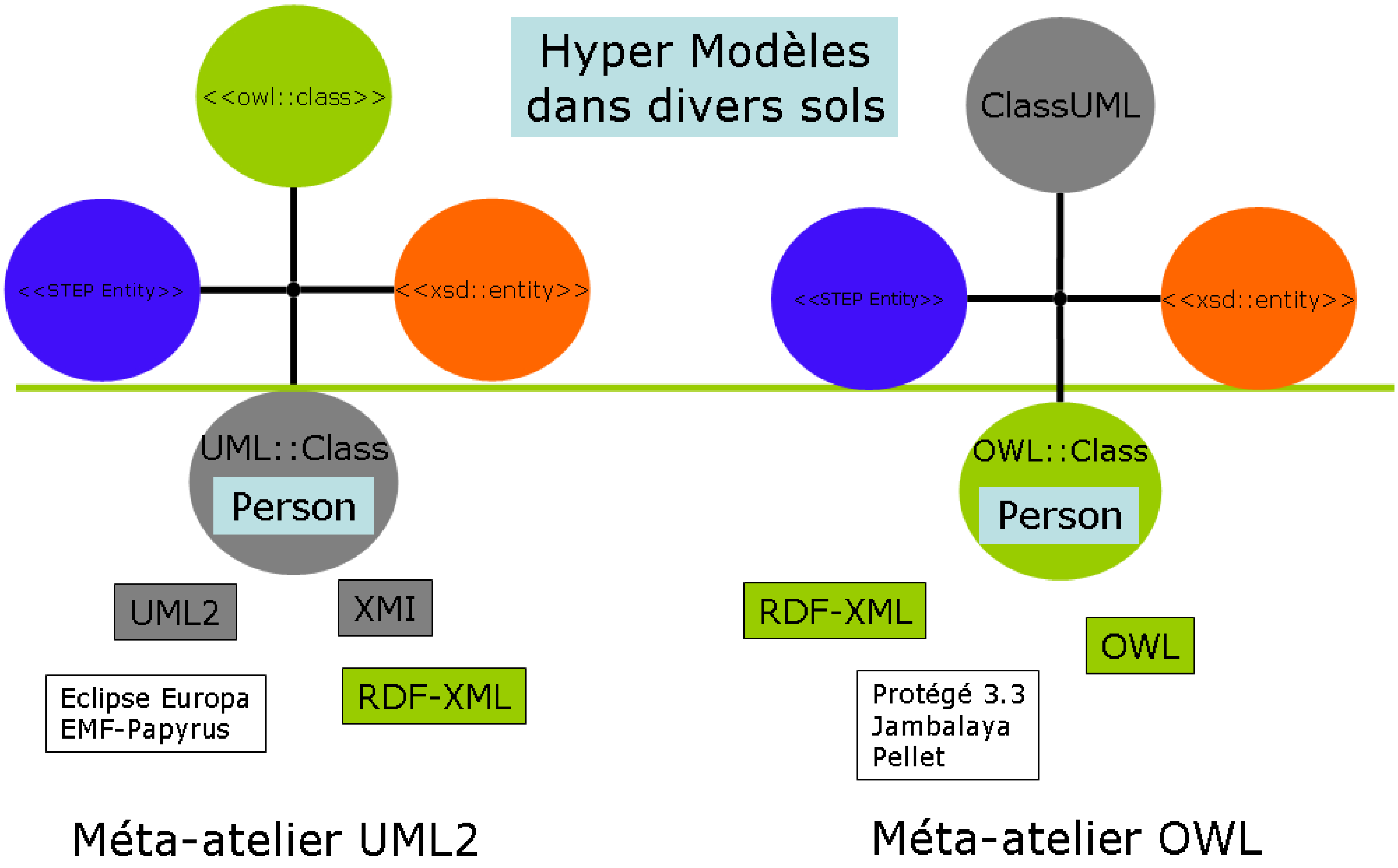
pellet owl

a	b	c
rdfs:label	rdf:type	owl:AnnotationProperty
rdfs:comment	rdf:type	owl:AnnotationProperty
owl:versionInfo	rdf:type	owl:AnnotationProperty
xsd:string	rdf:type	rdfs:Datatype
Cylindricity_tolerance	rdf:type	owl:Class
Cylindricity_tolerance	rdfs:subClassOf	T2_Geometric_tolerance
T2_Geometric_tolerance	rdf:type	owl:Class
T2_Geometric_tolerance	rdfs:subClassOf	CC19_onfiguration_controlled_process_planning_of_components_and_assemblies_with_3D_shape_representation_including_f
T2_Geometric_tolerance	rdfs:subClassOf	CC14_feature_based_design
T2_Geometric_tolerance	rdfs:subClassOf	CC20_Conformance_Class_for_Data_Storage_and_retrieval_systems
T2_Geometric_tolerance	rdfs:subClassOf	CC13
T2_Geometric_tolerance	rdfs:subClassOf	CC12_Process_planning_of_components_with_form_feature_and_tolerance_data
T2_Geometric_tolerance	rdfs:subClassOf	CC15_Feature_based_design_with_flexible_feature_placement
T2_Geometric_tolerance	rdfs:subClassOf	G_geometry
T2_Geometric_tolerance	rdfs:comment	Geometric tolerance
T2_Geometric_tolerance	rdfs:comment	This unit of functionality specifies the representation of geometric tolerances with a datum reference, such as parallelism o geometric tolerances without a datum reference, such as straightness or flatness. The tolerances are defined relative to tl object. This UoF allows the definition of up to three datum references that are either single datum references, compound d targets and additionally the specification of tolerance zones. The definition of the presentation of the Tolerance informatior associative_annotation UoF (D2).
Organization_relationship.related	rdf:type	owl:ObjectProperty
Organization_relationship.related	rdf:type	owl:FunctionalProperty
Organization_relationship.related	rdfs:comment	The related specifies the second Organization in an Organization_relationship. NOTE The semantics of this attribute are defi 'relation_type'. See organization_relationship to organization for the application assertion. Each Organization_relationship is r Organization . Each Organization is referenced by zero or more Organization_relationship objects as related. NOTE 1 The rela

Rechercher : knol

http://www.plm-interop.net/semanticRepository/AP214ARMed2.owl#CC15_Feature_based_design_with_flexible_feature_placement

Extended Hyper models in several “Grounds” with associated meta-worbench



Hyper Modèles dans divers sols

Eclipse Europa
EMF-Papyrus

Protégé 3.3
Jambalaya
Pellet

Méta-atelier UML2

Méta-atelier OWL