Model Writer

Progress on the Industrial Use Cases

WP1 overview

3 main use cases:

Airbus	Regulation documentation & Design rule repository
Havelsan	Requirement and ALM tool
Ford Otosan	Design specification with CAD (FEAD, GDR)

- Project Review 1 Conclusions and Actions 2015:
  - Focus on the most rewarding use cases with the best exploitation prospects
  - Decrease MW ambition: reduce the effort on UC and put the effort on technical work packages

AIRBUS industrial use cases

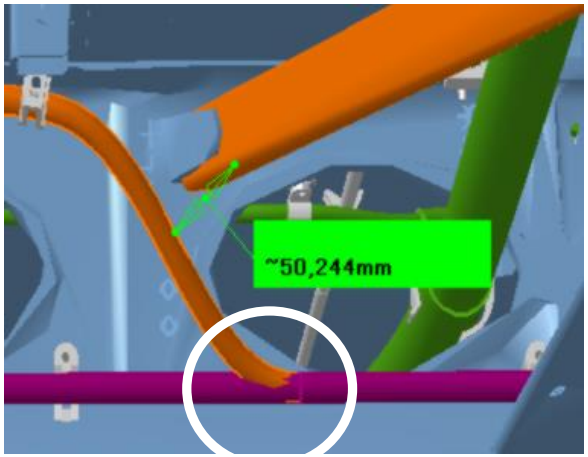
Anne MONCEAUX

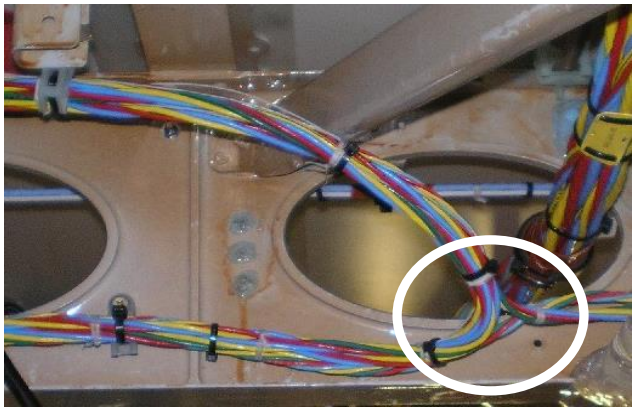
AIRBUS GROUP INNOVATIONS

Airbus use cases in ModelWriter

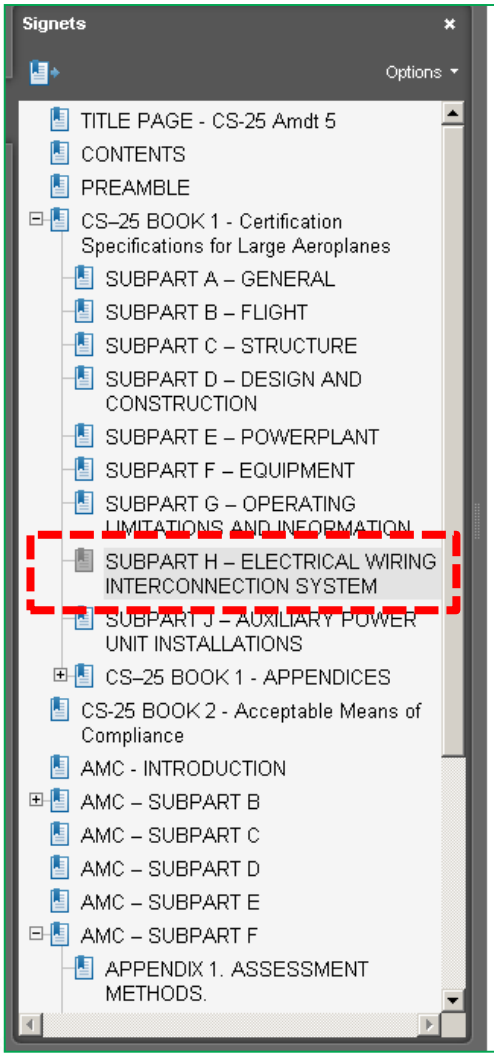
- We decided to concentrate on some problematics related to System Installation
  - SIDP is used (under Non Disclosure agreement) as a use case
- We primarily focus on Electrical, Water Waste, and Fuel Systems

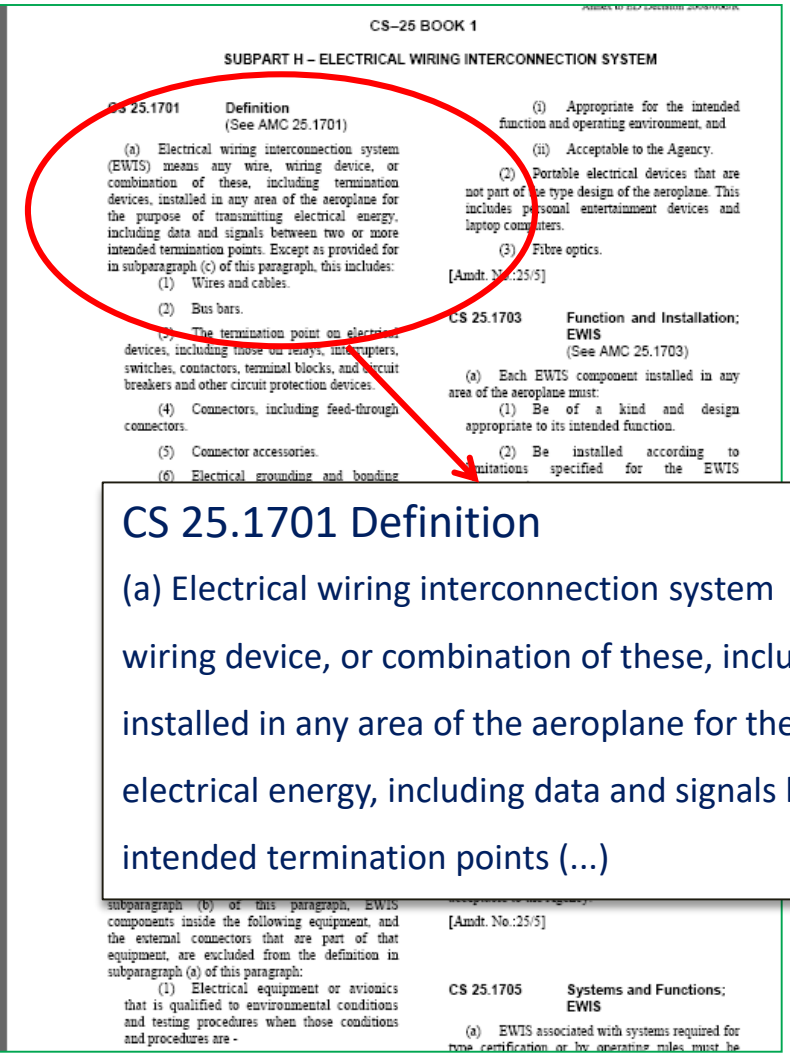
- System installation:
  - obeys to some Regulations
  - is specified by some rules/requirements/principles
  - the design and the manufactured product are checked against these rules





Certification Specification – CS 25 (EASA)





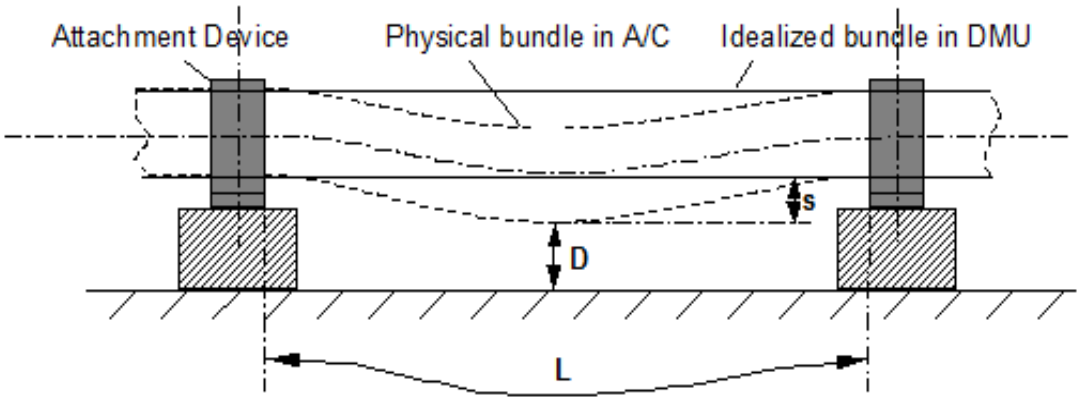
CS 25.1701 Definition

(a) Electrical wiring interconnection system (EWIS) means any wire, wiring device, or combination of these, including termination devices, installed in any area of the aeroplane for the purpose of transmitting electrical energy, including data and signals between two or more intended termination points (...)

System Installation Design Principles

SIDP92A001V-A-784

For installation of optical and electrical harnesses additional clearance for sagging (s) shall be provided as detailed below:



s...Sagging of bundle (real behavior of physical bundle in A/C due to gravity, ageing, etc.)
D...Required Distance
L...Actual length of a bundle segment between two Attachment Points (as designed in DMU)

Figure 6: Sagging of bundles between attachment points

Note: Unless the bundle has a straight routing, L is bigger than the pitch between the Attachment Points.

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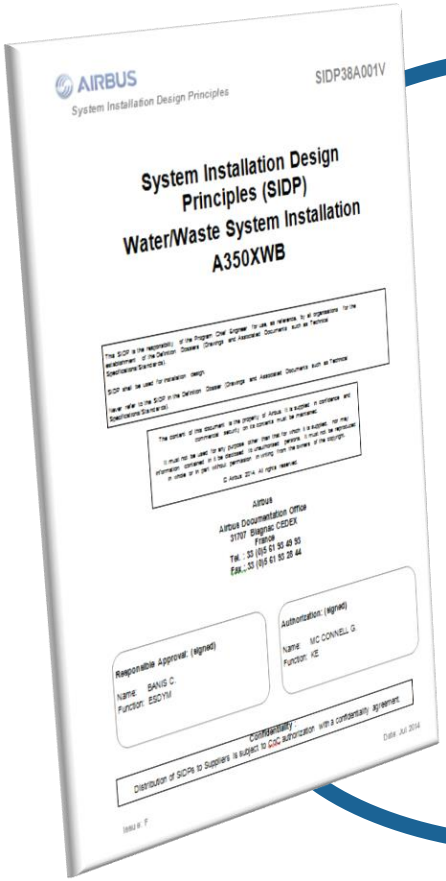
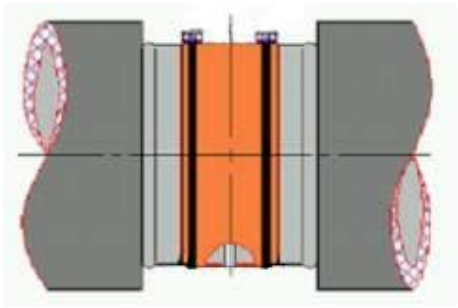
Rule traceability & design check



Traceability



Check

Problem statement & objectives

1. Model and manage the design rules: since SIDP (design principles) are todays kinds of natural language requirements and explanations:
   - not all the rules can be directly formalized in a way to be used to verify the design
   - rules are spread over various products/programs
   - rules evolve
   - rules are complex artefacts made of text and picture and tables….

   ⇒ This problem is the one we have been considering primarily in the scope of ModelWriter, trying to define a rule model and knowledge base

2. Enable mapping between rule model and design model, in order to automate identification of conflicts between rules and design, and then automate analysis of the impact of changes in rules or in design.

   ⇒ This 2d objective is not a primary one for Airbus in ModelWriter because of the challenge of mapping 3D design models to the BOM… and because lack of skills and data in the context of the project

   BUT to be consider to make the system amenable for formal analysis / & we welcome Ford Otosan Use case

Problem statement & objectives

(1) Manage rules/design principles and improve traceability	
Easier search/retrieval of rules	- save costs/time by supporting DP consultation / retrieval in accordance to the needs
Easier change impact analysis at rules level	- save DP updating costs/time - avoid non-compliance of design caused by DP updating lead time
Easier traceability between artefacts (BOM DB, design models, CAD models…)	- keep traceability from upstream regulations to requirements and to downstream design models
(2) Automate identification of design conflicts against rules	
Easier consistency checking of the design (CAD) data	- Save time to retrieve applicable rules - avoid non-compliance of design wrt rules

Some Facts, Impact, and KPIs

- Scope of 900 documents
- ATA : disciplines: 6179 ATA number (chapter+subchapters)
- Today (@MW project start) duration of documents updating process: ~ 6 months
- 900 to 1000 potential users per Program or 200 per Derivatives
- Total number of rules? ~3000 rules (TBC)
- Expected Rule coverage in the use cases? ~50%
  - 966 rewritten rules (quality to be checked)
  - Coming from 7 different SIDP docs (SIDP 92 is missing in the table below that shows the coverage of rewritten rules wrt to SIDP docs)

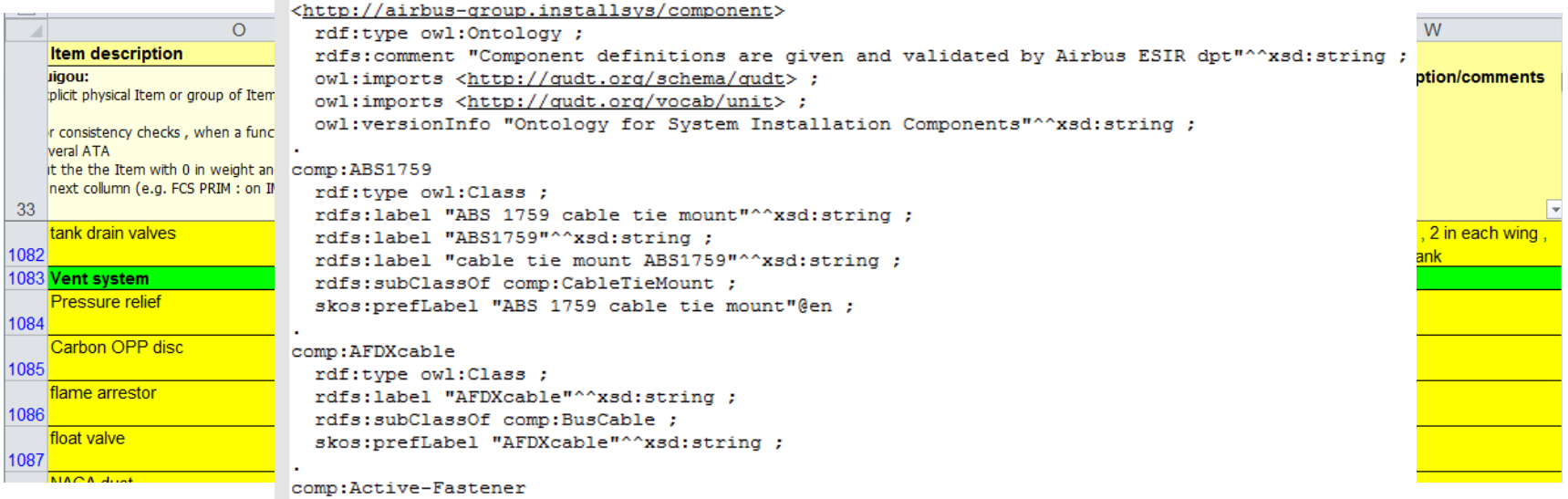
ATA	21	28	29	36	38
A330Neo	0%	67%	100%	67%	0%
A350	25%	0%	100%	0%	33%

Back-up Slides

UC-FR-03 - Synchronization of Regulation Documentation with a Design Rule Repository

Anne MONCEAUX
Airbus Group Innovation

Ex. BOM, Component taxonomy, Component ontology



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33		
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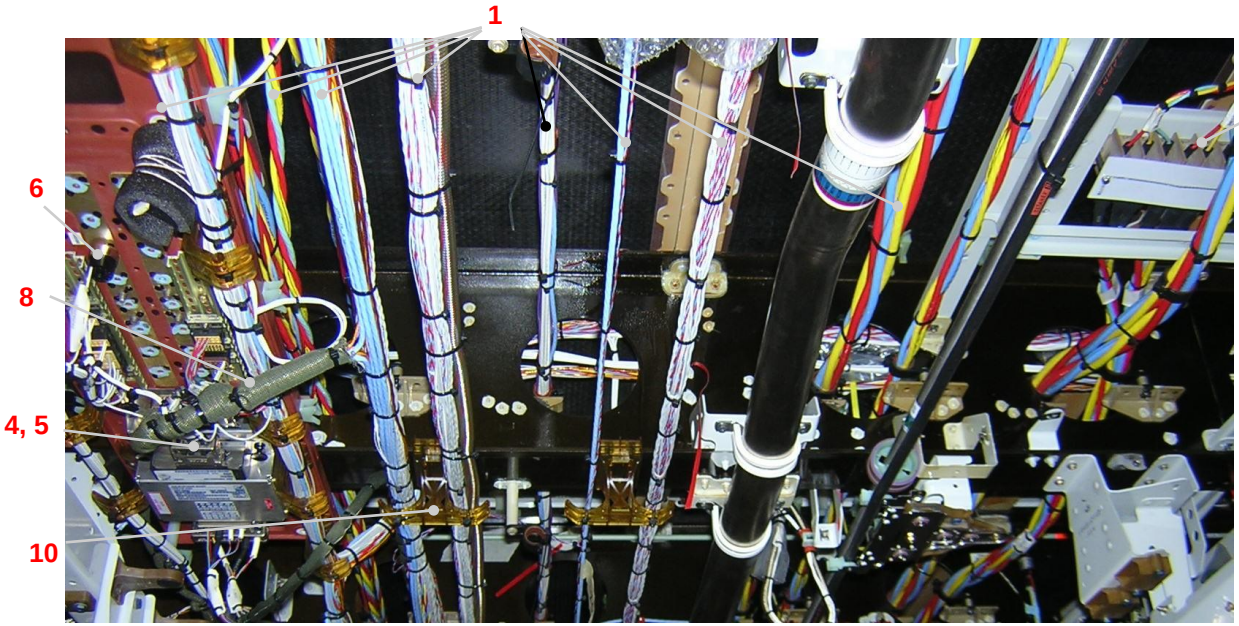
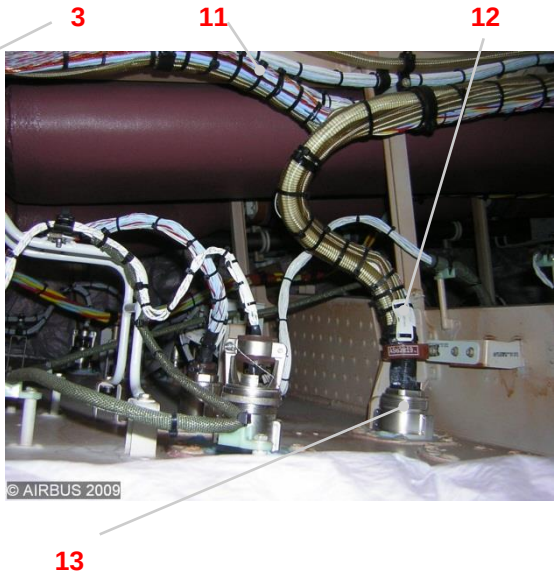
1083	**Vent system**	ank
1084	Pressure relief	
1085	Carbon OPP disc	
1086	flame arrestor	
1087	float valve	

```
.
<http://airbus-group.installsys/component>
  rdf:type owl:Ontology ;
  rdfs:comment "Component definitions are given and validated by Airbus ESIR dpt"^^xsd:string ;
  owl:imports <http://qudt.org/schema/qudt> ;
  owl:imports <http://qudt.org/vocab/unit> ;
  owl:versionInfo "Ontology for System Installation Components"^^xsd:string ;
.
comp:ABS1759
  rdf:type owl:Class ;
  rdfs:label "ABS 1759 cable tie mount"^^xsd:string ;
  rdfs:label "ABS1759"^^xsd:string ;
  rdfs:label "cable tie mount ABS1759"^^xsd:string ;
  rdfs:subClassOf comp:CableTieMount ;
  skos:prefLabel "ABS 1759 cable tie mount"@en ;
.
comp:AFDXcable
  rdf:type owl:Class ;
  rdfs:label "AFDXcable"^^xsd:string ;
  rdfs:subClassOf comp:BusCable ;
  skos:prefLabel "AFDXcable"^^xsd:string ;
.
comp:Active-Fastener
  rdf:type owl:Class ;
  rdfs:label "active fastener"^^xsd:string ;
  rdfs:subClassOf comp:Fastener ;
  rdfs:subClassOf [
      rdf:type owl:Restriction ;
      owl:hasValue "true"^^xsd:boolean ;
      owl:onProperty comp:isActive ;
    ] ;
  skos:prefLabel "active fastener"@en ;
.
comp:Active_component
  rdf:type owl:Class ;
  rdfs:label "active component"@en ;
  rdfs:label "active element"@en ;
  rdfs:label "active item"@en ;
```

Electrical wiring interconnection system (EWIS)

⇒ Mainly: **Aircraft electrical common installation (ATA92)**

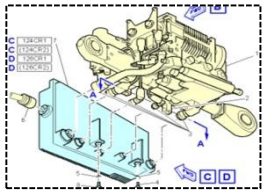


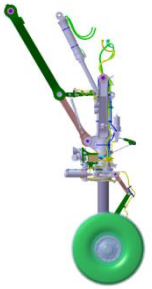


⇒ But also: **part of Systems equipment wiring:**

- Power distribution centers wiring
- External wiring of equipment
- Wiring of equipment not qualified to appropriate standards e.g. EUROCAE ED-14 / RTCA DO-160

cf CS 25.1701(b)&(c)





Illustrate traceability between all aspects of A/C wiring

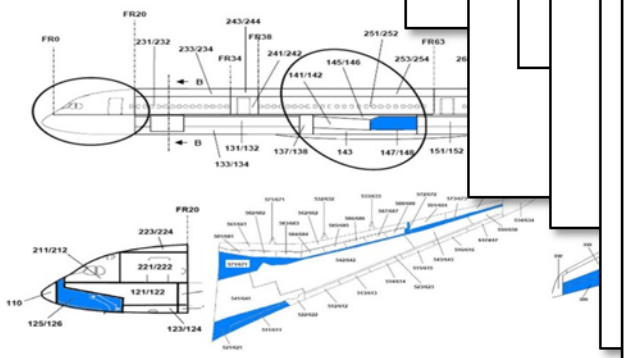
EWIS components design,

EWIS architecture - routes defi

EWIS installation design pr
requirements

Systems functional des
Systems equipment de

Environmental c



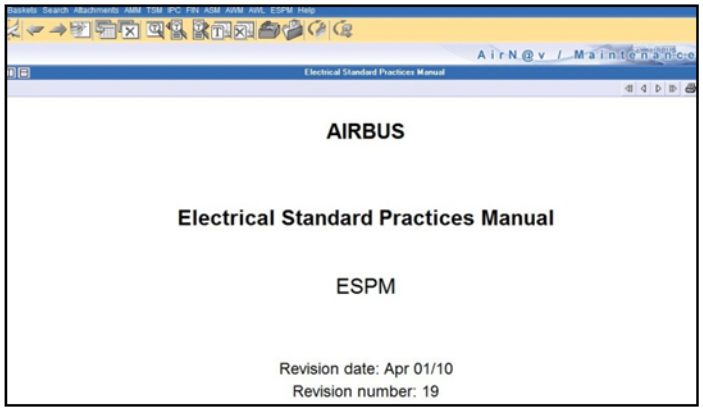
Safety analyses

EWIS definition process, V&V

Interfaces

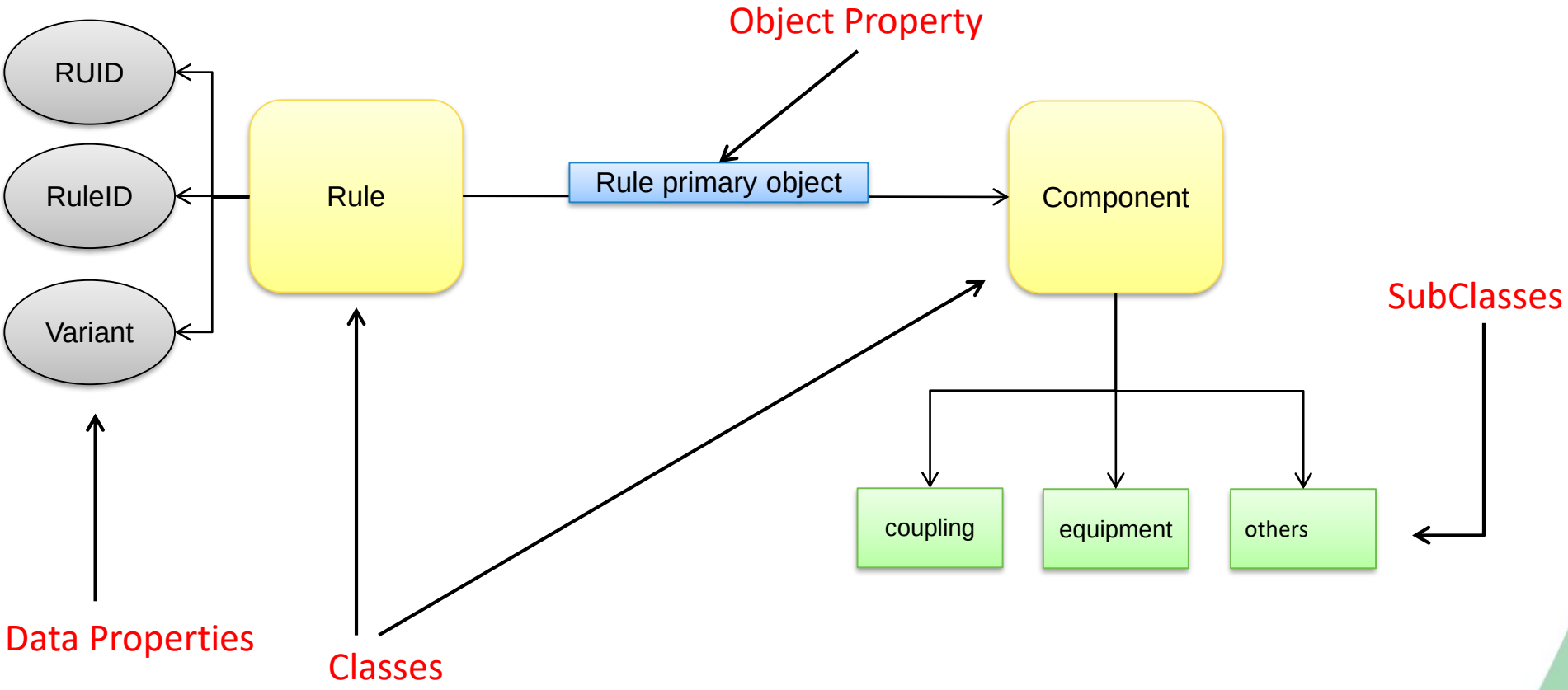
Manufacturing procedures

EWIS ICA, maintenance instructions



Etc…

Data representation



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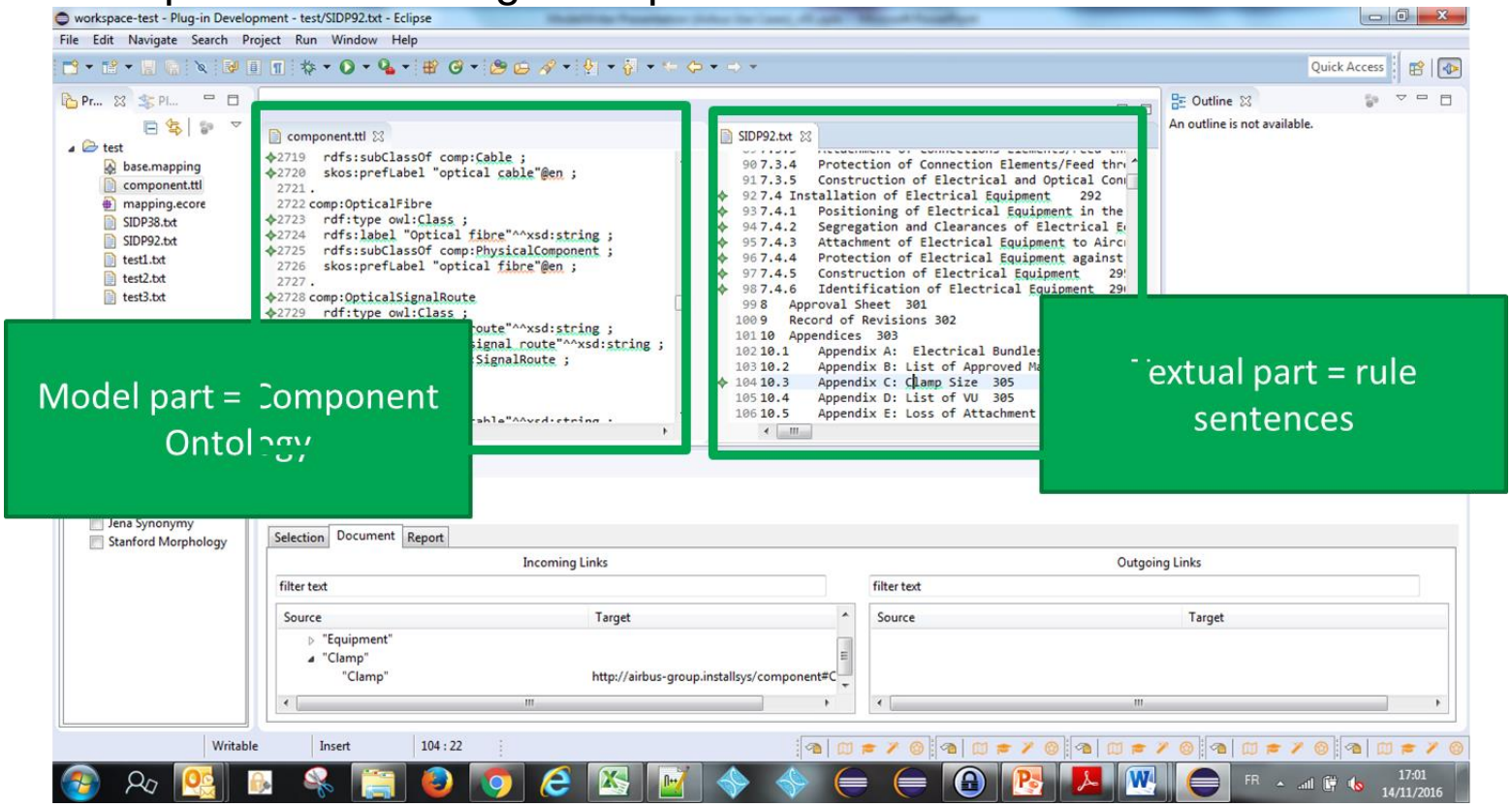
UC-FR-03 Synchronization of regulation documentation with a design rule repository

Status 1st iteration*: synchronizing the SIDP KB content and rule text part

- Experimented using WP2 parser + WP4 MW Core

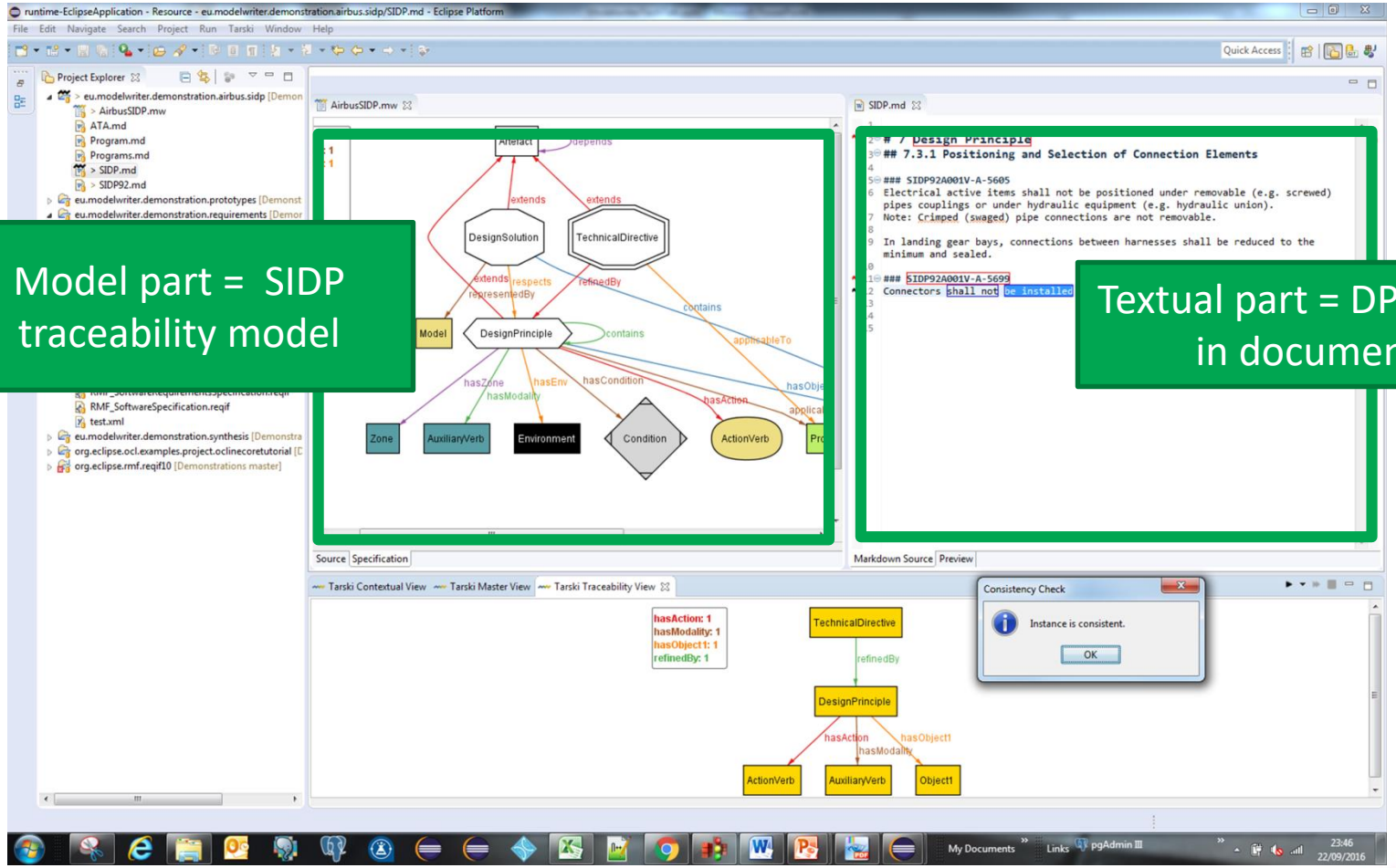


* 1st iteration = using individual DP normalized sentences"
  2d iteration = using NL DP inside documents

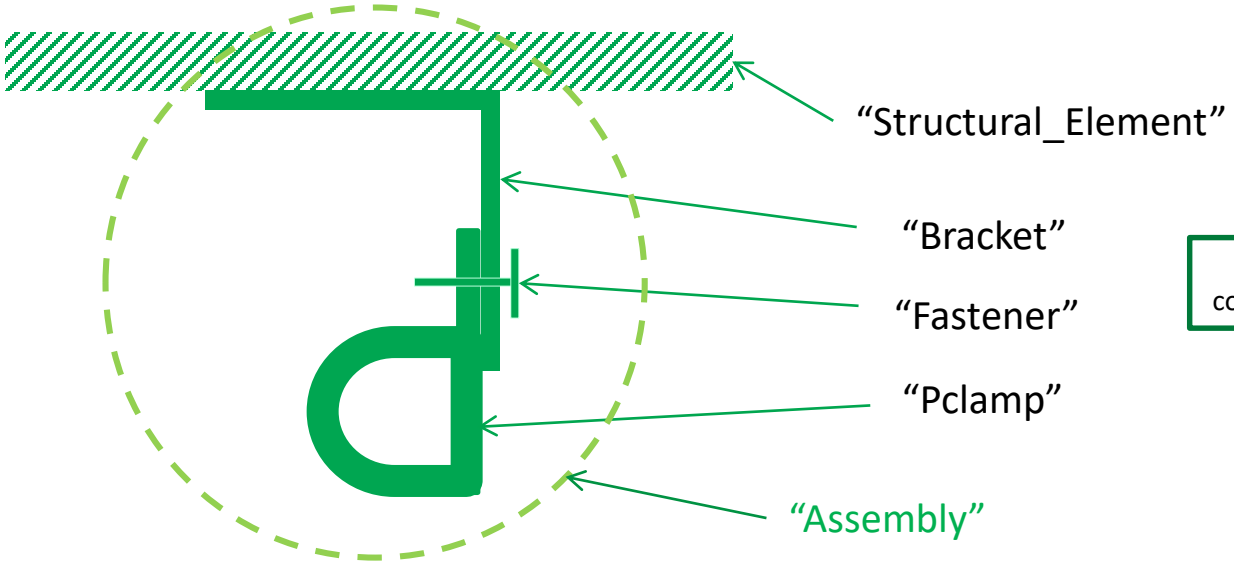
UC-FR-03b – extension to synch traceability between artefacts

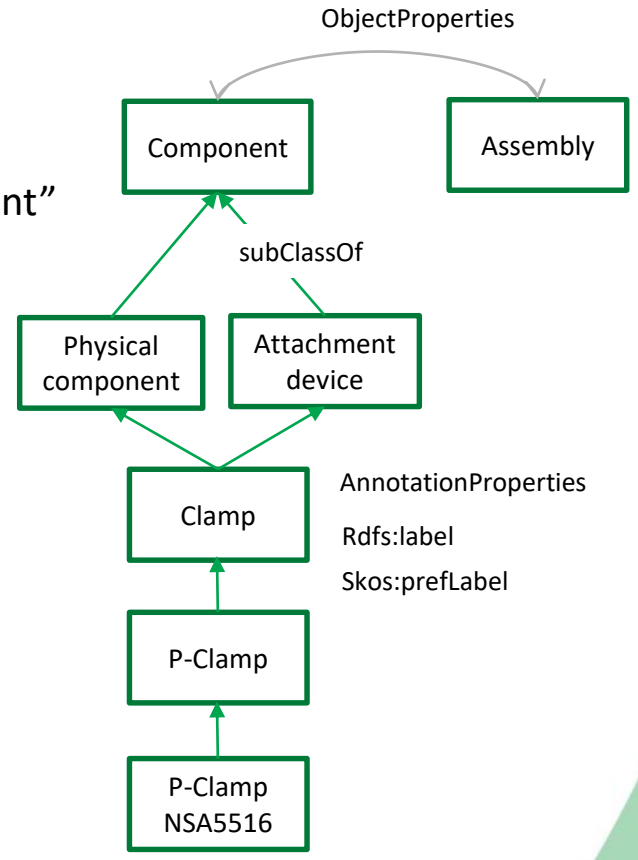
Status : synchronizing the SIDP domain artefacts

- Test using WP3 Tarsky

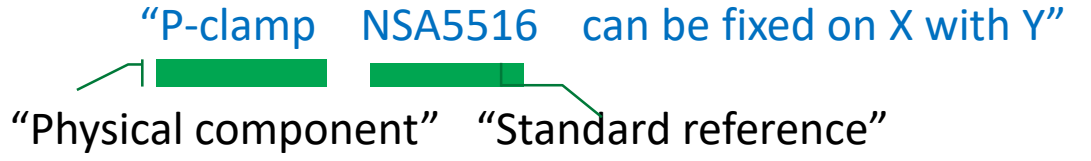


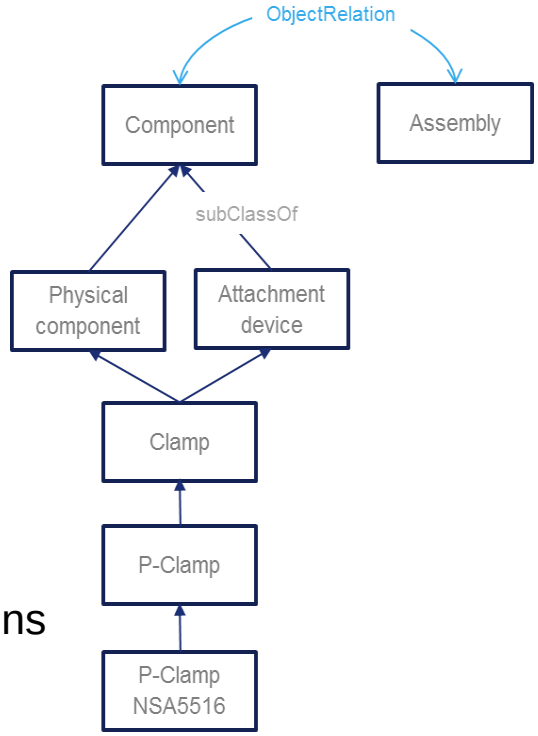
UC-FR-04 - Component taxonomy and ontology (Model part)





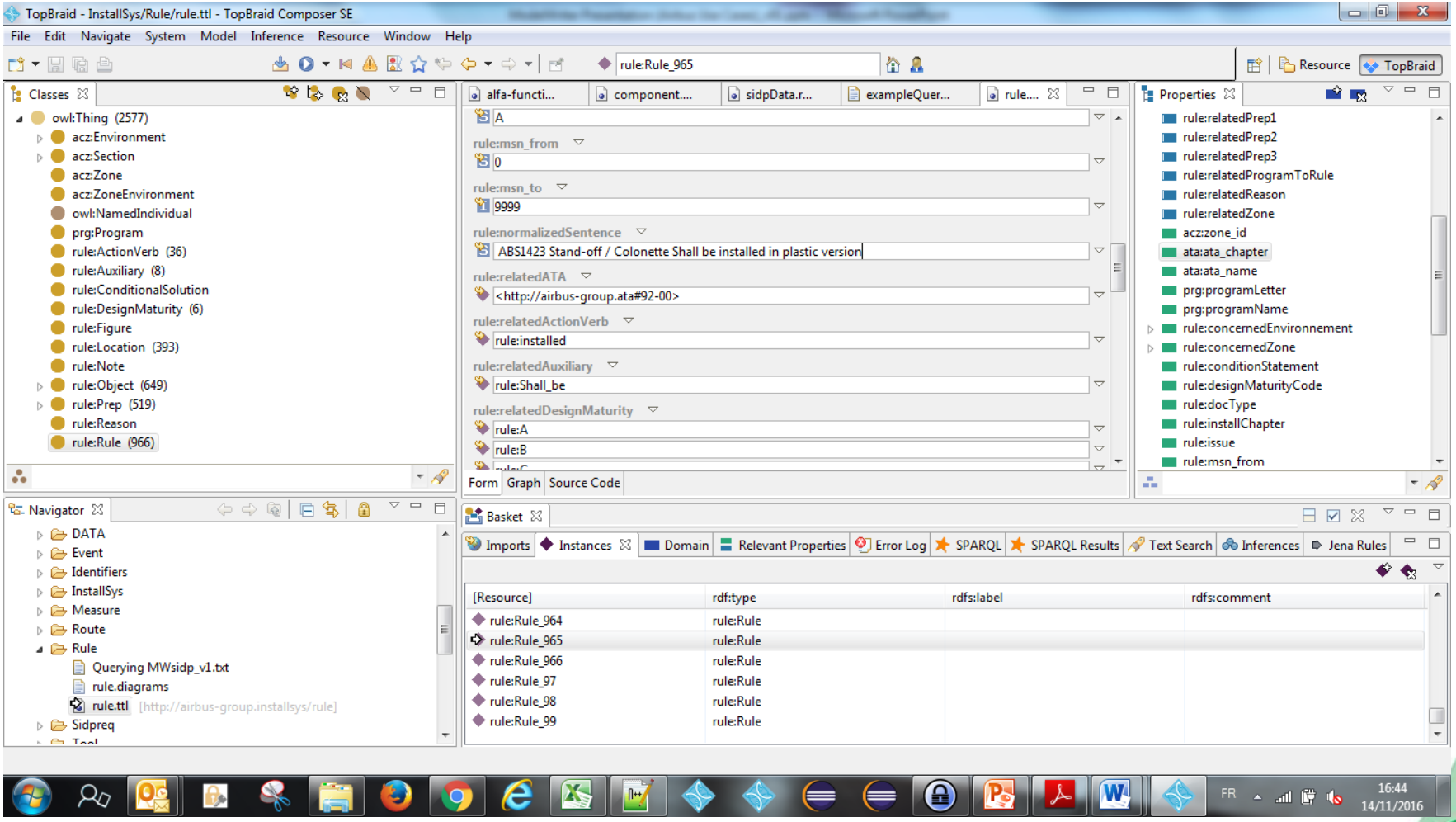
UC-FR-04 - Component taxonomy and ontology (Model part)



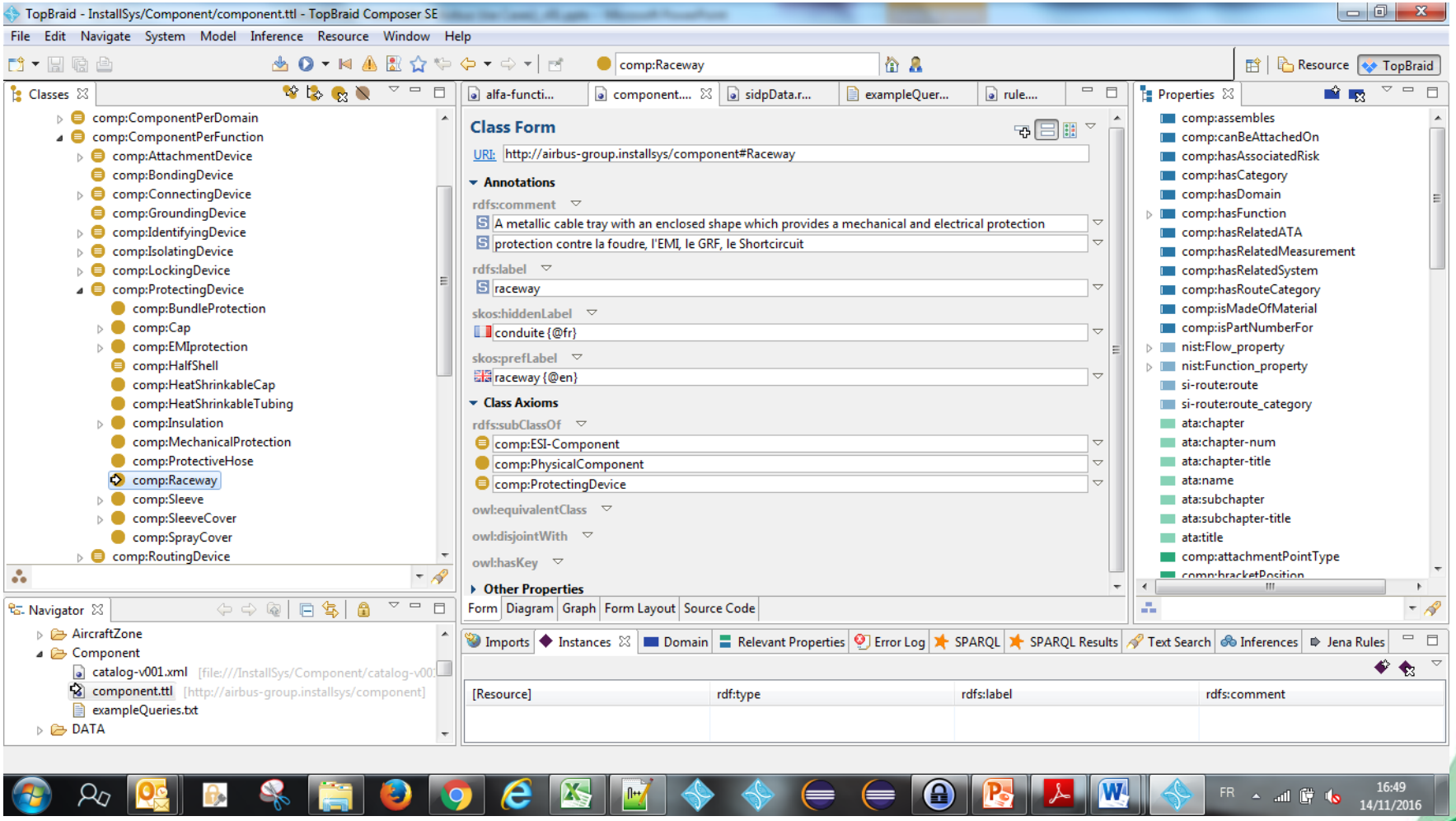


- NLP Parsing uses this taxonomy. Labels + assumptions such as a physical component may be referred to using its name or its reference or both concatenated
- Inference rule: a rule applying to a component type (Attachment device) applies to its subtypes (P-clamp)
- Document display : when searching rules applying to a component type (P-Camp) → retrieve and display rules applying to super-types

Rules (DB with normalized sentences)



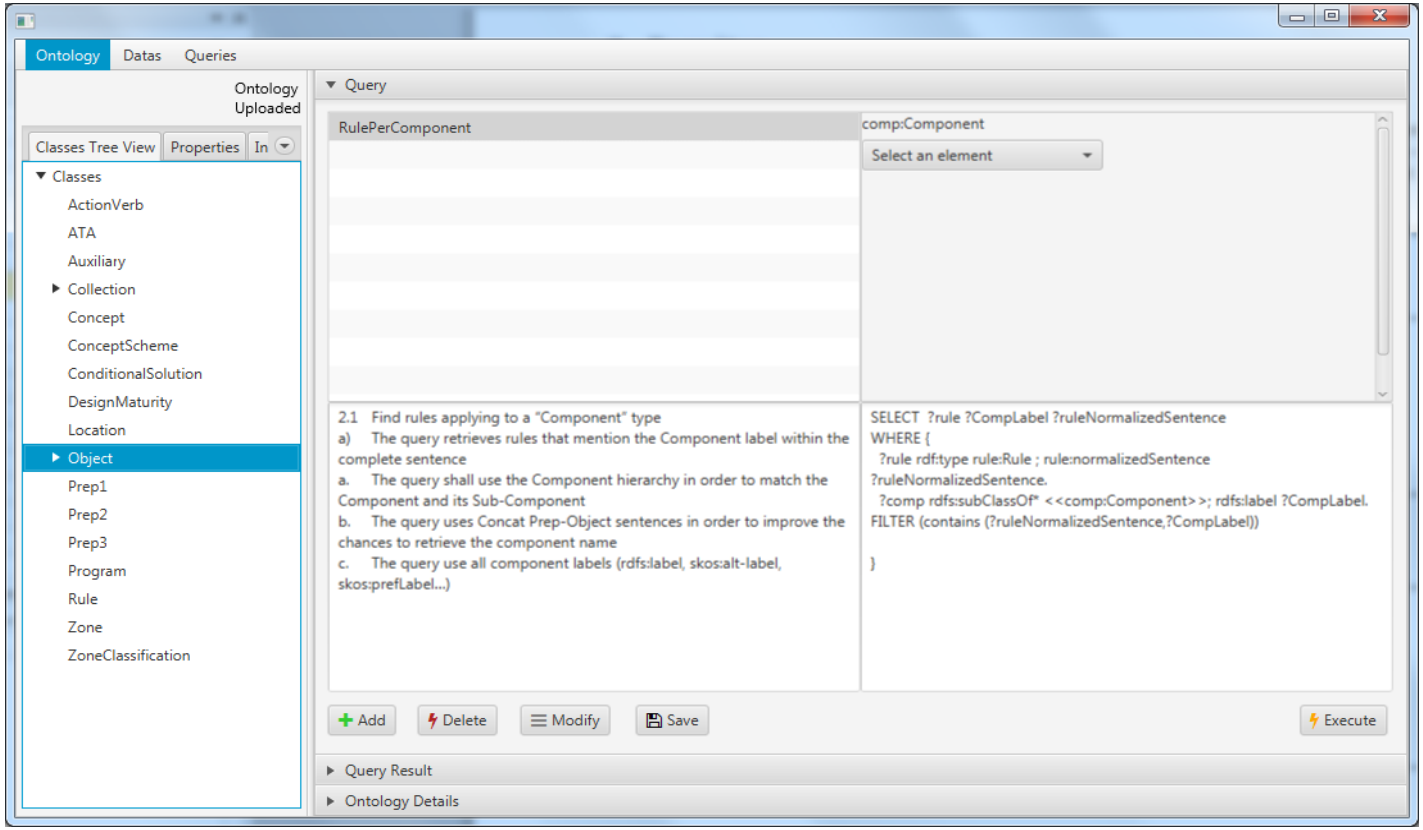
Component ontology



SPARQL queries

Status : model based queries specification

- Preliminary study with Loria (Text to RDF)
- 1 internship on RDFizer and Query management



Thank you for your attention!
Any question ?