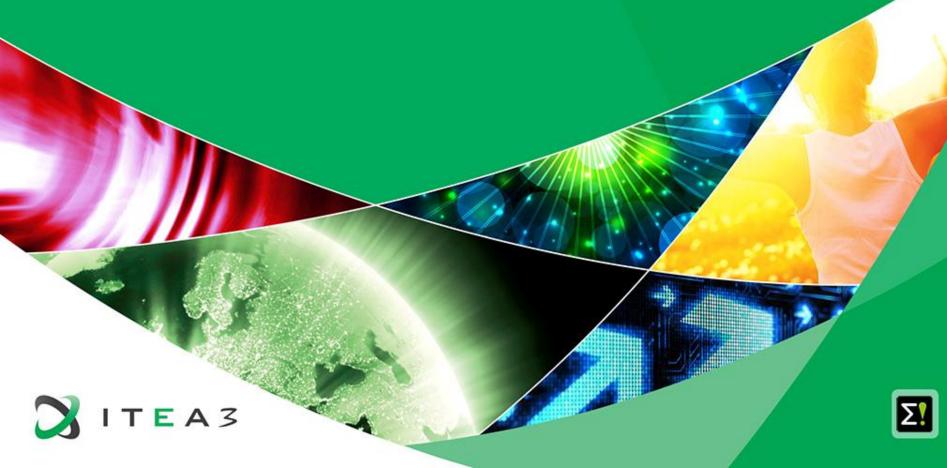
### **Model Writer**

**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



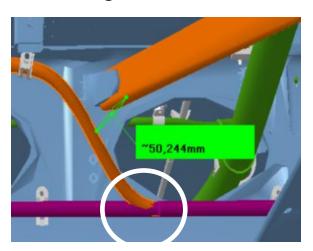
### AIRBUS industrial use cases





#### 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 someRegulations 🕨
  - is specified by some rules/requirements/principles
  - the design and the manufactured product are checked against these rules 🔃

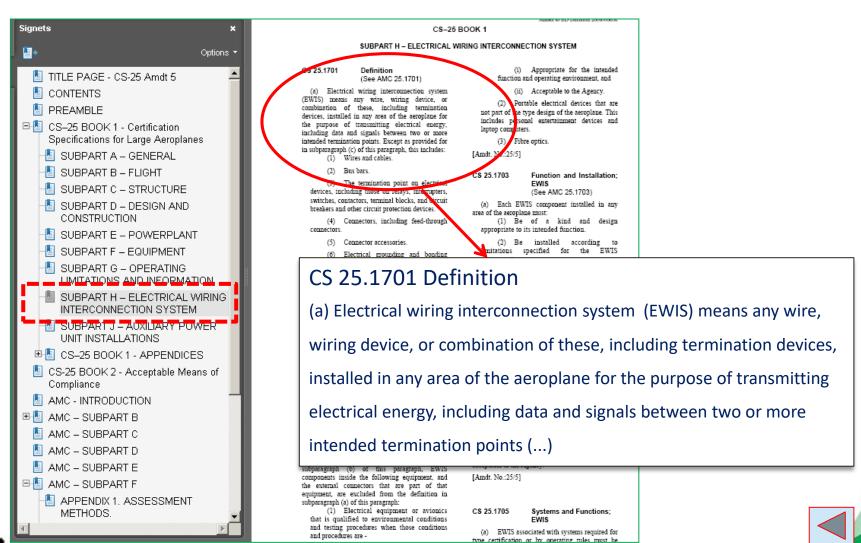






## **Certification Specification – CS 25** (EASA)





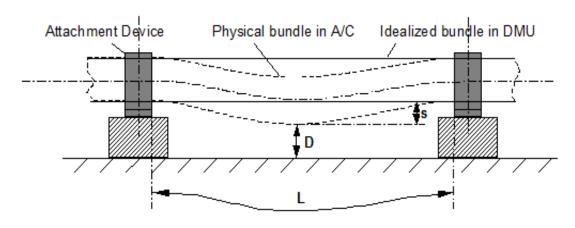




### **System Installation Design Principles**

#### 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

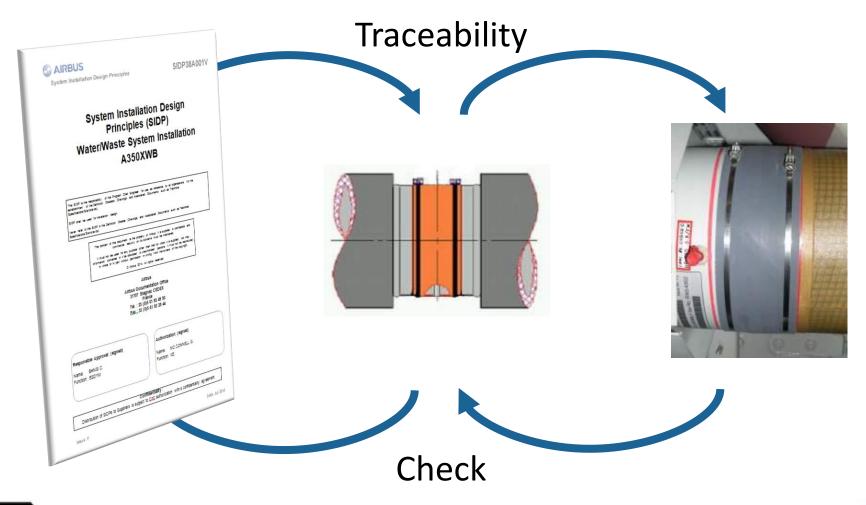
Note: Unless the bundle has a straight routing, L is bigger than the pitch between the Attachment Points.



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### Rule traceability & design check







### **Problem statement & objectives**

- 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**

14\00	/   •			
(1) Manage rule	s/design	nrinciples	and improve	traceability
(±) Manage rais	,3/ GC3IBII	Principies	and implove	. Claccability

Easier search/retrieval of rules	<ul> <li>save costs/time by supporting DP consultation / retrieval in accordance to the needs</li> </ul>
Easier change impact analysis at rules level	<ul><li>save DP updating costs/time</li><li>avoid non-compliance of design caused by DP updating lead time</li></ul>
Easier traceability between artefacts (BOM DB, design models, CAD models)	<ul> <li>keep traceability from upstream regulations to requirements and to downstream design models</li> </ul>

### (2) Automate identification of design conflicts against rules

Easier consistency checking of the	-	Save time to retrieve applicable
design (CAD) data		rules
	-	avoid non-compliance of design wrt
		rules





### Some Facts, Impact, and KPIs

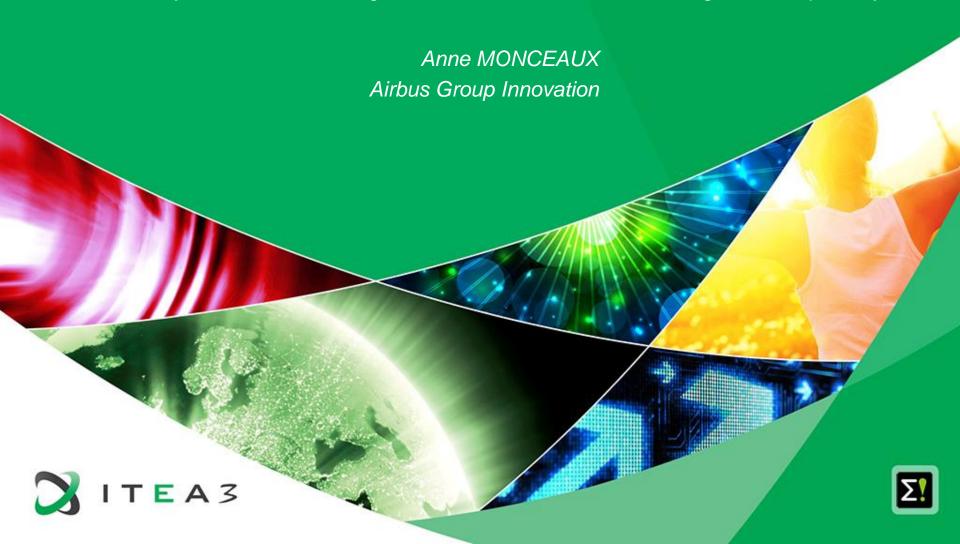
- Scope of 900 documents
- ATA: disciplines: 6179 ATA number (chapter+subchapters)
- Today (@MW project start) duration of documents updating process:
   6 months
- 900 to 1000 potential users per Program or 200 per Derivatives
- Total number of rules? ~3000 rules (TBC)
- Expected Rule coverage in the 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



## Ex. BOM, Component taxonomy, Component ontology



ption/comments

2 in each wing

```
<http://airbus-group.installsys/component>
                              rdf:type owl:Ontology;
   Item description
                              rdfs:comment "Component definitions are given and validated by Airbus ESIR dpt"^^xsd:string ;
                              owl:imports <http://qudt.org/schema/qudt>;
   plicit physical Item or group of Item
                              owl:imports <a href="http://gudt.org/vocab/unit">http://gudt.org/vocab/unit</a>;
                              owl:versionInfo "Ontology for System Installation Components"^^xsd:string ;
   r consistency checks, when a func
   t the the Item with 0 in weight an comp: ABS1759
   next collumn (e.g. FCS PRIM: on II
                              rdf:type owl:Class;
33
                              rdfs:label "ABS 1759 cable tie mount"^^xsd:string ;
   tank drain valves
                              rdfs:label "ABS1759"^^xsd:string;
1082
                              rdfs:label "cable tie mount ABS1759"^^xsd:string ;
1083 Vent system
                              rdfs:subClassOf comp:CableTieMount;
    Pressure relief
                              skos:prefLabel "ABS 1759 cable tie mount"@en ;
1084
    Carbon OPP disc
                            comp:AFDXcable
1085
                              rdf:type owl:Class;
   flame arrestor
                              rdfs:label "AFDXcable"^^xsd:string ;
1086
                              rdfs:subClassOf comp:BusCable ;
   float valve
                              skos:prefLabel "AFDXcable"^^xsd:string ;
1087
                            comp:Active-Fastener
                              rdf:type owl:Class;
```

rdfs:label "active fastener"^^xsd:string ;

owl:hasValue "true"^^xsd:boolean ;
owl:onProperty comp:isActive ;
];
skos:prefLabel "active fastener"@en ;

rdfs:subClassOf comp:Fastener ;

rdf:type owl:Restriction ;

rdfs:label "active component"@en ;
rdfs:label "active element"@en ;
rdfs:label "active item"@en ;

rdfs:subClassOf [

comp:Active\_component
 rdf:type owl:Class;

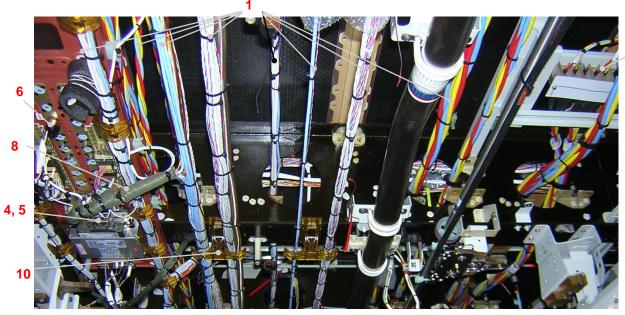




### Electrical wiring interconnection system (EWIS)



⇒ Mainly: Aircraft electrical common installation (ATA92)

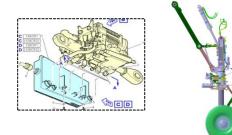




#### ⇒ But also: **part of Systems equipment wiring:**

- 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)

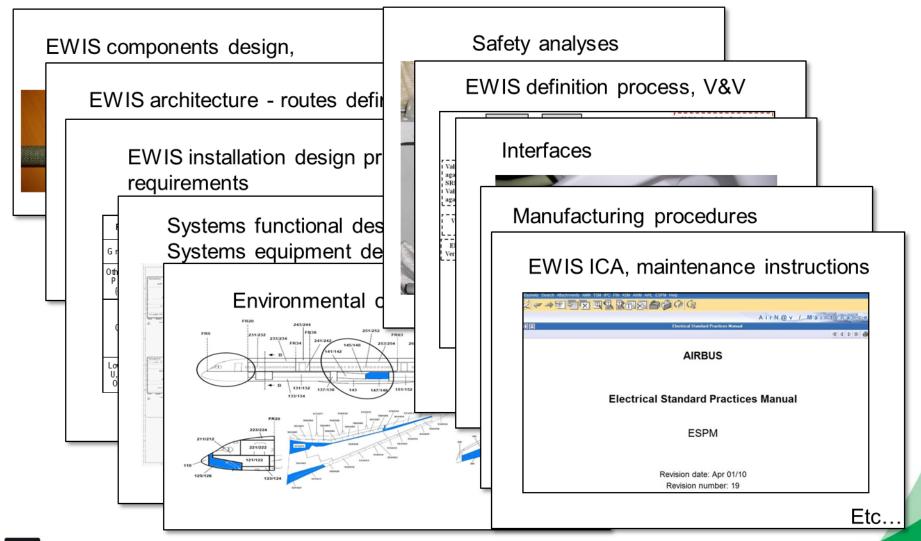


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### Illustrate traceability between all aspects of A/C wiring

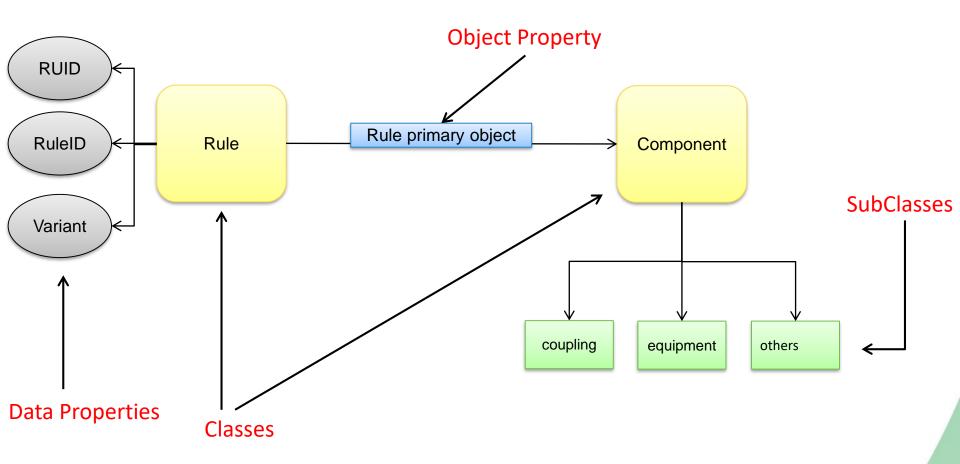








### **Data representation**





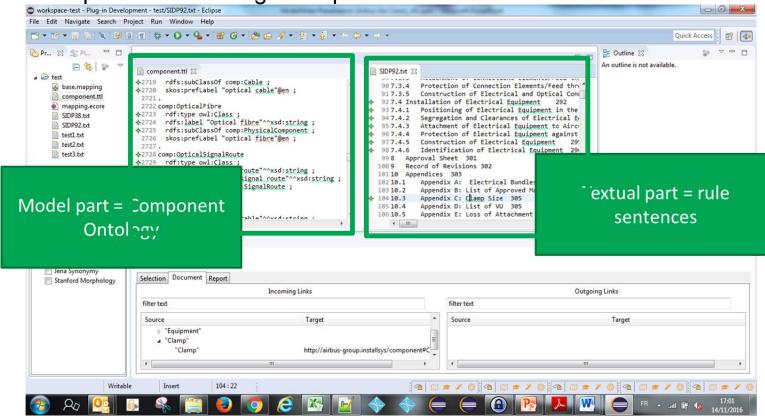
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### UC-FR-03 Synchronization of regulation documentation with a design rule repository



Status 1<sup>st</sup> iteration\*: synchronizing the SIDP KB content and rule text part

Experimented using WP2 parser + WP4 MW Core





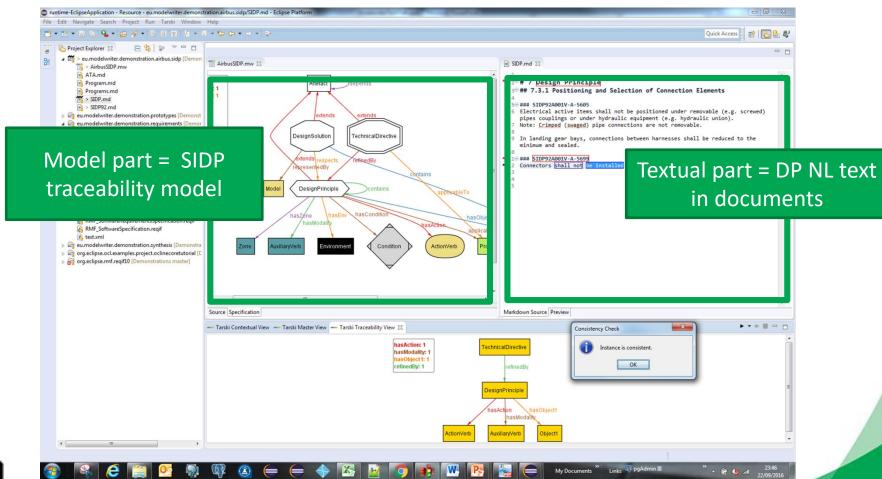
\* 1<sup>st</sup> iteration = using individual DP normalized sentences" 2d iteration = using NL DP inside documents

### UC-FR-03b – extension to synch traceability N ITEA3 between artefacts



#### Status: synchronizing the SIDP domain artefacts

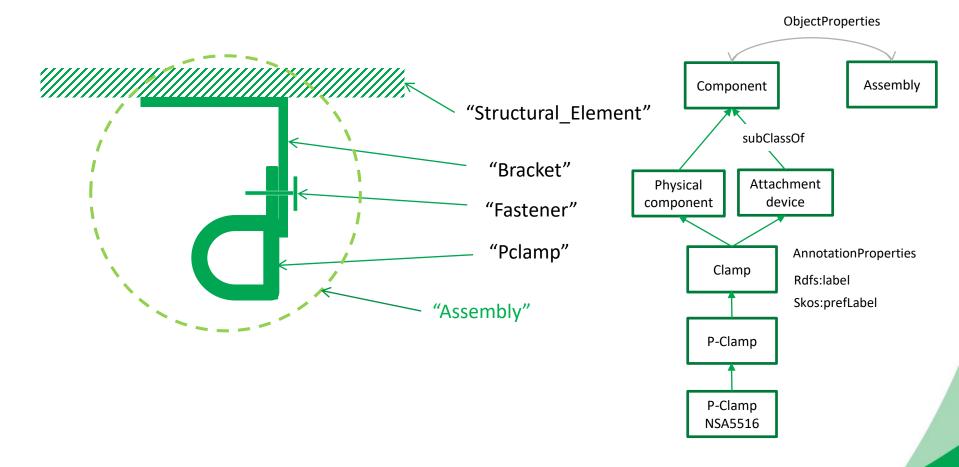
Test using WP3 Tarsky





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



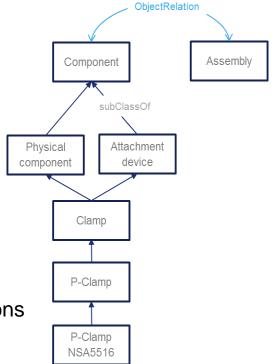




### UC-FR-04 - Component taxonomy and ontology (Model part)





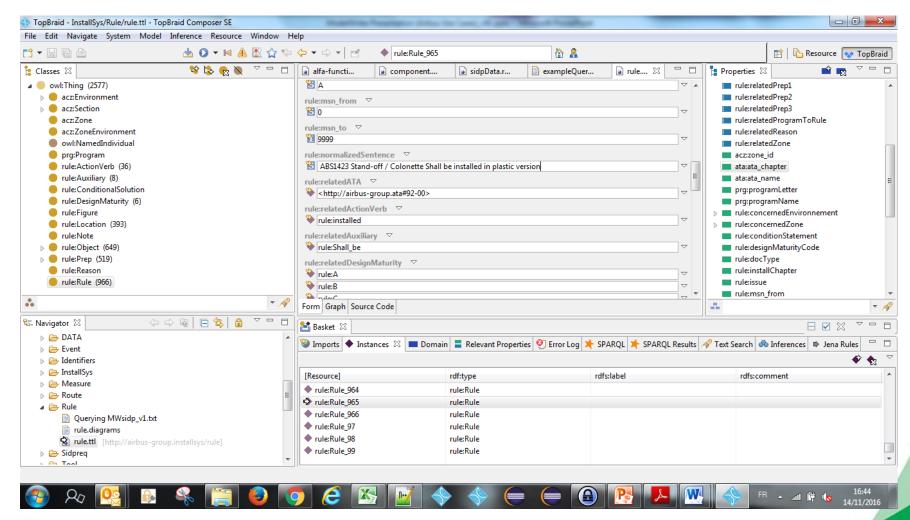


- NLP Parsing uses this taxonomy. Labels + assumptions such as a physical component may be referred to using its name or its reference or both concatenated
- Inference rule: a rule applying to a component type (Attachment device) applies to its subtypes (P-clamp)
- Document display: when searching rules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





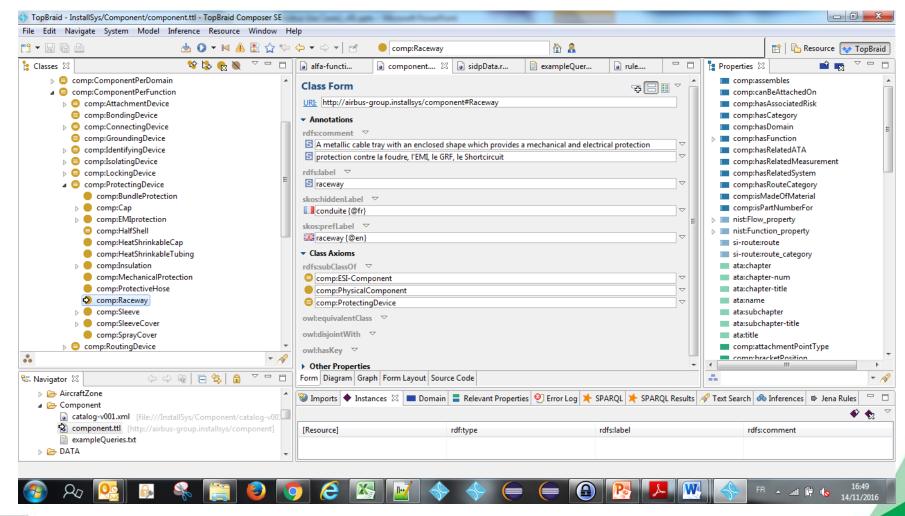
### Rules (DB with normalized sentences)







### **Component ontology**



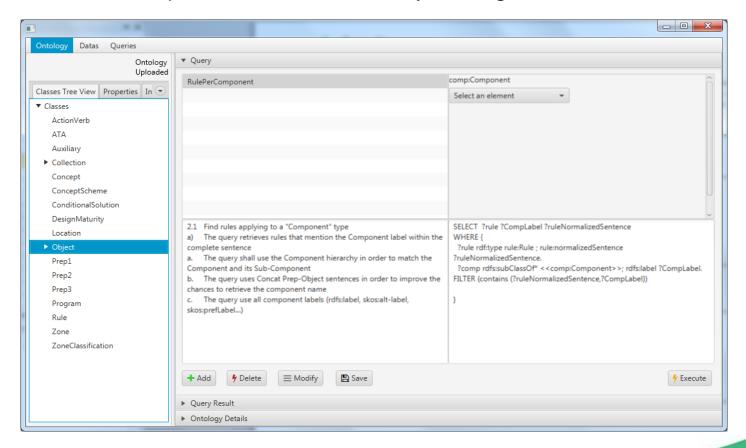




### **SPARQL** queries

#### 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?

