NIST 15926 Conformance Testing Project : Test Case Overview
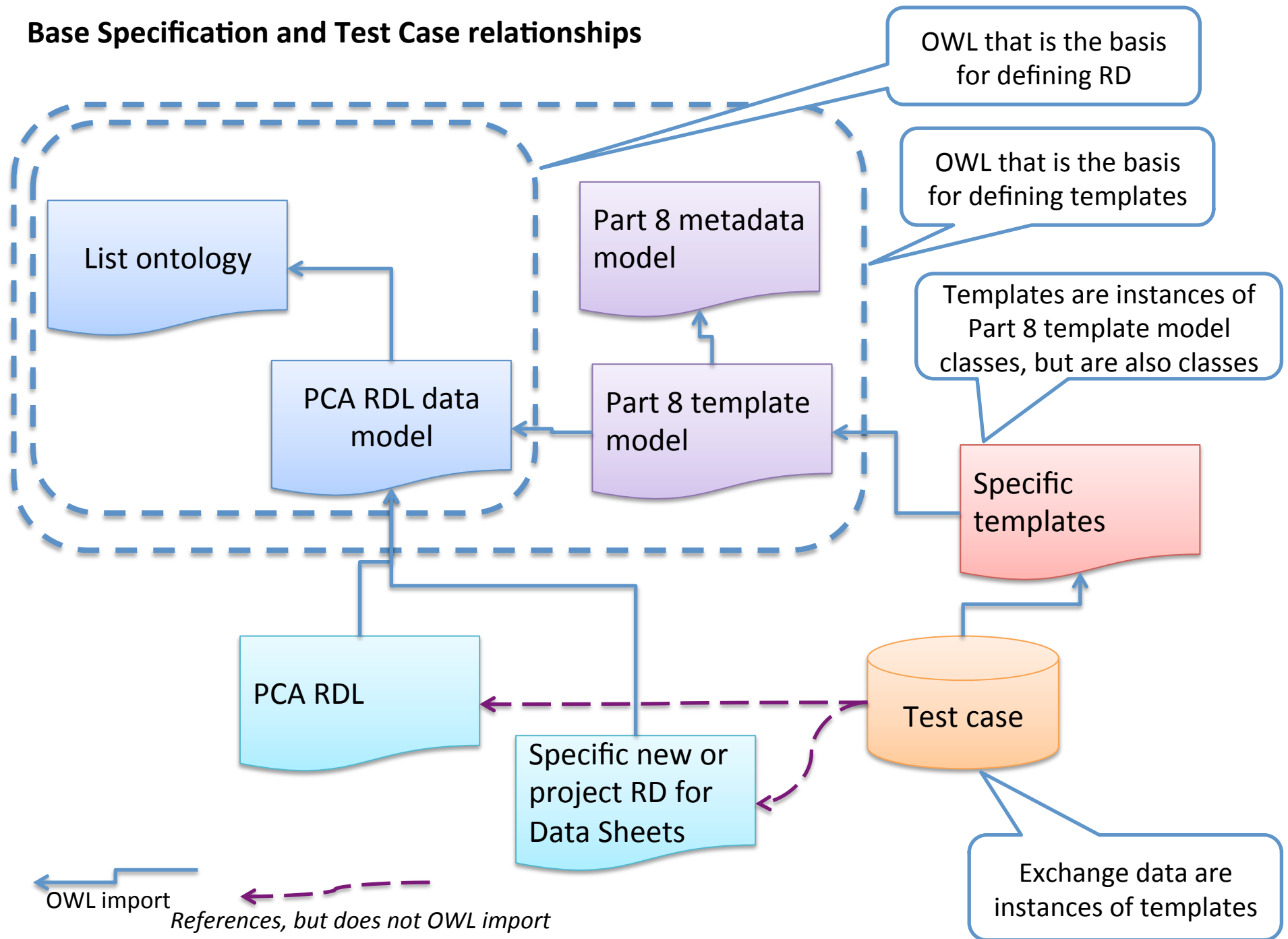
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2015-08-11

For EDRC

- Base specification :
  - PCA RDL data model (dm) and list ontology (list)
  - Part 7/8 template model (p7tpm) and metadata model (meta)
  - Specific templates (tpl)
  - RD for Data Sheets (pcardl,rdlfacade,myrd)
- Test Case, Test Suite
  - EDRC Use Case 1 – granular, complete coverage in 20 test cases
  - EDRC Use Case 2 Annex E example files as a start to be upgraded by EDRC

Base Specification and Test Case relationships

OWL that is the basis for defining RD

OWL that is the basis for defining templates

Templates are instances of Part 8 template model classes, but are also classes

List ontology

Part 8 metadata model

PCA RDL data model

Part 8 template model

Specific templates

PCA RDL

Specific new or project RD for Data Sheets

Test case

Exchange data are instances of templates

OWL import

References, but does not OWL import

Prefixes for graph URIs used in Test Cases

@prefix dm: <http://rds.posccaesar.org/2008/02/OWL/ISO-15926-2_2003#> .
@prefix list: <http://www.co-ode.org/ontologies/list.owl#>

@prefix meta: <http://standards.iso.org/iso/15926/meta#> .
@prefix p7tm: <http://standards.iso.org/iso/15926/tm#>

@prefix tpl: <http://data.posccaesar.org/tpl/> .

@prefix rdlfacade: <http://rdl.rdlfacade.org/data#> .
@prefix myrd: <http://www.mycompany.com/iso15926/edrc/refdata#> .
@prefix pcardl: <http://data.posccaesar.org/rdl/>

Atomic test case breakdown

- Driven from Use Case 1 table of contents

General Information Section
    Project Information, Tag Number and Document Data
        Job Number
        Item Number
        Revision Number
        Date
Operating Conditions Section
    Properties
        Normal Capacity
        Other Capacity

Property Templates
    Capacity Normal
    Capacity Other
    Capacity Rated
    Suction Pressure Max
    Suction Pressure Rated
    Discharge Pressure
    Differential Pressure
    Differential Head
    NPSHA
    Process Variations
    Starting Conditions
    Service Continuous
    Service Intermittent
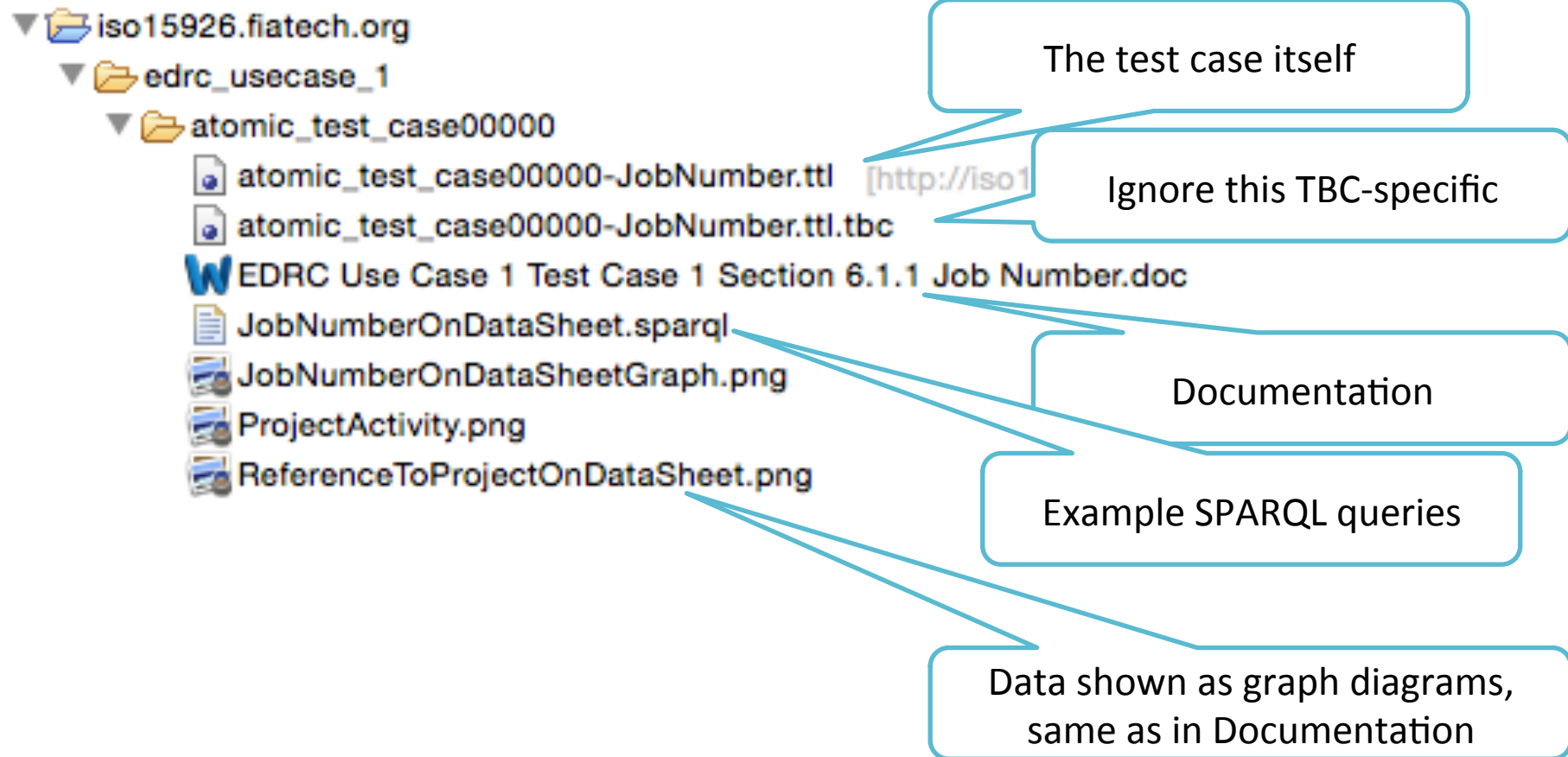   Starts Per Day
    Parallel Operations Required

Test Case Format

- An OWL Turtle file containing the test case data
  - A test case may owl:import another test case
- Some OWL Turtle files containing new RD
- A word document with explanation, comment and any questions
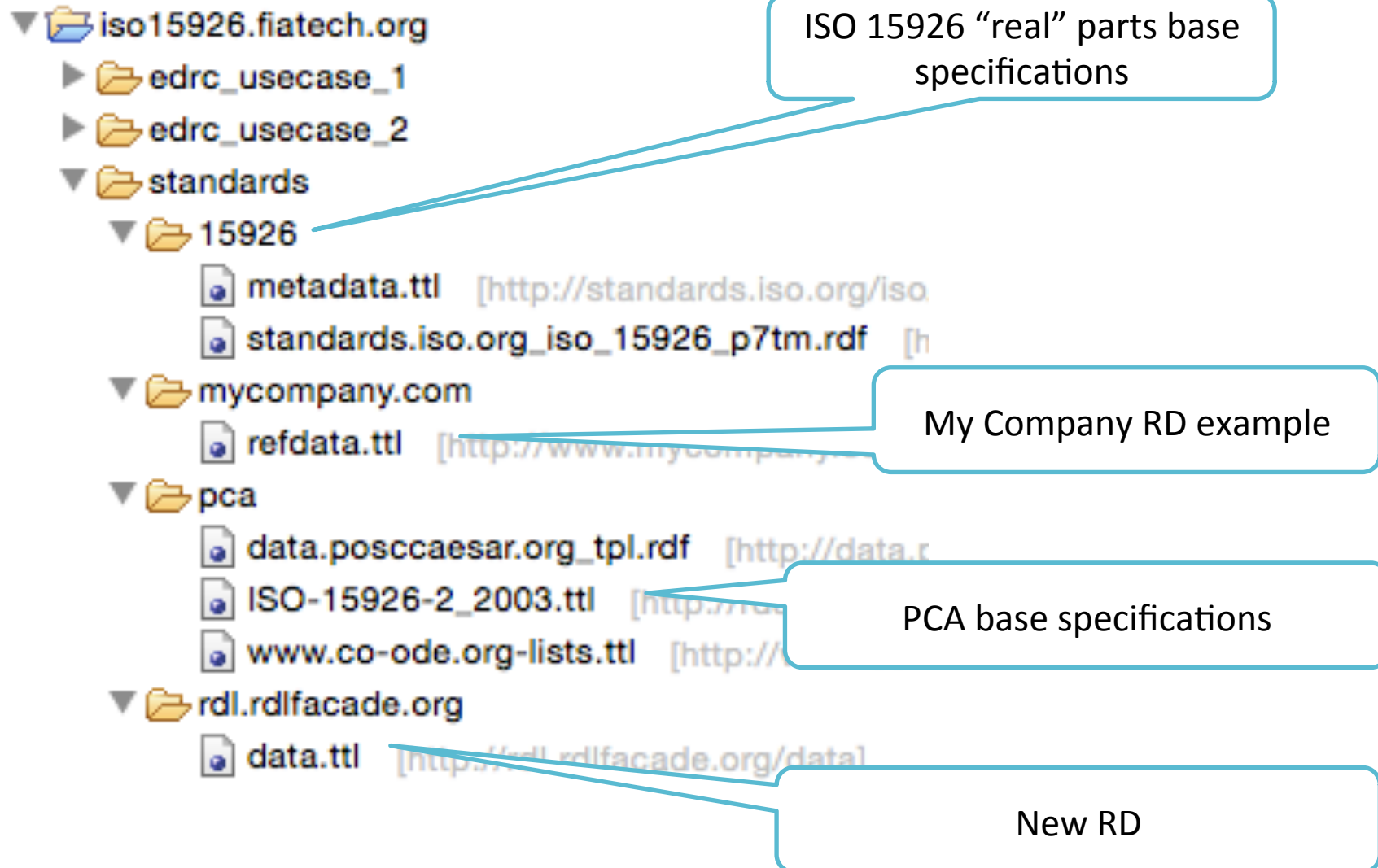- SPARQL query file(s)
- Instance diagram graph figure(s)

RD for Use Case 1 Test Cases

- Published PCA RDL as found at
  - http://data.posccaesar.org/rdl/
- "New" RD required for the test cases that should eventually be in PCA (I think), base URI for now is
  - http://rdl.rdlfacade.org/data
- "New" RD company-specific example, base URI is
  - http://www.mycompany.com/iso15926/edrc/refdata
- Atomic test case 00004 data is enumerated class, unclear if this is considered RD.

Use Case 1 Test Case(s) Folder Contents : Atomic and Complex

▼ 📂 iso15926.fiatech.org
    ▼ 📂 edrc_usecase_1
        ▼ 📂 atomic_test_case00000
            📄 atomic_test_case00000-JobNumber.ttl   [http://iso1
            📄 atomic_test_case00000-JobNumber.ttl.tbc
            📘 EDRC Use Case 1 Test Case 1 Section 6.1.1 Job Number.doc
            📄 JobNumberOnDataSheet.sparql
            🖼 JobNumberOnDataSheetGraph.png
            🖼 ProjectActivity.png
            🖼 ReferenceToProjectOnDataSheet.png

The test case itself

Ignore this TBC-specific

Documentation

Example SPARQL queries

Data shown as graph diagrams, same as in Documentation

"standards" Folder Contents

▼ 📂 iso15926.fiatech.org
    ▶ 📂 edrc_usecase_1
    ▶ 📂 edrc_usecase_2
    ▼ 📂 standards
        ▼ 📂 15926
            📄 metadata.ttl   [http://standards.iso.org/iso
            📄 standards.iso.org_iso_15926_p7tm.rdf   [h
        ▼ 📂 mycompany.com
            📄 refdata.ttl   [http://www.mycompany
        ▼ 📂 pca
            📄 data.posccaesar.org_tpl.rdf   [http://data.r
            📄 ISO-15926-2_2003.ttl   [http://rd
            📄 www.co-ode.org-lists.ttl   [http://
        ▼ 📂 rdl.rdlfacade.org
            📄 data.ttl   [http://rdl.rdlfacade.org/data]

Callouts:
- ISO 15926 "real" parts base specifications
- My Company RD example
- PCA base specifications
- New RD

"test" Folder Contents

Atomic test case example ttl – Item Number

```
# baseURI: http://iso15926.fiatech.org/edrc_usecase_1/atomic_test_case00001-ItemNumber
# imports: http://data.posccaesar.org/tpl/

@prefix atc00001: <http://iso15926.fiatech.org/edrc_usecase_1/atomic_test_case00001-ItemNumber#> .
@prefix dm: <http://rds.posccaesar.org/2008/02/OWL/ISO-15926-2_2003#> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix tpl: <http://data.posccaesar.org/tpl/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .

<http://iso15926.fiatech.org/edrc_usecase_1/atomic_test_case00001-ItemNumber>
  rdf:type owl:Ontology ;
  owl:imports tpl: ;
  owl:versionInfo "Created with TopBraid Composer"^^xsd:string ;
  rdfs:comment "EDRC Use Case 1 Section 6.1.2 Item Number"^^xsd:string ;
  .
atc00001:ClassificationOfIndividual_1
  rdf:type tpl:ClassificationOfIndividual ;
  tpl:hasClassified atc00001:PossibleIndividual_1 ;
  rdfs:label "Pump is CENTRIFUGAL PUMP"^^xsd:string ;
  rdfs:comment "EDRC Use Case 1 Section 6.1.2 Item Number"^^xsd:string ;
  tpl:hasClassifier <http://data.posccaesar.org/rdl/RDS416834> ;
  .
atc00001:ClassifiedIdentificationOfIndividual_1
  rdf:type tpl:ClassifiedIdentificationOfIndividual ;
  tpl:hasIdentificationType <http://data.posccaesar.org/rdl/RDS2100944981> ;
  tpl:hasIdentified atc00001:PossibleIndividual_1 ;
    rdfs:label "Pump P-11100A"^^xsd:string ;
  tpl:valIdentifier "P-11100A"^^xsd:string ;
  rdfs:comment "EDRC Use Case 1 Section 6.1.2 Item Number"^^xsd:string ;
  .
atc00001:PossibleIndividual_1
  rdf:type dm:PossibleIndividual ;
  rdfs:comment "EDRC Use Case 1 Section 6.1.2 Item Number"^^xsd:string ;
  rdfs:label "Pump"^^xsd:string ;
  .
```

Item Number data as graph diagram
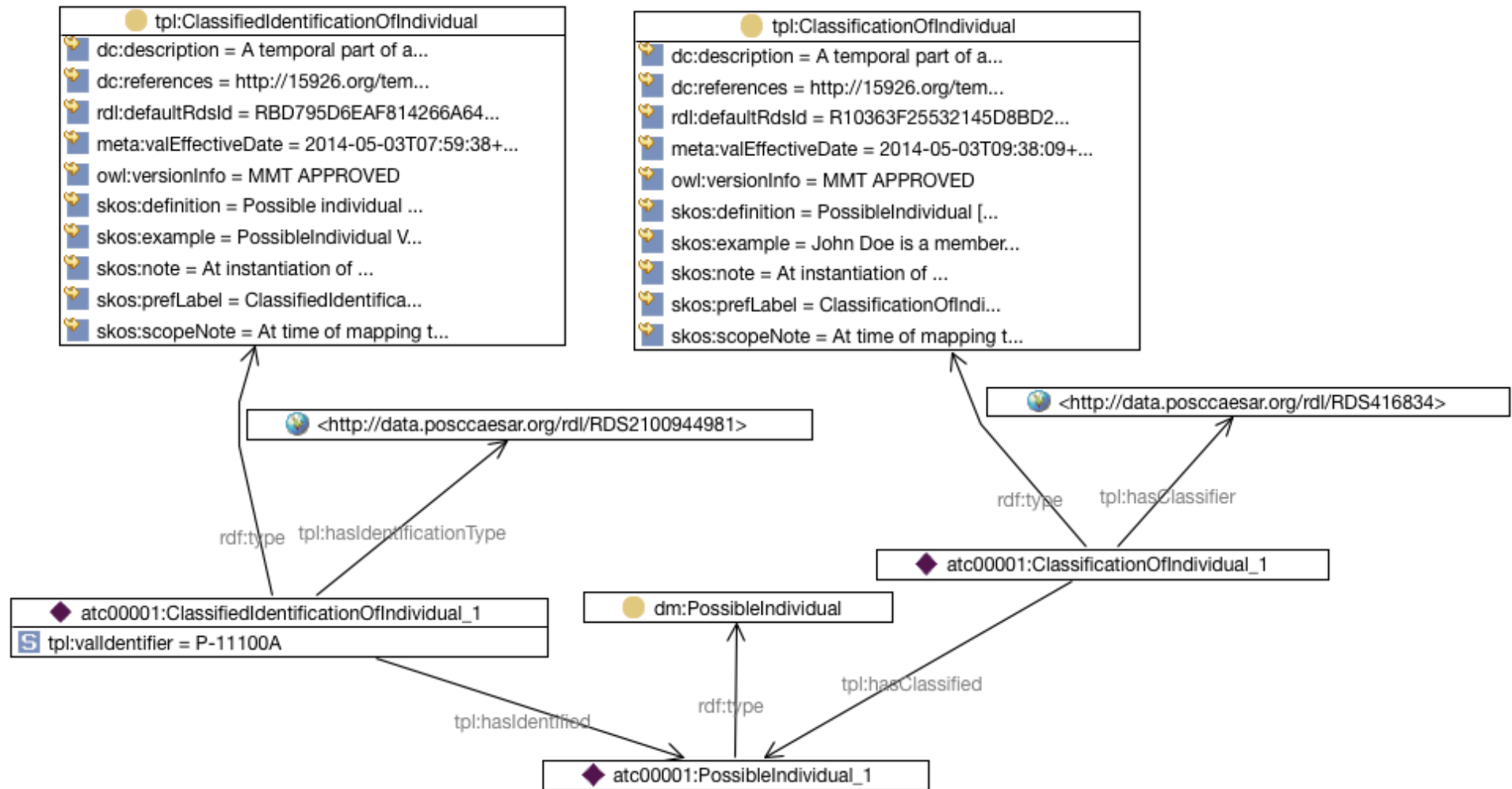
Comments

- The Test case do not "OWL import" RD, but could. There seems to be a view that RD is an <u>external</u> reference and so the Test cases reflect that fact.
  - This lessens the need to have the full RDL available to the tool used to create 15926 data, as some tools will report errors in files if the OWL imported RD were not available.
  - The globe icon shows in the instance diagrams shows non-OWL-imported URIs (see previous slide for example).
- As an aside : There is nothing in the Use Case 1 test cases or templates that could not have been defined using the "real" 15926 7-8 OWL artifacts. Would benefit industry to have the rationale for not doing so better explained.

Testing

- SPARQL as basis of testing for OWL-based data exchange
  - OWL is "open world", so full data validation not supported by tools
- A few possibilities for performing tests
  - Use pure SPARQL query producing a SPARQL result set
  - Use SPIN Constraint and/or SPIN Rule, and now SHACL
  - Write software that performs testing (e.g. Ruby using RDF.rb)

Example pure SPARQL :
Select Job Number (Project code) on Datasheet

- Select JobNumberOnDataSheet value from Activity that is a Project and has a Project Identification Code and is referenced on a ClassOfInformationObject that is a Datasheet

```
SELECT ?JobNumberOnDataSheet
WHERE {
  ?activity rdf:type dm:Activity .
  ?classificationofindividual tpl:hasClassified ?activity .
  ?classificationofindividual rdf:type tpl:ClassificationOfIndividual .
  ?classificationofindividual tpl:hasClassifier <http://data.posccaesar.org/rdl/RDS9629> .

  ?referencetoindividualondocument tpl:hasReferred ?activity .
  ?referencetoindividualondocument tpl:hasDocument ?classofinformationobject .
  ?referencetoindividualondocument rdf:type tpl:ReferenceToIndividualOnDocument .

  ?classificationofclassofindividual tpl:hasClassifier <http://data.posccaesar.org/rdl/RDS250334> .
  ?classificationofclassofindividual tpl:hasClassified ?classofinformationobject .
  ?classofinformationobject rdf:type dm:ClassOfInformationObject .
  ?classificationofclassofindividual rdf:type tpl:ClassificationOfClassOfIndividual .

  ?classifiedidentificationofindividual tpl:hasIdentified ?activity .
  ?classifiedidentificationofindividual tpl:hasIdentificationType <http://rdl.rdlfacade.org/data#RA279224C9180470BAE922CFCBA21A78F> .
  ?classifiedidentificationofindividual rdf:type tpl:ClassifiedIdentificationOfIndividual .
  ?classifiedidentificationofindividual tpl:valIdentifier ?JobNumberOnDataSheet .
}
```

Performing Tests

- SemWeb community working to support "closed world"
- W3C RDF Data Shapes Working Group
  - http://www.w3.org/2014/data-shapes/wiki/Main_Page
  - Editors draft of SHACL published July 2015
    - https://w3c.github.io/data-shapes/shacl/
  - Tutorial
    - http://www.topquadrant.com/technology/shacl/tutorial/
  - SPIN W3C member submission extension to W3C standard SPARQL with intent to migrate to W3C Recommendation, and that has now started to happen
  - SHACL, among other things, can be applied on top of OWL data exchange files to validate data
  - Next page shows example of adding constraint over Activity by separately declaring it to also be a SHACL **ShapeClass** and attaching a SPARQL query as a constraint including error message
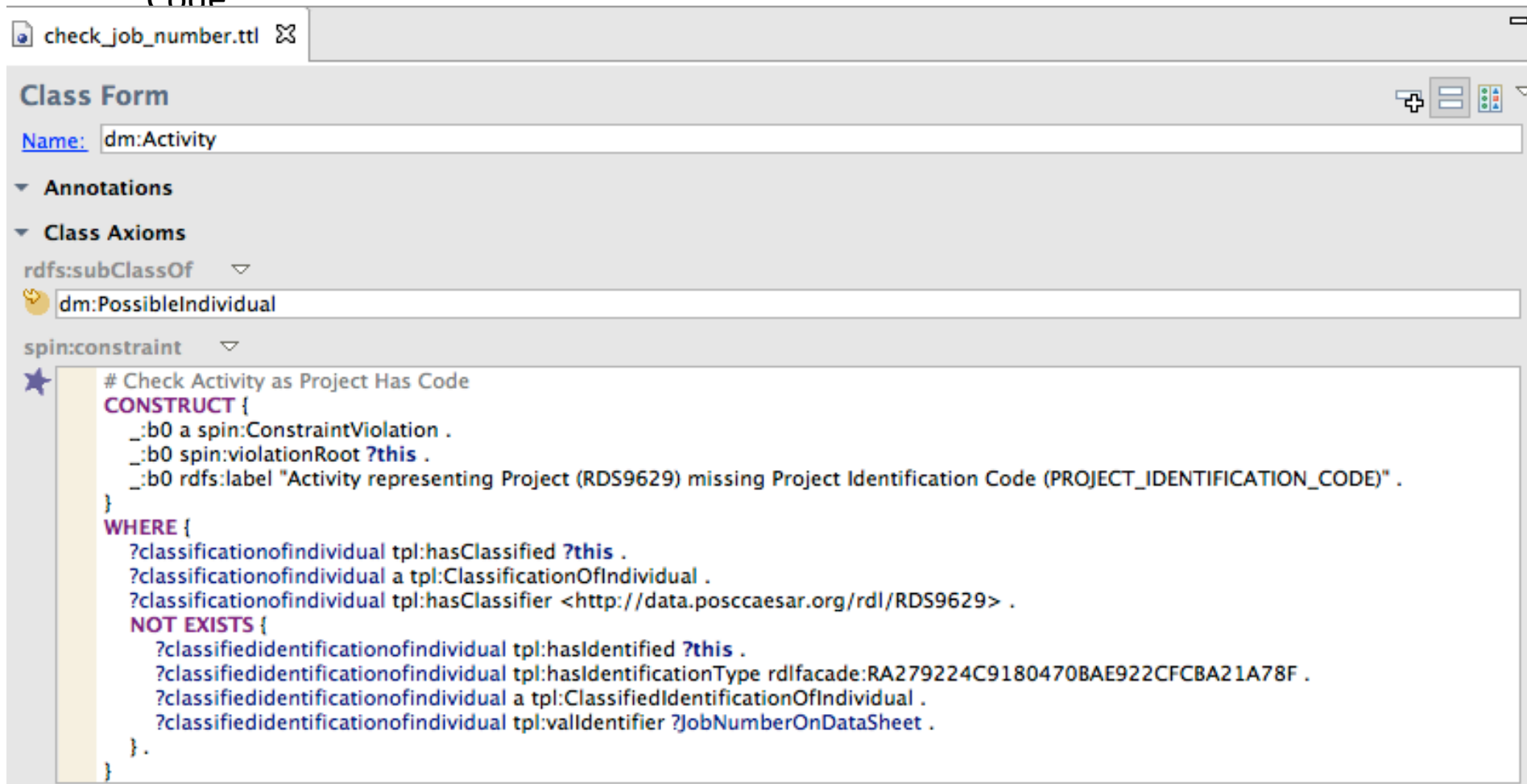
Activity representing Project (RDS9629) with Project Identification Code (PROJECT_IDENTIFICATION_CODE) not on a Data Sheet (RDS250334)

Shape Form

URI `http://rds.posccaesar.org/2008/02/OWL/ISO-15926-2_2003#Activity`

▼ **Annotations**

▼ **Constraints**

sh:property ▽

sh:inverseProperty ▽

sh:constraint ▽

⭐ Check full path Activity to Datasheet

> sh:sparql ▽
>
> ```
> # Check full path Activity to Datasheet
> SELECT ?this
>  WHERE {
>    ?classificationofindividual tpl:hasClassified ?this .
>    ?classificationofindividual a tpl:ClassificationOfIndividual .
>    ?classificationofindividual tpl:hasClassifier <http://data.posccaesar.org/rdl/RDS9629> .
>    ?classifiedidentificationofindividual tpl:hasIdentified ?this .
>    ?classifiedidentificationofindividual tpl:hasIdentificationType rdlfacade:RA279224C9180470BAE922CFCBA21A78F .
>    ?classifiedidentificationofindividual a tpl:ClassifiedIdentificationOfIndividual .
>    ?classifiedidentificationofindividual tpl:valIdentifier ?JobNumberOnDataSheet .
>    NOT EXISTS {
>       ?referencetoindividualondocument tpl:hasReferred ?this .
>       ?referencetoindividualondocument tpl:hasDocument ?classofinformationobject .
>       ?referencetoindividualondocument a tpl:ReferenceToIndividualOnDocument .
>       ?classificationofclassofindividual tpl:hasClassifier <http://data.posccaesar.org/rdl/RDS250334> .
>       ?classificationofclassofindividual tpl:hasClassified ?classofinformationobject .
>       ?classofinformationobject a dm:ClassOfInformationObject .
>       ?classificationofclassofindividual a tpl:ClassificationOfClassOfIndividual .
>    } .
> }
> ```
>
> rdfs:comment ▽
>
> S Check full path Activity to Datasheet
>
> sh:message ▽
>
> S Activity representing Project (RDS9629) with Project Identification Code (PROJECT_IDENTIFICATION_CODE) not on a Data Sheet (RDS250334)

Example SPIN constraint :
Check Activity as Project has Id Code

- Report error if Activity that is a Project BUT does not have a Project Identification Code


```
check_job_number.ttl

Class Form

Name: dm:Activity

▼ Annotations

▼ Class Axioms

rdfs:subClassOf  ▽
  dm:PossibleIndividual

spin:constraint  ▽
  # Check Activity as Project Has Code
  CONSTRUCT {
      _:b0 a spin:ConstraintViolation .
      _:b0 spin:violationRoot ?this .
      _:b0 rdfs:label "Activity representing Project (RDS9629) missing Project Identification Code (PROJECT_IDENTIFICATION_CODE)" .
  }
  WHERE {
      ?classificationofindividual tpl:hasClassified ?this .
      ?classificationofindividual a tpl:ClassificationOfIndividual .
      ?classificationofindividual tpl:hasClassifier <http://data.posccaesar.org/rdl/RDS9629> .
      NOT EXISTS {
          ?classifiedidentificationofindividual tpl:hasIdentified ?this .
          ?classifiedidentificationofindividual tpl:hasIdentificationType rdlfacade:RA279224C9180470BAE922CFCBA21A78F .
          ?classifiedidentificationofindividual a tpl:ClassifiedIdentificationOfIndividual .
          ?classifiedidentificationofindividual tpl:valIdentifier ?JobNumberOnDataSheet .
      } .
  }
```

Example SPIN constraint :
Check full path Activity to Datasheet
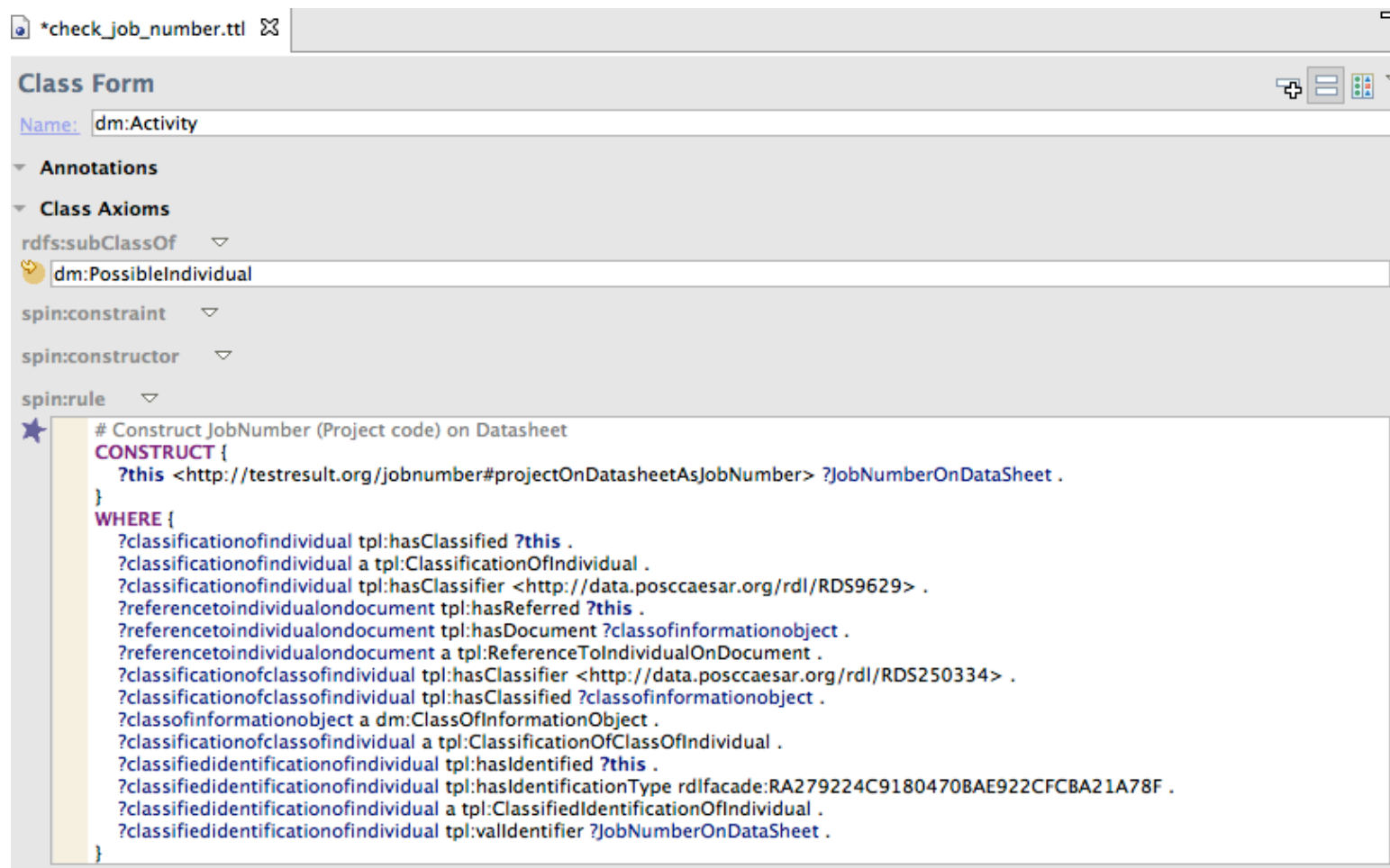
- Report error if Activity that is a Project and has a Project Identification Code BUT is not referenced on a ClassOfInformationObject that is a Datasheet

```
# Check full path Activity to Datasheet
CONSTRUCT {
    _:b0 a spin:ConstraintViolation .
    _:b0 spin:violationRoot ?this .
    _:b0 rdfs:label "Activity representing Project (RDS9629) with Project Identification Code (PROJECT_IDENTIFICATION_CODE) not on a Data
Sheet (RDS250334)" .
}
WHERE {
    ?classificationofindividual tpl:hasClassified ?this .
    ?classificationofindividual a tpl:ClassificationOfIndividual .
    ?classificationofindividual tpl:hasClassifier <http://data.posccaesar.org/rdl/RDS9629> .
    ?classifiedidentificationofindividual tpl:hasIdentified ?this .
    ?classifiedidentificationofindividual tpl:hasIdentificationType rdlfacade:RA279224C9180470BAE922CFCBA21A78F .
    ?classifiedidentificationofindividual a tpl:ClassifiedIdentificationOfIndividual .
    ?classifiedidentificationofindividual tpl:valIdentifier ?JobNumberOnDataSheet .
    NOT EXISTS {
        ?referencetoindividualondocument tpl:hasReferred ?this .
        ?referencetoindividualondocument tpl:hasDocument ?classofinformationobject .
        ?referencetoindividualondocument a tpl:ReferenceToIndividualOnDocument .
        ?classificationofclassofindividual tpl:hasClassifier <http://data.posccaesar.org/rdl/RDS250334> .
        ?classificationofclassofindividual tpl:hasClassified ?classofinformationobject .
        ?classofinformationobject a dm:ClassOfInformationObject .
        ?classificationofclassofindividual a tpl:ClassificationOfClassOfIndividual .
    } .
}
```

Example SPIN rule :
Construct Job Number (Project code) on Datasheet

- Construct JobNumberOnDataSheet value from Activity that is a Project and has a Project Identification Code and is referenced on a ClassOfInformationObject that is a Datasheet

Example SPIN magic property : get PCA RDL hasDesignation

OPTIONAL {
    ?class pcardlprop:designation ?classlabel
}

Use this in a query

Rather than this

OPTIONAL { SERVICE <http://data.posccaesar.org/rdl/> {
    ?class <http://data.posccaesar.org/rdl/hasDesignation> ?classlabel .}
    }

Magic Property Form

Name: pcardlprop:designation

▼ Annotations
rdfs:label ▽
[S] designation

▼ Definition
rdfs:subClassOf ▽
[▭] spin:MagicProperties

spin:constraints (Arguments, left side) ▽
[★] Argument sp:arg1 : dm:Thing

spin:body ▽
[★] SELECT ?designation
     WHERE {
        OPTIONAL {
           SERVICE <http://data.posccaesar.org/rdl/> {
              ?arg1 <http://data.posccaesar.org/rdl/hasDesignation> ?designation .
           } .
        } .
     }

spin:returnType ▽
[D] xsd:string

▼ Other Properties
rdf:type ▽
[●] spin:MagicProperty

Example SPIN magic property : get PCA RDL classifier hasDesignation

?class pcardlprop:classifierDesignation ?classlabel

Use this in a query

Rather than this

Magic Property Form

Name: pcardlprop:classifierDesignation

▼ Annotations

rdfs:comment ▽

S return the designation of the classes by which arg1 is classified in the PCA RDL

rdfs:label ▽

S classifier designation

▼ Definition

rdfs:subClassOf ▽

▭ spin:MagicProperties

spin:constraints (Arguments, left side) ▽

★ Argument sp:arg1 : dm:Thing

spin:body ▽

★
```
SELECT ?designation
WHERE {
    OPTIONAL {
        SERVICE <http://data.posccaesar.org/rdl/> {
            ?classification dm:hasClassified ?arg1 .
            ?classification dm:hasClassifier ?classifier .
            ?classifier <http://data.posccaesar.org/rdl/hasDesignation> ?designation .
        } .
    } .
}
```

spin:returnType ▽

D xsd:string

▼ Other Properties

rdf:type ▽

● spin:MagicProperty

Availability

- Release 1.0 of test cases delivered, cover all of Use Case 1
  - Download Release 1 original "master" from :
    - https://github.com/usnistgov/iso15926
  - D Price additions (e.g. SHACL) and corrections are at :
    - https://github.com/dpricetq/iso15926

Change Log

- 2015-06-10 : Initial release
- 2015-08-11 : Added SHACL example