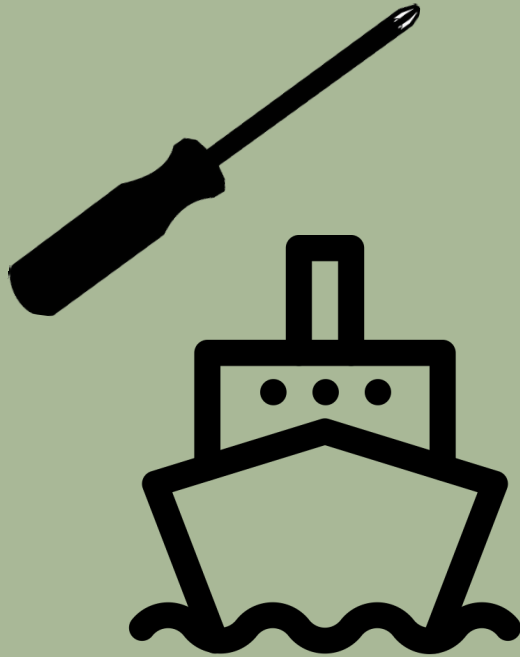


THIS IS AN ONTOLOGY, NOT A SCREWDRIVER

Helena Simões Patrício | Maria Inês Cordeiro | Pedro Nogueira Ramos

SWIB24
Semantic Web in Libraries



Created by icon 54
from Noun Project

There are two sorts of tools in the world:

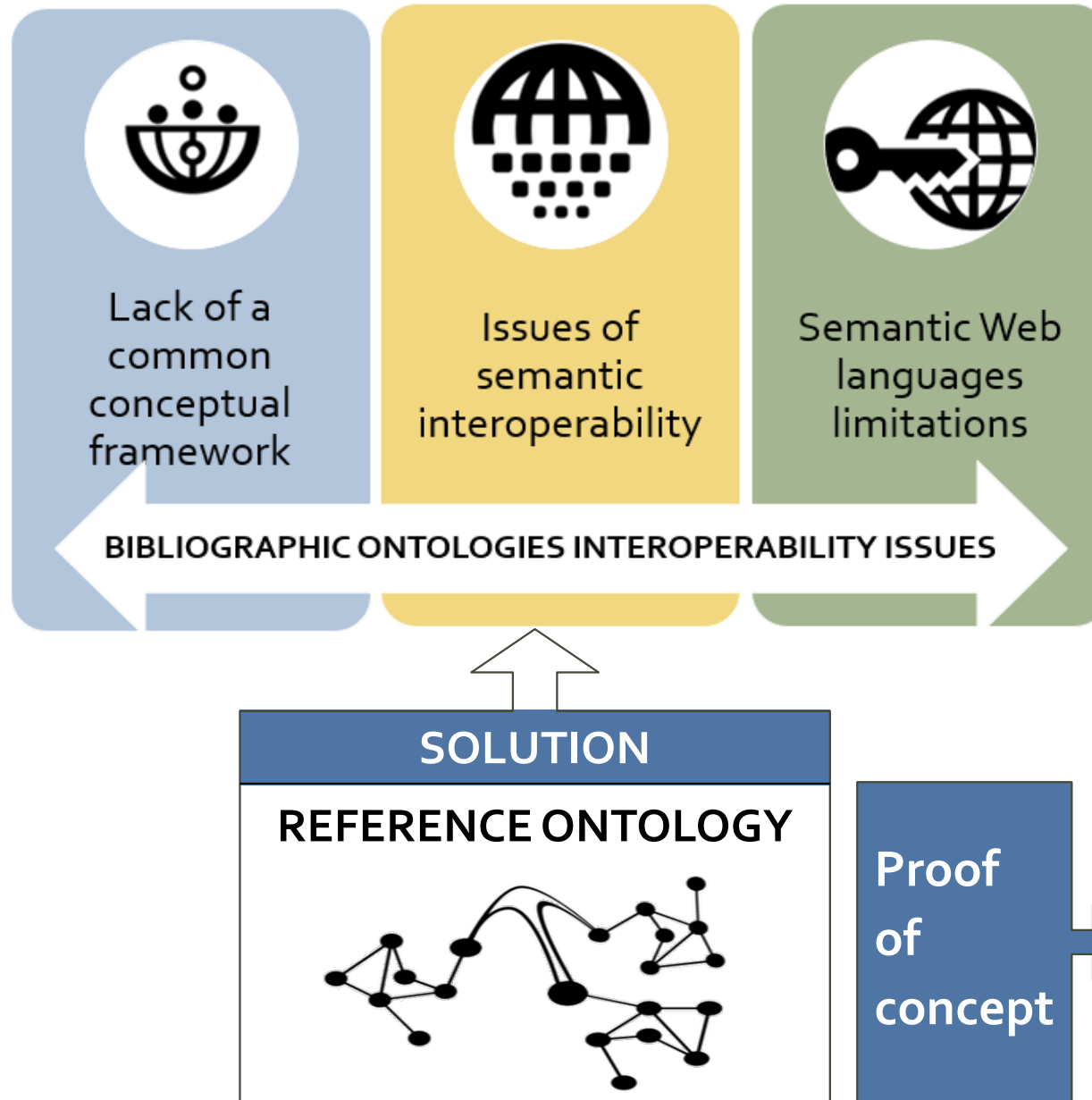
tools like a hammer or a **screwdriver** which can be
used by one person;

tools like **steamships** which require
the **cooperative activity of a number of persons** to use.

Words have been thought of too much in the model of the
first sort of tool.

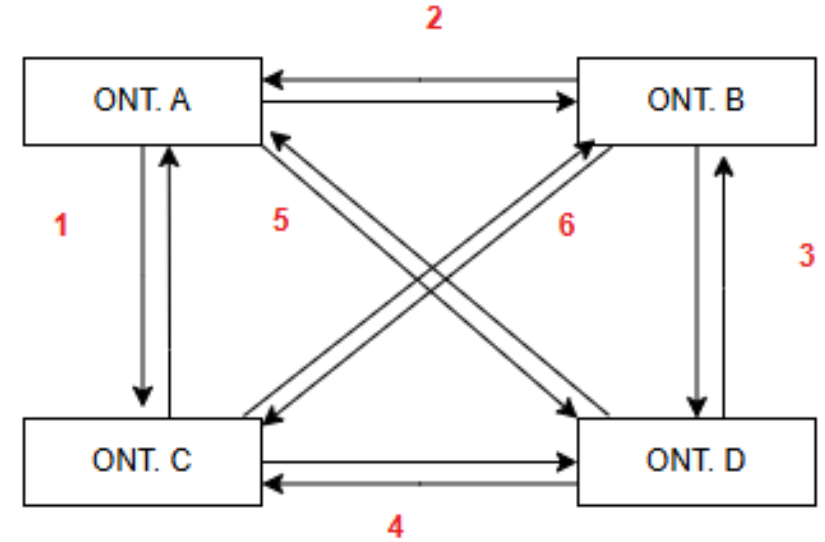
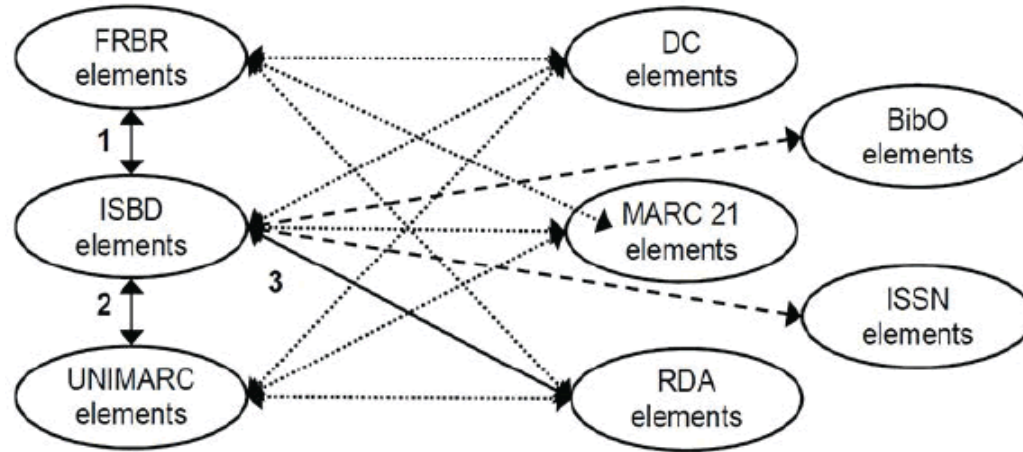
Hillary Putnam

OVERVIEW AND OBJECTIVES





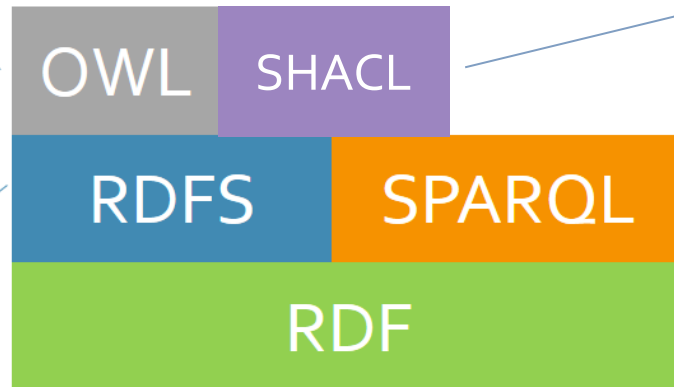
Issues of semantic interoperability



Semantic Web languages limitations

What makes logical sense to say?

What words do we have?



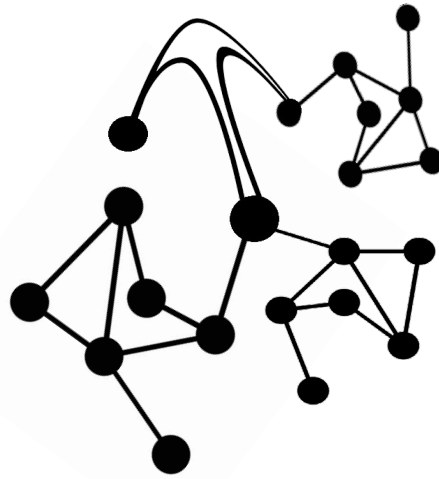
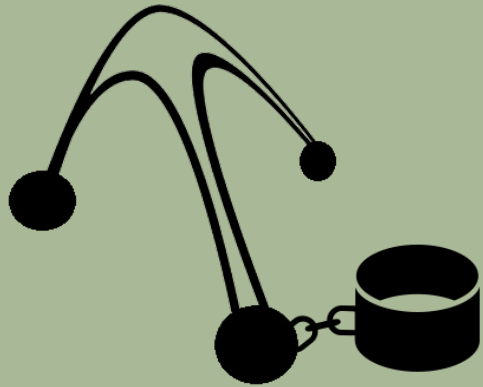
(Cyganiak, 2016)

Statements: What is being said?

Is that word used correctly?
 What do you need to know from me?
 You can't say that here!
 I'd never say that!

What did you say about XYZ?

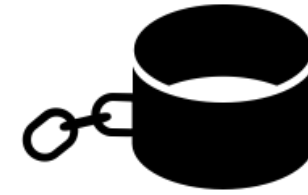
REFERENCE ONTOLOGY WITH SHACL CONSTRAINTS



REFERENCE ONTOLOGY
SEMANTIC MEDIATION



SHACL CONSTRAINTS
IMPOSE AND VALIDATE DATA RESTRICTIONS



❖ Selected interoperability problems

- Polysemy of bf:Work
- Whole-Part relationship

❖ Real-world examples

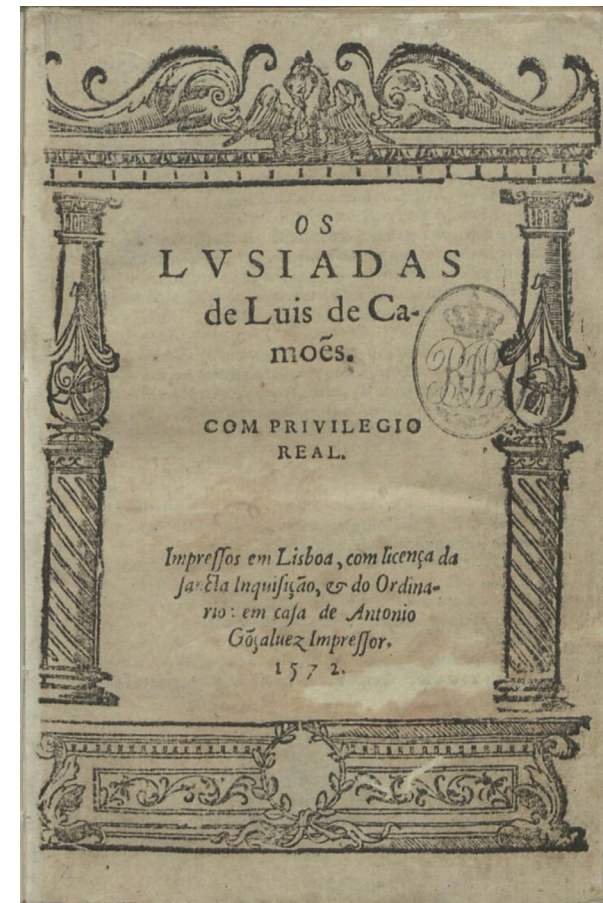
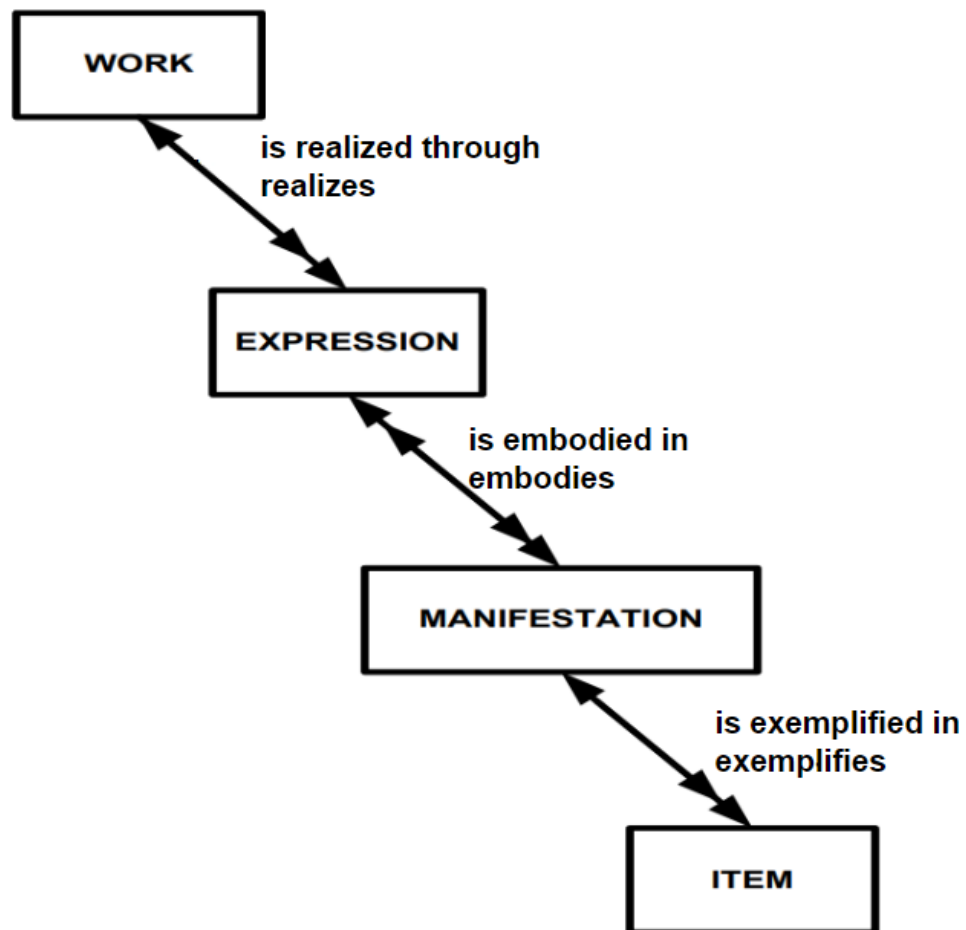
- Library of Congress dataset → BibFrame
- National Library of Spain dataset → BNE Ontology (BNEO) → RDA

REFERENCE
ONTOLOGY

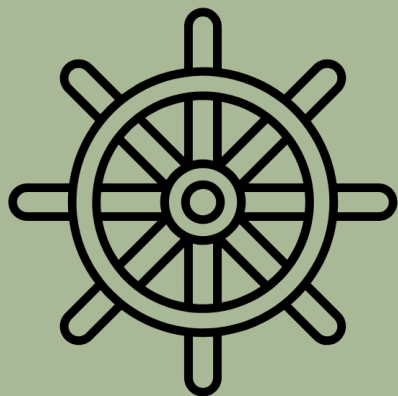


PROOF OF
CONCEPT

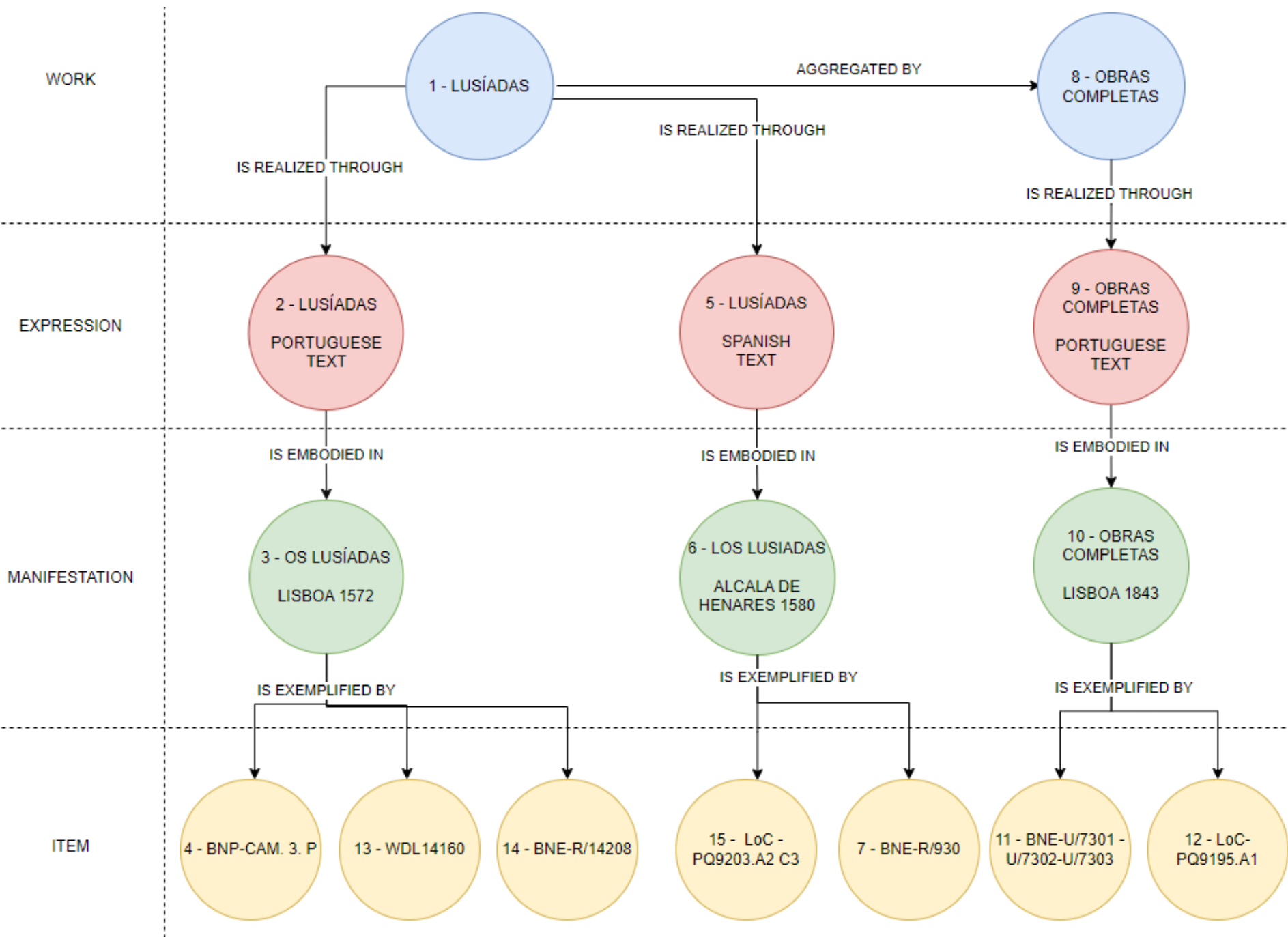
“The Lusiads” example



REFERENCE ONTOLOGY



PROOF OF CONCEPT



REFERENCE ONTOLOGY

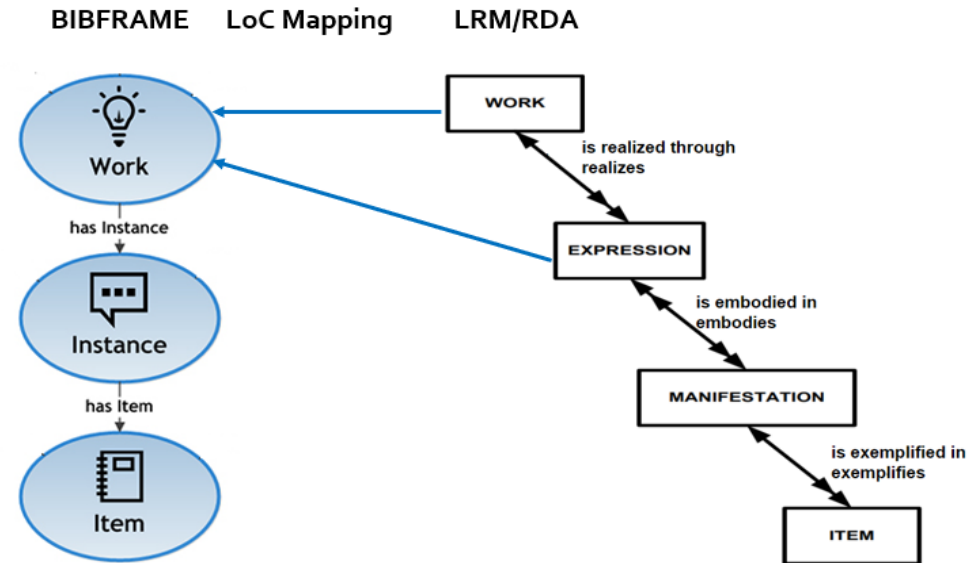


POLYSEMY OF BF:WORK

❖ BF lower granularity

WEMI entities	LRM	RDA	BIBFRAME
<i>Work</i>	E2 Work	C10001 Work	bf:Work
<i>Expression</i>	E3 Expression	C10006 Expression	
<i>Manifestation</i>	E4 Manifestation	C10007 Manifestation	bf:Instance
<i>Item</i>	E5 Item	C10003 Item	bf:Item

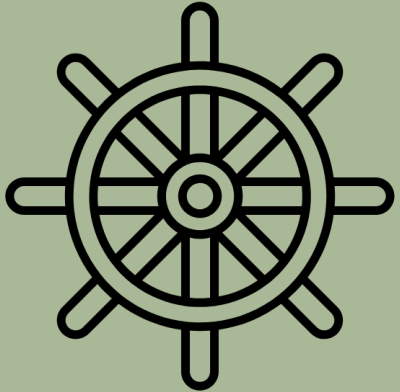
❖ Point-to-point mapping



❖ Specific interoperability problems:

- Conceptual confusion
- Absence of a parent Work common to multiple Expressions – the “Zapounidou problem”
- Absence of domain restriction for bf:language – not addressed here

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POLYSEMY OF BF:WORK

❖ **Conceptual confusion**

bf:Work instances can correspond to the concepts:

- Work or Expression
- Work and Expression

❖ **RO solution:**

- **A distinct class for each concept**

bf:Work → Work

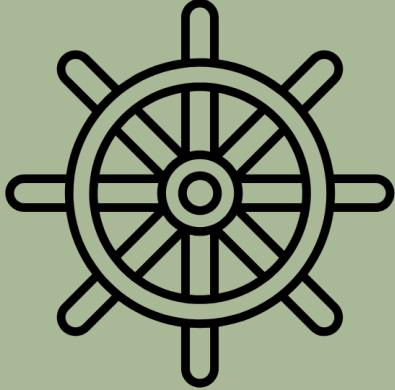
(orowl:Obra)

bf:Work subclasses (bf:Text; bf:Audio, etc.) → Expression
(orowl:Expressao)

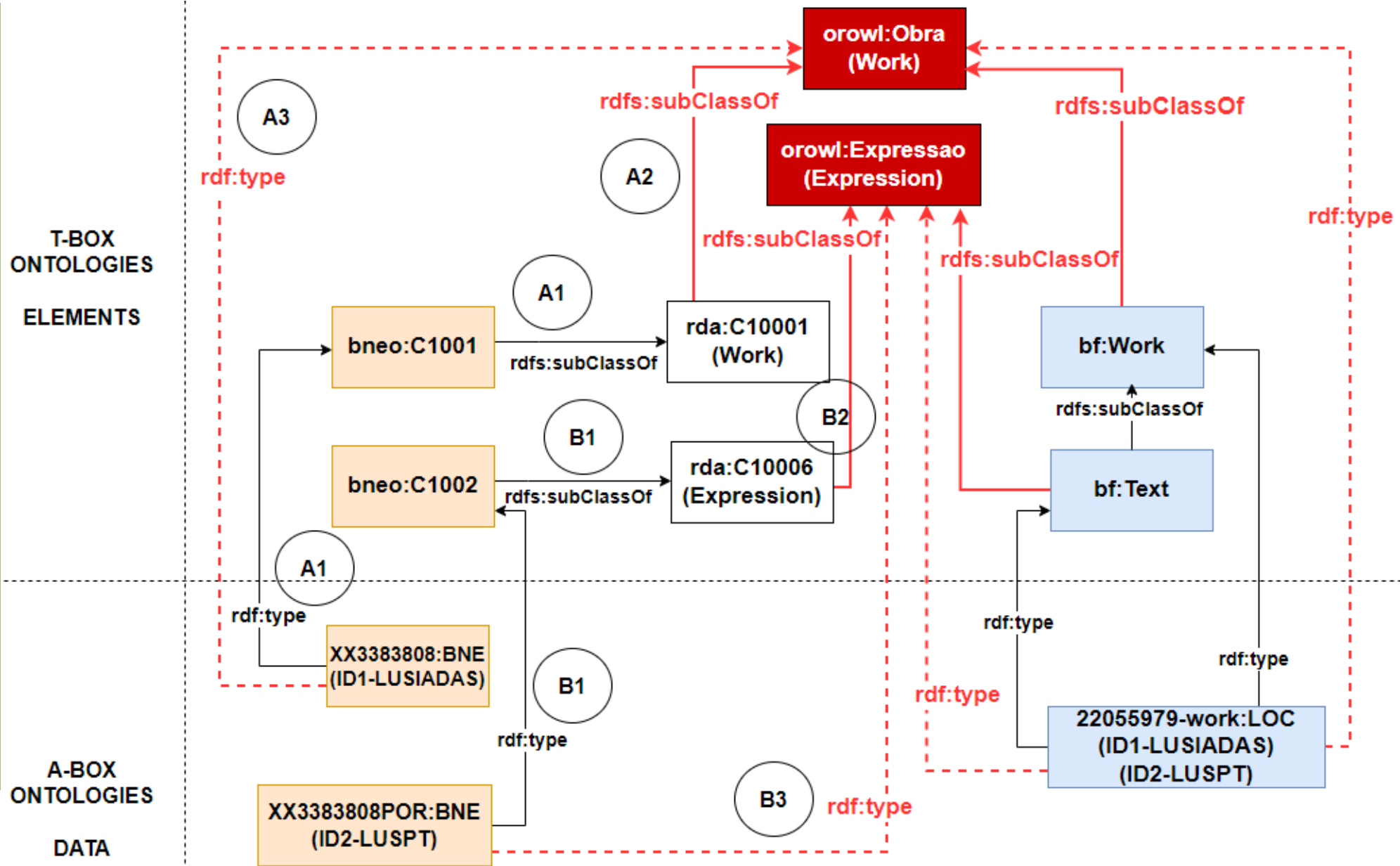
- **Class hierarchy**

❖ RO solution = a distinct class for each concept + class hierarchy

REFERENCE ONTOLOGY

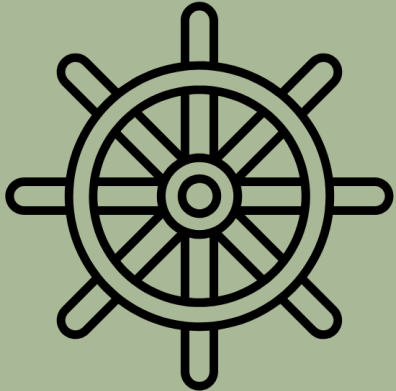


POLYSEMY OF BF:WORK



❖ RO solution = a distinct class for each concept + class hierarchy

REFERENCE
ONTOLOGY



POLYSEMY OF
BF:WORK

DL query:

Query (class expression)

orowl:Expressao

Execute Add to ontology

Query results

Instances (34 of 34)

- <http://datos.bne.es/resource/XX1909424>
- <http://datos.bne.es/resource/XX3383808por>
- <http://id.loc.gov/resources/works/1585524>
- <http://id.loc.gov/resources/works/22055979>
- <http://id.loc.gov/resources/works/9244465>

Explanation for: <http://datos.bne.es/resource/XX3383808por> Type orowl:Expressao

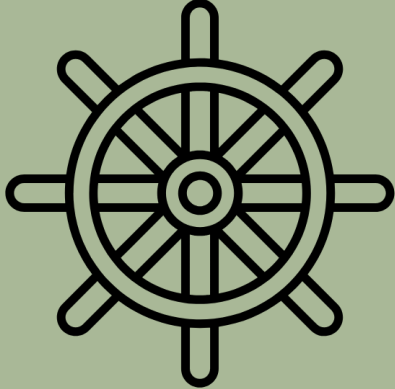
- <http://datos.bne.es/resource/XX3383808por> Type ns4:C1002
- ns4:C1002 SubClassOf rdac:C10006
- rdac:C10006 SubClassOf orowl:Expressao

Explanation for: <http://id.loc.gov/resources/works/22055979> Type orowl:Expressao

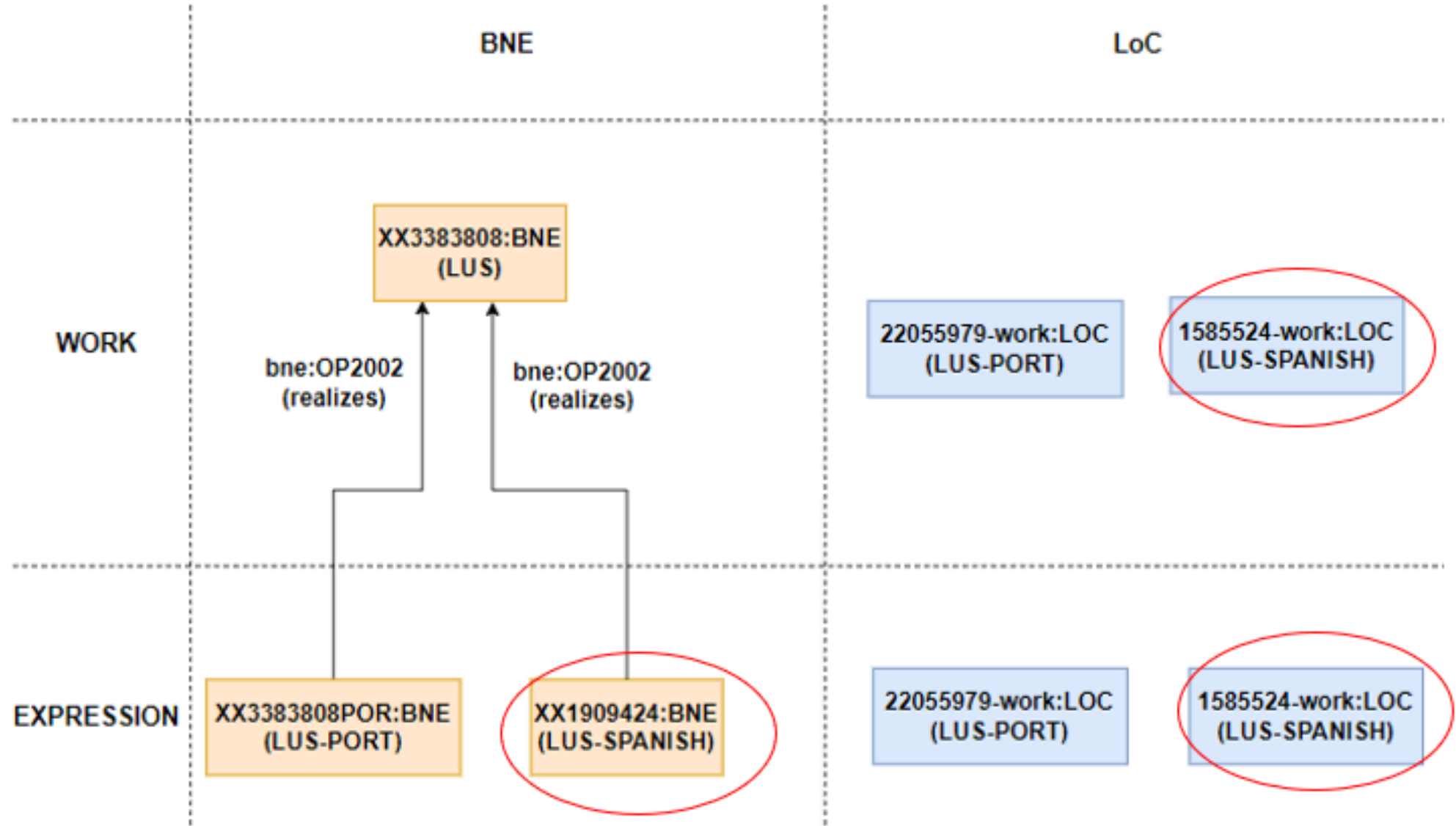
- <http://id.loc.gov/resources/works/22055979> Type bf:Text
- bf:Text SubClassOf orowl:Expressao

❖ “Zapounidou problem” – Absence of a common Work

REFERENCE ONTOLOGY

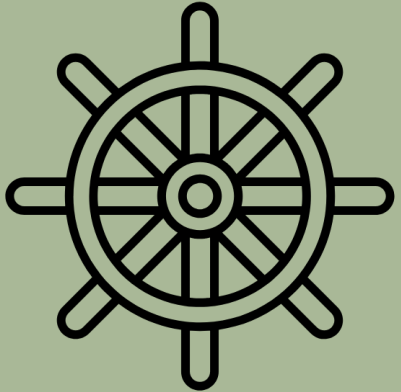


POLYSEMY OF BF:WORK



❖ “Zapounidou problem” – Absence of a common Work

REFERENCE
ONTOLOGY



POLYSEMY
OF
BF:WORK

Query to search BF Works in the LoC dataset:

DL query:

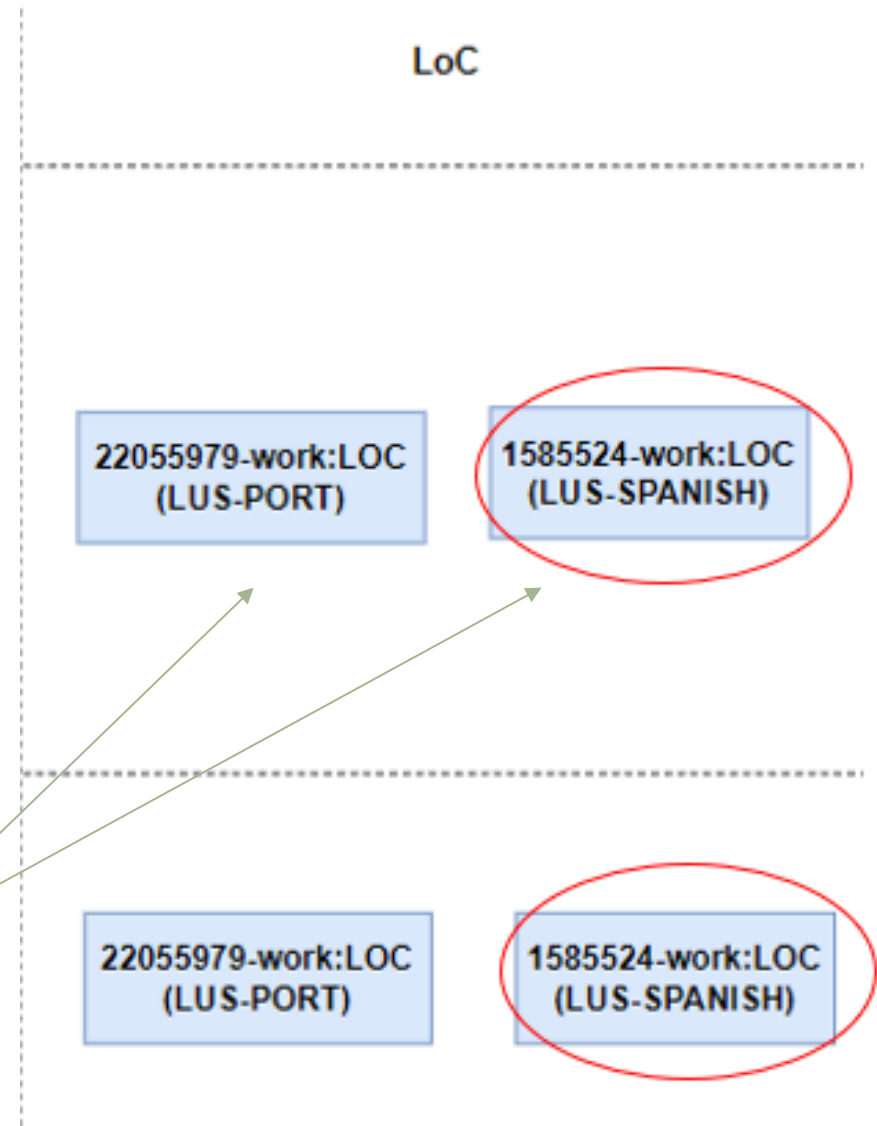
Query (class expression)

bf:Work

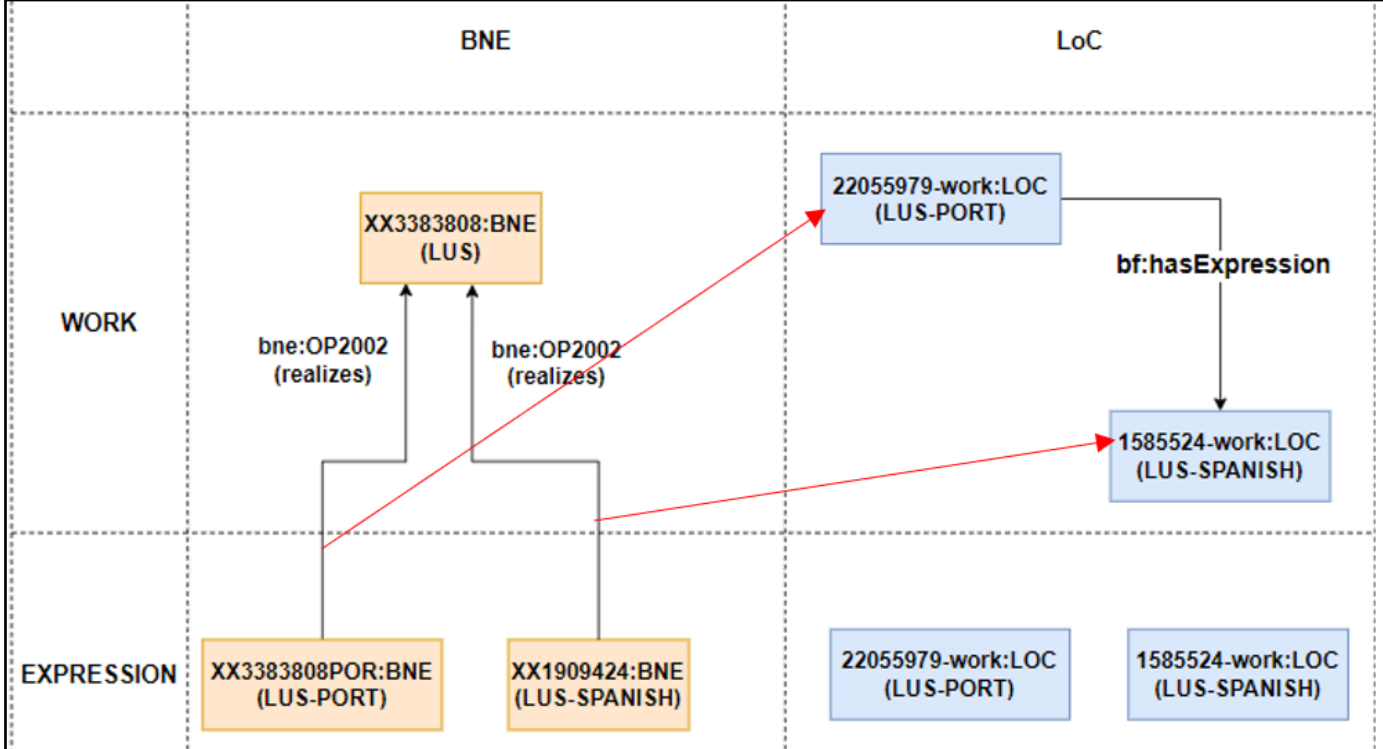
Query results

Instances (7 of 7)

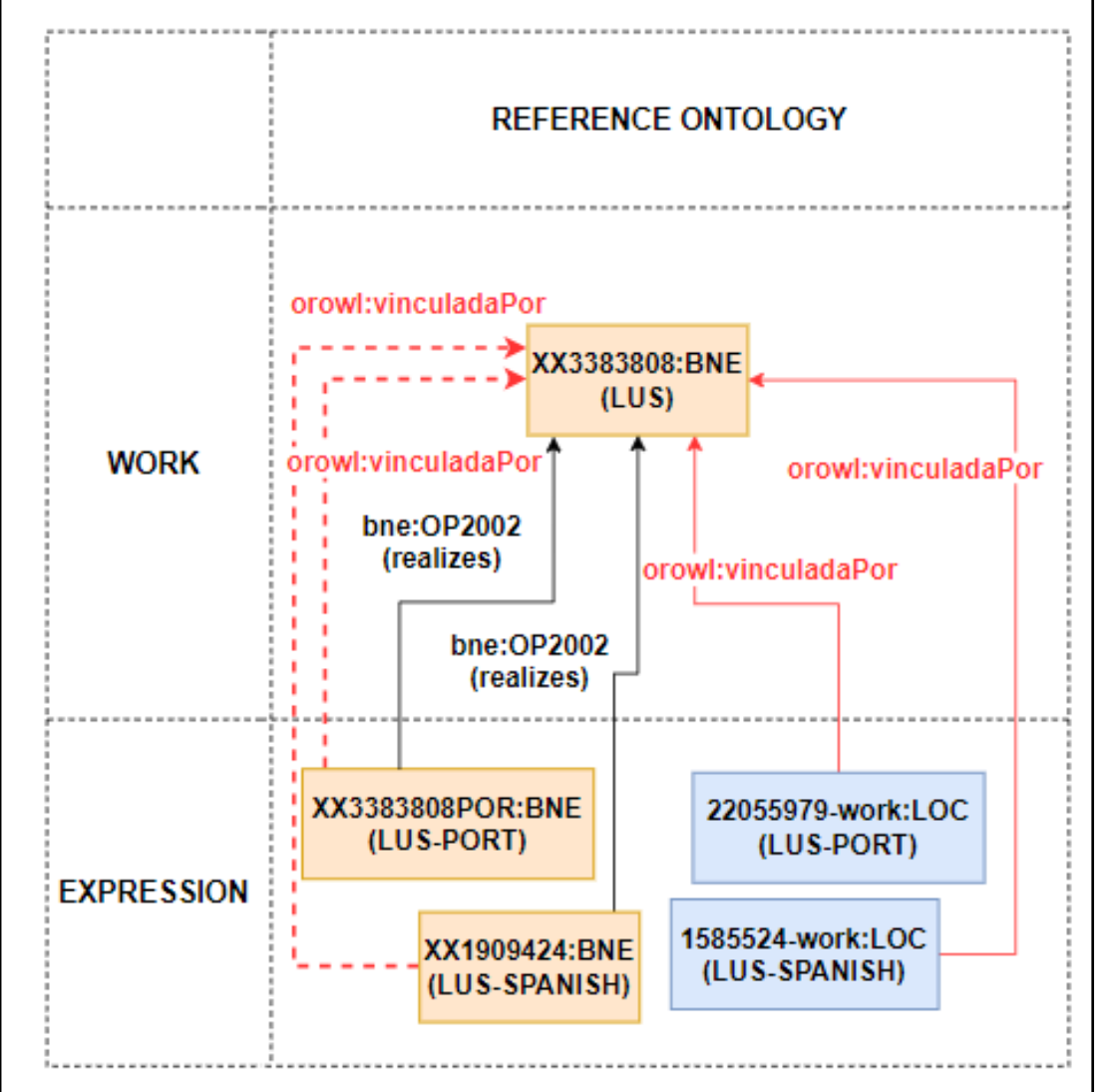
- ◆ <http://id.loc.gov/resources/works/1585524>
- ◆ <http://id.loc.gov/resources/works/22055979>



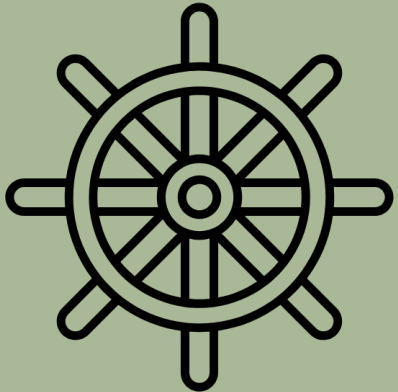
❖ Library of Congress Mapping solution



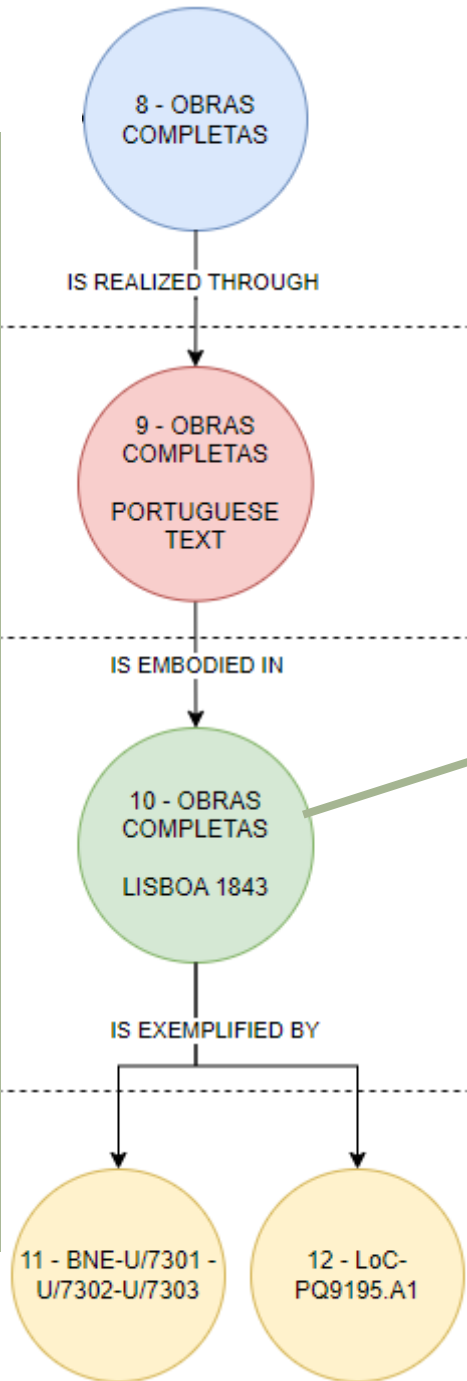
❖ RO solution



REFERENCE ONTOLOGY

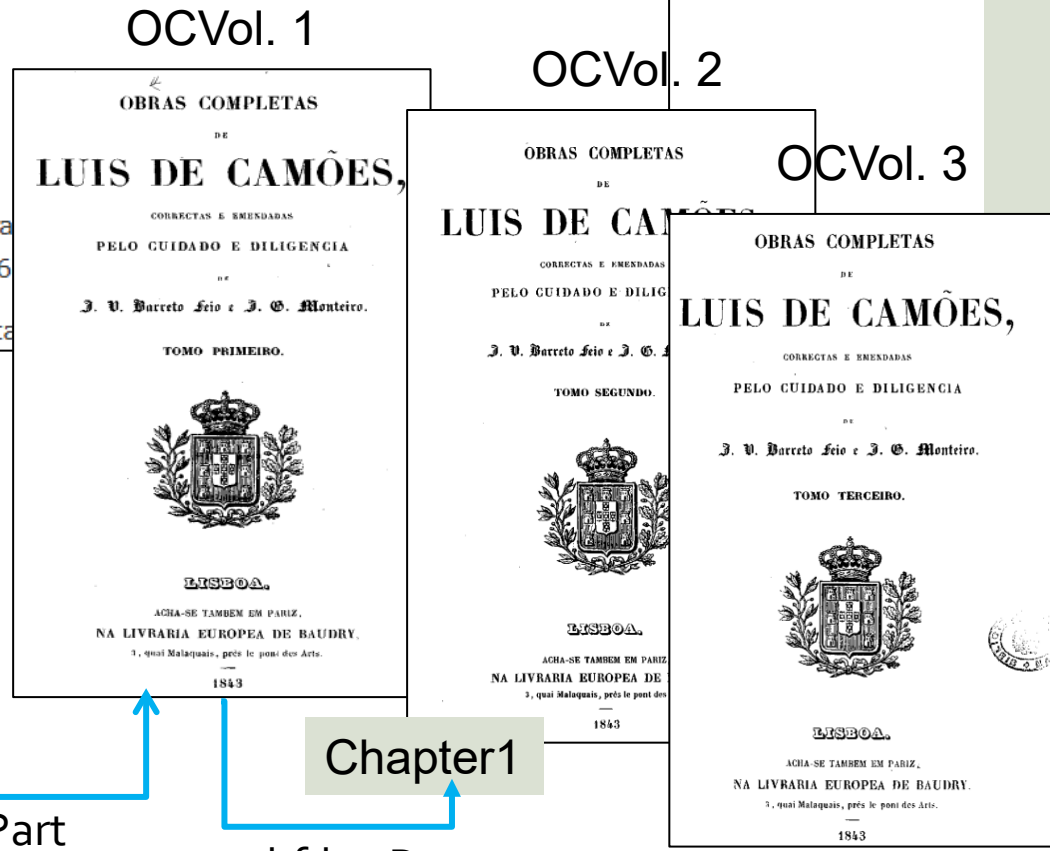


WHOLE-PART PROPERTIES OMISSION

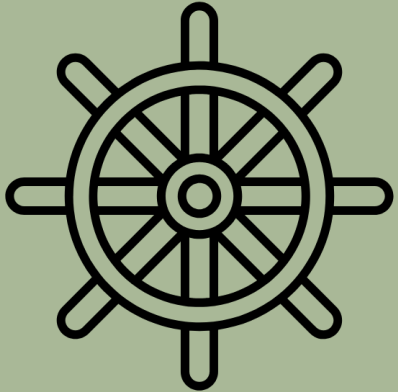


9244465-Instance:LOC

Obras completas de Luis de Camões [Texto impreso] / correctas e emendadas diligencia de J. V. Barreto Feio e J. G. Monteiro
Camões, Luís de (1524?-1580)
Feio, J. V. Barreto
Monteiro, J. G.
1843
Lisboa : Na Livraria Europea de Baudry
Libro
3 v.; 23 cm
U/7301
U/7302
U/7303
bdh0000010105
821.134.3-82"15"
82
Obras Maestras > Literatura
v. 1. Os Lusíadas (XLII, 396 p.)
v. 2. Rimas (LXIX, 420 p.)
v. 3. Rimas, comedias, cartas

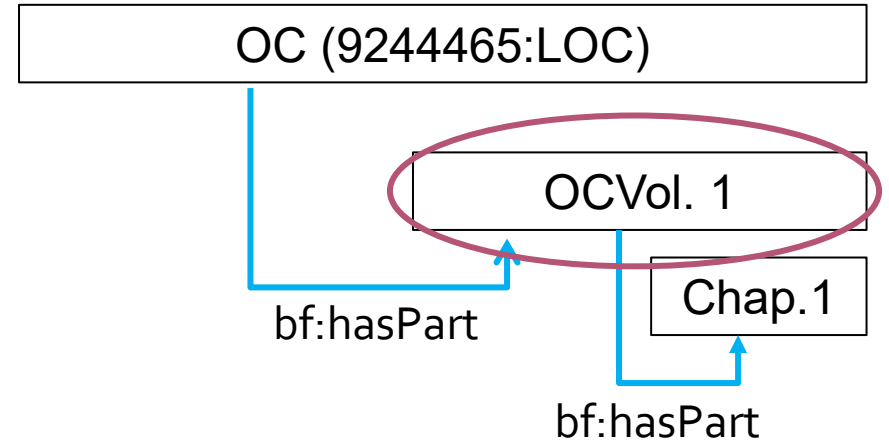


REFERENCE ONTOLOGY



WHOLE-PART PROPERTIES OMISSION

❖ Lack of transitivity



Query: What are the parts of “Complete Works - 924465” – using bf:hasPart?

DL query:


Query (class expression)

```
inverse bf:hasPart value <http://id.loc.gov/resources/instances/9244465>
```

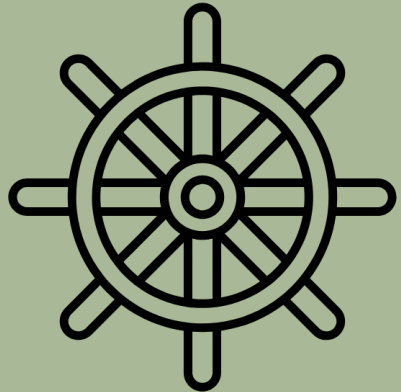
Execute Add to ontology

Query results

Instances (1 of 1)

 orowl:OCVol1


REFERENCE ONTOLOGY





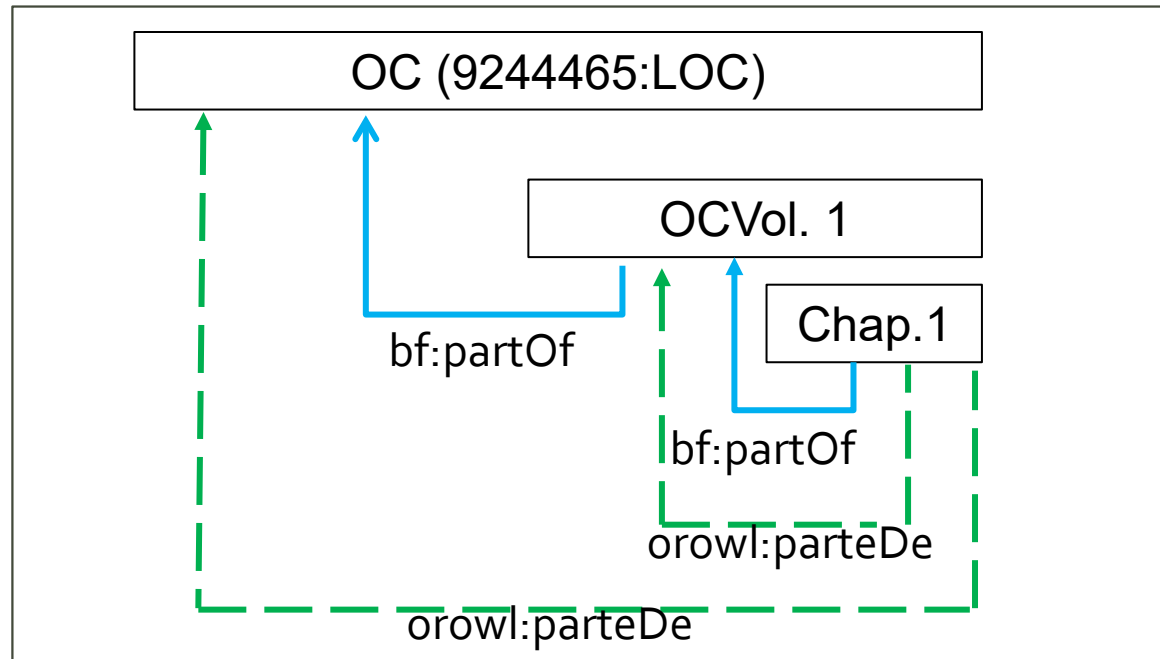
WHOLE-PART PROPERTIES OMISSION

❖ RO Solution = Transitivity + Property hierarchy

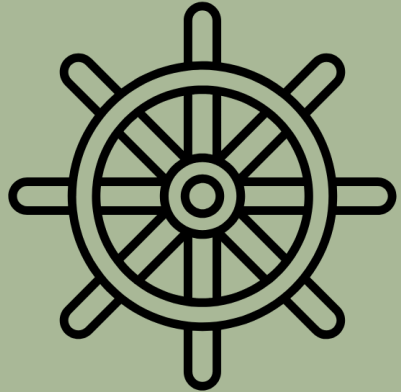
```
<owl:ObjectProperty rdf:about="http://www.xpto.com/orowl-validacao.owl#parteDe">  
  <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#TransitiveProperty"/>  
  <rdfs:domain rdf:resource="http://www.xpto.com/orowl-validacao.owl#Obra"/>  
  <rdfs:range rdf:resource="http://www.xpto.com/orowl-validacao.owl#Obra"/>  
</owl:ObjectProperty>
```

SuperProperty Of (Chain) 

 bf:partOf  SubPropertyOf orowl:parteDe

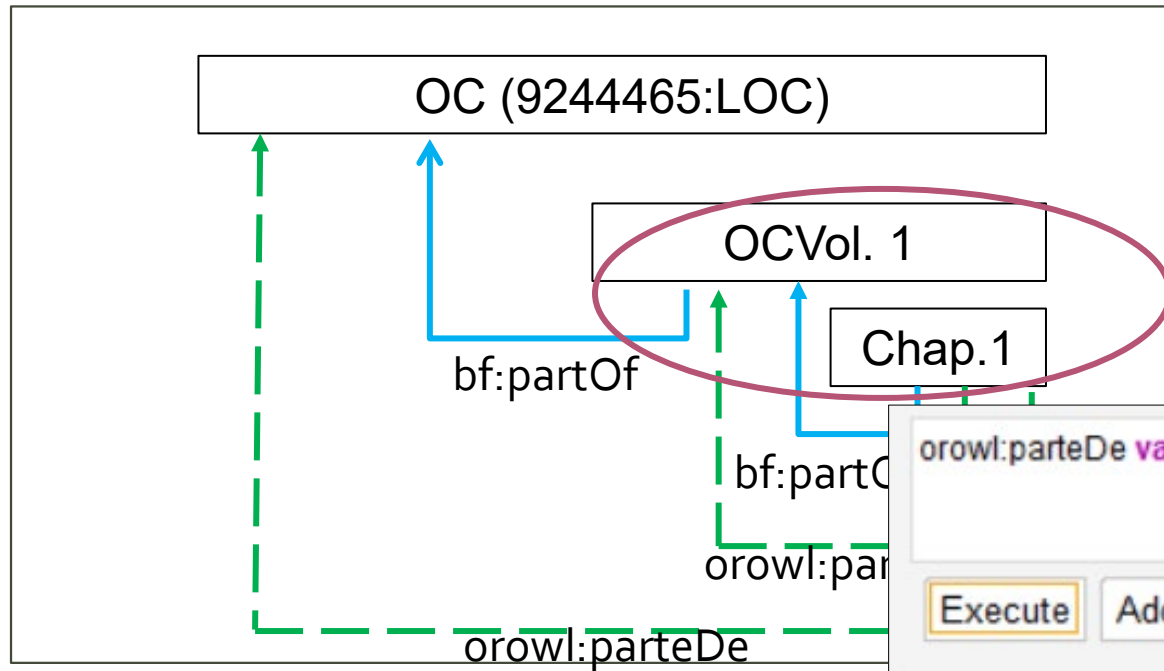


REFERENCE ONTOLOGY



WHOLE-PART PROPERTIES OMISSION

❖ RO Solution = Transitivity + Property hierarchy



Query: What are the parts of "Complete Works - 924465" – using RO property?

orowl:parteDe value <http://id.loc.gov/resources/instances/9244465>

Query results

Instances (2 of 2)

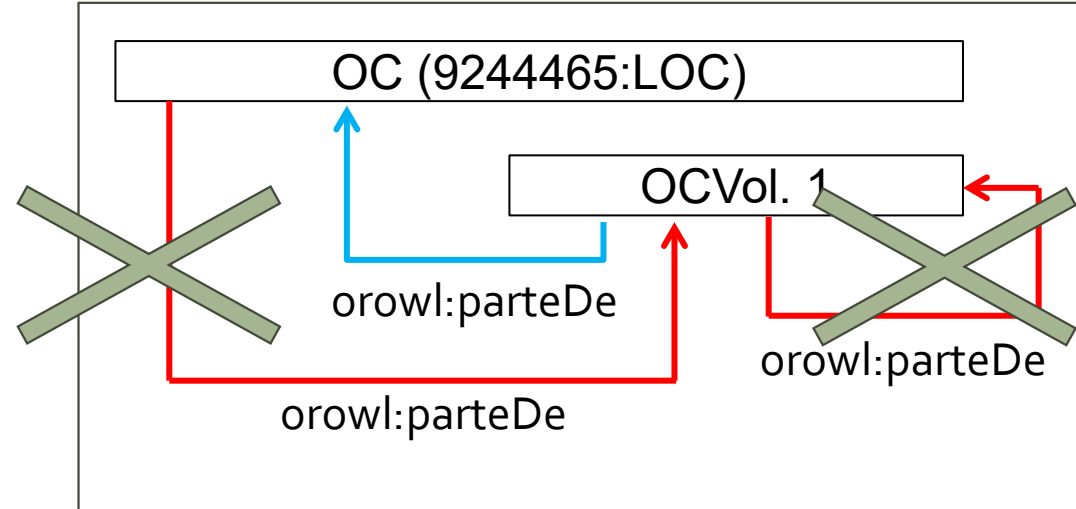
- orowl:OCVol1
- orowl:OCVol1Chapter1

SHACL CONSTRAINTS



WHOLE-PART PROPERTIES OMISSION

❖ Lack of non-reflexivity and asymmetry



```
orowl:Obra rdf:type sh:NodeShape ;  
dash:closedByTypes "true"^^xsd:boolean ;  
sh:property [  
  sh:path orowl:parteDe ;  
  dash:nonRecursive "true"^^xsd:boolean ;
```

❖ Lack of non-reflexivity

Recursion error

Resource Form

Name: orshaclus:OCVol1

Annotations	Other Properties
rdawo:P10148 ▾	bf:appliedMaterial ▾
orowl:parteDe ▾	bf:baseMaterial ▾
◆ orshaclus:OCVol1 ▾	bf:bookFormat ▾
orowl:temTítulo ▾	bf:carrier ▾
orowl:tradLiv ▾	bf:digitalCharacteristic ▾
orowl:vinculadaPor ▾	bf:dimensions ▾

Shape	[Component]	Message
Property orowl:parteDe: nonRecursive	dash:nonRecursive	✖ Points back at itself (recursively)

Focus Node	Path	Value
◆ orshaclus:OCVol1	■ orowl:parteDe	◆ orshaclus:OCVol1

SHACL
CONSTRAINTS

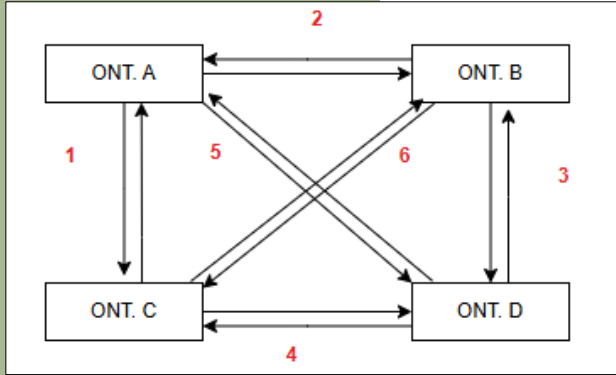


WHOLE-PART
PROPERTIES
OMISSION

CONCLUSIONS:

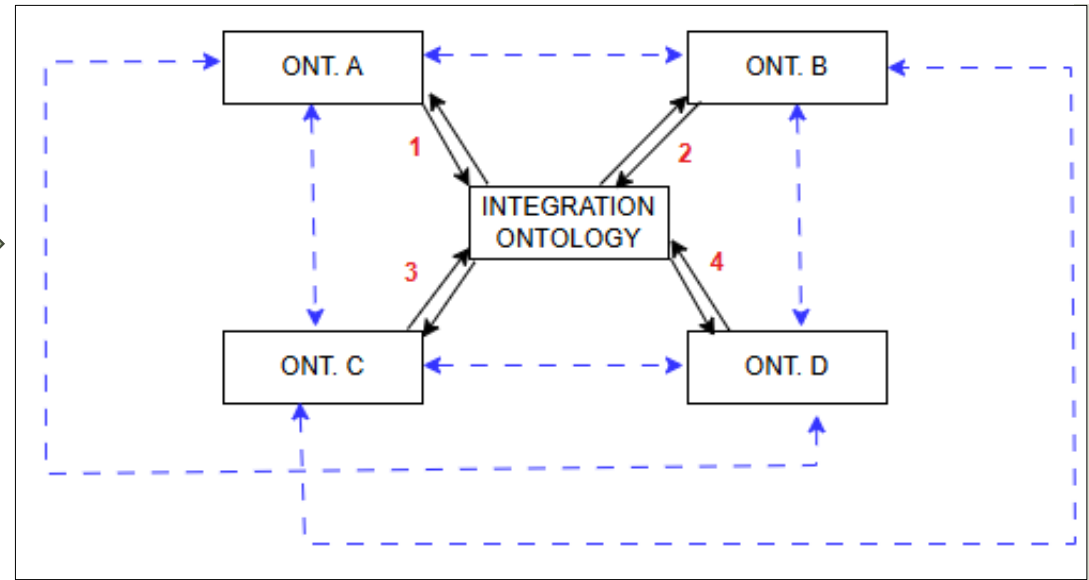


Issues of semantic interoperability



REFERENCE ONTOLOGY

SHACL CONSTRAINTS



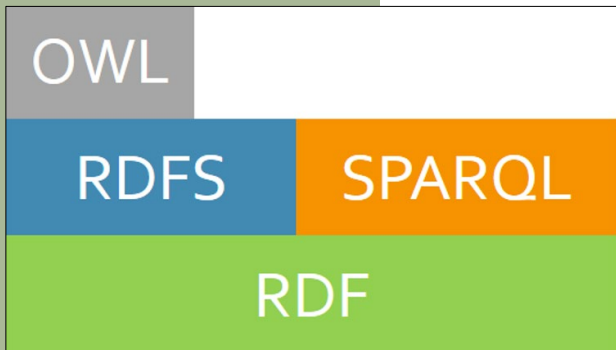
THIS DATA IS VALIDATED

The Shapes Constraint Language (SHACL) validates the data

(ONTOTEXT, 2023)



Semantic Web languages limitations



REFERENCE
ONTOLOGY
WITH SHACL
CONSTRAINTS

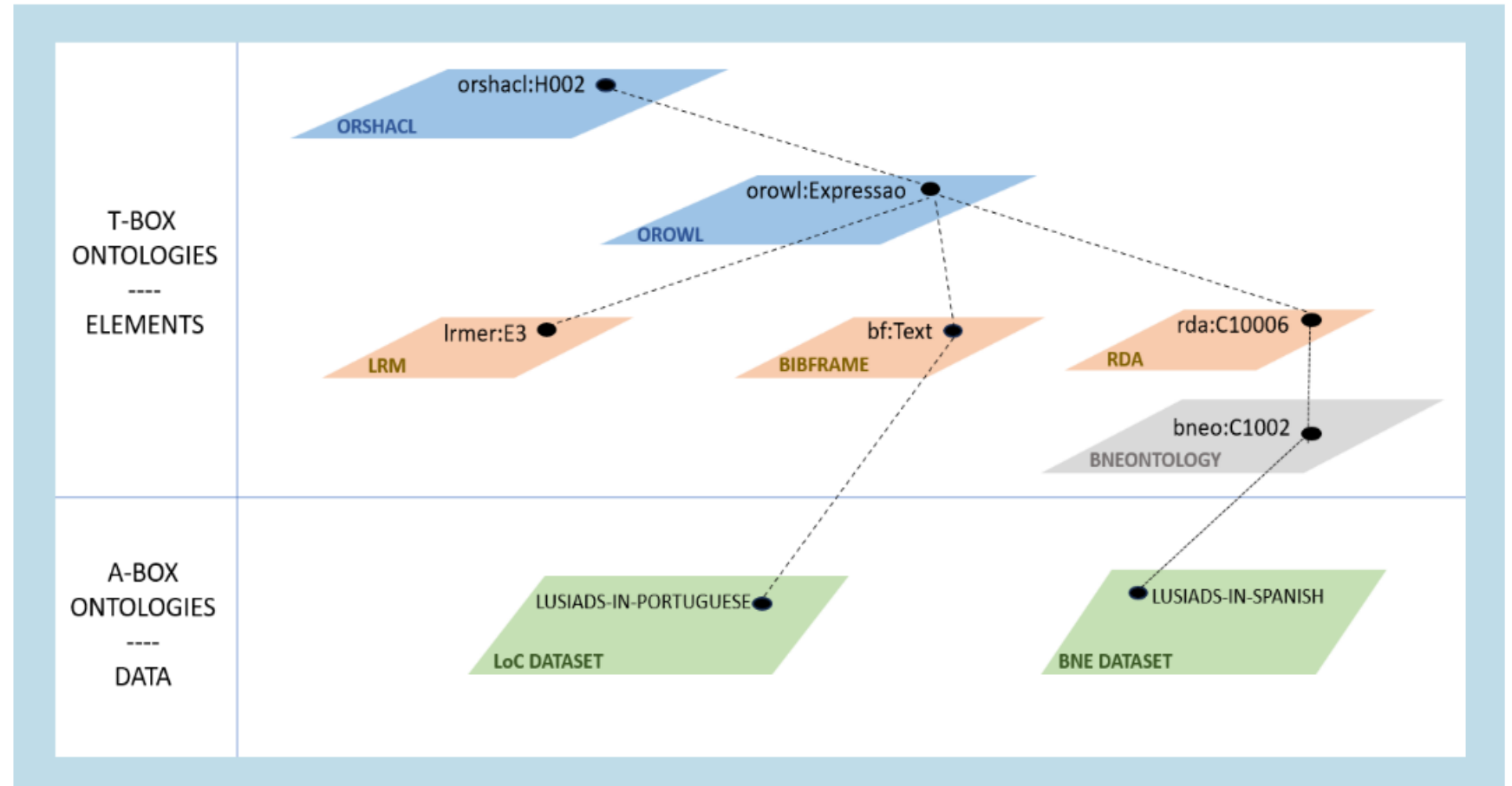


The Reference Ontology with SHACL constraints:

- **Allows for inference of implicit information**
- **Does not replace or modify the source-ontologies**
- **Overcomes semantic omissions**
- **Overcomes limitations of RDF/OWL**

Data integration, semantic mediation and SHACL validation

REFERENCE
ONTOLOGY
WITH SHACL
CONSTRAINTS



More information at <https://libraryreferenceontology.com/>

REFERENCE ONTOLOGY

WITH SHACL CONSTRAINTS



THANK YOU!

helena_margarida_patricio@iscte-iul.pt