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# An Approach for Bridging the Gap Between Business Rules and the Semantic Web

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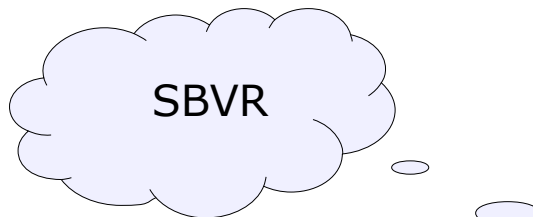
Orlando 2007-10-26



# Nature of the Task – Mapping

## SBVR

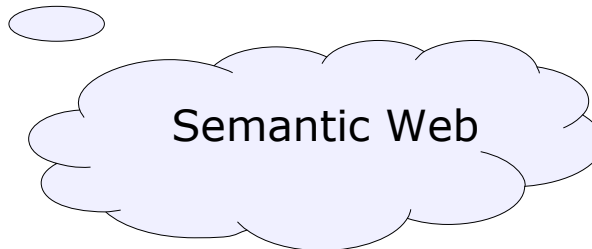
- OMG Specification, since 2006
- Semantics of Business Vocabularies and Business Rules
- essentially based on first order and modal logic
- orientation on the language of **business people**



?

## Semantic Web (Vision, W3C Standards)

- based on various logics
- orientation on **machine processing** of logic-based knowledge

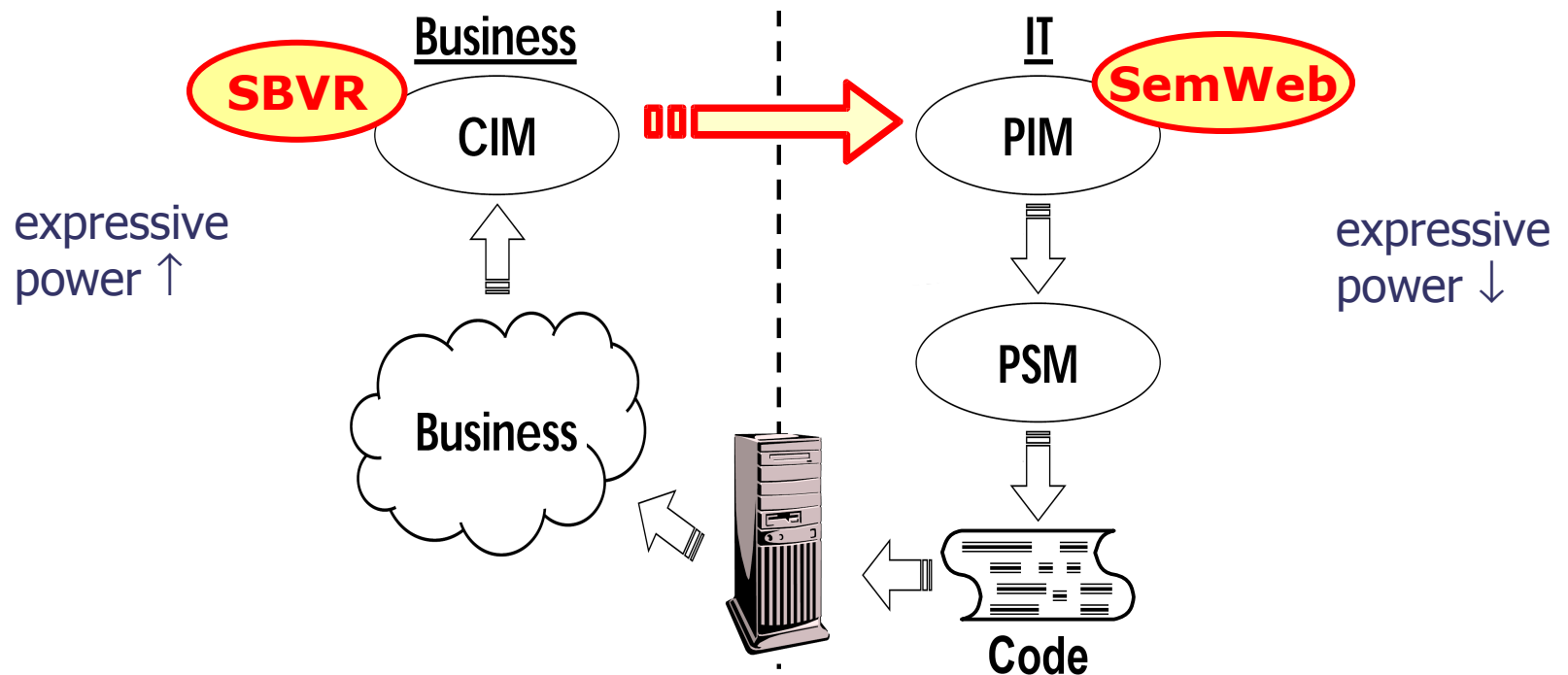


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  - language selection  
(OWL, R2ML)
4. Mapping
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# SBVR in the MDA context

– An Example for "Model Driven Integrity Engineering" (MDIE) –



*"MDA Big Picture" following [Schacher]*

# Example: Domain Model in SBVR

– following [Baisley], fragments –

## Vocabulary

employee

...

manager

Definition

employee that manages others

General concept

employee

Synonym

supervisor

employee<sub>1</sub> *is under* employee<sub>2</sub>

Synonymous Form

employee<sub>2</sub> *over* employee<sub>1</sub>

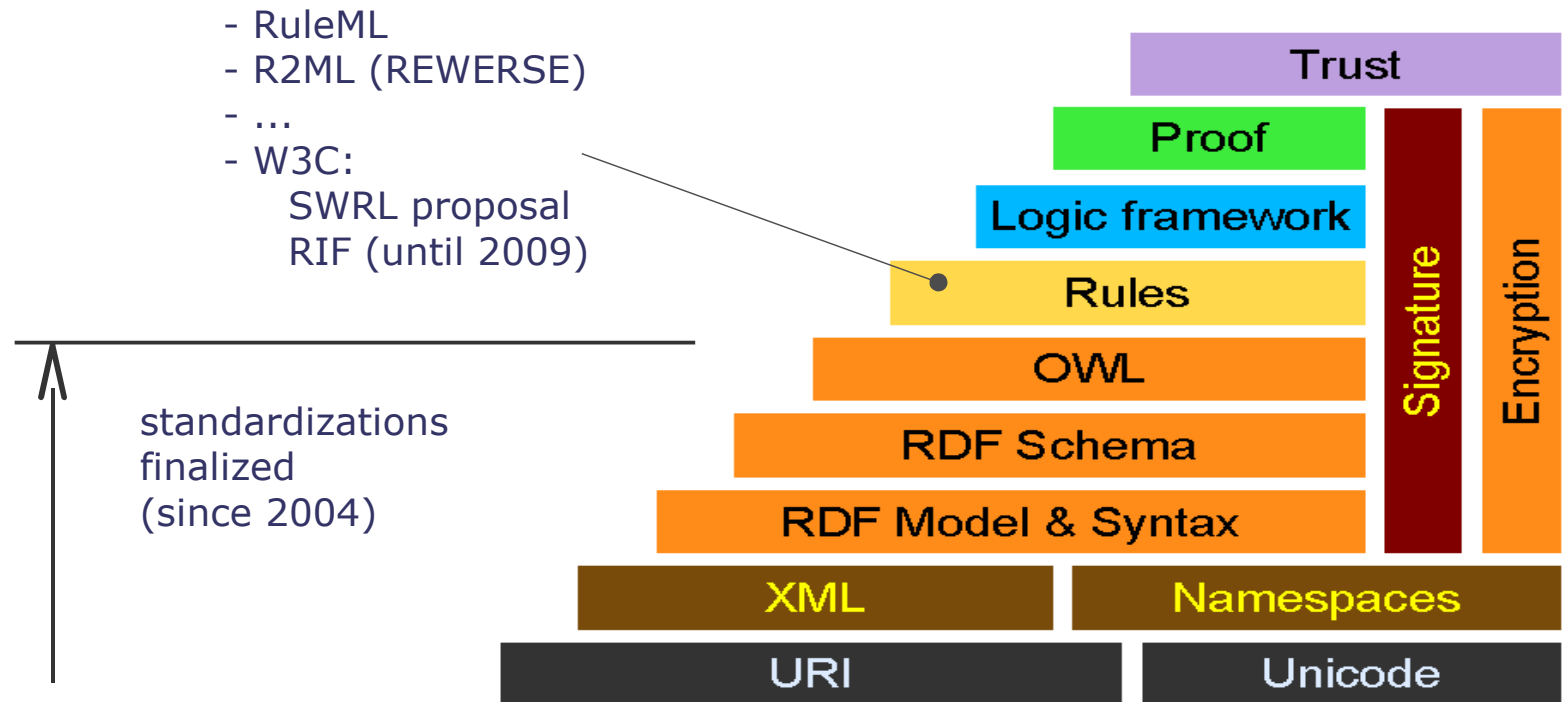
## Rules

MC No Selfmanagement

Rule Statement

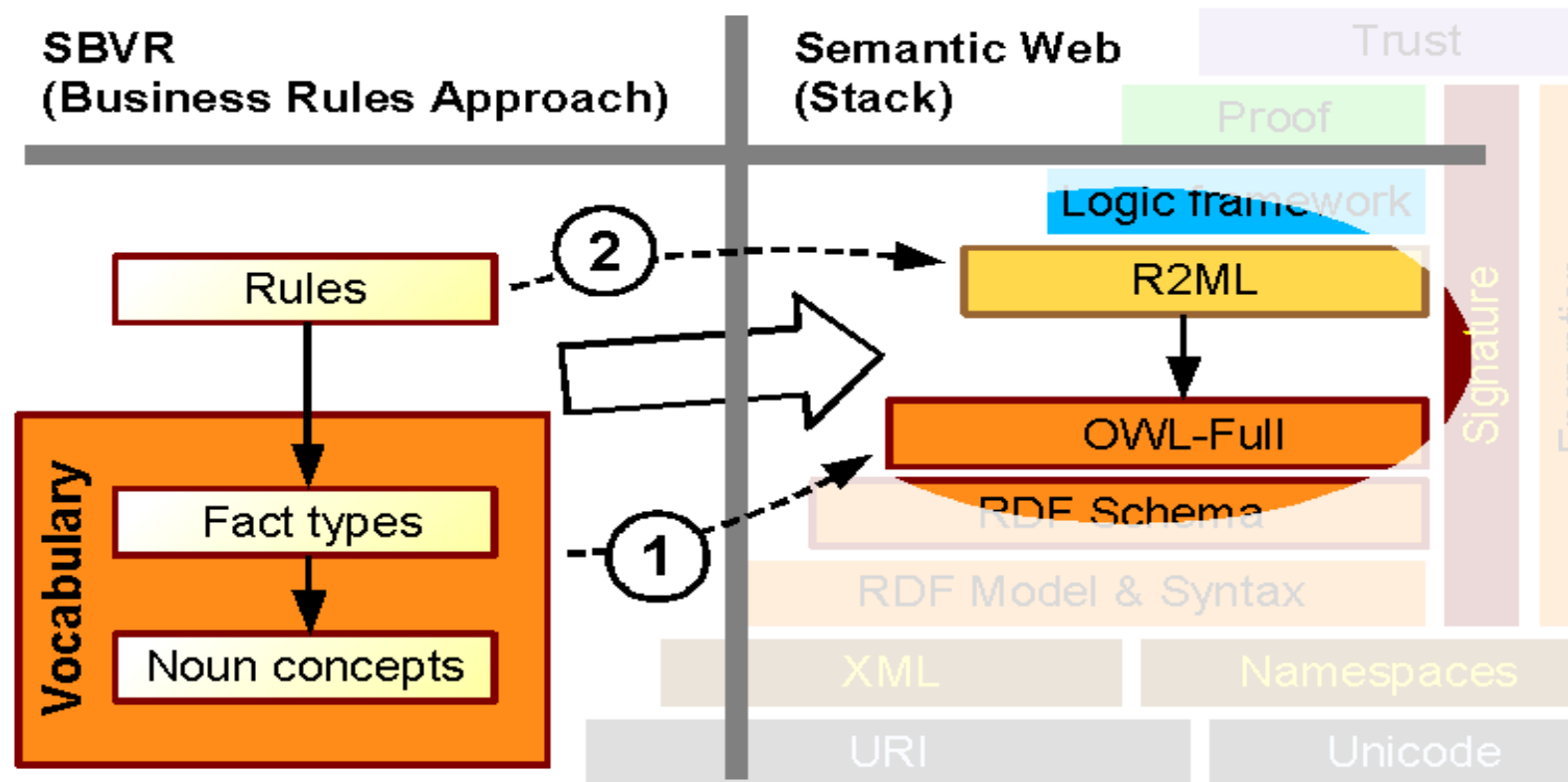
It is prohibited that an employee *is a*  
manager *over* the employee

# Semantic Web Overview

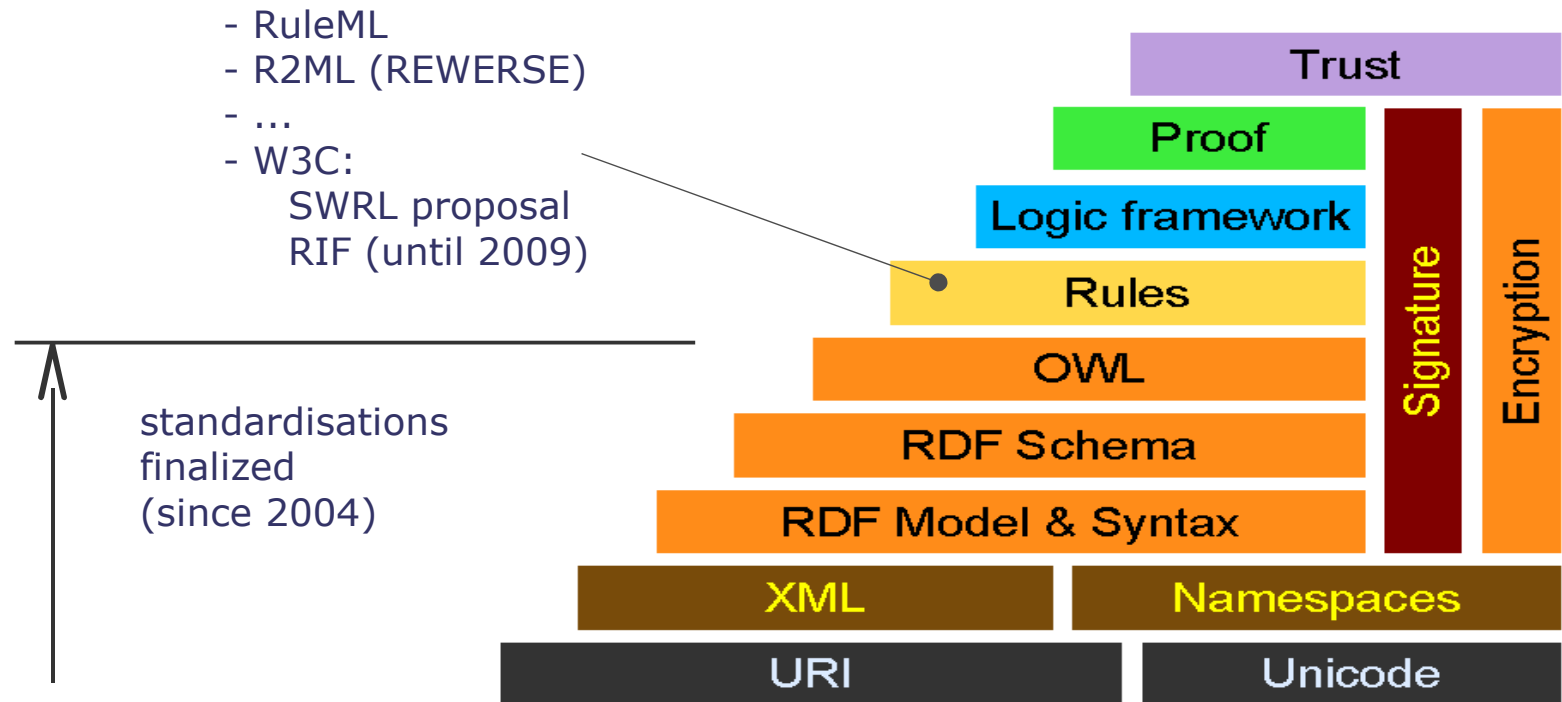


*Semantic Web Stack (Version 2002)*  
*[Berners-Lee]; adapted*

# Splitting Transformation, Target Languages



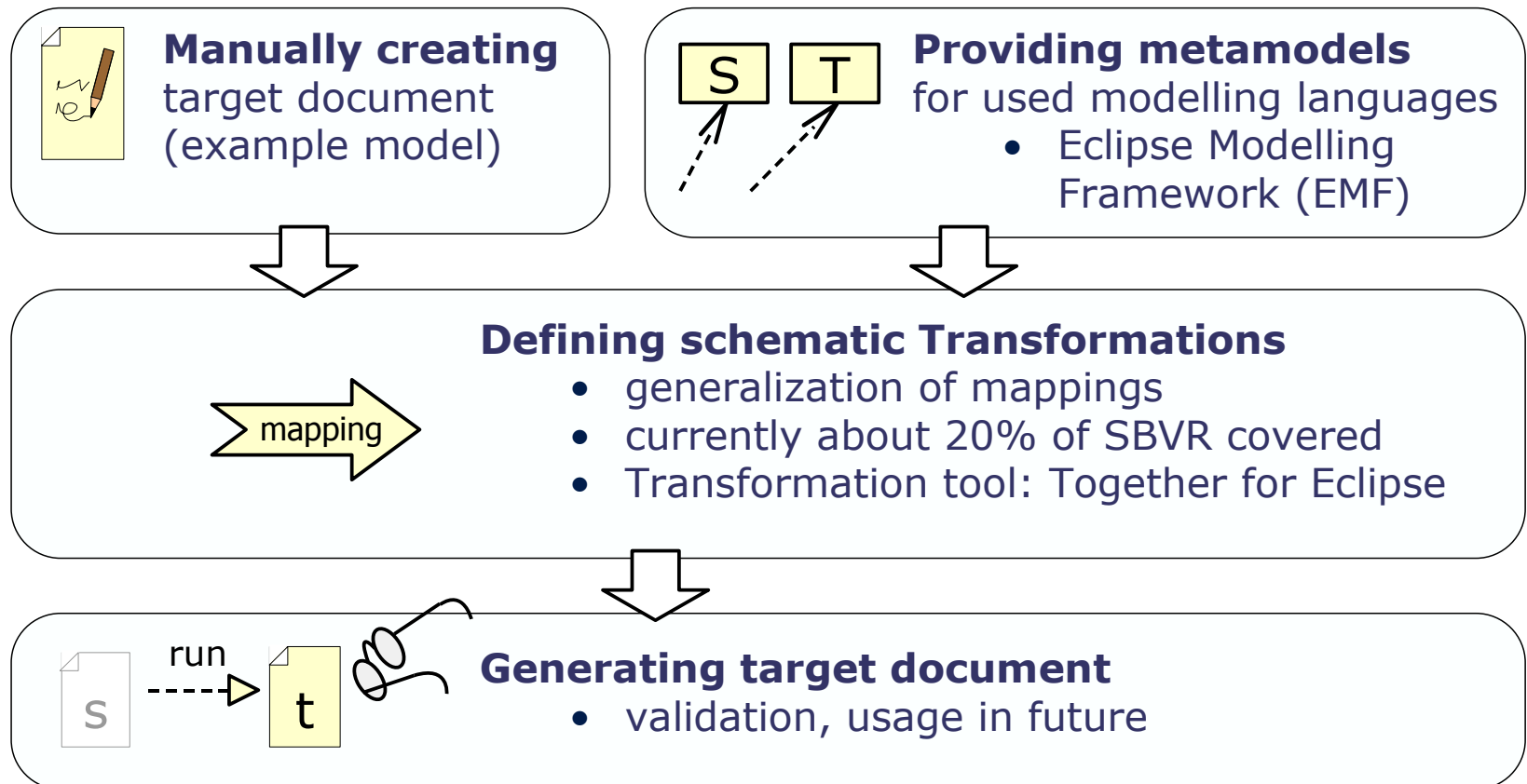
# Semantic Web Overview



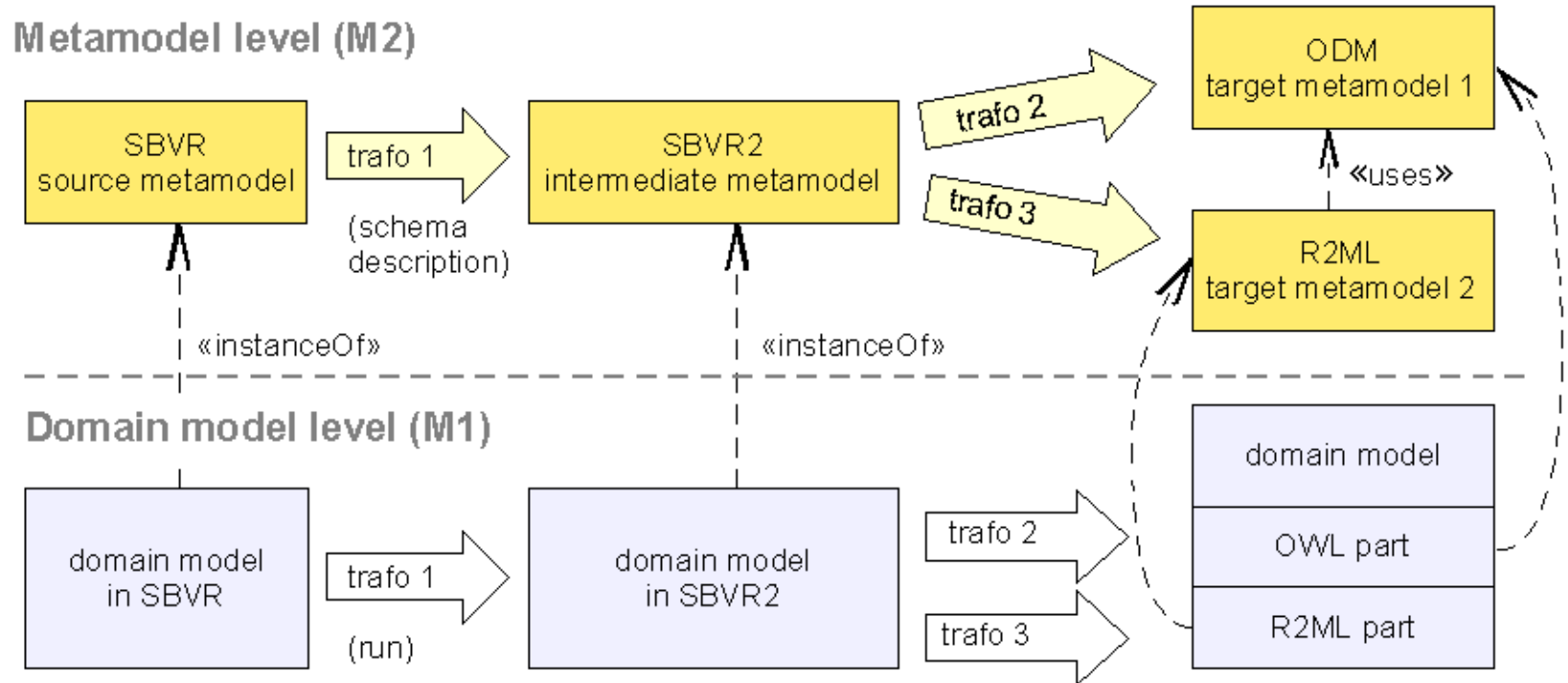
*Semantic Web Stack (Version 2002)*  
*[Berners-Lee]; adapted*



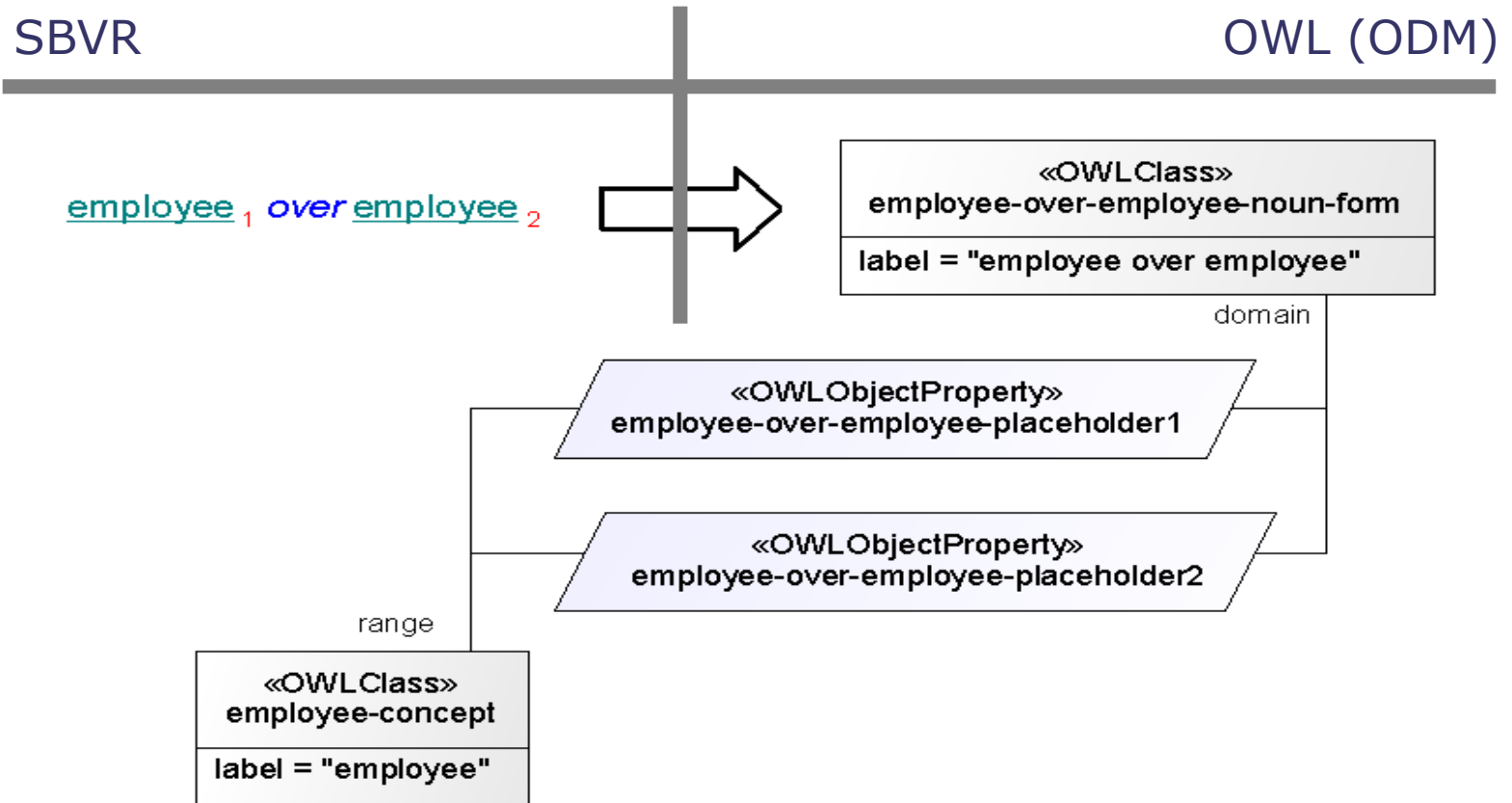
# Mapping Procedure and Prototyping



# Transformation Chain








## Example: Mapping of Vocabulary



# Rule Mapping

## 1. Integrity rules (in SBVR having modality, explicitly described)

 alethic	<b>It is necessary that...</b>	<b>r2ml::AlethicIntegrityRule</b>
 alethic	It is possible that...	no mapping possible
 deontic	<b>It is obligatory that...</b>	<b>r2ml::DeonticIntegrityRule</b>
 deontic $\neg$	It is prohibited that...	
 deontic	It is permitted that...	no mapping possible

## 2. Derivation rules (in SBVR implicitly described)

e.g. via closed definitions  
not considered here

## Example: Deontic Rule to R2ML

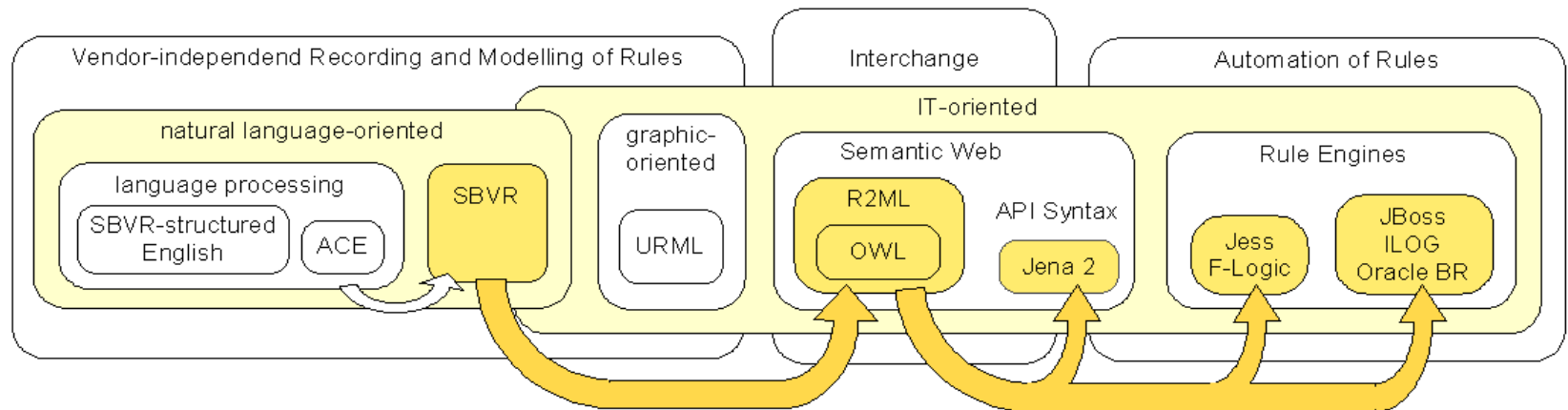
It is prohibited that an employee *is* a manager *over* the employee.

$\Box_{\text{deontic}} \neg \exists e_1 \in \text{employee} \exists e_2 \in \text{manager} ( \text{thing is thing} (e_1, e_2) \mid \text{employee over employee} (e_2, e_1) )$

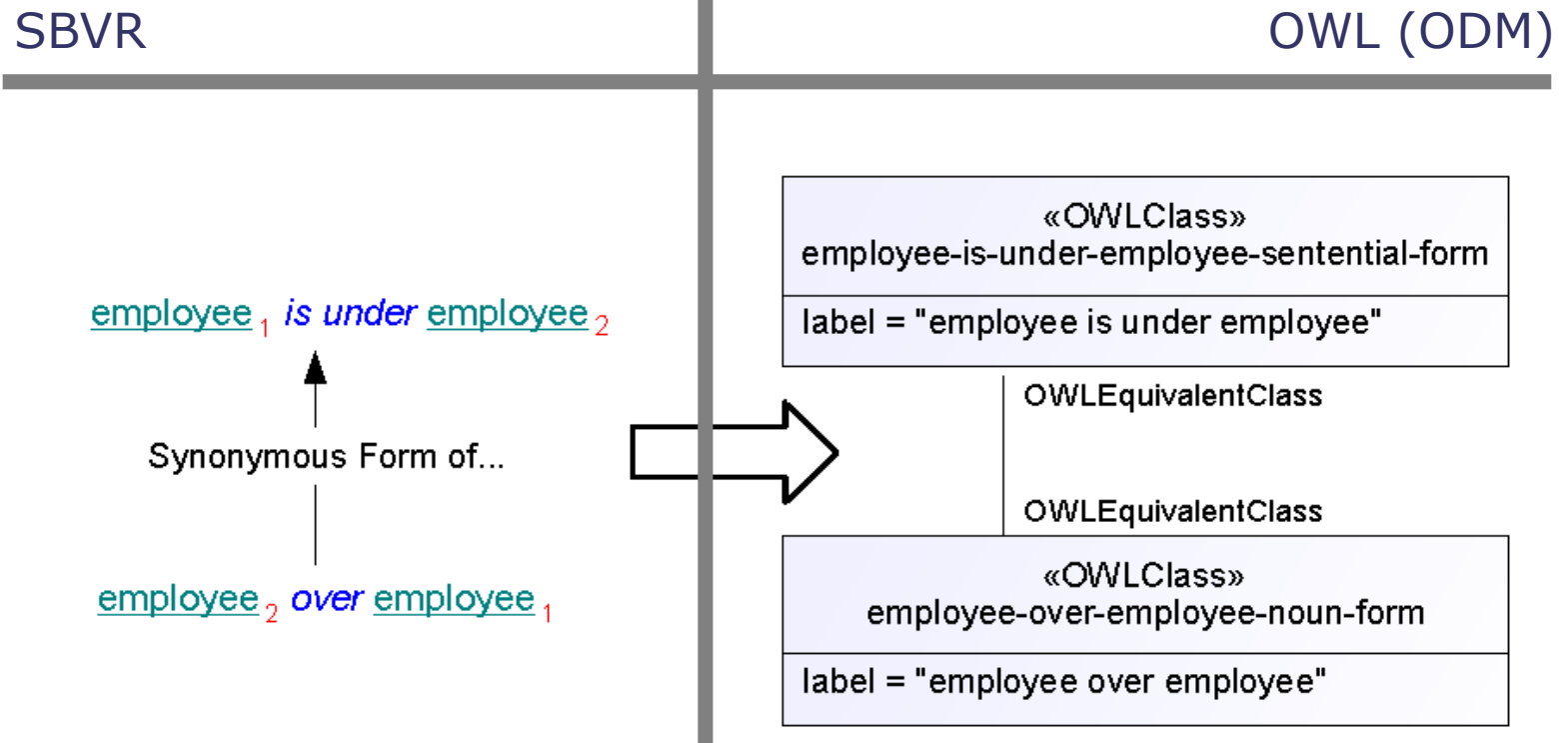
```
<RuleBase externalVocabularyID=...>
  <ruleSet xsi:type="IntegrityRuleSet">
    ...
    <integrityRule xsi:type="DeonticIntegrityRule">
      ...
      <quantifiedFormula xsi:type="ExistentiallyQuantifiedFormula">
        <objectVariable classID="manager" name="e2"/>
        ...
        <logicalFormula xsi:type="Conjunction">
          ...
          <logicalFormula xsi:type="ObjectDescriptionAtom"
            classID="employee-over-employee">
            <objectSlot referencePropertyID="employee-over-employee-role1">
              <object>
                <objectTerm xsi:type="ObjectVariable" name="e2"/>
              </object>
            </objectSlot>
          </logicalFormula>
        </logicalFormula>
      </quantifiedFormula>
    </integrityRule>
  </ruleSet>
</RuleBase>
```

# Summary and Outlook

- Conclusion
  - mapping approach is suitable (SBVR → Semantic Web)
  - prototype extensible (conceptually, EMF, Together QVT)
  - loss in expressive power (anticipated)
- Vision
  - excellent opportunities for automating SBVR-specified business rules
  - by efficient transformer tools via the Semantic Web (OWL, RIF)

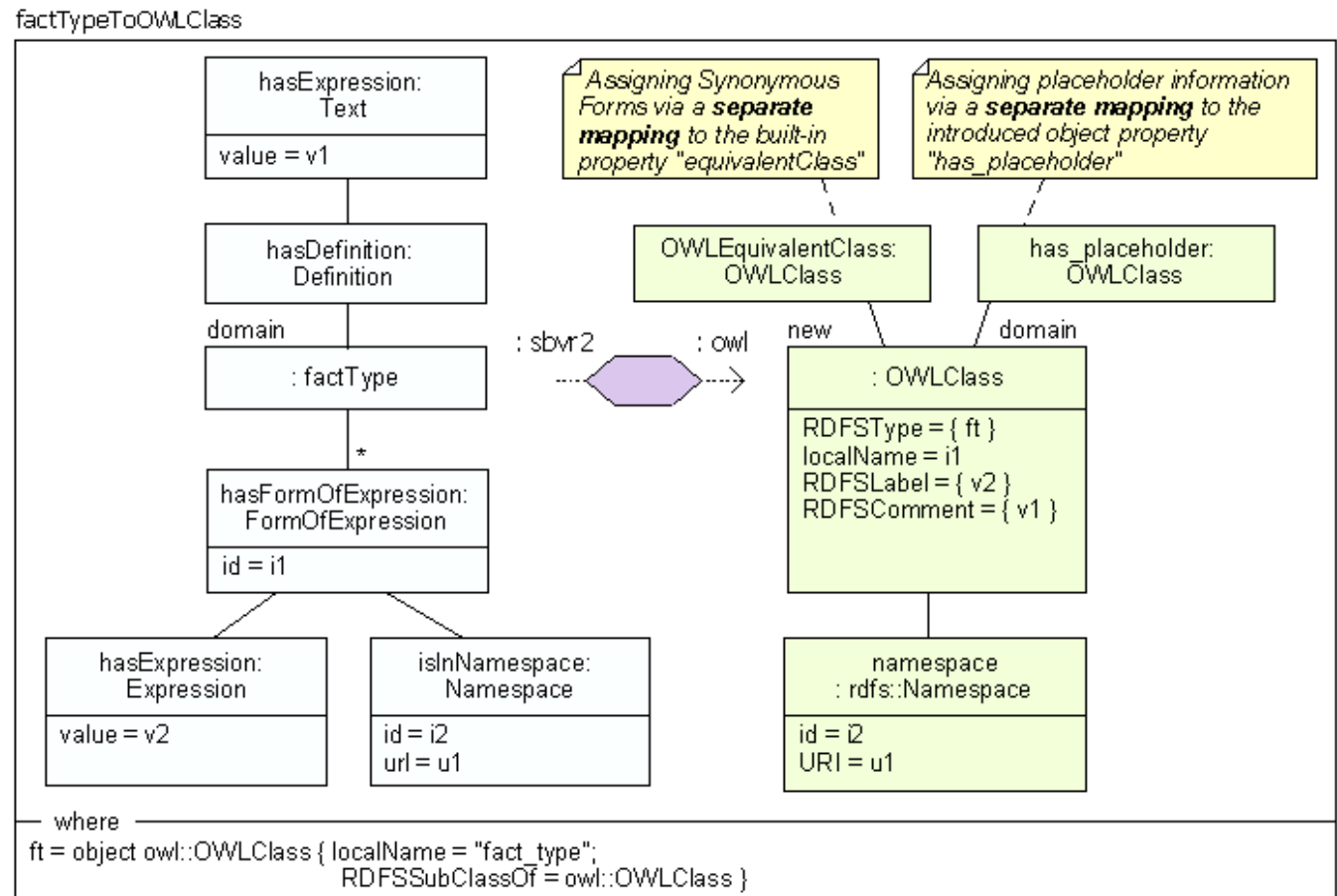


## Example: Mapping of Vocabulary



# Mapping Concept: SBVR FactType

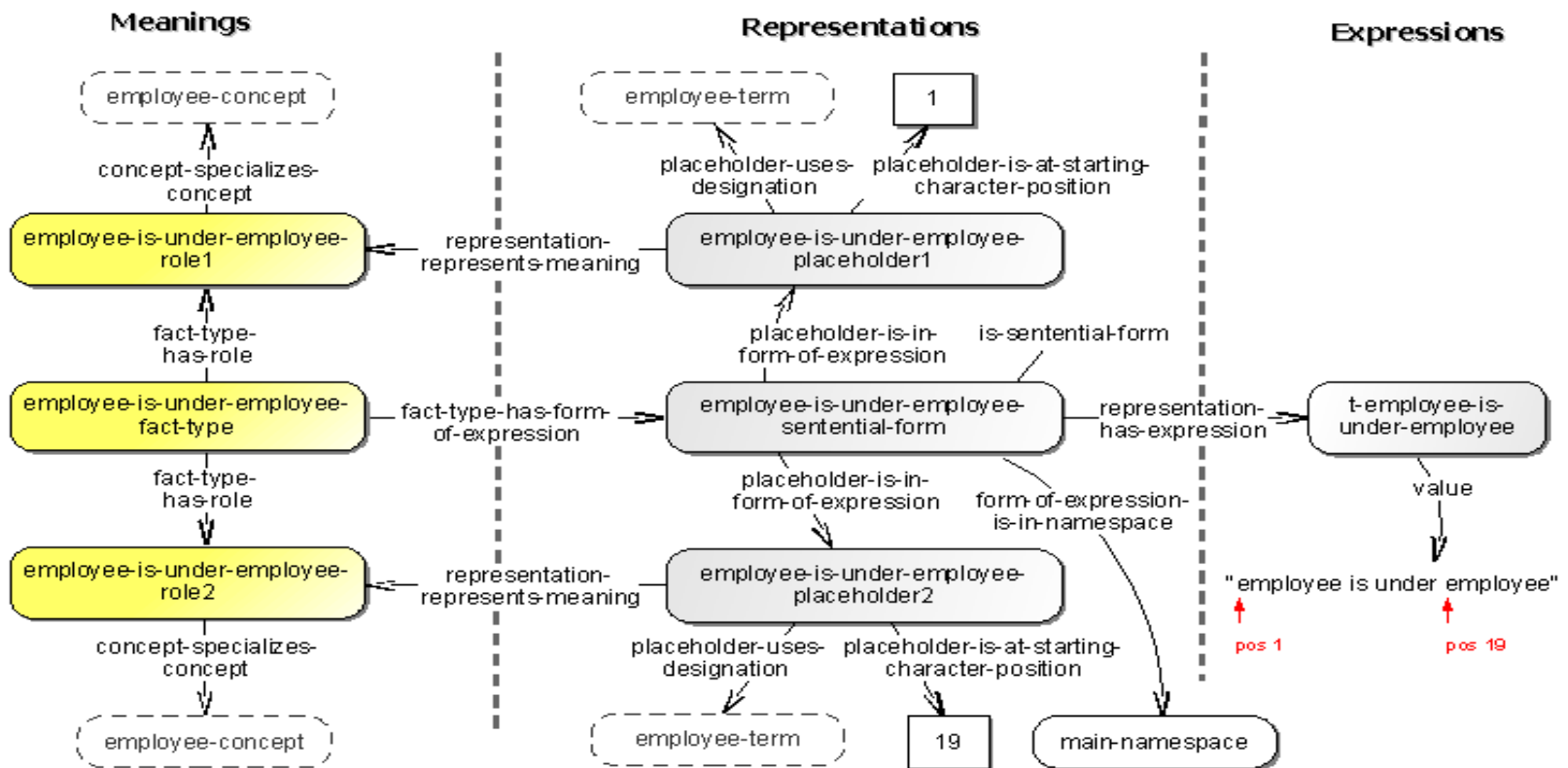
- Depiction following QVT (graphical syntax of the QVT relational language)
- For element and attribute names see metamodels





# Example: Domain Fact Type in SBVR graphically

– role and placeholder linkage simplified –



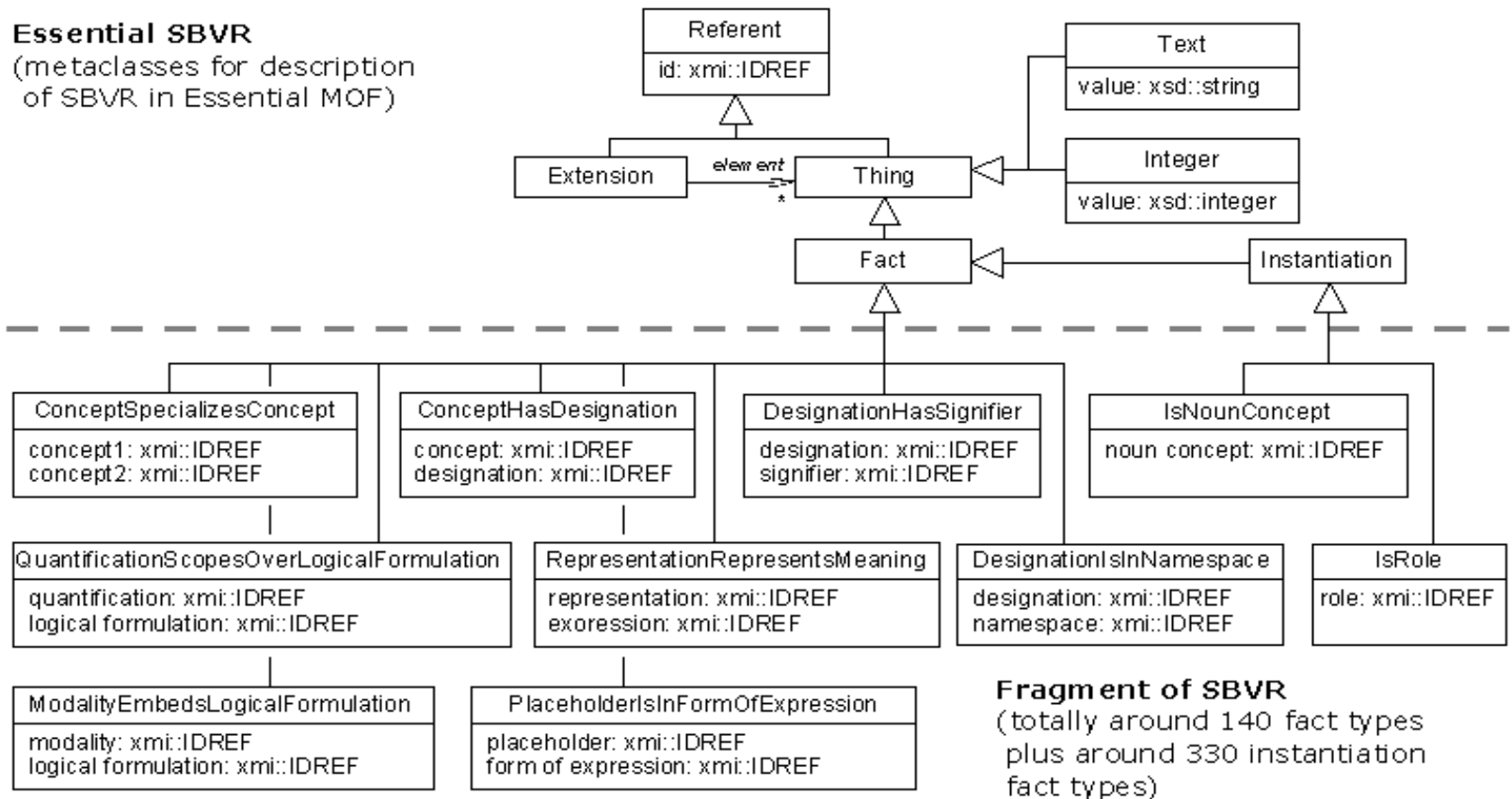
## Example: Domain Model in XMI ([Baisley], fragments)

```
<xmi...>
  <esbvr:Thing xmi:id="employee-is-under-employee-fact-type"/>
  <esbvr:Thing xmi:id="employee-is-under-employee-sentential-form"/>
  ...
  <esbvr:Extension xmi:id="employee-is-under-employee-roles"
    element="employee-is-under-employee-role1..."/>
  <esbvr:Text xmi:id="t-employee-is-under-employee"
    value="employee is under employee"/>
  ...
  <sbvr:fact-type-has-role
    fact-type="employee-is-under-employee-fact-type"
    role="employee-is-under-employee-roles"/>
  <sbvr:fact-type-has-form-of-expression
    concept="employee-is-under-employee-fact-type"
    form-of-expression="employee-is-under-employee-sentential-form"/>
  <sbvr:representation-has-expression
    representation="employee-is-under-employee-sentential-form"
    expression="t-employee-is-under-employee"/>
  ...
</xmi:xmi>
```

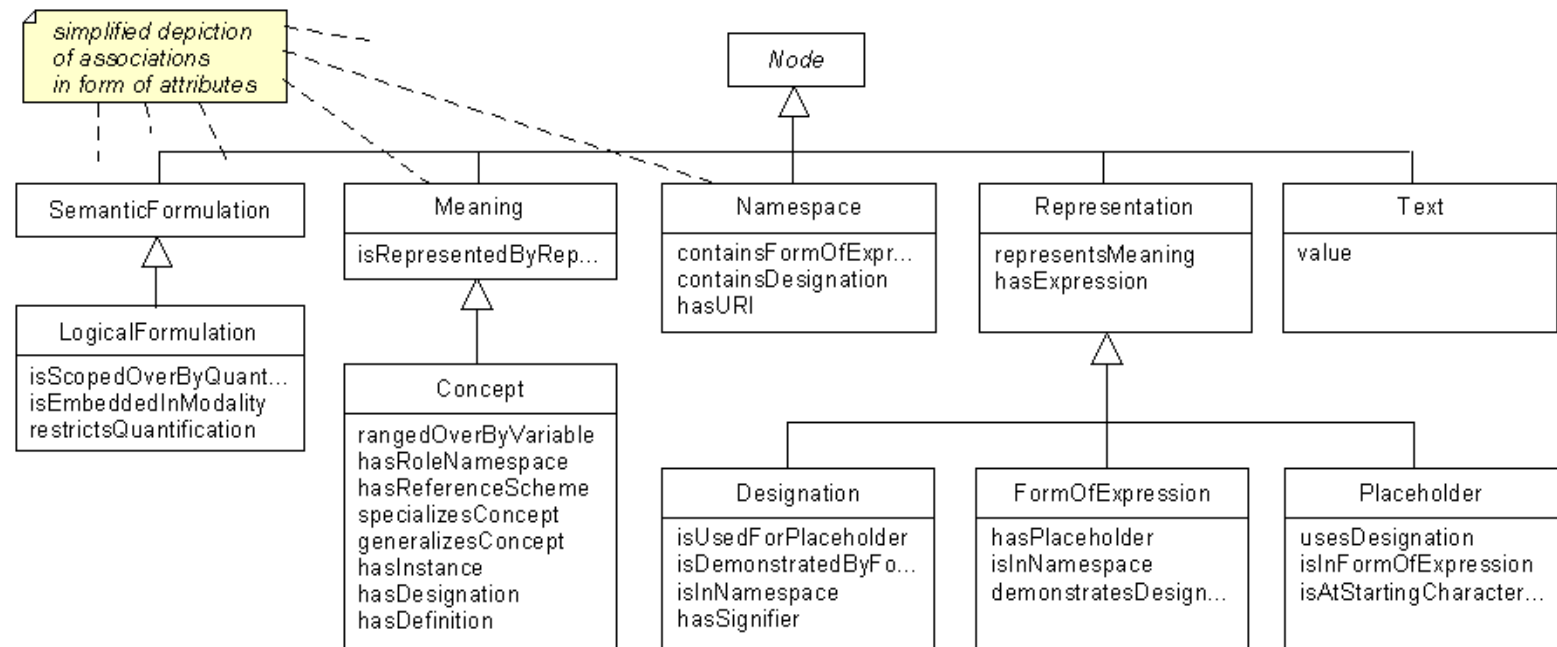
# Source Metamodel: SBVR (EMF implementation, fragment)

## Essential SBVR

(metaclasses for description of SBVR in Essential MOF)



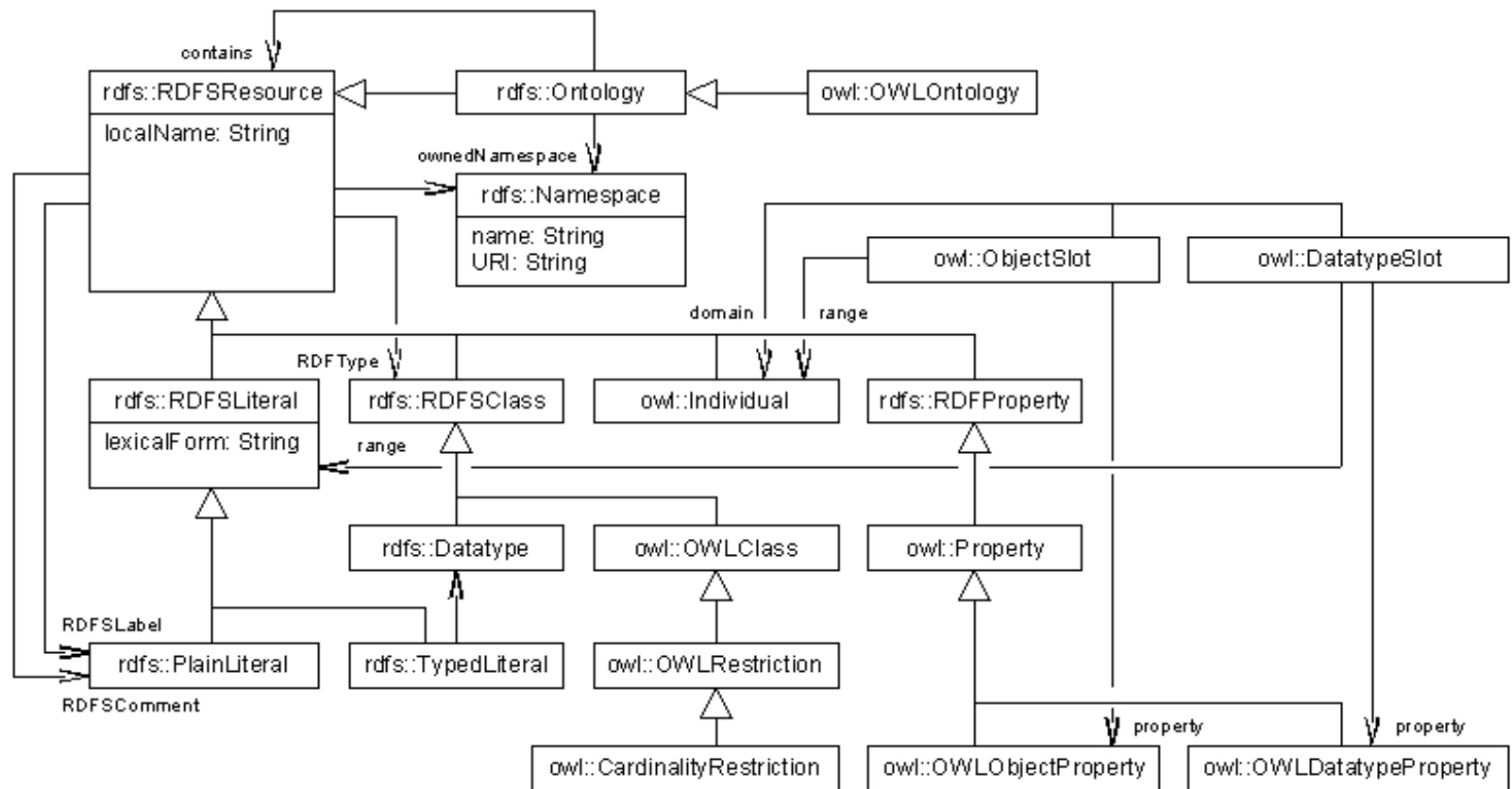
## Intermediate Metamodel: SBVR2 (fragment)



SBVR fact types embedded into the context of typed nodes standing for noun concepts

- thinner und deeper class hierarchy
- transformation: code simplification, performance ↑

## Target Metamodel: ODM (EODM implementation, fragment)



# Target Metamodel: R2ML (EMF implementation, fragment)

