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

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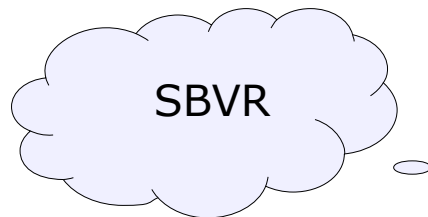
Orlando 2007-10-26



Nature of the Task – Mapping

SBVR

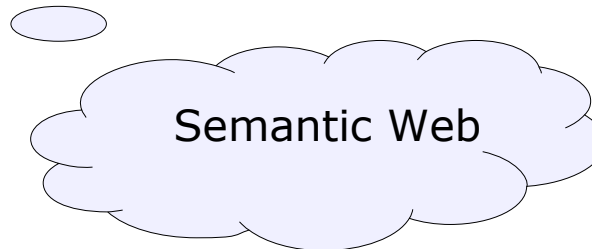
- OMG Specification, since 2006
- Semantics of Business Vocabularies and Business Rules
- essentially based on first order and modal logic
- orientation on the language of **business people**



?

Semantic Web (Vision, W3C Standards)

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

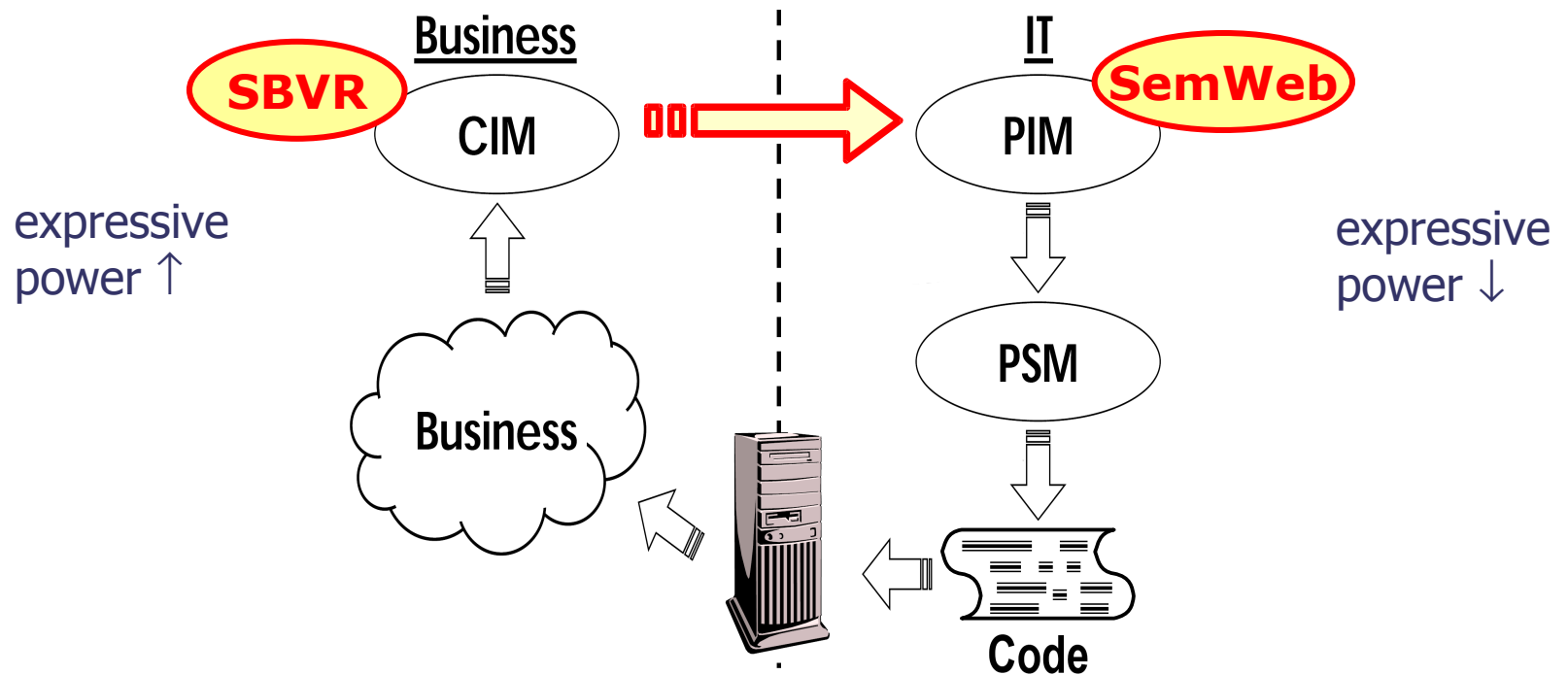


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 - model driven context
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 - language selection
(OWL, R2ML)
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SBVR in the MDA context

- 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

employee₁ *is under* employee₂

Synonymous Form

employee₂ *over* employee₁

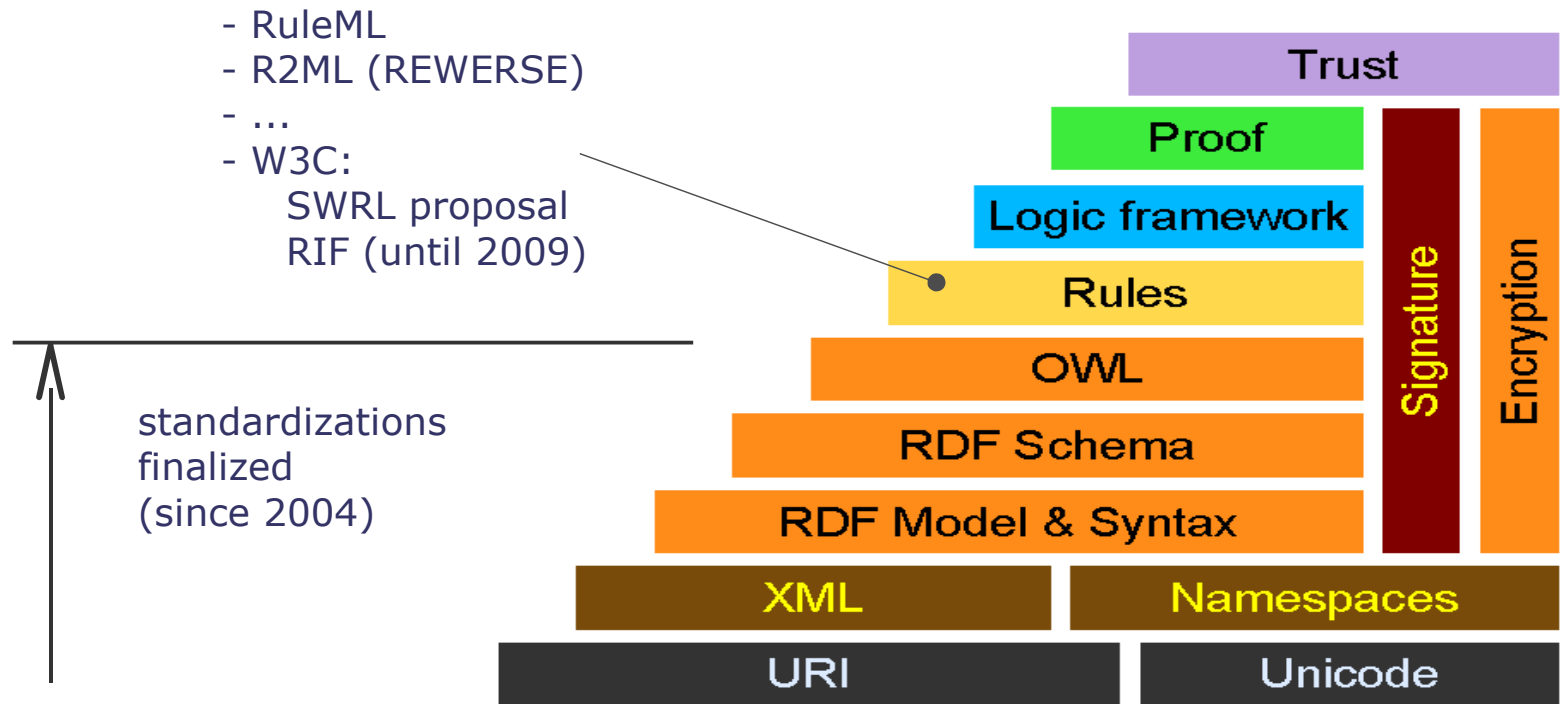
Rules

MC No Selfmanagement

Rule Statement

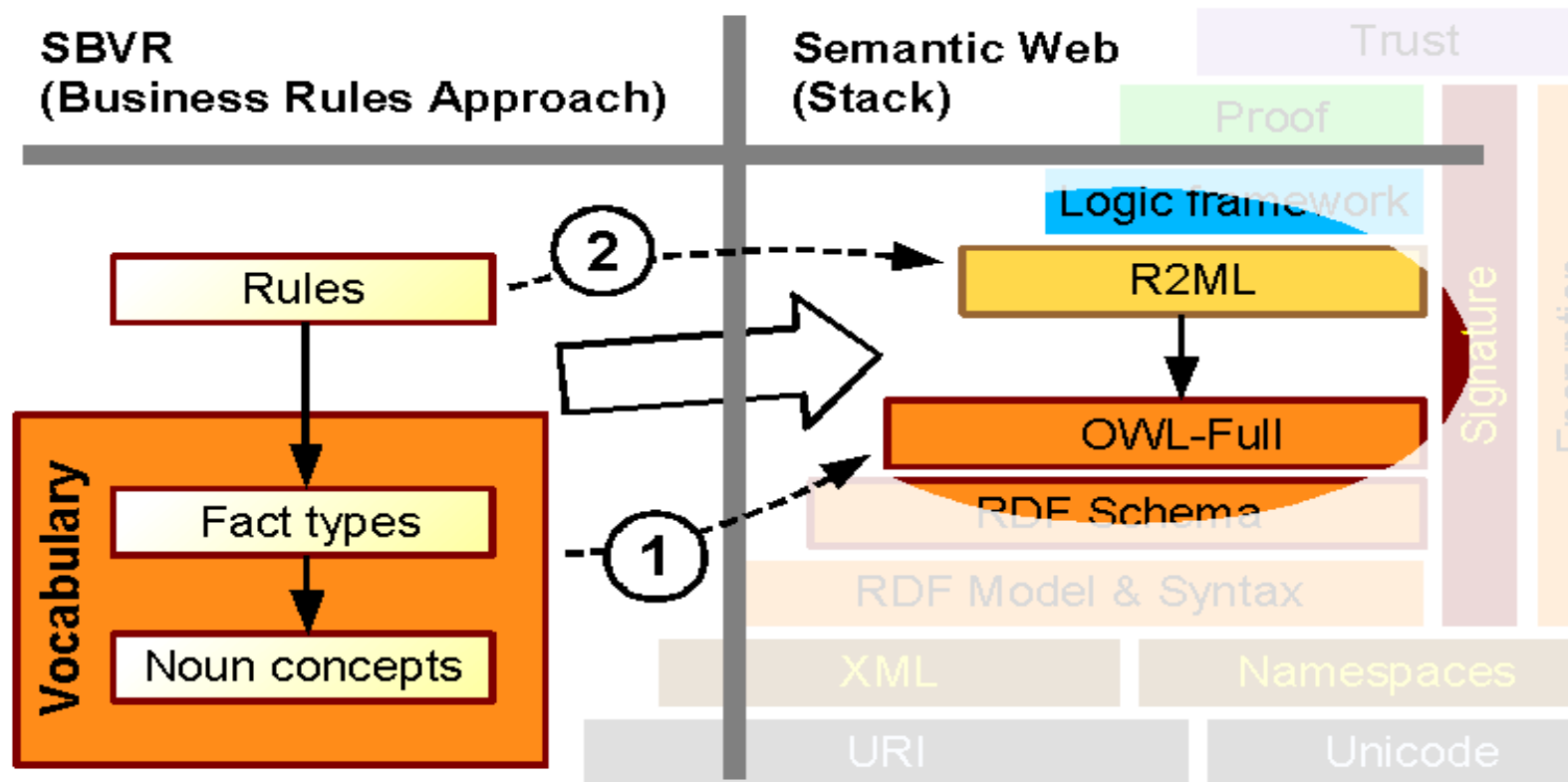
It is prohibited that an employee *is a*
manager *over* the employee

Semantic Web Overview

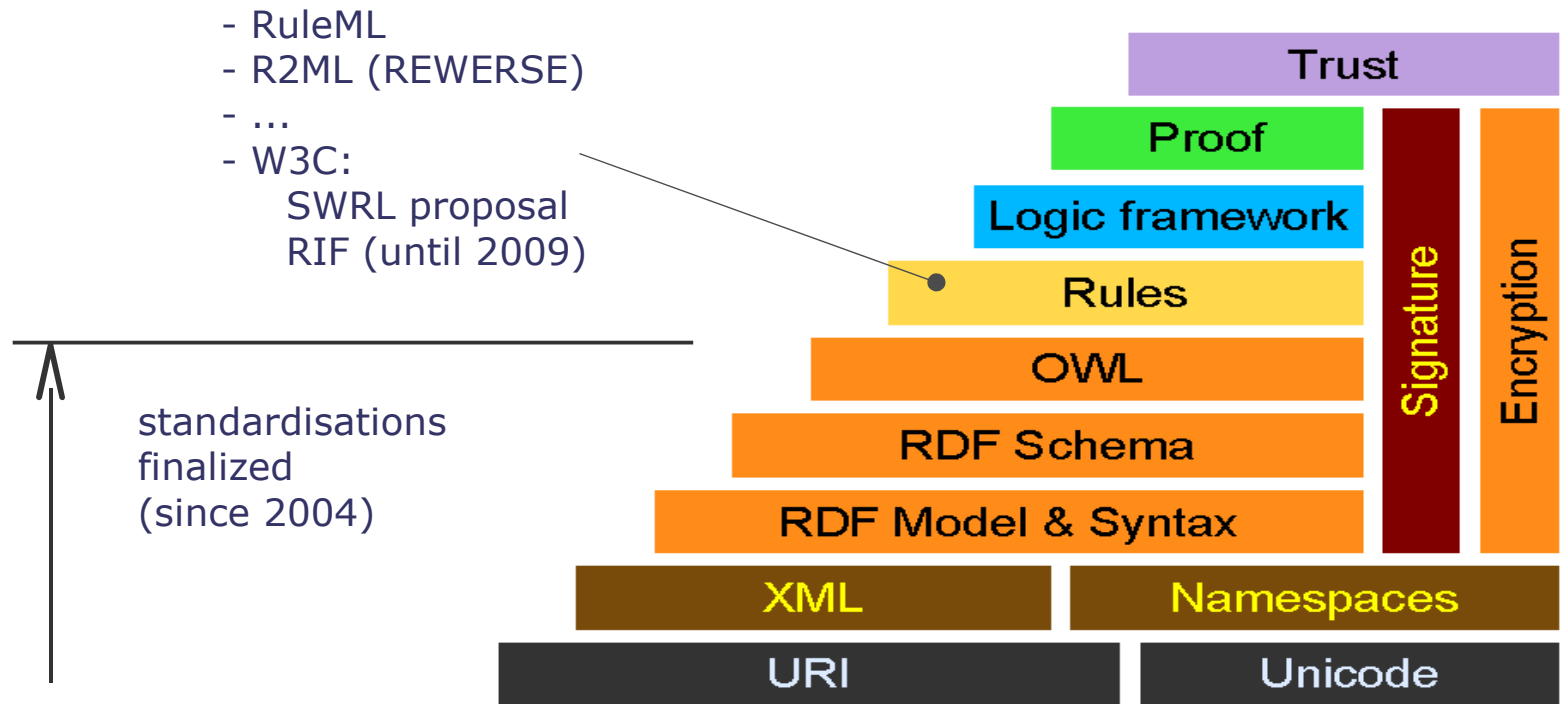


Semantic Web Stack (Version 2002)
[Berners-Lee]; adapted

Splitting Transformation, Target Languages

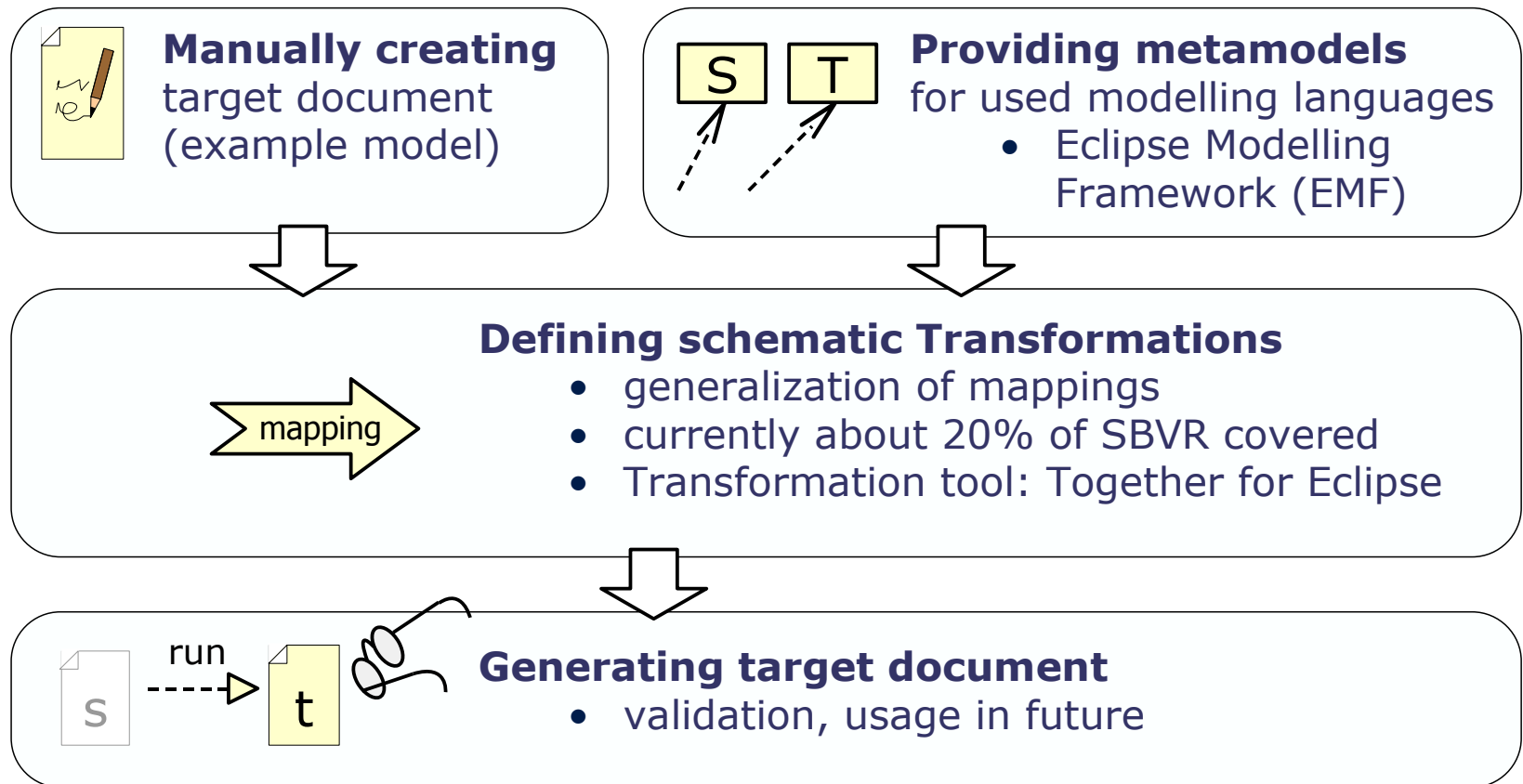


Semantic Web Overview

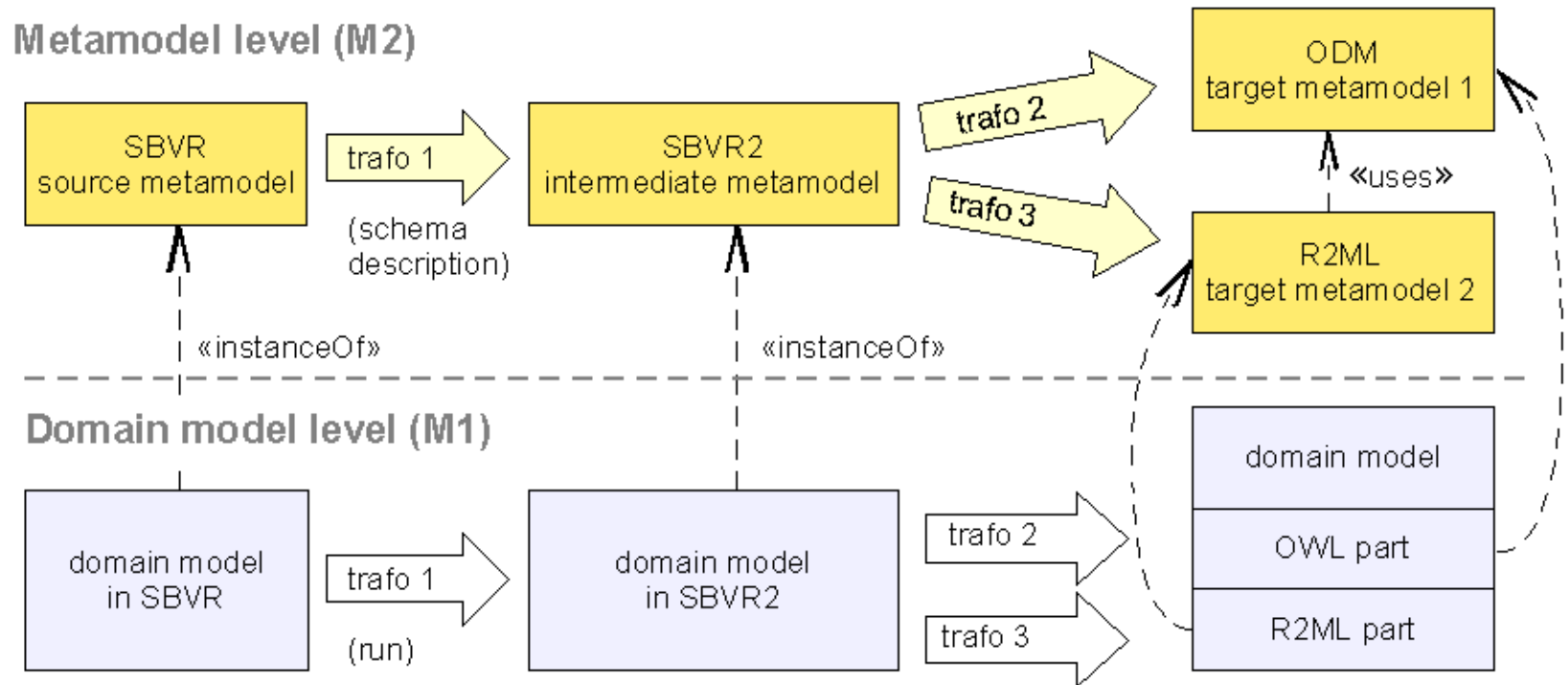


Semantic Web Stack (Version 2002)
[Berners-Lee]; adapted

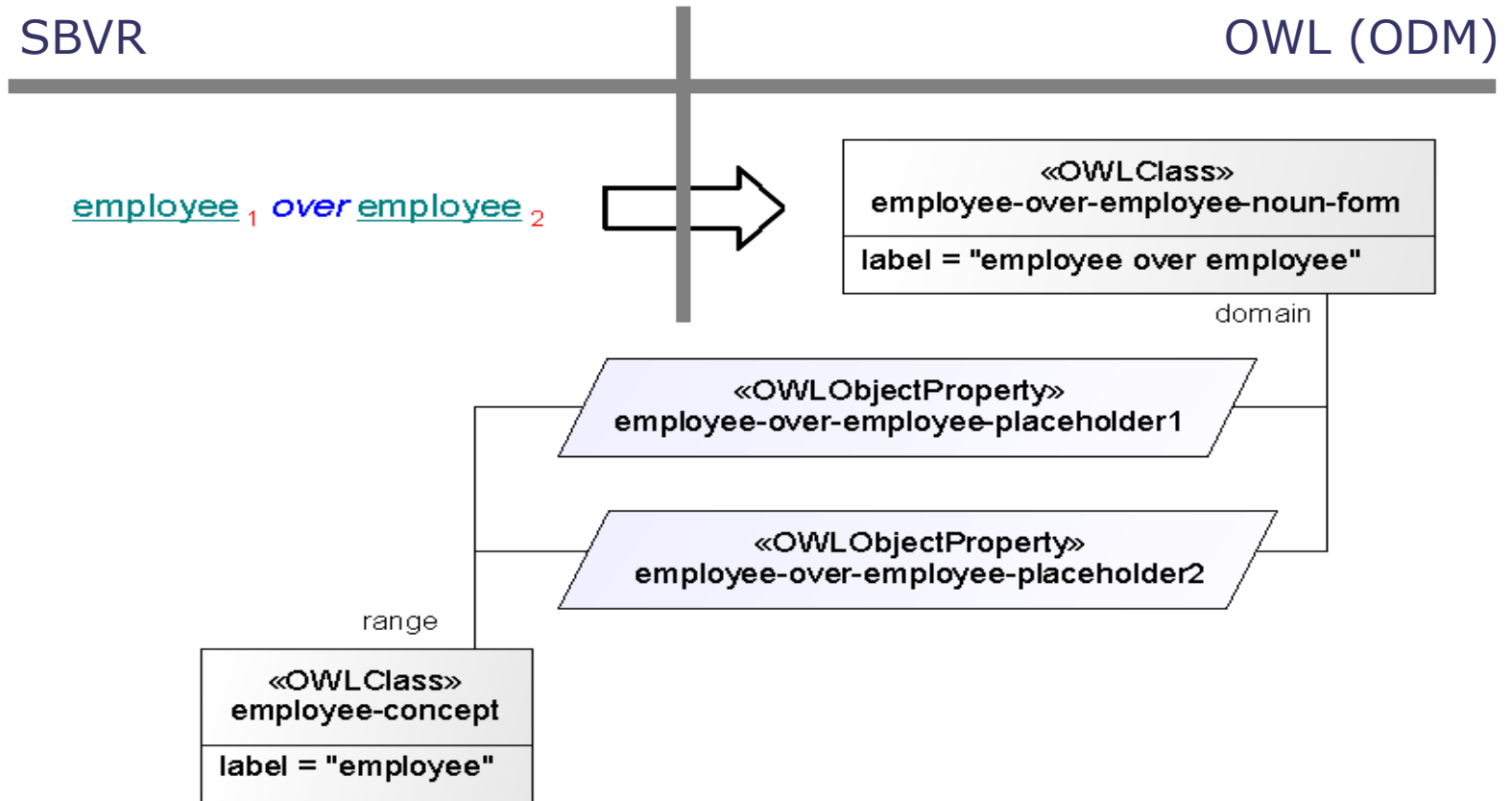
Mapping Procedure and Prototyping



Transformation Chain



Example: Mapping of Vocabulary



Rule Mapping

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

| | | |
|---|---------------------------------|-----------------------------------|
| <input type="checkbox"/> alethic | It is necessary that... | r2ml::AlethicIntegrityRule |
| <input type="checkbox"/> alethic | It is possible that... | no mapping possible |
| <input type="checkbox"/> deontic | It is obligatory that... | r2ml::DeonticIntegrityRule |
| <input type="checkbox"/> deontic \neg | It is prohibited that... | |
| <input type="checkbox"/> 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

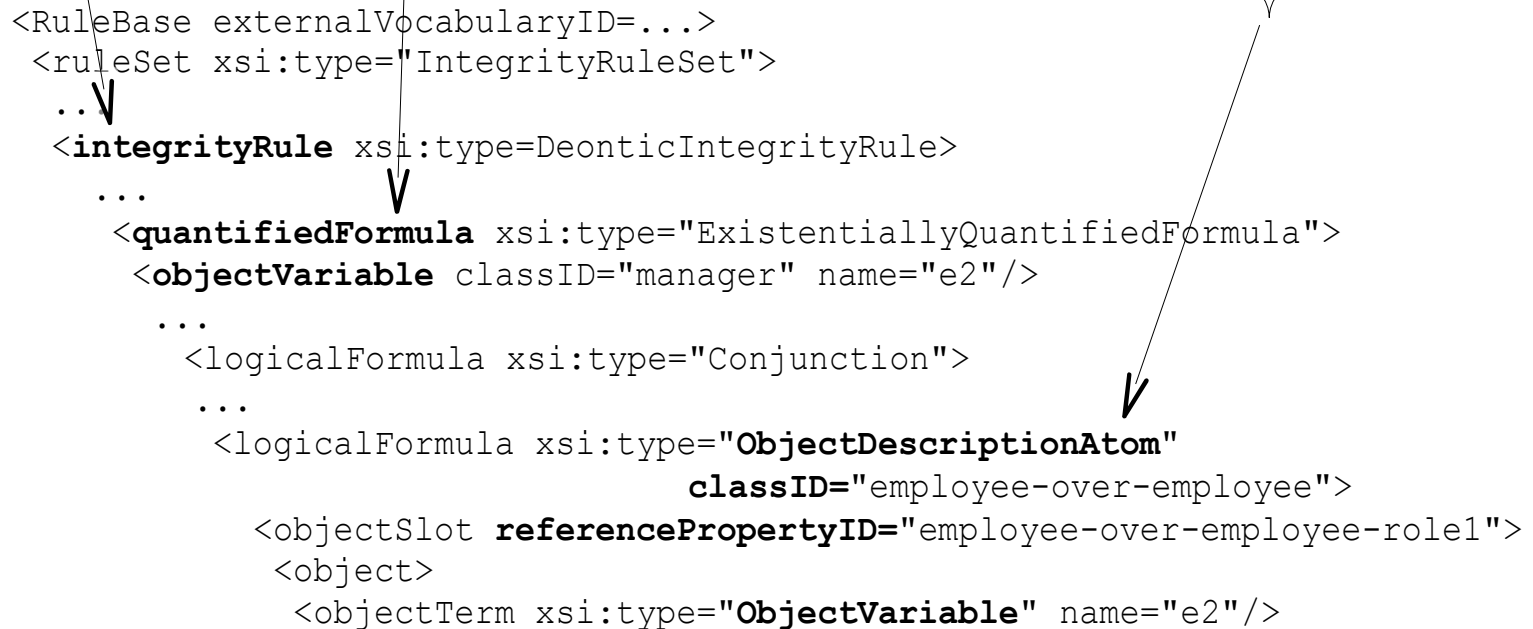
It is prohibited that an employee is a manager over the employee.

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

```

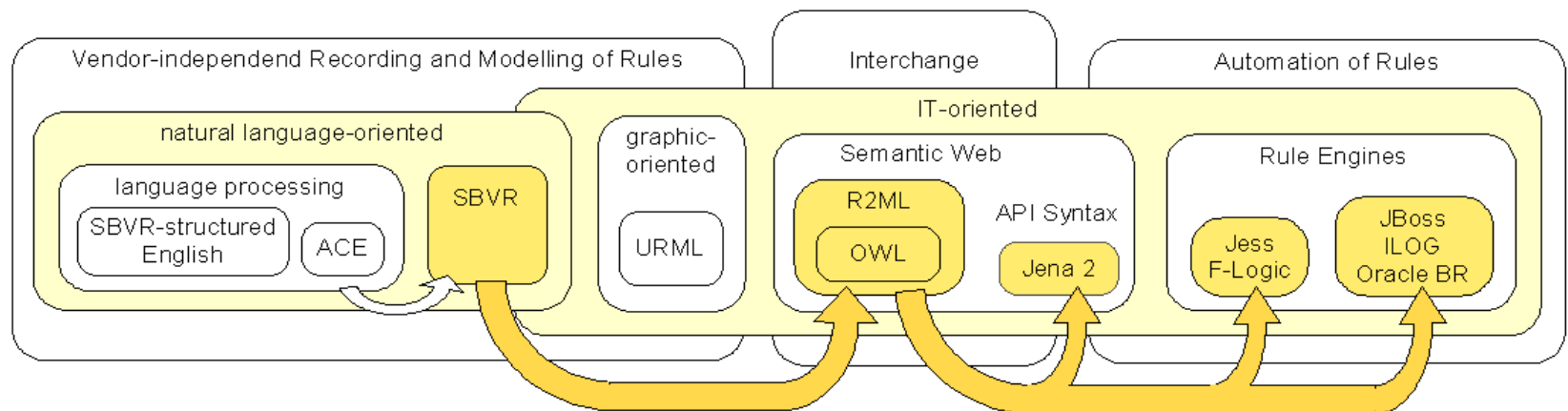
<RuleBase externalVocabularyID=...>
  <ruleSet xsi:type="IntegrityRuleSet">
    ..
    <integrityRule xsi:type=DeonticIntegrityRule>
      ...
      <quantifiedFormula xsi:type="ExistentiallyQuantifiedFormula">
        <objectVariable classID="manager" name="e2"/>
        ...
        <logicalFormula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

```



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

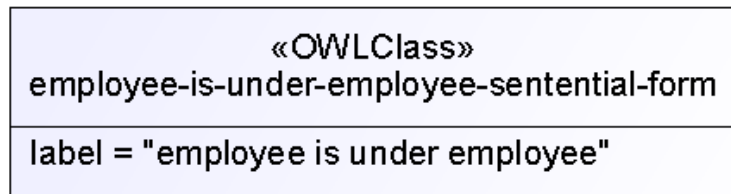
SBVR

OWL (ODM)

employee₁ *is under* employee₂

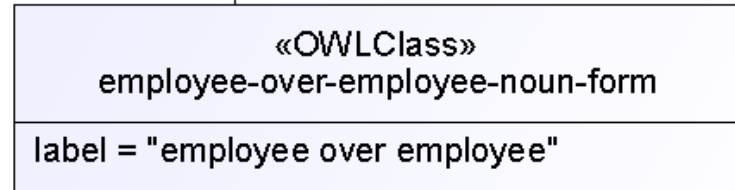
Synonymous Form of...

employee₂ *over* employee₁



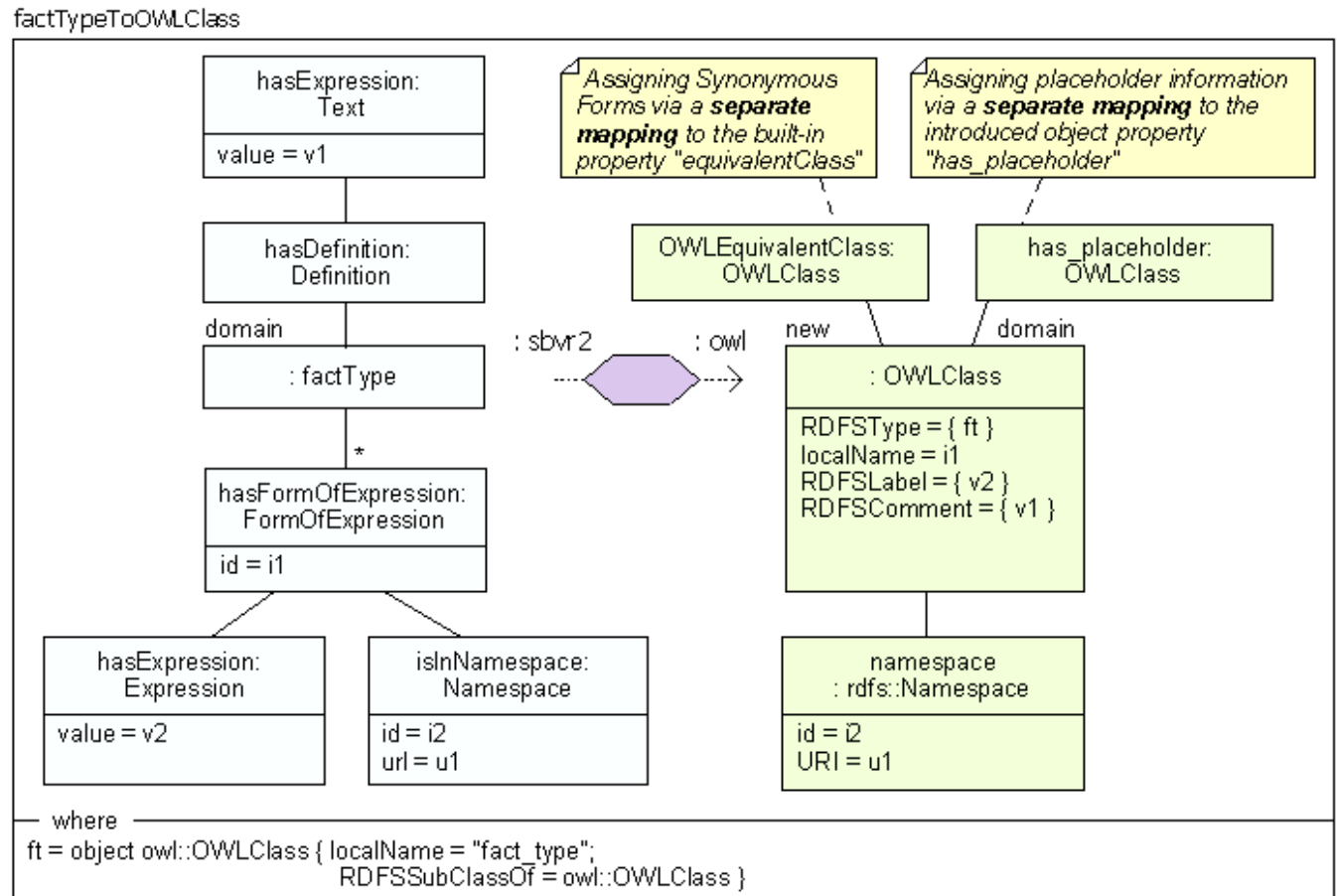
OWLEquivalentClass

OWLEquivalentClass



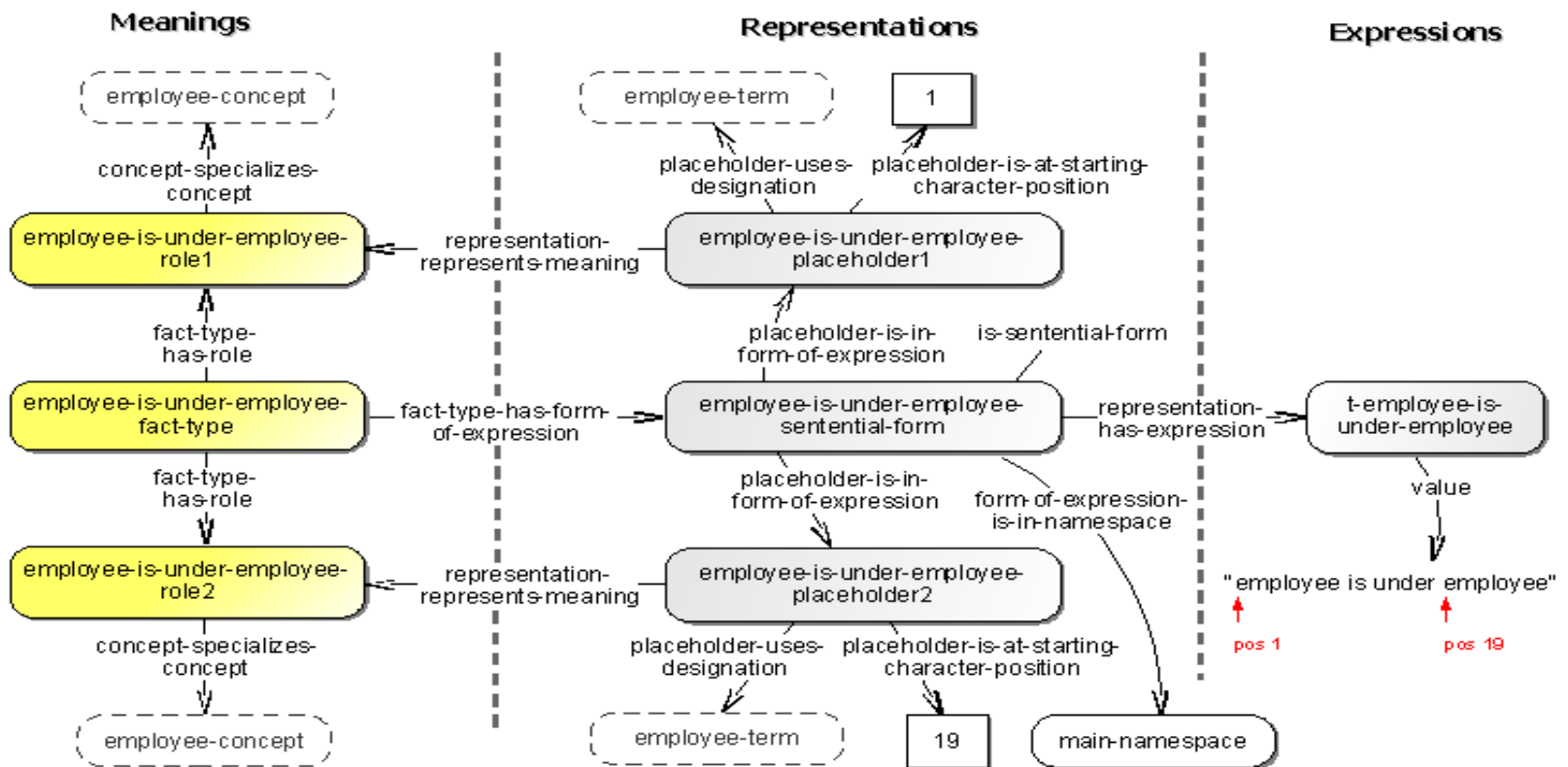
Mapping Concept: SBVR FactType

- 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 -



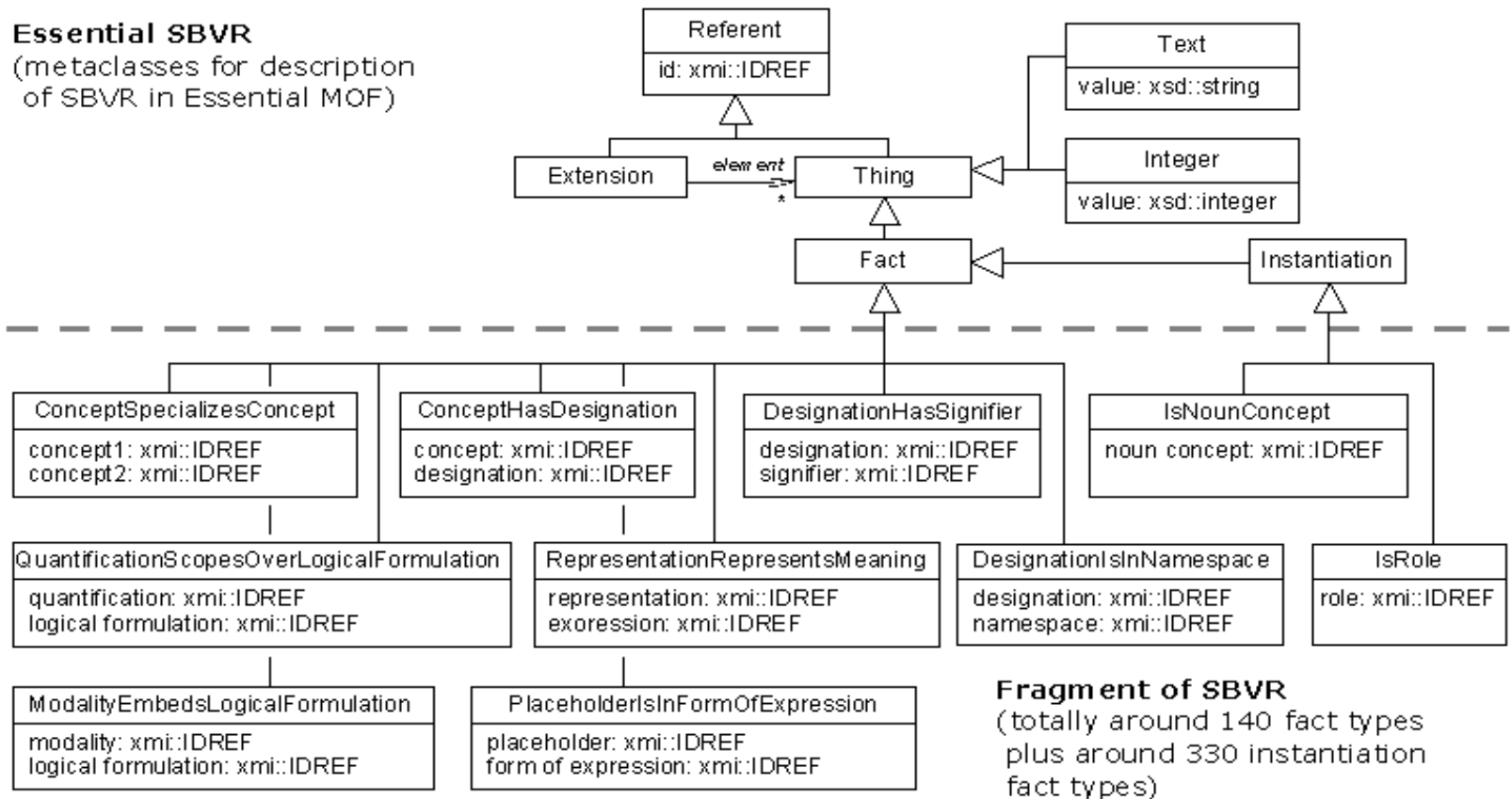
Example: Domain Model in XMI ([Baisley], fragments)

```
<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>
```

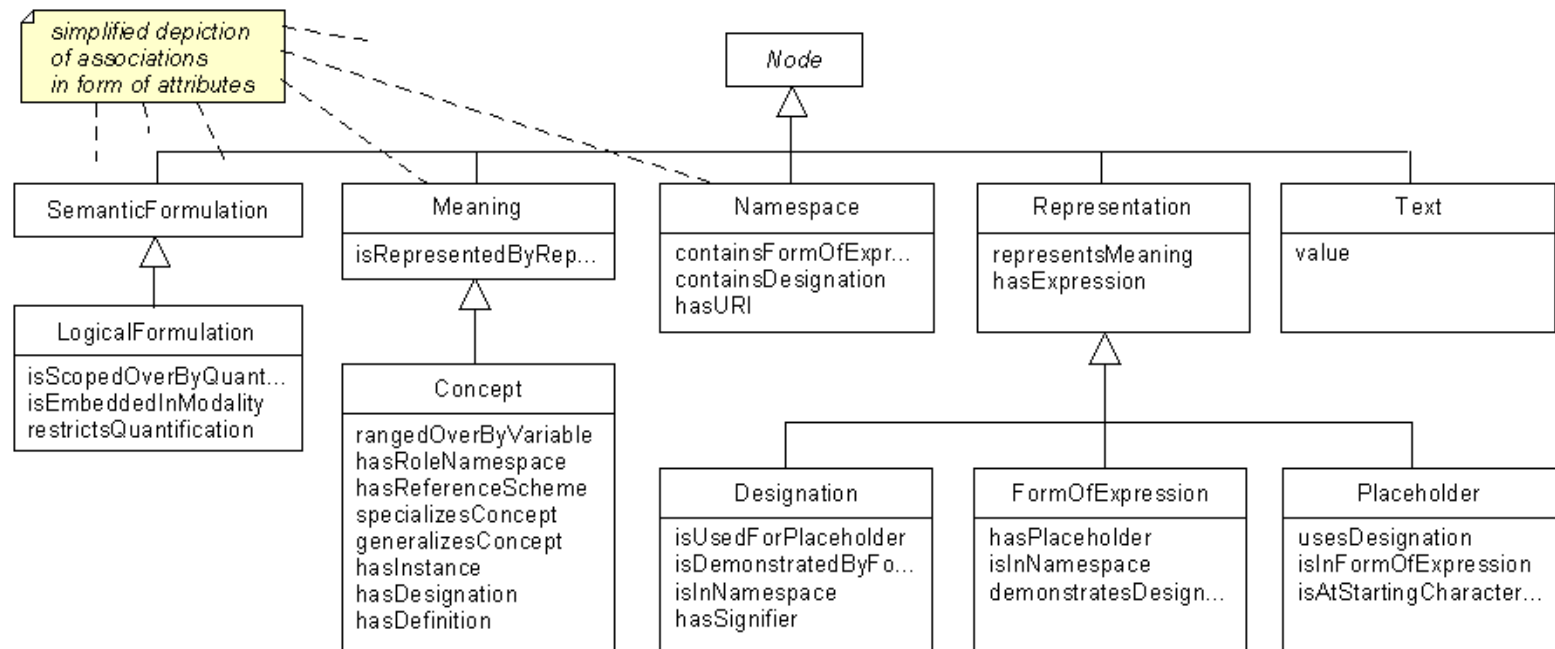
Source Metamodel: SBVR (EMF implementation, fragment)

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: R2ML (EMF implementation, fragment)

