

Separating Semantics and Implementation

From a Single Ontologically Sound Conceptual Model
to Multiple Physical Schema Languages

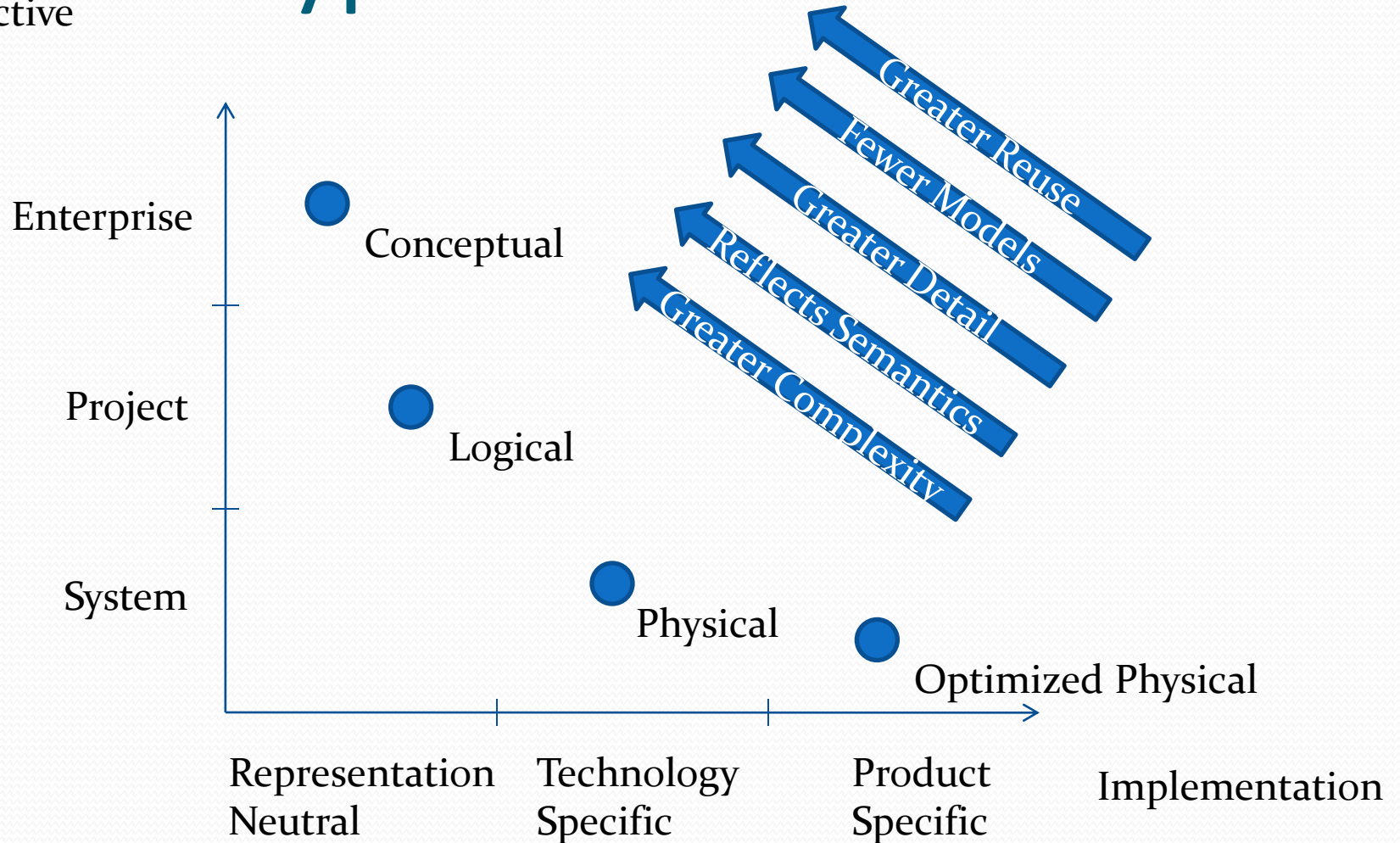
Bruce T. Bauman, U.S. DoD

Agenda

- Motivation
- Challenge
- OntoUML
- Compiling
 - RDFS
 - XSD
 - SQL
- Summary
- Further Work
- Conclusion

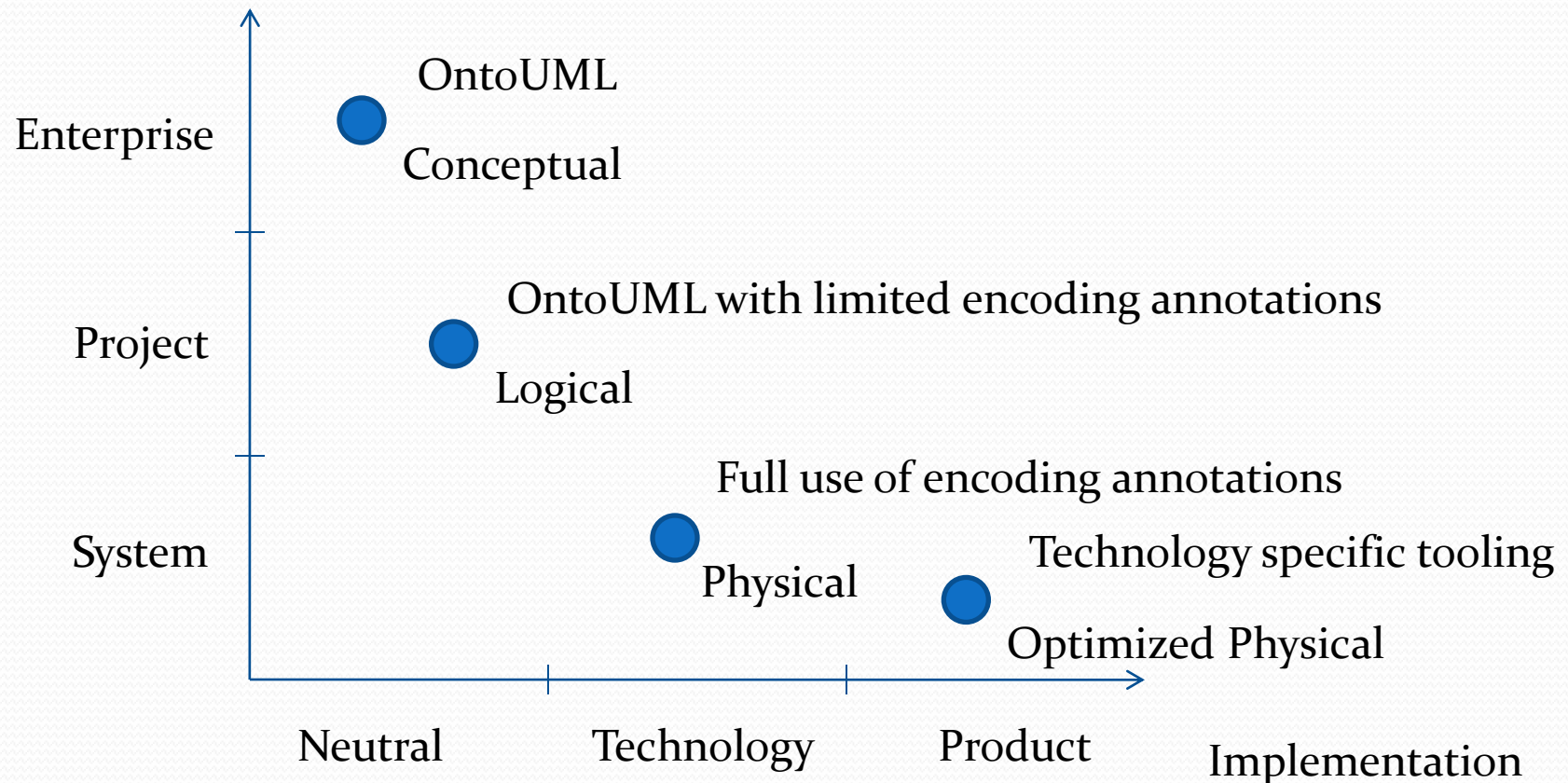
Model Types

Perspective



Model Types - Languages

Perspective



Why existing languages don't cut it

- Languages pitched at analysis and design (e.g., UML, ERD)
 - Optimized for design targeting specific technologies
 - Don't have a well defined semantic mapping
- Implementation languages (e.g., XML Schema, DDL, OWL, RDFS)
 - Clearly they have made implementation trades.
- Natural Language
 - Not precise enough.

Unified Foundational Ontology (UFO)

- Created by Giancarlo Guizzardi
- For Conceptual / Analysis modeling
- Ontologically Based
- UML class diagram notation

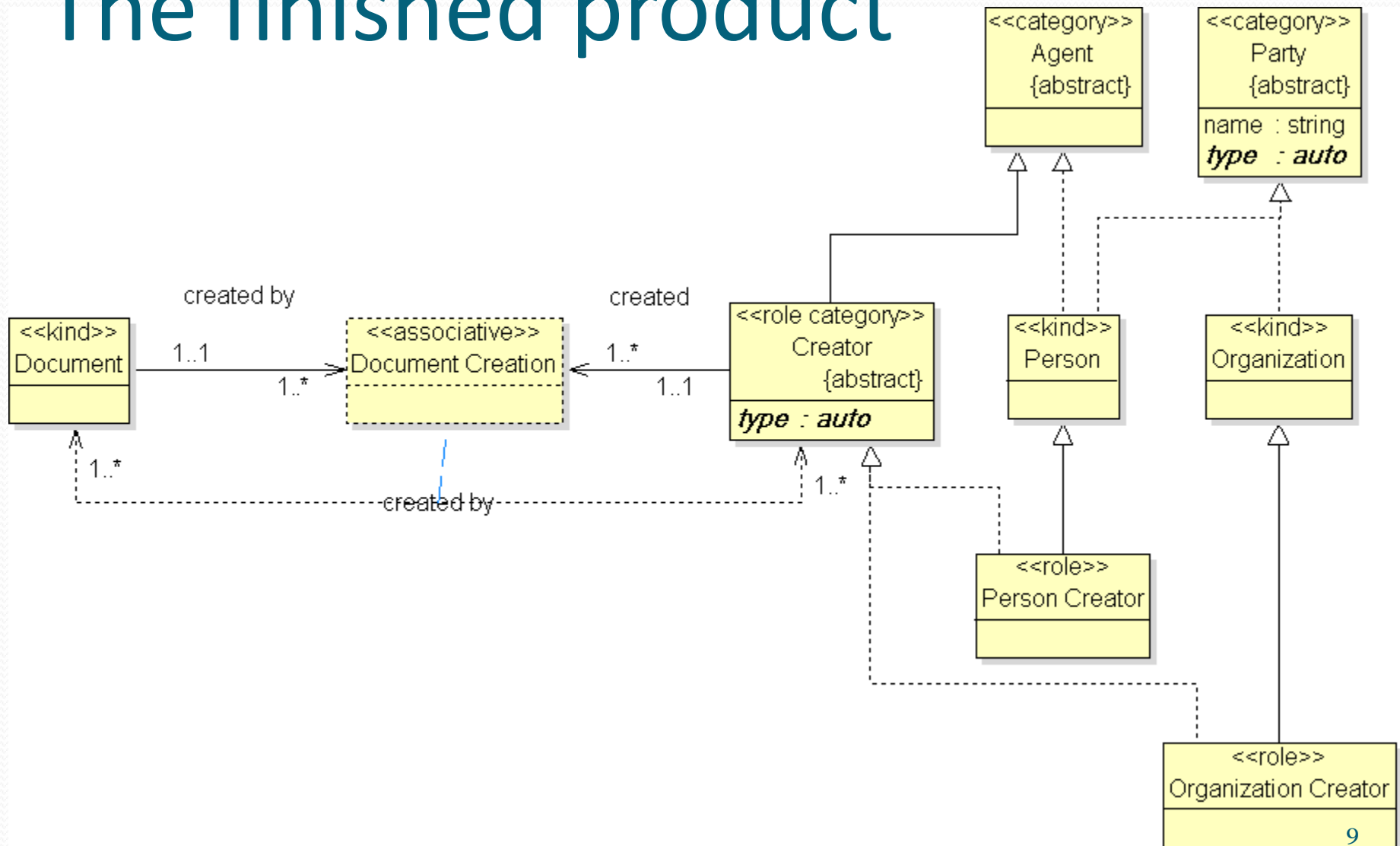
Our subset of OntoUML

- Classes
 - <<kind>> <<category>>
 - <<role>> <<roleCategory>>
 - <<dependent>> <<associative>>
 - <<event>>
- Associations
 - <<non-dependency>> <<dependency>>
 - <<composition>> <<aggregation>> (merelological relations)
- Attributes
- Datatypes
 - <<primitive>> <<domain>>3 <<enumeration>>
 - <<structure>> <<union>>3

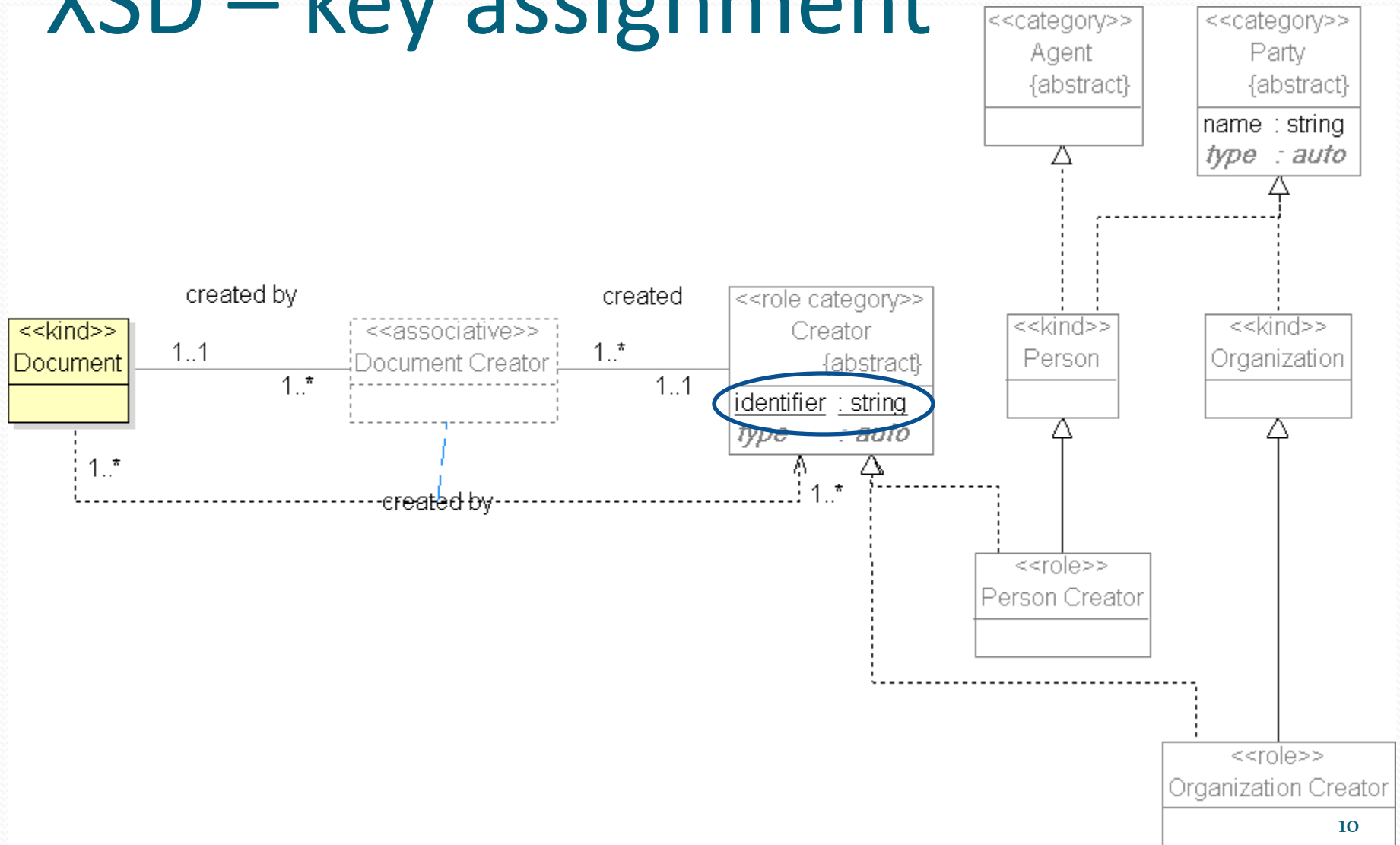
Classes

Concept	Rigidity	Identity	Existential Dependence	Example
<<kind>>	Rigid	Unified	Independent	Person
<<role>>	Anti-Rigid	Unified	Independent	Spouse
<<dependent>>	Rigid	Unified	Dependent	Mental State
<<associative>>	Rigid	Unified	Dependent	Marriage
<<category>>	Rigid	Dispersive	Independent	Party
<<roleCategory>>	Anti-Rigid	Dispersive	Independent	Customer

The finished product



XSD – key assignment



Association Encoding - embed



Include Association: true <input type="checkbox"/> false <input checked="" type="checkbox"/> Global <input type="checkbox"/>	
<u>A</u> N/A	<u>B</u> Navigable <input checked="" type="checkbox"/> Include Endpoint true <input type="checkbox"/> false <input checked="" type="checkbox"/> Encoding : embed

```

<Source>
  <Id>Value</Id>
  <Attrib>Value</Attrib>
  <Target>
    <Id>Value</Id>
    <Attrib>Value</Attrib>
  </Target>
</Source>
  
```

Association Encoding - reference



Include Association: true <input type="checkbox"/> false <input checked="" type="checkbox"/> Global <input type="checkbox"/>	
<u>A</u> N/A	<u>B</u> Navigable <input checked="" type="checkbox"/> Include Endpoint true <input checked="" type="checkbox"/> false <input type="checkbox"/> Encoding : reference

```

<Source>
  <Target>
    <Id>FK Value</Id>
  </Target>
</Source>
  
```

Association Encoding - link



Include Association: true <input type="checkbox"/> false <input checked="" type="checkbox"/> Global <input type="checkbox"/>	
<u>A</u> N/A	<u>B</u> Navigable <input checked="" type="checkbox"/> Include Endpoint true <input checked="" type="checkbox"/> false <input type="checkbox"/> Encoding : link

```

<Source>
<Target href="" />
</Source>
  
```

Association Encoding - parts



Include Association: true <input type="checkbox"/> false <input checked="" type="checkbox"/> Global <input type="checkbox"/>	
<u>A</u> N/A	<u>B</u> Navigable <input checked="" type="checkbox"/> Include Endpoint true <input type="checkbox"/> false <input checked="" type="checkbox"/> Encoding : reference

```

<Source>
  <Target>FK Value</Target>
</Source>
  
```

Association Encoding - parts



Include Association: true <input checked="" type="checkbox"/> false <input type="checkbox"/> Global <input type="checkbox"/>	
<u>A</u> N/A	<u>B</u> Navigable <input checked="" type="checkbox"/> Include Endpoint true <input checked="" type="checkbox"/> false <input type="checkbox"/> Encoding : reference

```

<Source>
  <Association>
    <Target>
      <Id>FK Value</Id>
    </Target>
  </Association>
</Source>
  
```

Association Encoding - parts



Include Association: true <input checked="" type="checkbox"/> false <input type="checkbox"/> Global <input checked="" type="checkbox"/>	
<u>A</u> N/A	<u>B</u> Navigable <input checked="" type="checkbox"/> Include Endpoint true <input type="checkbox"/> false <input checked="" type="checkbox"/> Encoding : reference

```

<Association>
  <Source>FK Value</Source>
  <Target>FK Value</Target>
</Association>
  
```


Successes / Observations

- It actually does work
- Used on many projects
- Model reuse is occurring
- Encoding rules are sufficient however new encoding patterns are still being discovered
- Projects select very different encodings

Challenges

- Hard but not too hard
 - Physical Model Duality (encoding can seem like magic)
 - Tools
- Really Hard
 - Talent
 - Culture
- Things to consider
 - Return on Investment

Future Work

- Better visualization
- Change management
- Continue to improve documentation
- Prototype other implementations
- Explore semi-automatic translation

Questions

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