

# An evaluation of the strict meaning of owl:sameAs in the field of BIM GIS Integration

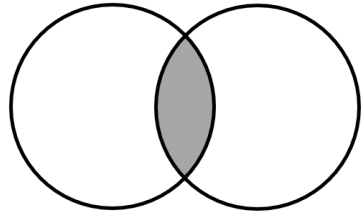
M.sc. F. Beck, M.sc. A. Abualdenien, Prof. A. Borrmann

12th October 2021



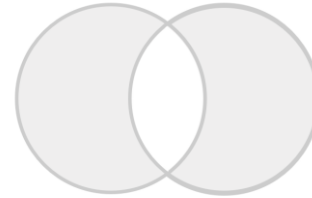
- Why BIM-GIS Integration?
- Problem of BIM-GIS Integration
- Semantics of Links (e.g. owl:sameAs)
- Current solution approaches
- Conclusion

# Why BIM-GIS Integration?



... because they cover the **same** information

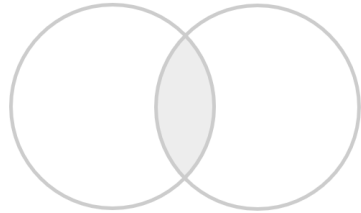
e.g. urban solar energy assessment, indoor navigation



... because they cover **different** information

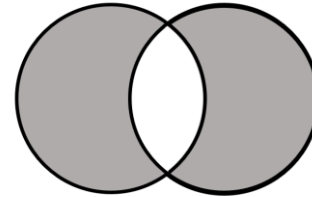
e.g. urban firefighting simulation

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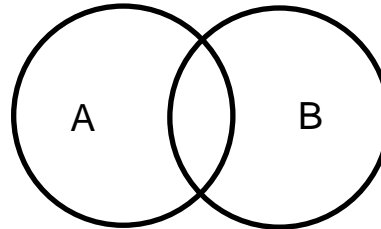


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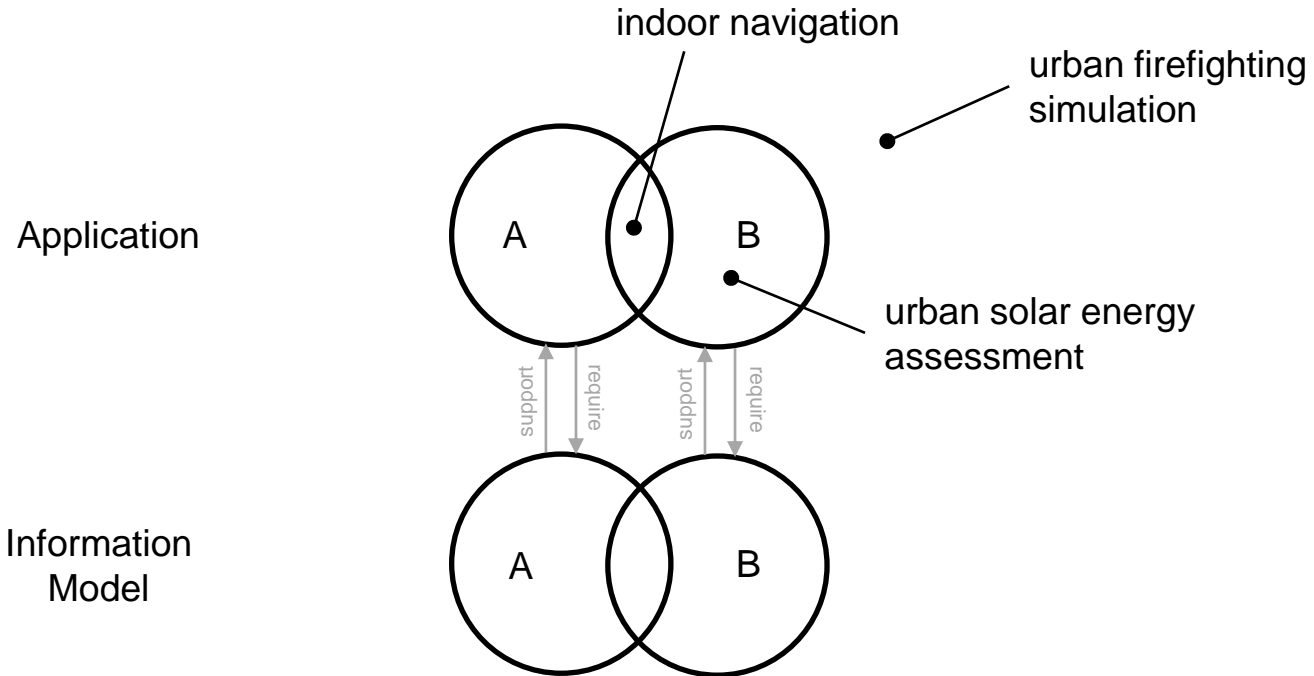
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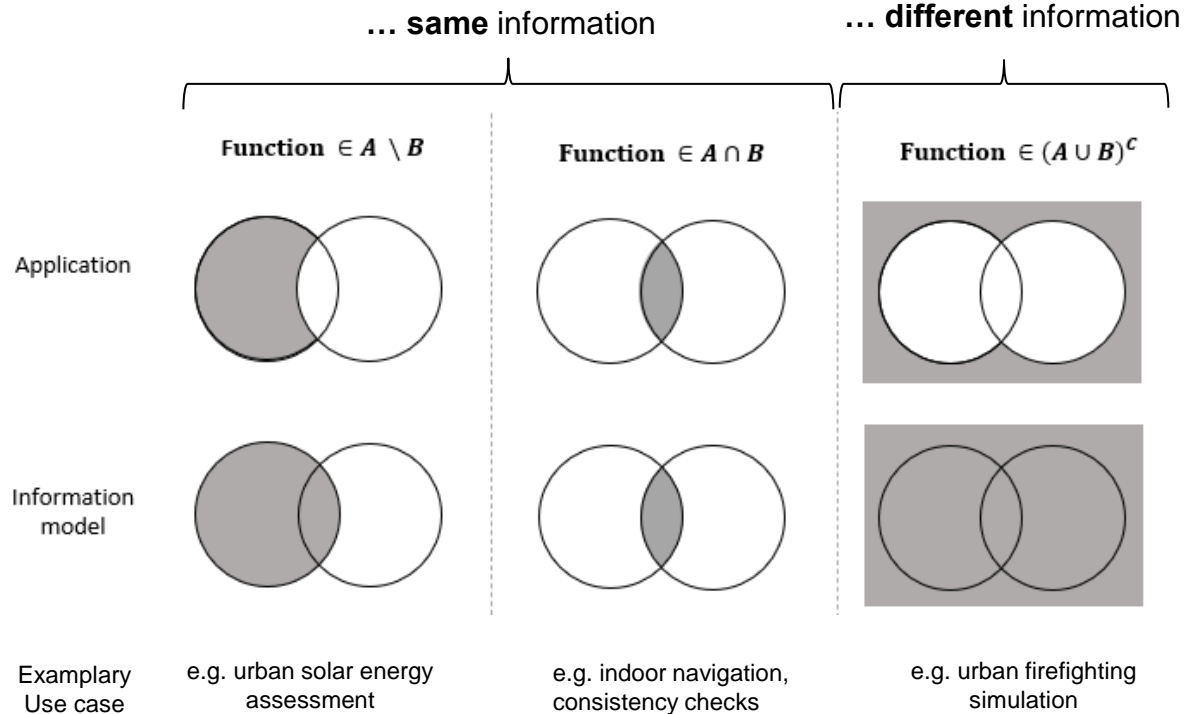
Information  
Model



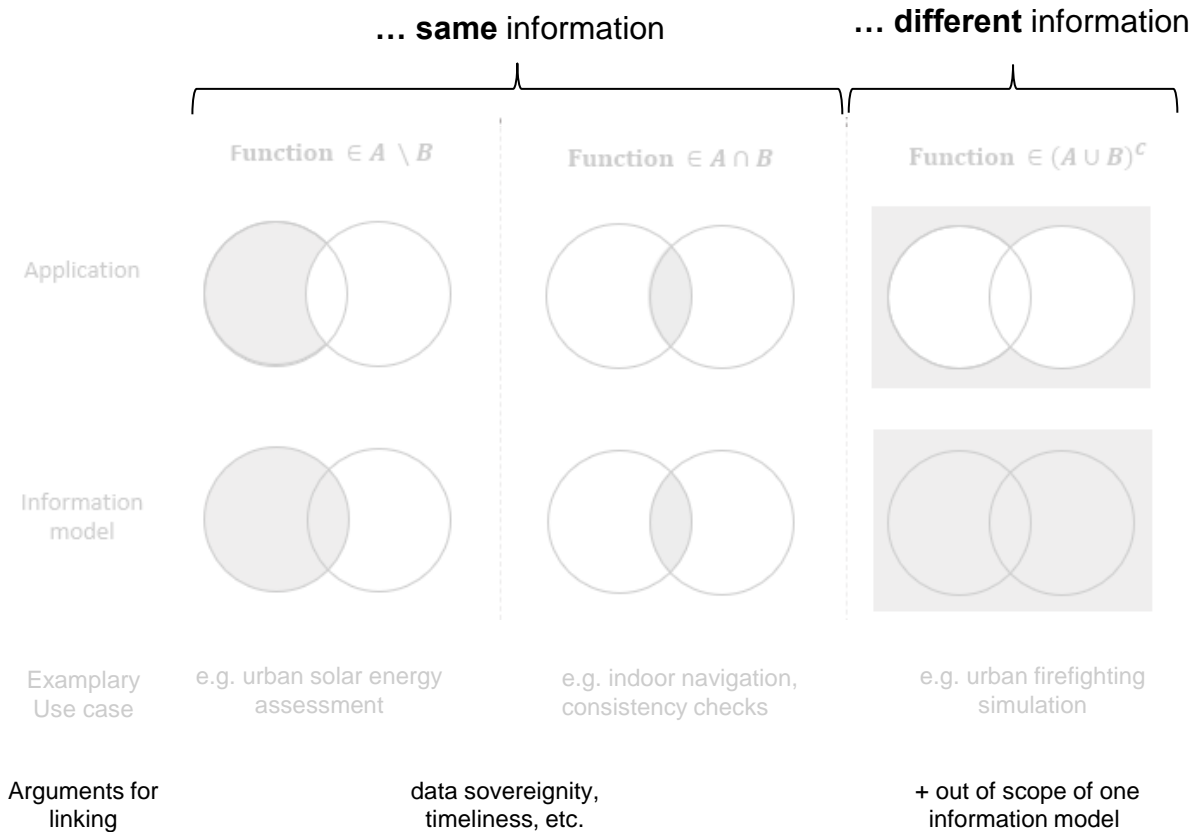
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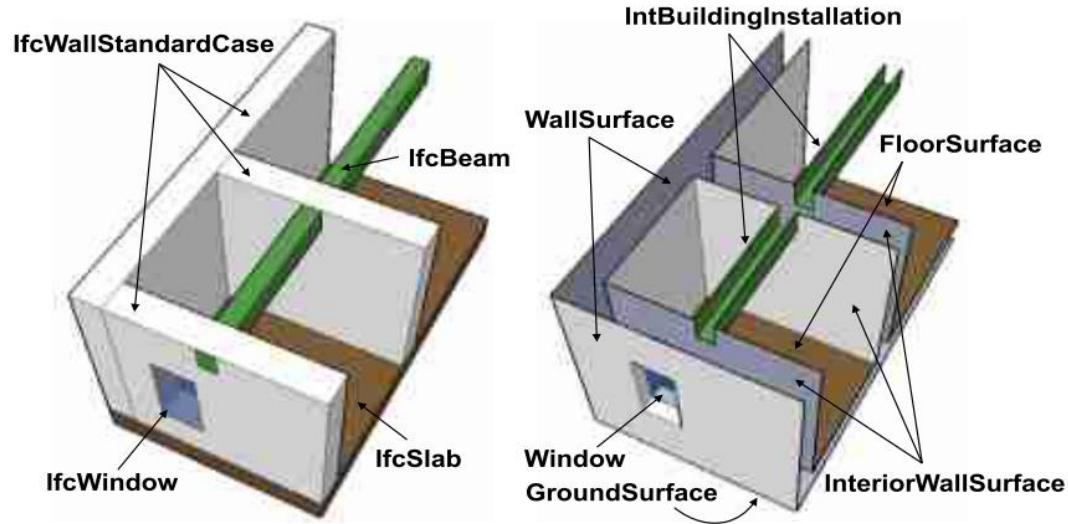


# Why linking?



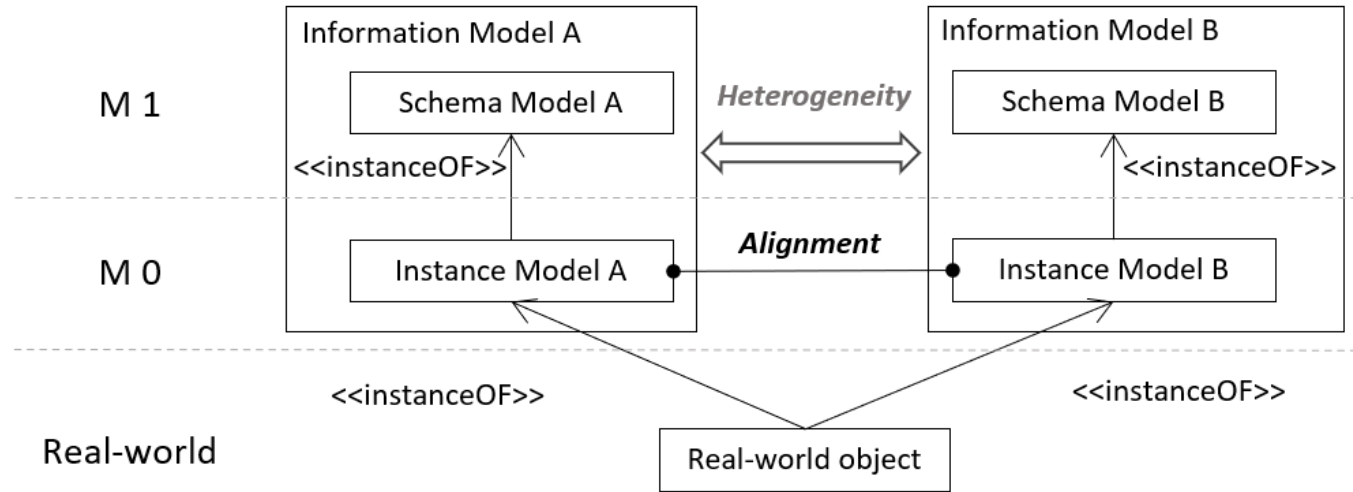


# Problem: Heterogeneities

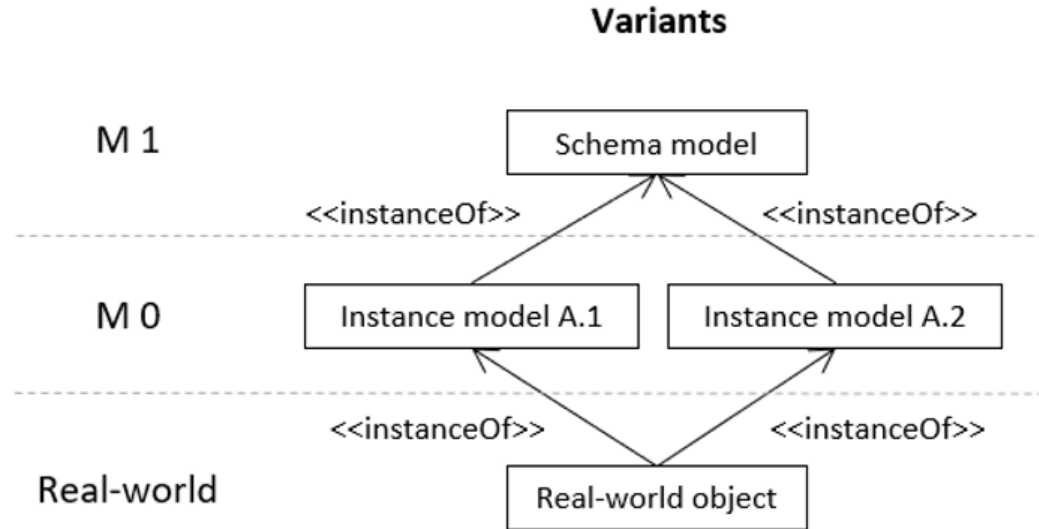


Nagel, Claus; Stadler, Alexandra; Kolbe, Thomas H. (2009): Conceptual Requirements for the Automatic Reconstruction of Building Information Models from Uninterpreted 3D Models. In *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.* 38, pp. 46–53, checked on 12/21/2020.

# Problem: Instance vs. schema level

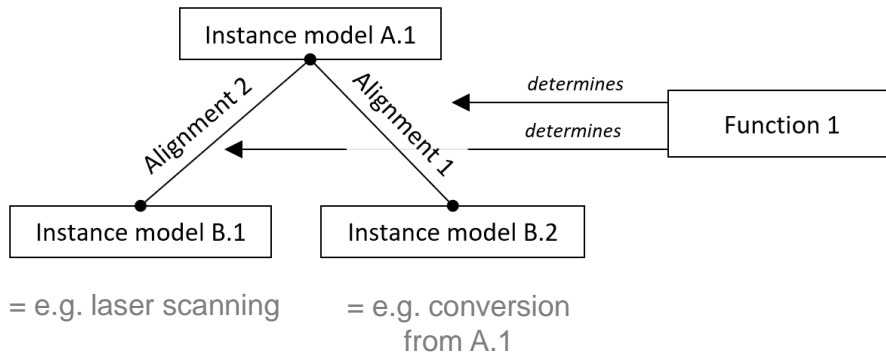


# Problem: Variants of instance models

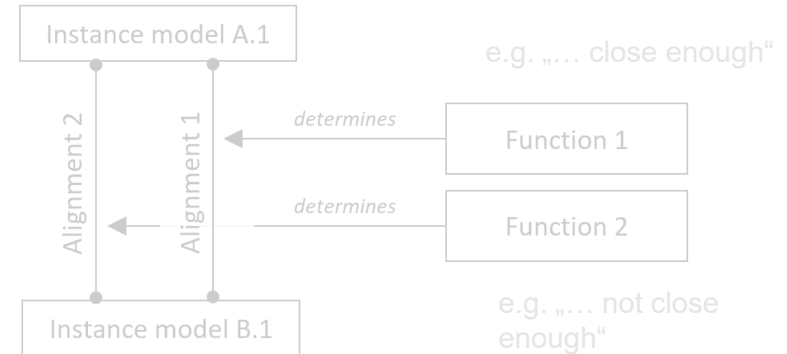


# Problem: Contextual variables

## Model-oriented

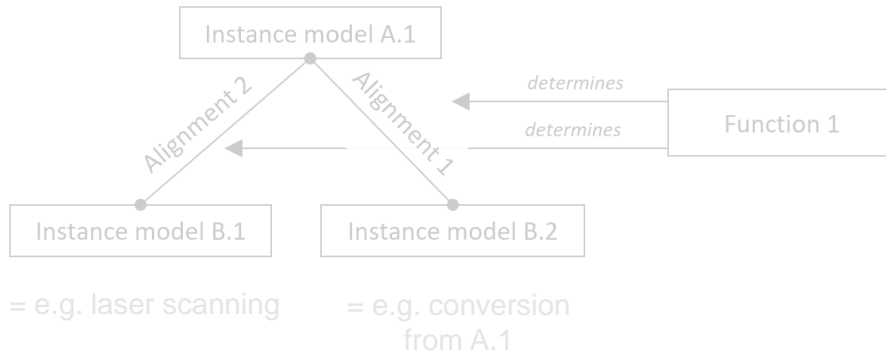


## Application-oriented

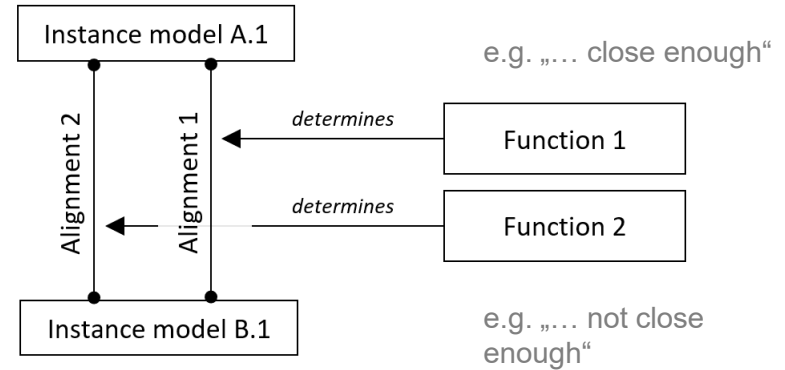


# Problem: Contextual variables

## Model-oriented



## Application-oriented



# Semantics of Links: Identity Links

e.g. **owl:sameAs** -> the linked objects “have the same ‘identity’ ”

<https://www.w3.org/TR/owl-ref/#sameAs-def> (last access on 10.10.2021)



Leibniz's law of identity of indiscernibles:

$$\forall x \forall y [x = y \rightarrow \forall F (Fx \leftrightarrow Fy)]$$

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Roughly spoken: “Everything stated about one object holds for the other object”

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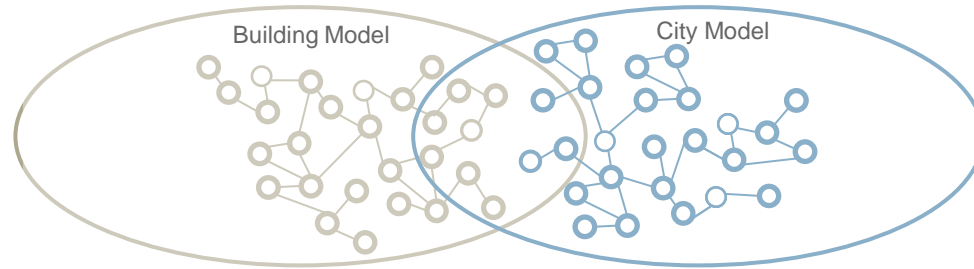
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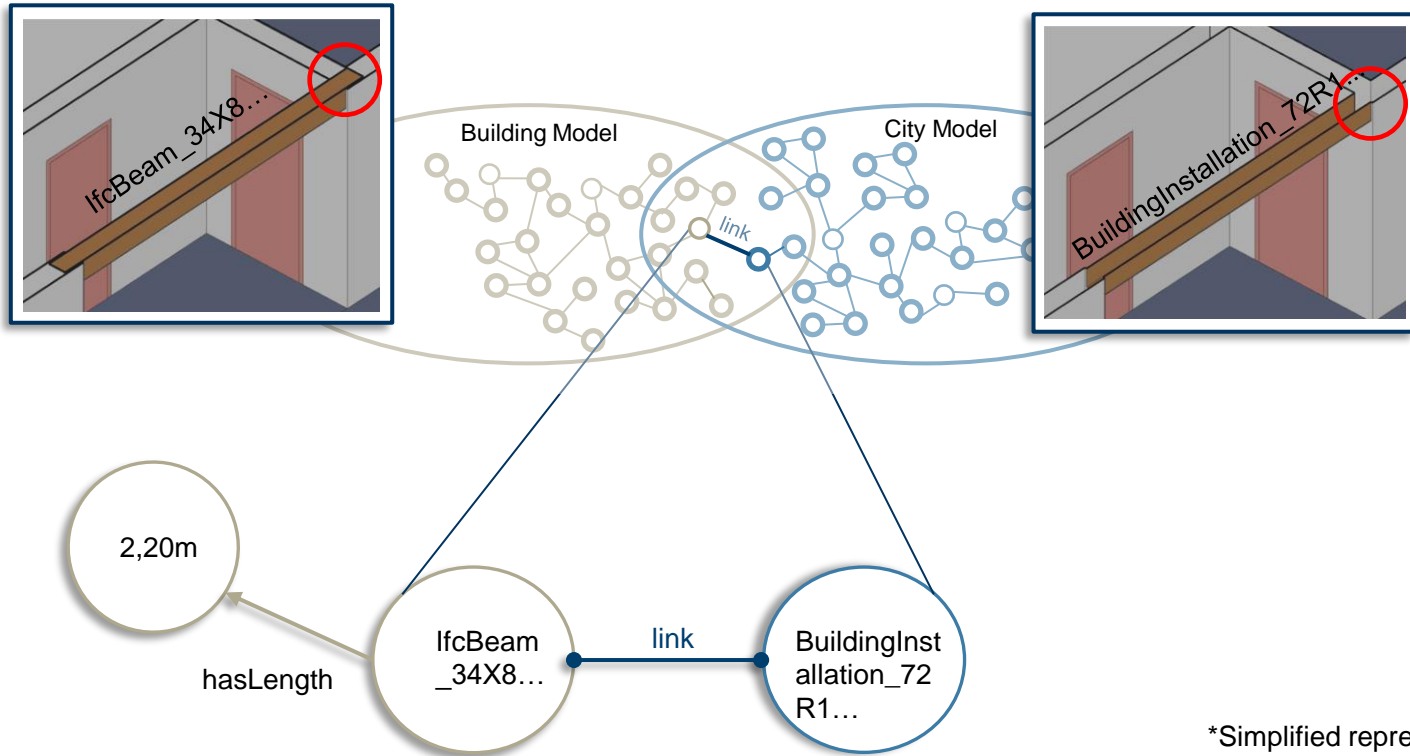
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# Semantics of Links: Corresponding, but not identical

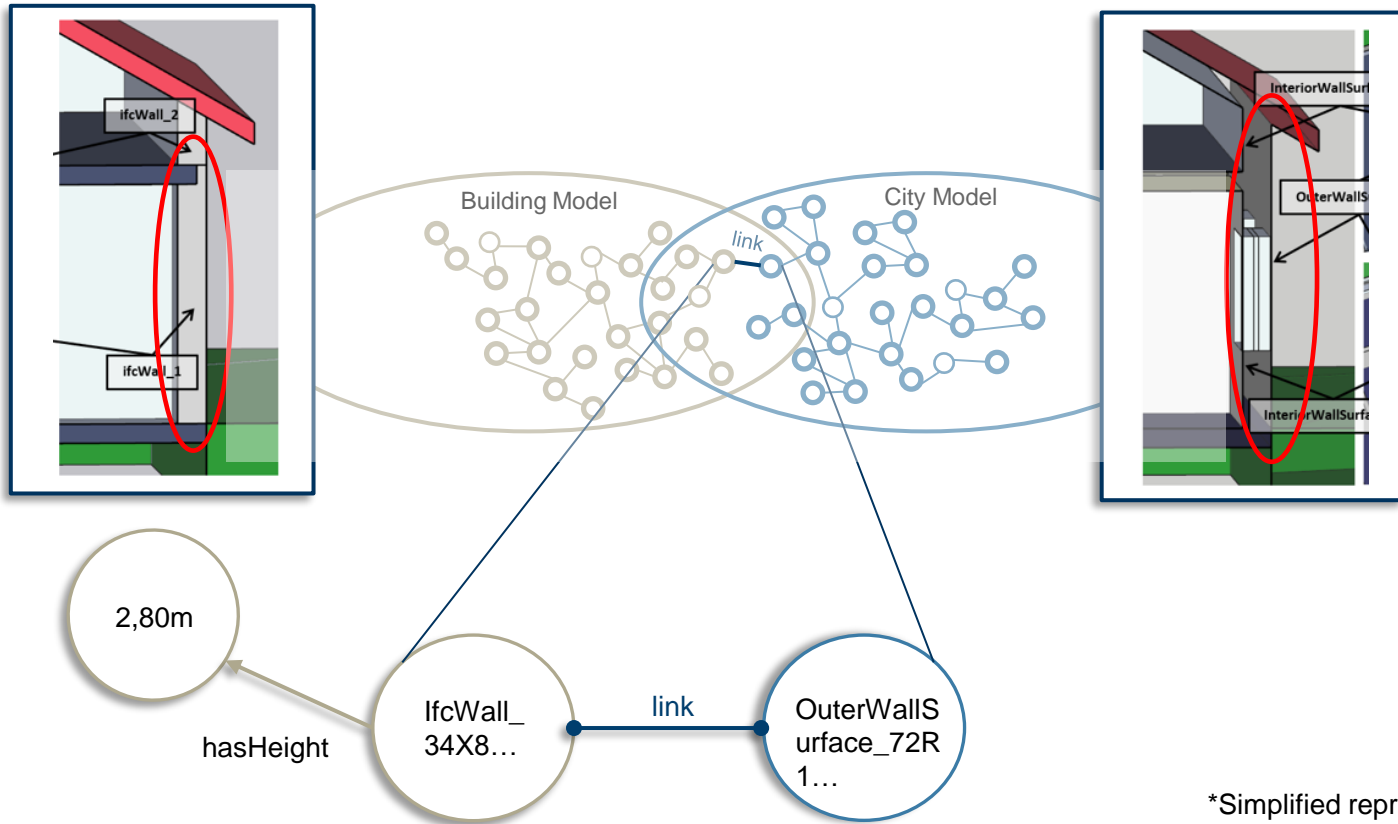


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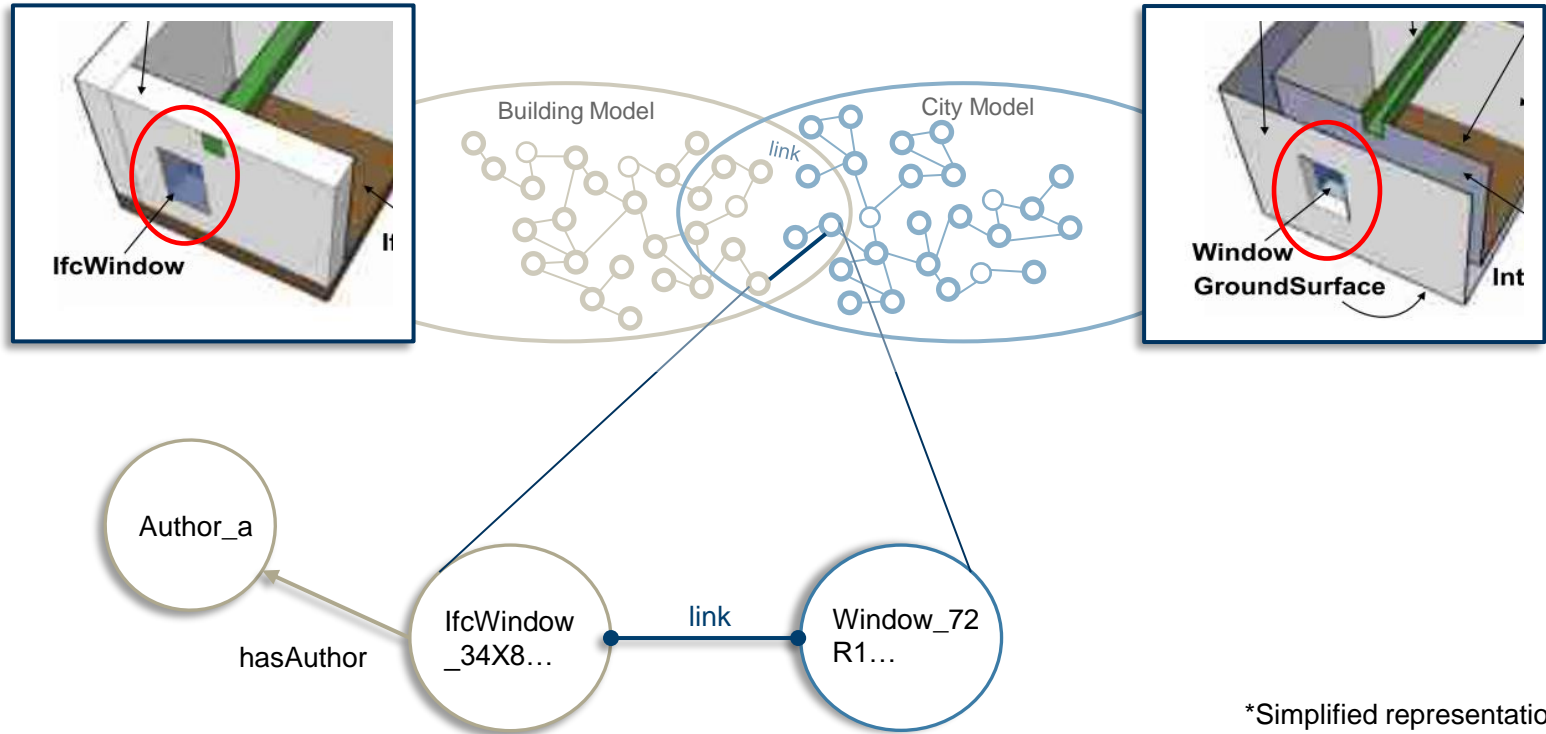
\*Simplified representation for illustration purposes

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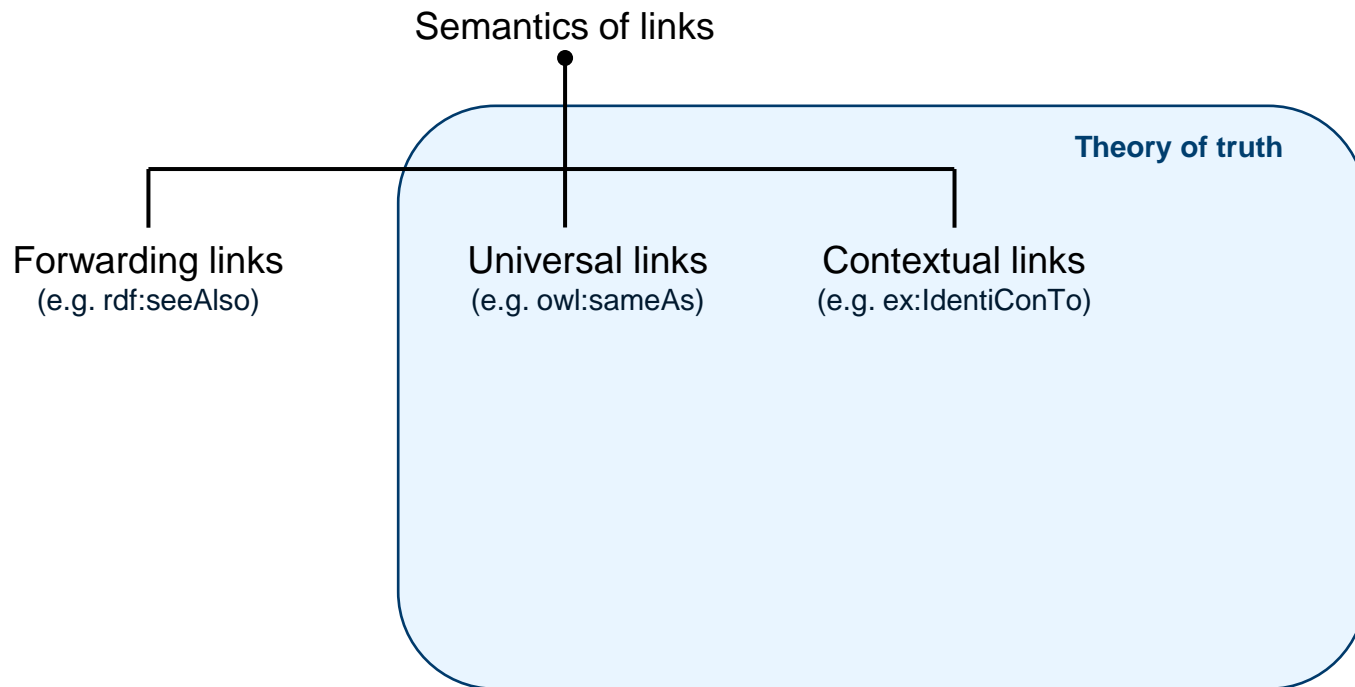
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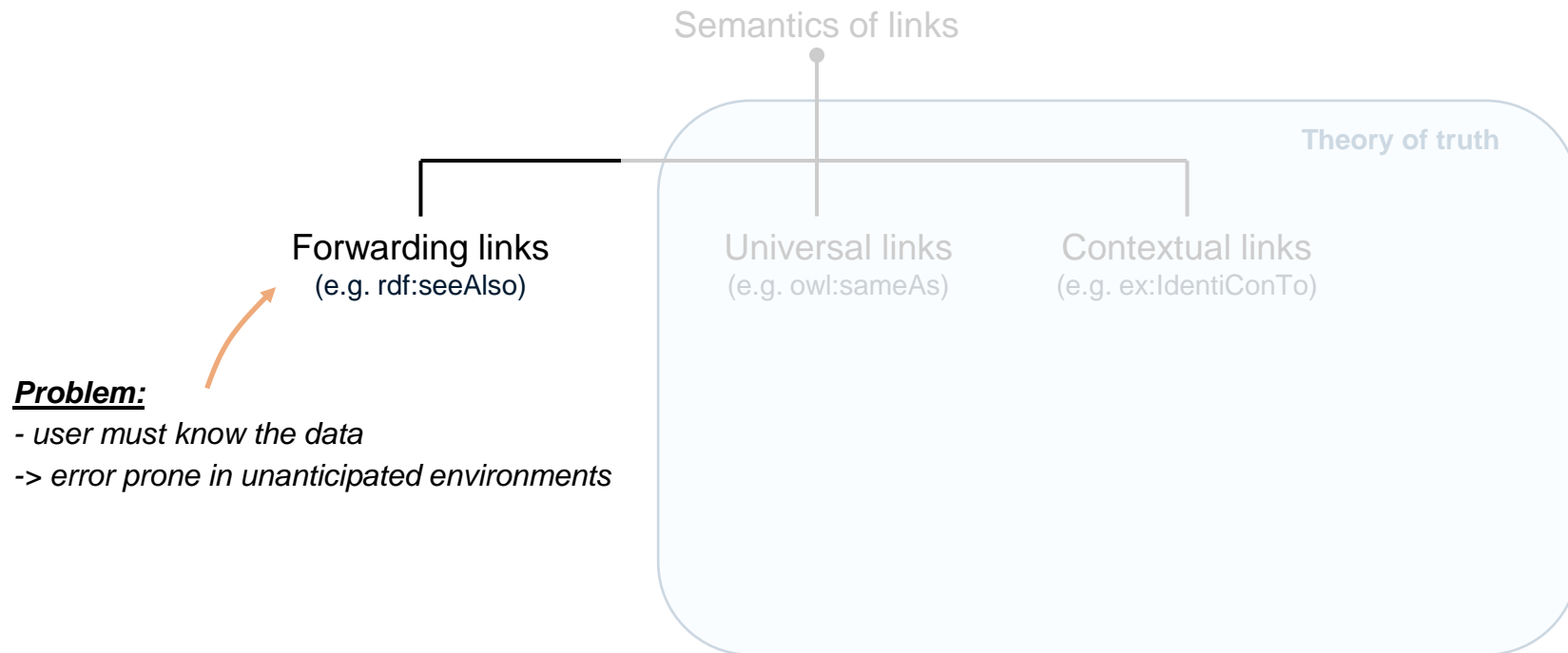


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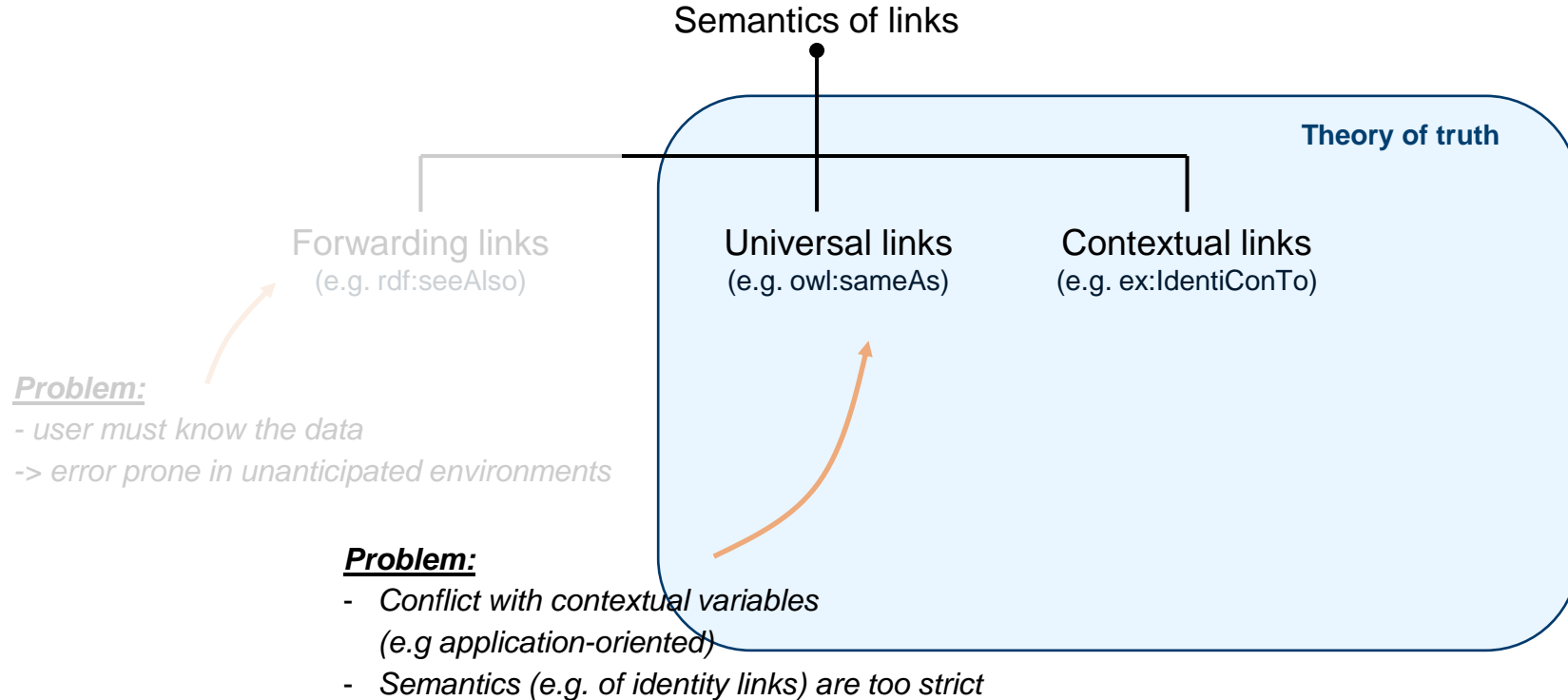
# Semantics of Links: Categories



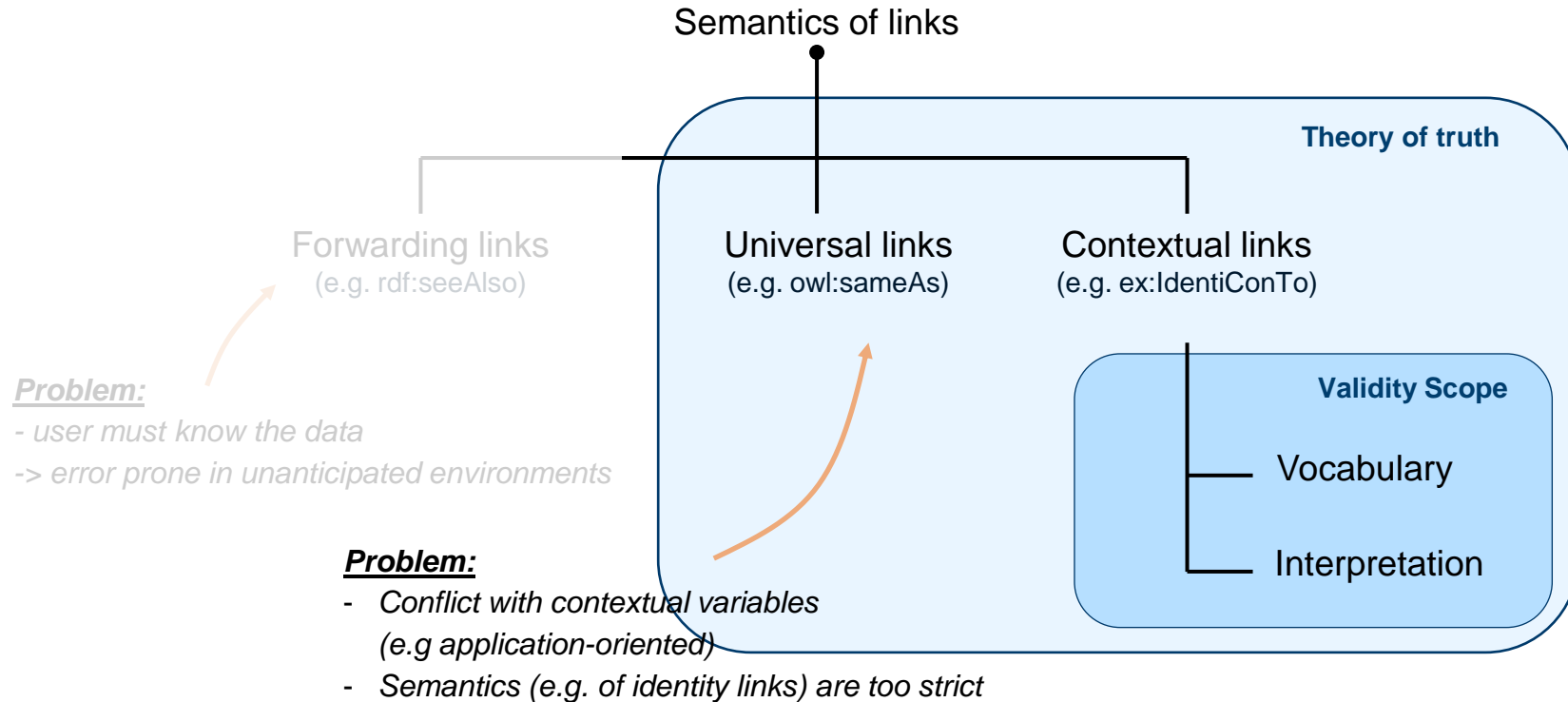
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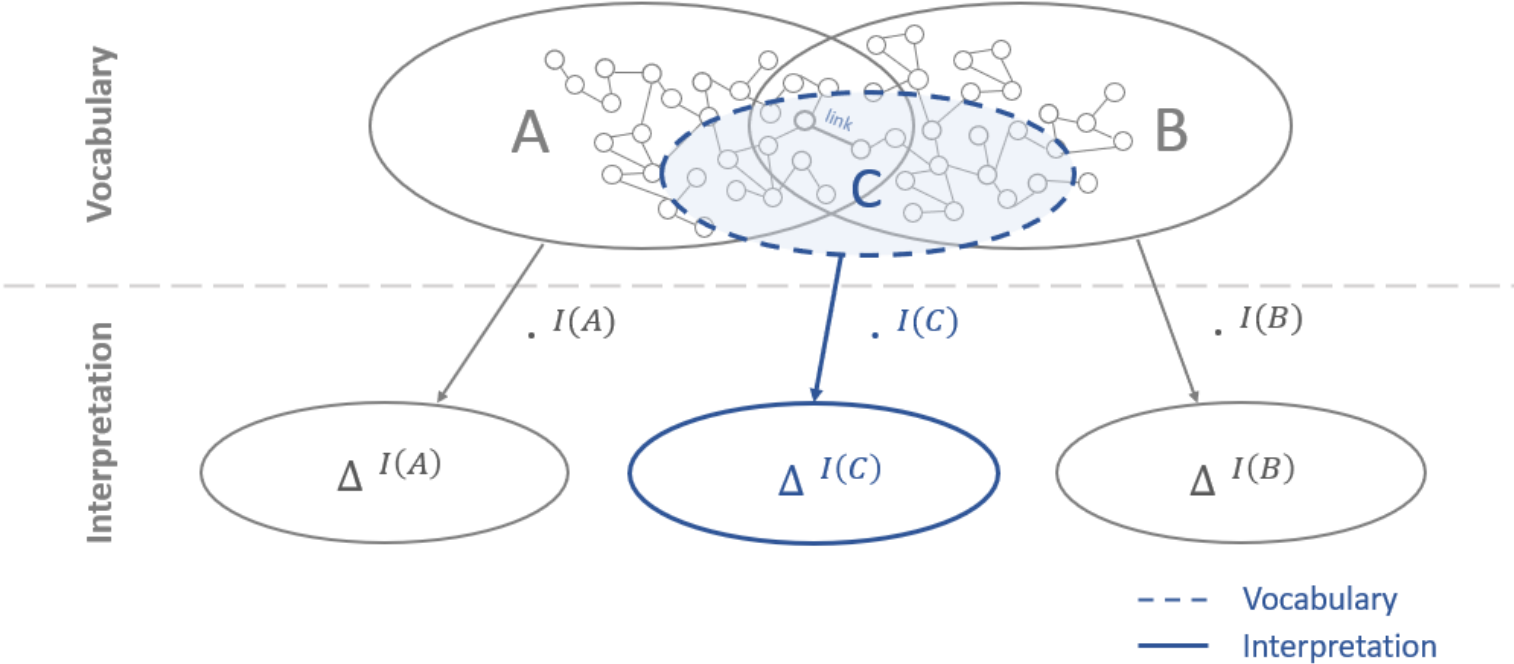


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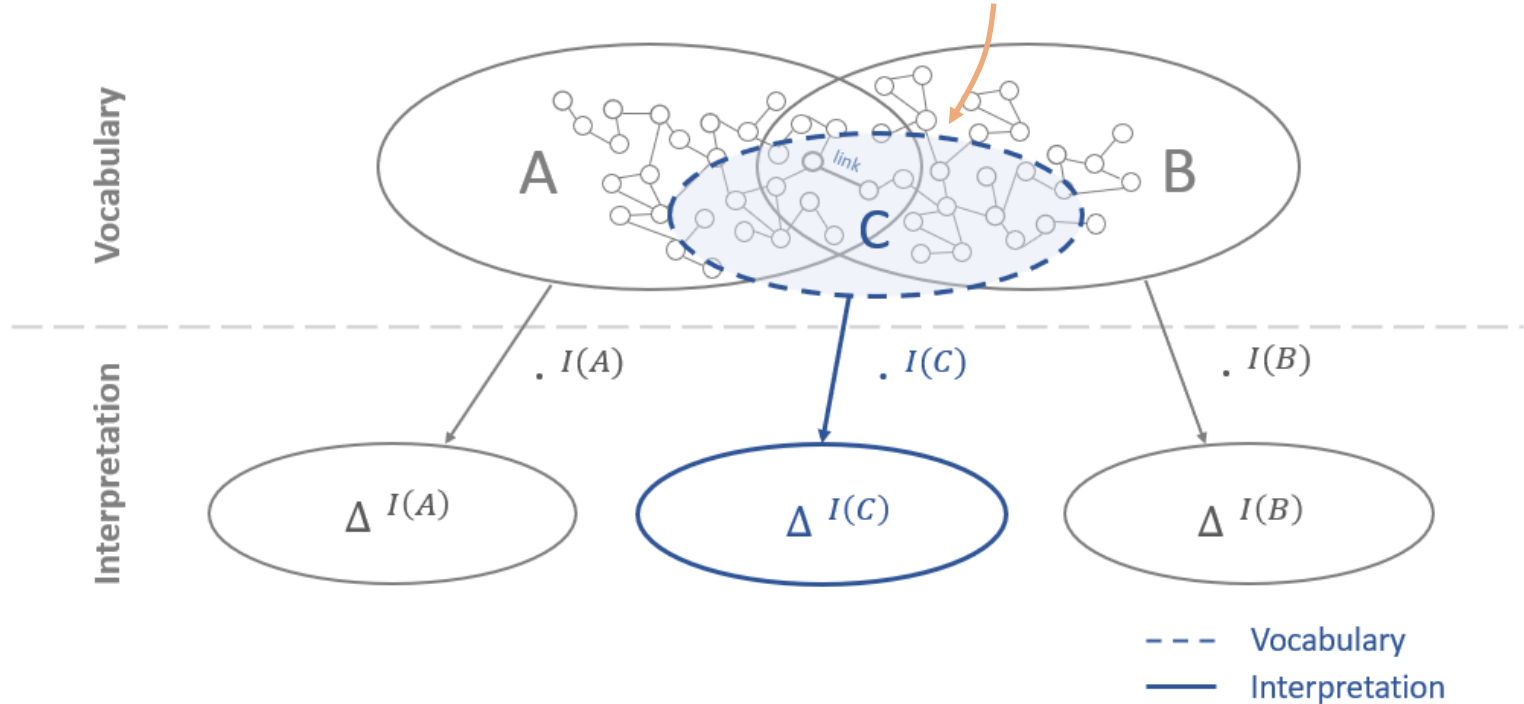


# Semantics of Links: Validity Scope



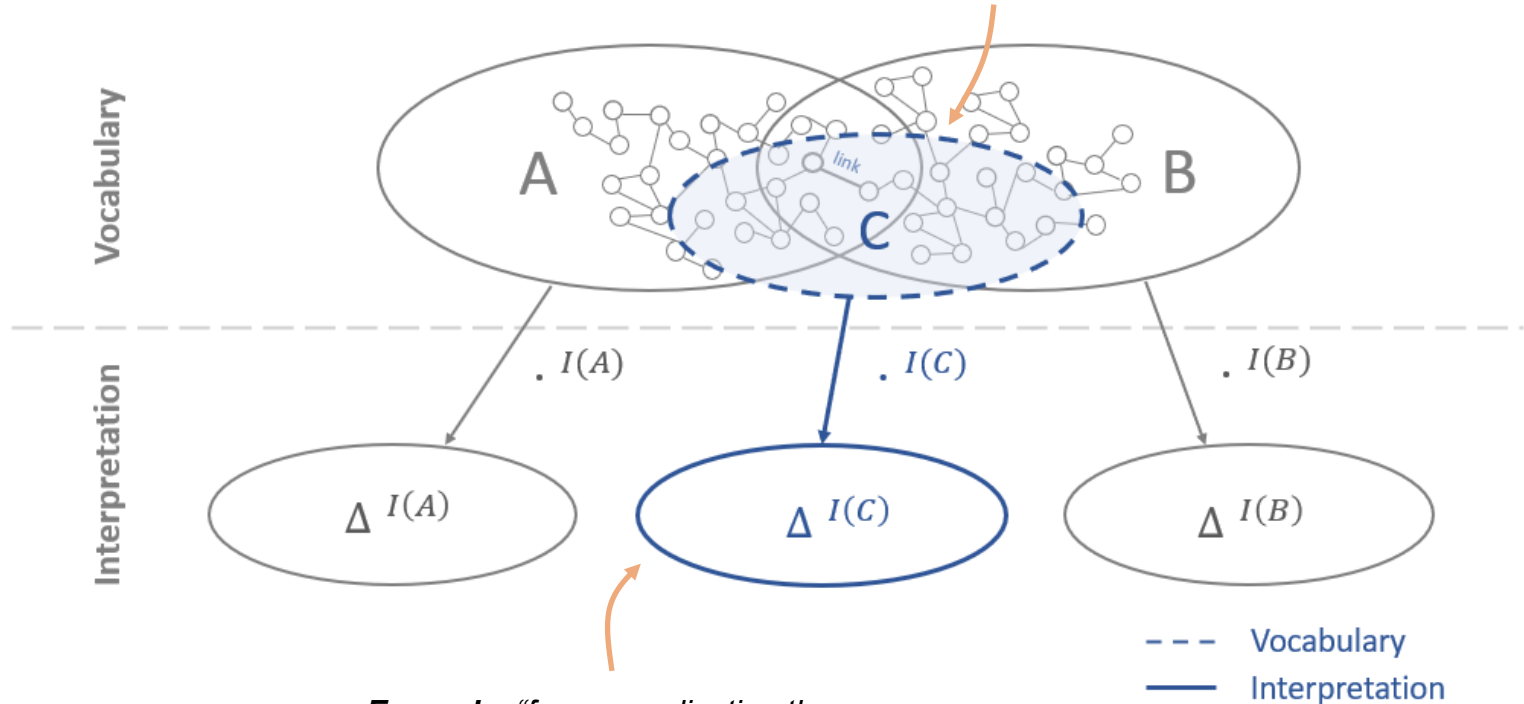
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**Example:** “material holds for both *IfcBeam* and *BuildingInstallation*“



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**Example:** “for my application the geometrical dimensions are ‘close enough’ “

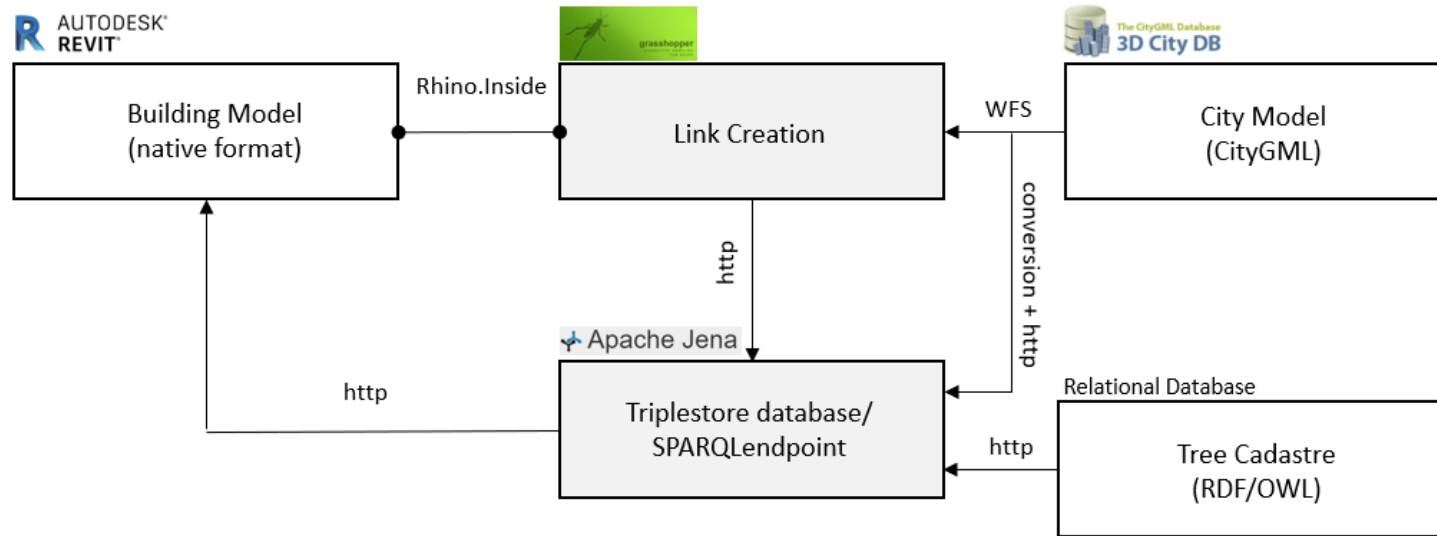
- **Classification of properties** (e.g. according to Leibniz' law)
  - High effort/ large graphs
  - Depends on perspective
- **Enhance links/ graphs through meta-data** (like use case, matching algorithm)
  - User must know the meaning of the meta-data

# Current solution approaches: Validity scope

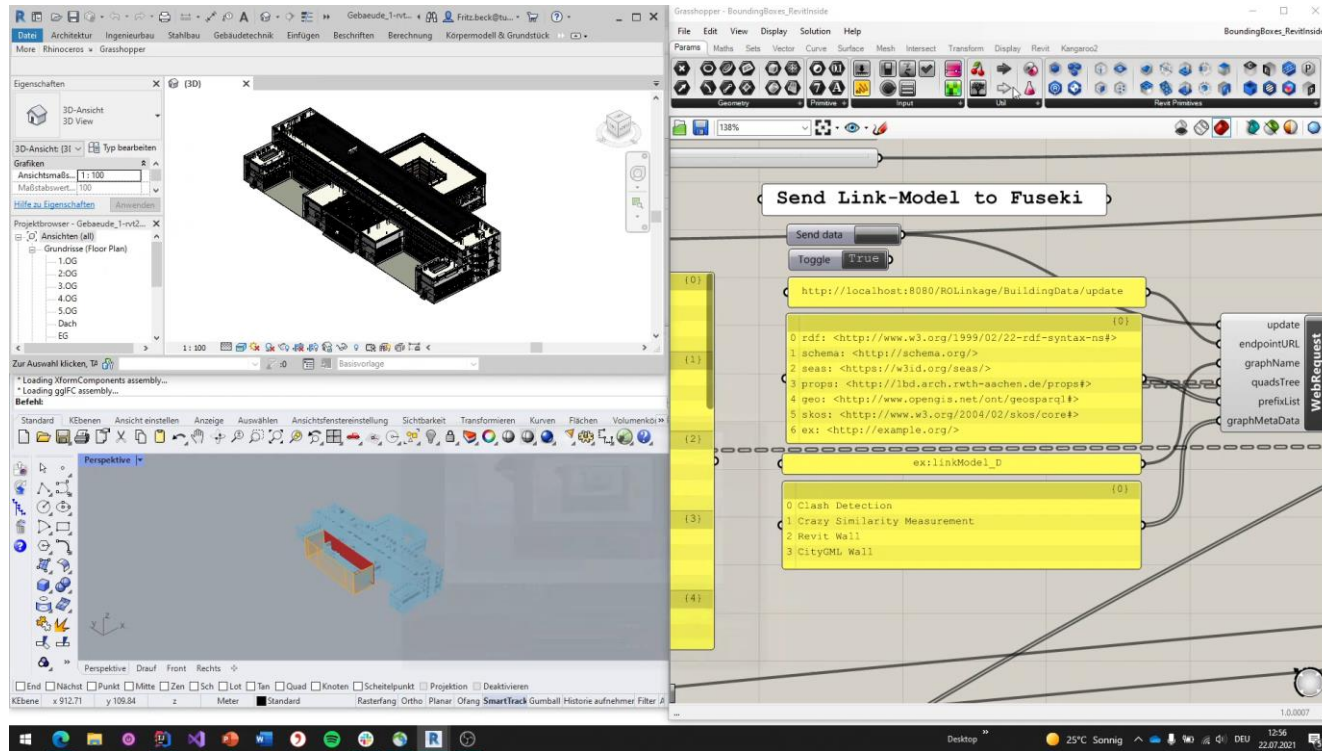


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- **Challenge for linking:**
  - Heterogeneities
  - Contextual aspects: Model- and application-oriented aspects
- **Identity links** (e.g. owl:sameAs):
  - Misleading for linking heterogeneous models
- **Current solution approaches**
  - Alternative links are often too weak for making inferences (in unanticipated environments)
  - Proposal: links must be enriched with well-defined similarity measurements *or* limit validity scope of links to specific use cases