Towards Formal Ontologies in Technology Risk Measurement

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Applying Ontologies to Simulation Engineering in the Financial Service Industry

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- Motivation
- Technology risk
- Background of simulation and ontologies
- Applying ontologies in risk measurement
- Exemplary application
- Conclusion and further work

Motivation

- The issue of managing operational technology risk becomes more and more important:

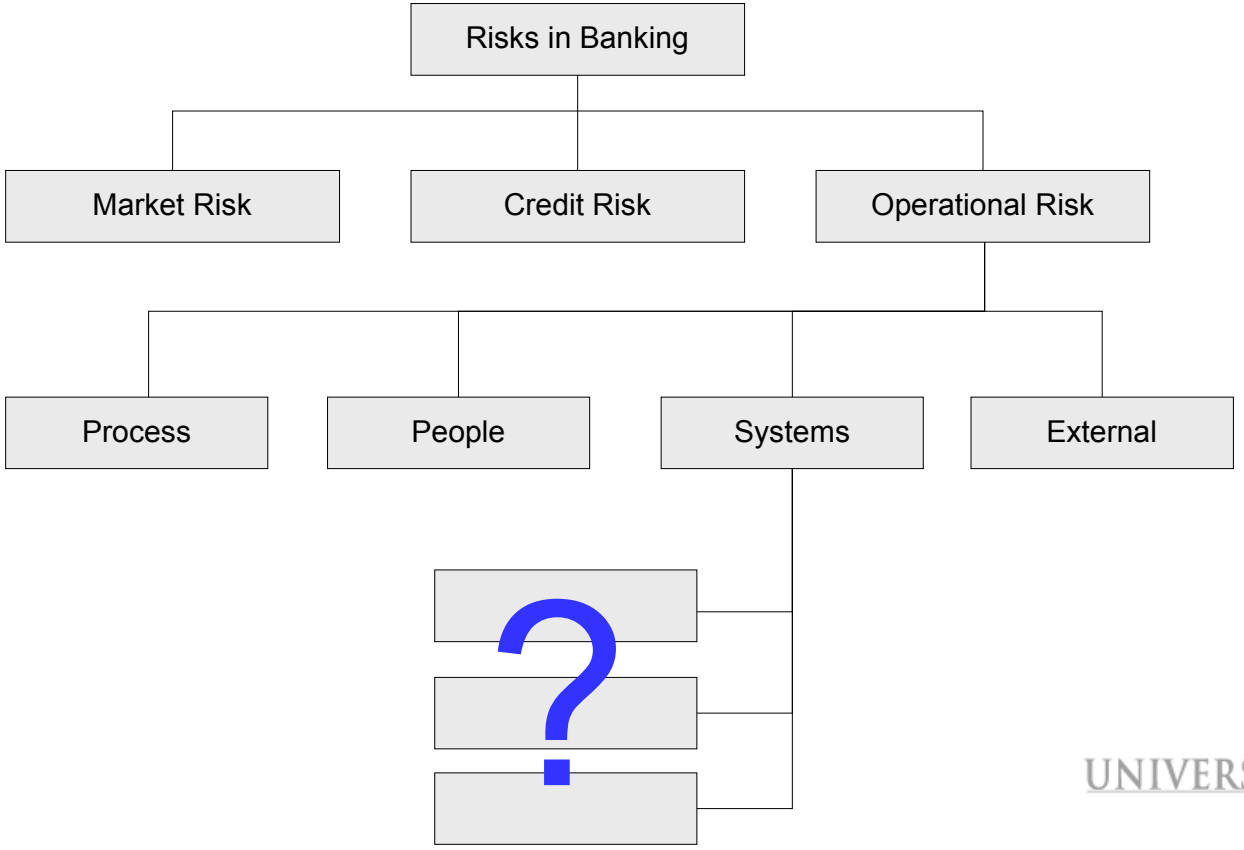
  ⇨ Compliance to IAS, dependence on electronic trading ...

- Managing operational technology risk is also about understanding the organizational knowledge.

  ⇨ For example to manage the risk in a trading environment one has to understand the processes and system topology ...

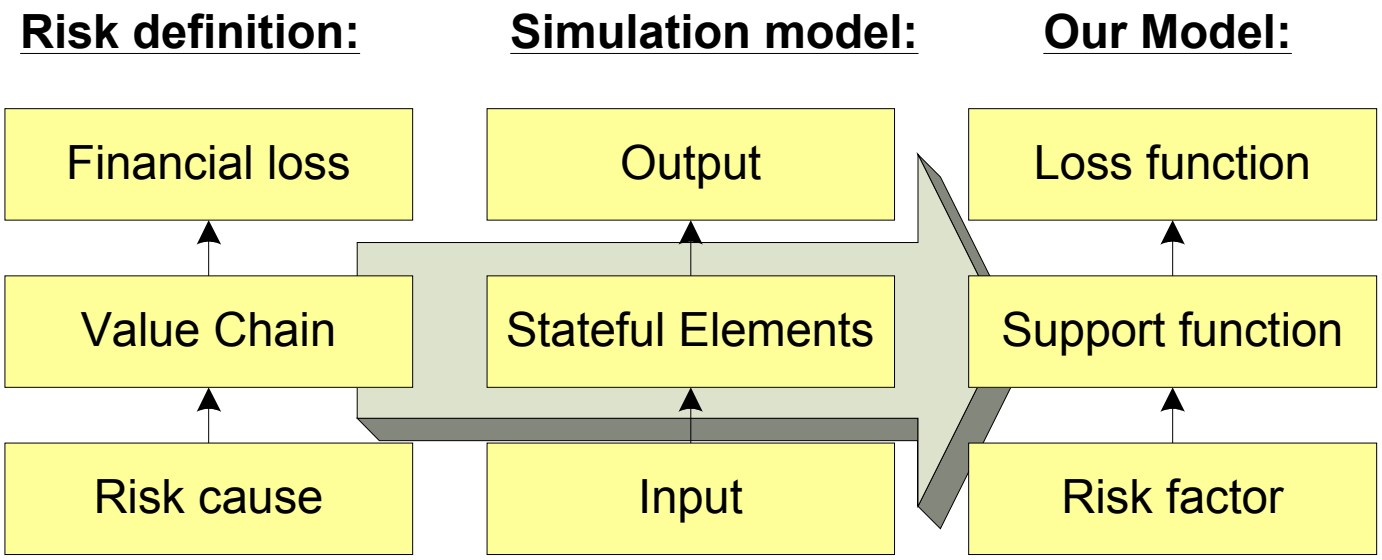
Technology Risk
▸ Financial Service Industry

- "[...] the risk of loss resulting from inadequate or failed processes, people and systems or from external events." (Basel 2004)



Technology Risk
▸ Model Building

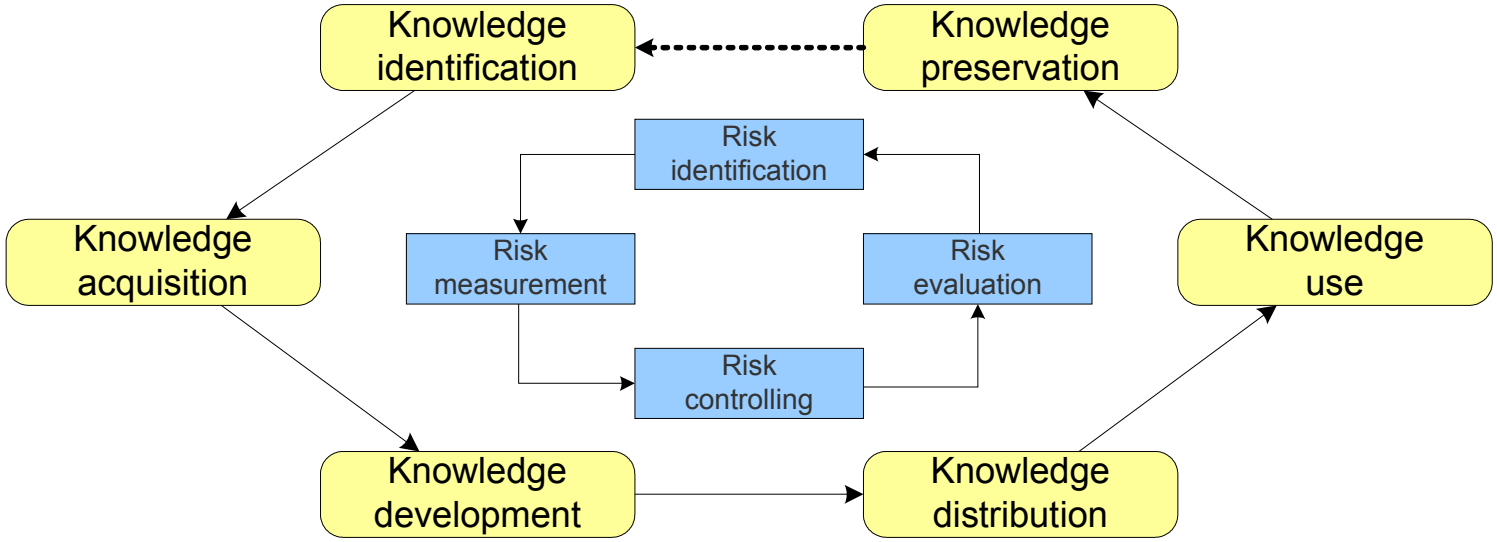
- Many different interpretations of technology risk exist: summarizing, categorizing, standardizing.
- Following market risk we make use of a quantitative and model-building approach (Kühn and Neu 2003).



Technology Risk

▸ Process Integration

- Risk management is divided into four sub-steps: Identification, measurement, controlling and evaluation.
- Furthermore it can be embedded in the organizational knowledge management process.



Background

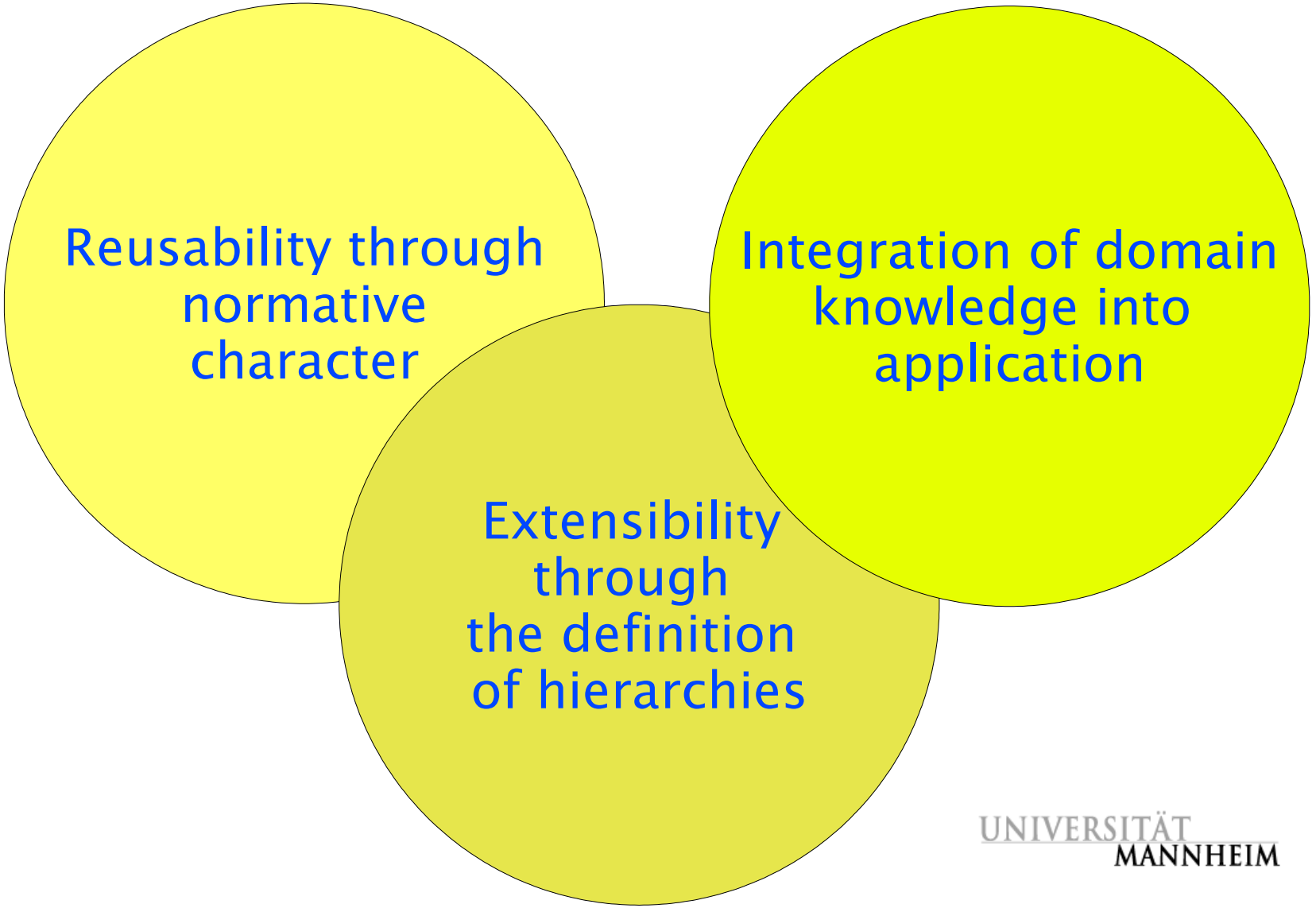
▸ Characteristics of Simulation

- There exist many different types of simulations:
  - Monte Carlo
  - Time discrete
  - Continuous simulations
- This taxonomy can be criticized as being too restrictive; for operational risk more than one simulation approach can be employed.

- We alternatively propose three requirements which must be fulfilled by a risk simulation platform:
  - reusability,
  - closing semantic gap,
  - adaptability.

Background

▸ Aspects of Ontologies



Applying Ontologies

▸ Reusing the simulation model

Problem: *Organizational knowledge or simulation parameters are coded into the simulation platform ...*

Solution:

- Technically decouple the domain model from the simulation platform.
- Support iterative changes of the intra-organizational risk model.
- Rely on standardized representation format.

Applying Ontologies

▸ Closing the Semantic Gap

Problem: *Domain experts and simulation engineers have to develop a common understanding ...*

Solution:

- Introduce an integrated representation format for simulation code **and** domain knowledge.
- Enable cross-validation of technical and functional aspects.
- Integrate domain knowledge directly into the simulation model to close the semantic gap between the knowledge representation and the simulation implementation.

Applying Ontologies

▸ Adapting to Knowledge Change

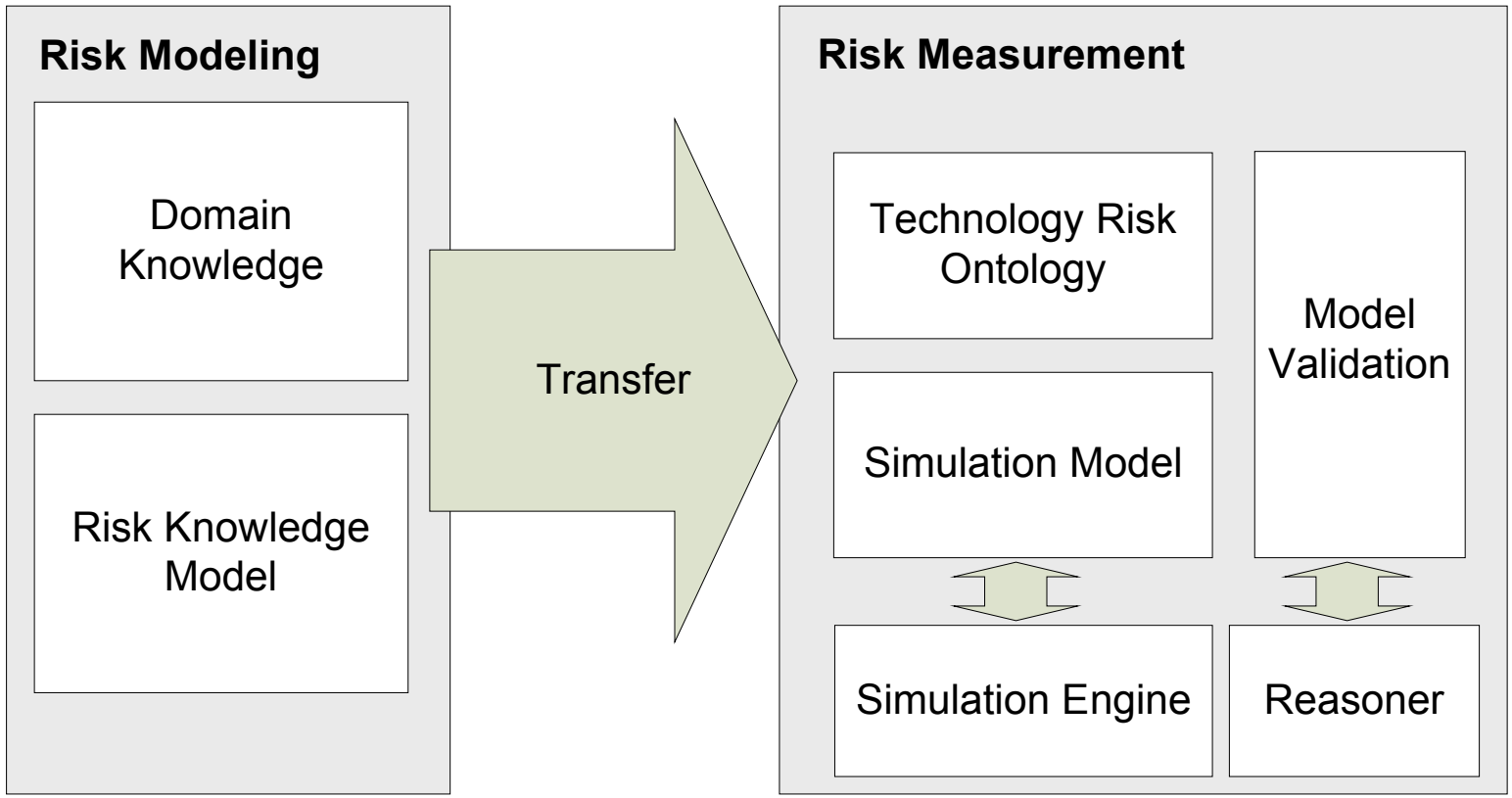
Problem: *Inter-organizational domain knowledge is likely to be diffuse or even contradictionary ...*

Solution:

- Identify the common basis of abstract risk management simulations.
- Allow for possible extensions of the abstract model
- Enable future restrictions to the abstract model.

Applying Ontologies

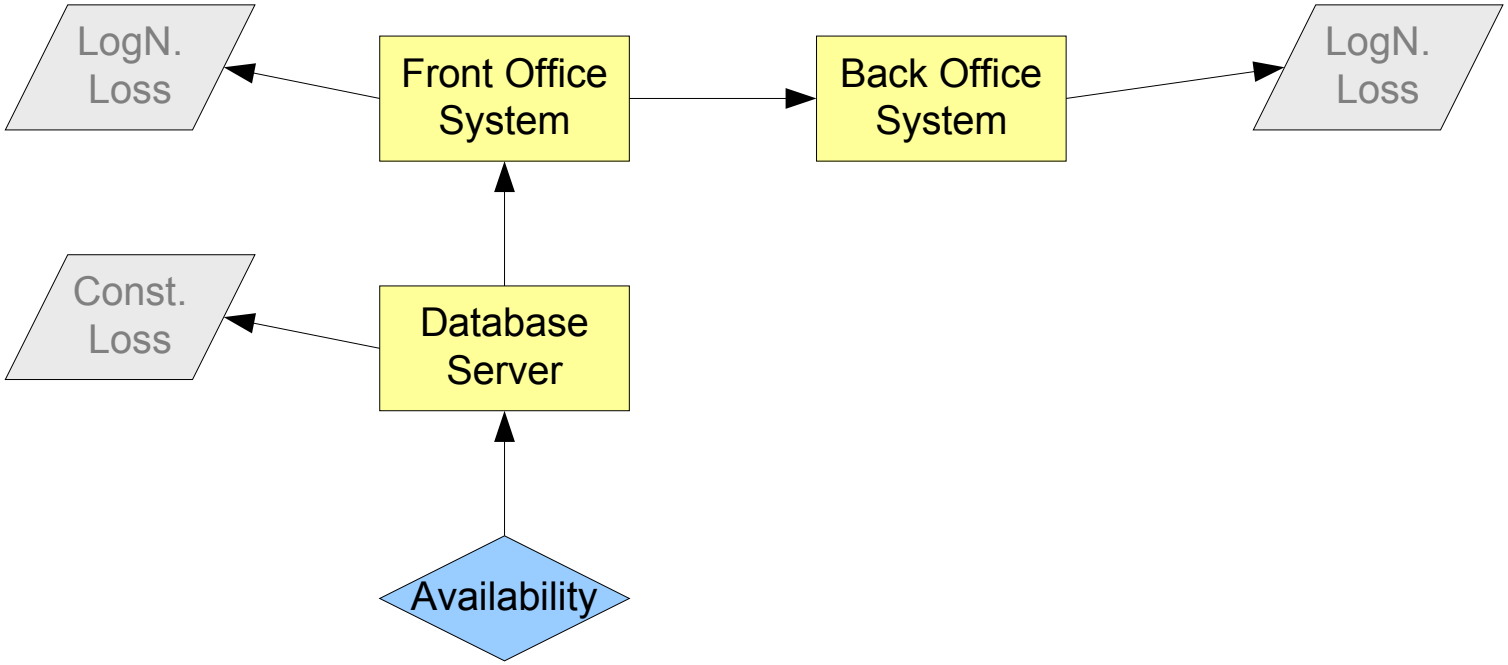
▸ Simulation Platform



Example

▸ Trading Environment Use Case

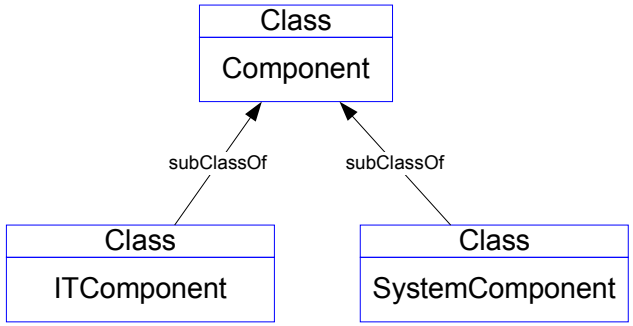
The following example represents a simplified trading environment:

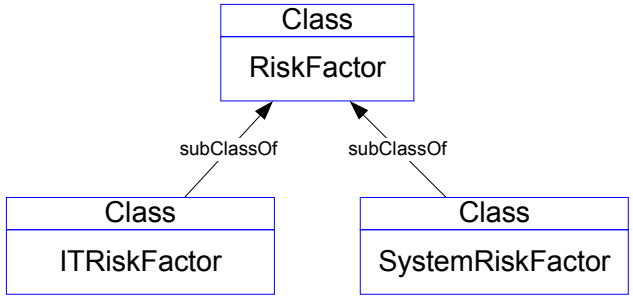


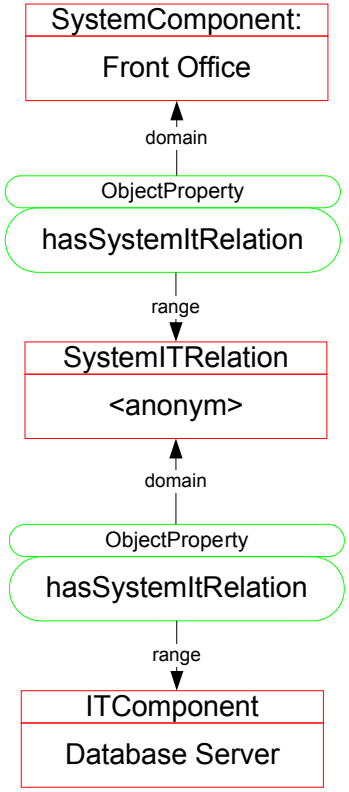
Example

Individual Knowledge

Excerpt of the OWL representation:







Conclusion

Lessons Learned

- General Aspects:
  - By applying ontologies to technology risk management we were able to fulfill the three presented requirements.
  - We consider our concept to be innovative. Related work covers only partial aspects.
- Design & Implementation:
  - OWL is suitable for separating simulation models from code.
  - Advantages compared to plain XML.
  - Due to simulation time we currently compile model representation into Java byte code.
- Process Integration:
  - The dynamic character of the underlying domain is supported.
  - UML can be applied during conceptualization.
  - Industrial use requires development of an integrated platform.

Conclusion

▸ Outlook

- Cooperation with domain experts and industry. partners in oder to refine our approach ...
- Extension of our concept to other risk domains:
  - Asset Liability Risk,
  - Credit Risk,
  - ...
- Elaborate on the question whether approach can be transferred to simulation engineering in general ...