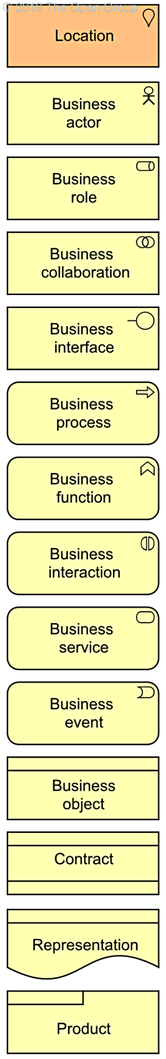
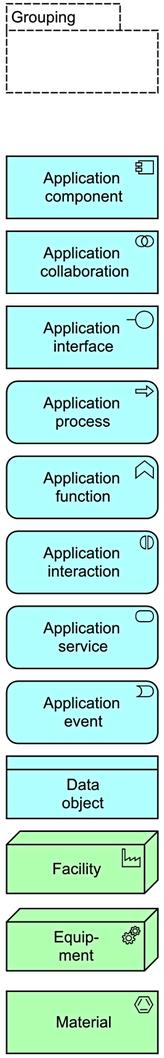
Selection of Interpretation in Enterprise Modelling

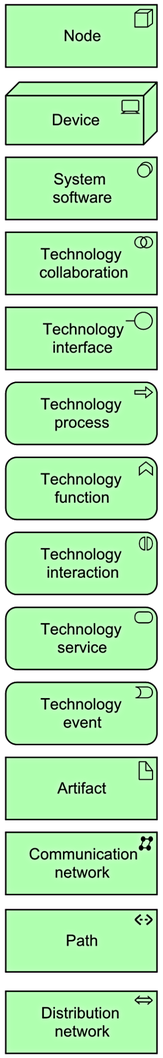
Agenda

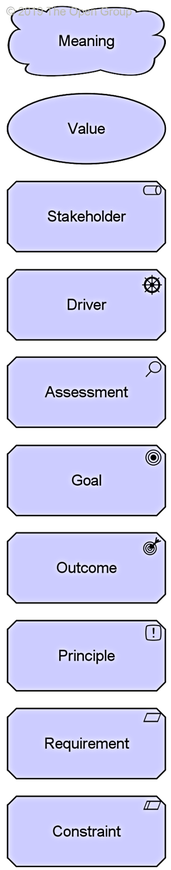
- [ ] The problem
- [ ] Selection of interpretation
- [ ] Towards reasoning
- [ ] Conclusion

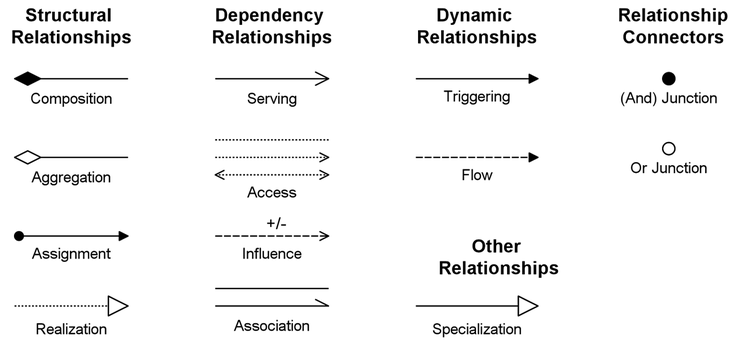
Many modelling concepts!



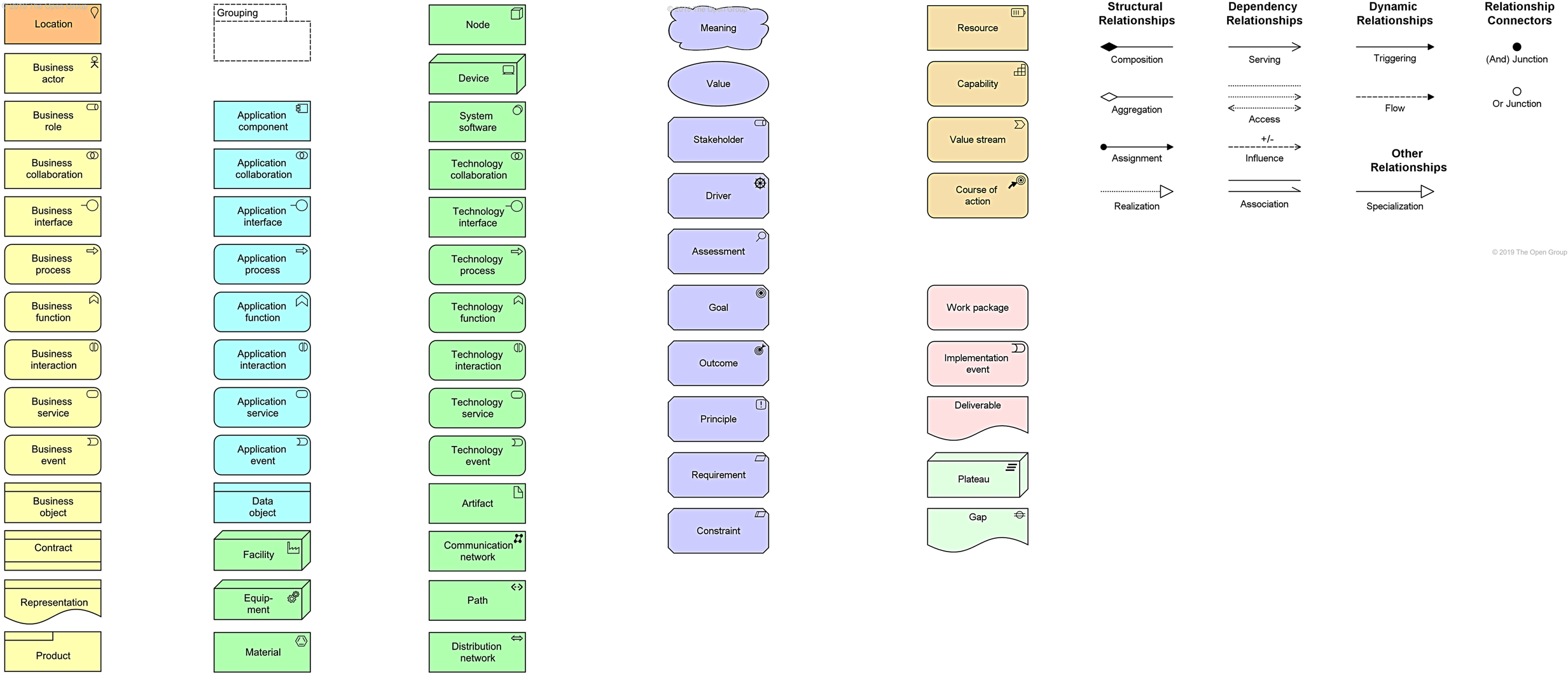




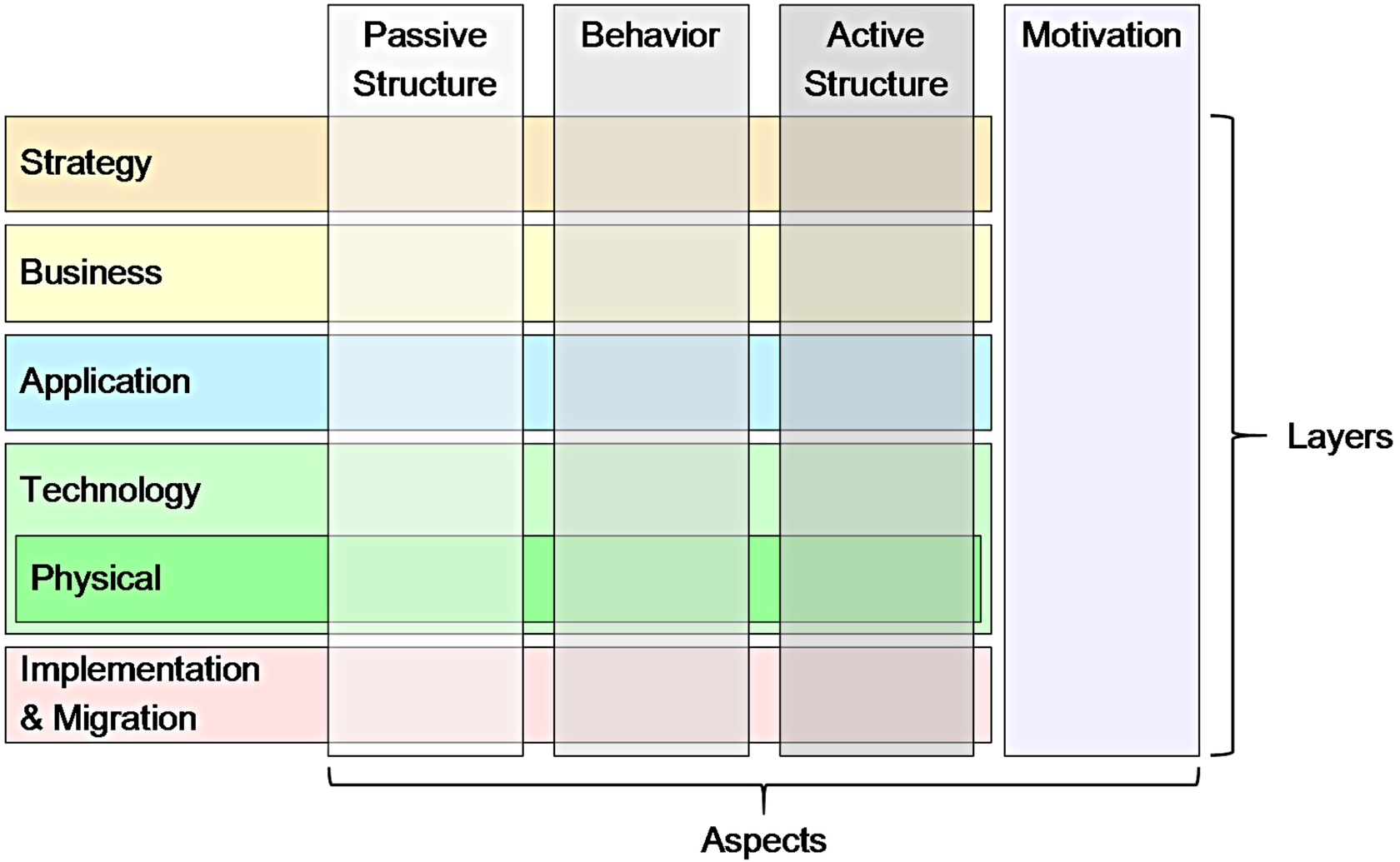




Too many modelling concepts?



Much to model



The problem

- Practitioners, and learners, find it difficult to select among the many concepts
- At the same time, the need for precision in terms of the specific concepts is appreciated

References

H. A Proper, W. Guédria, and J.-S. Sottet. Enterprise Modelling in the Digital Age. In V. Kulkarni, S. Reddy, T. Clark, and B. S. Barn, editors, Advanced Digital Architectures for Model-Driven Adaptive Enterprises, chapter 3, pages 46-67. IGI Global, Hershey, Pennsylvania, 2020. ISBN: 9781799801085

B. van Gils and H. A. Proper. Enterprise modelling in the age of digital transformation. In R. A. Buchmann, D. Karagiannis, and M. Kirikova, editors, The Practice of Enterprise Modeling - 11th IFIP WG 8.1. Working Conference, PoEM 2018, Vienna, Austria, October 31 - November 2, 2018, Proceedings, volume 335 of Lecture Notes in Business Information Processing, pages 257-273. Springer, Heidelberg, Germany, 2018. ISBN: 978-3-030-02301-0

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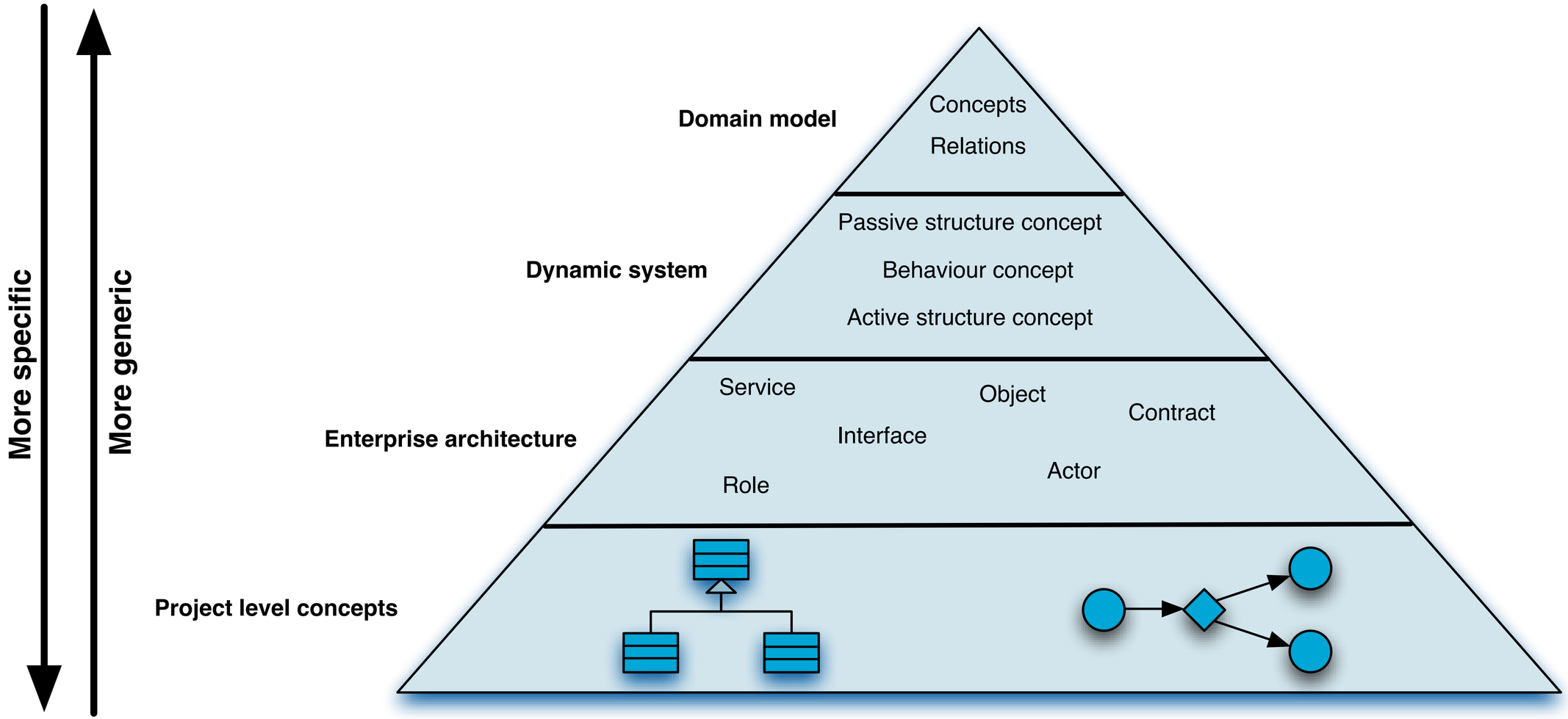
Agenda

- [x] The problem
- [ ] Selection of interpretation
- [ ] Towards reasoning
- [ ] Conclusion

Hierarchical design of languages

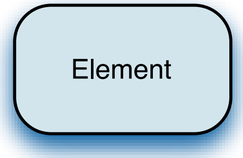


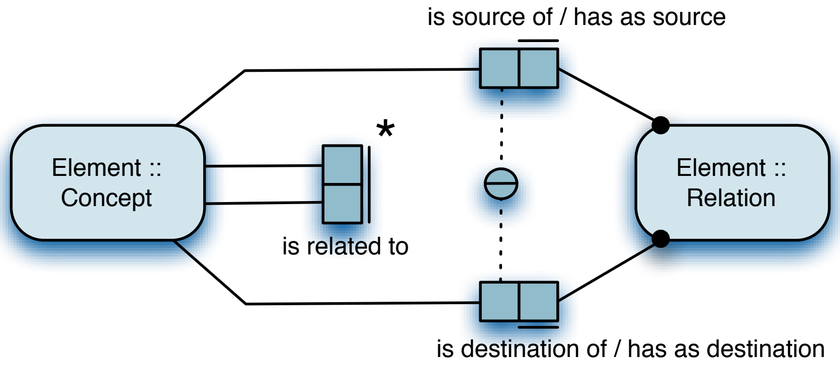
So, actually … a hierarchy

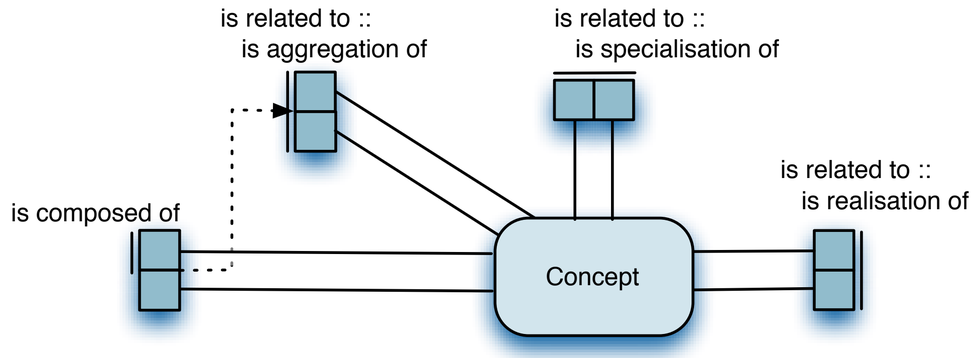
Hierarchical design of ArchiMate

M. M. Lankhorst, H. A. Proper, and H. Jonkers. The anatomy of the ArchiMate language. International Journal of Information System Modeling and Design, 1(1):1-32, 2010.

Hierarchical design of ArchiMate

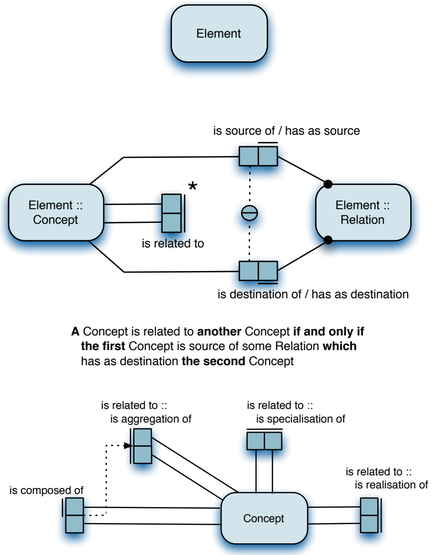






A Concept is related to **another** Concept **if and only if the first** Concept is source of some Relation **which** has as destination **the second** Concept

Hierarchical design of ArchiMate



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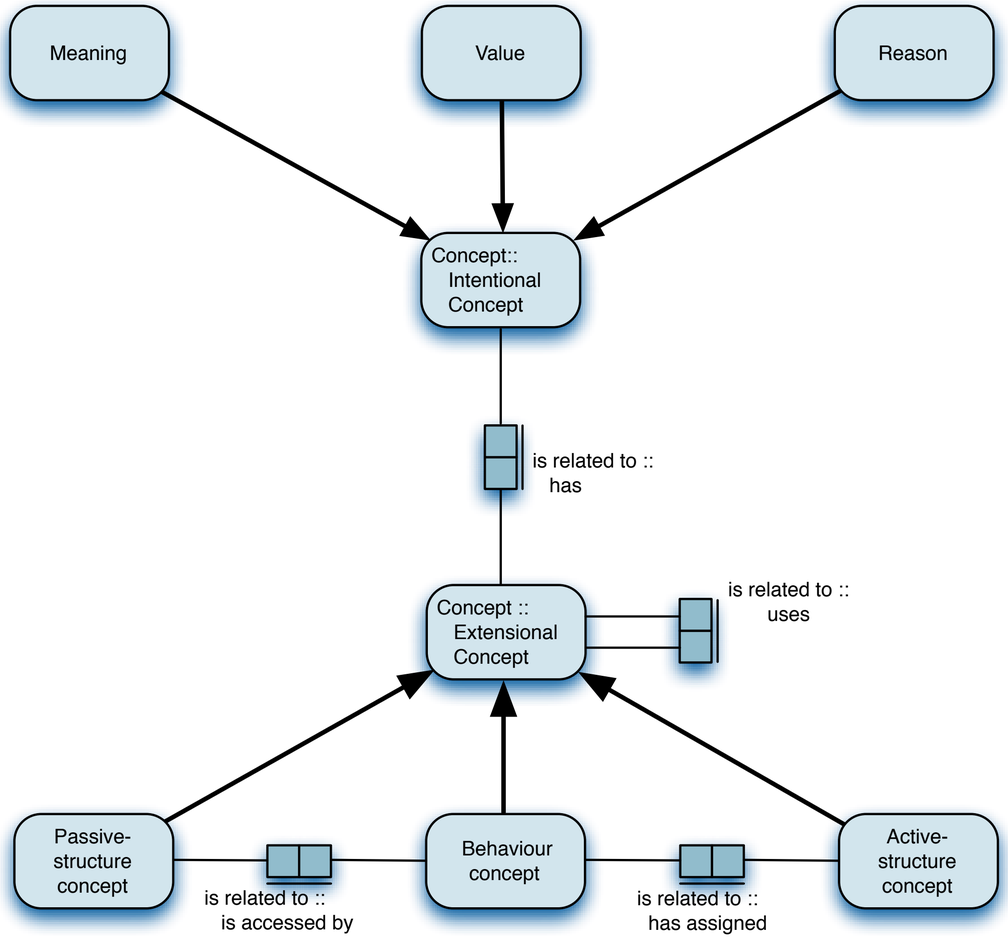

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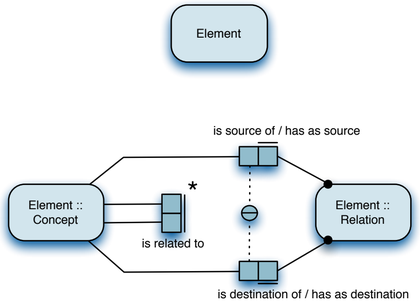

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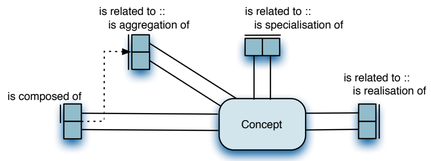
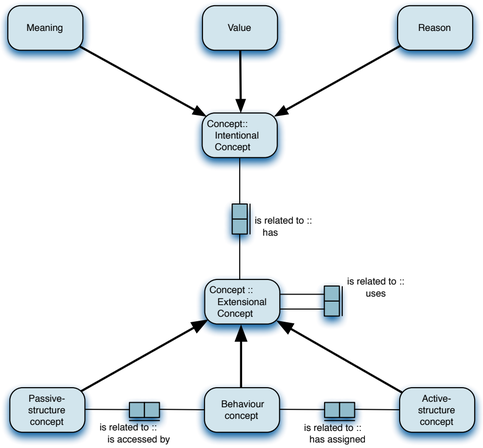
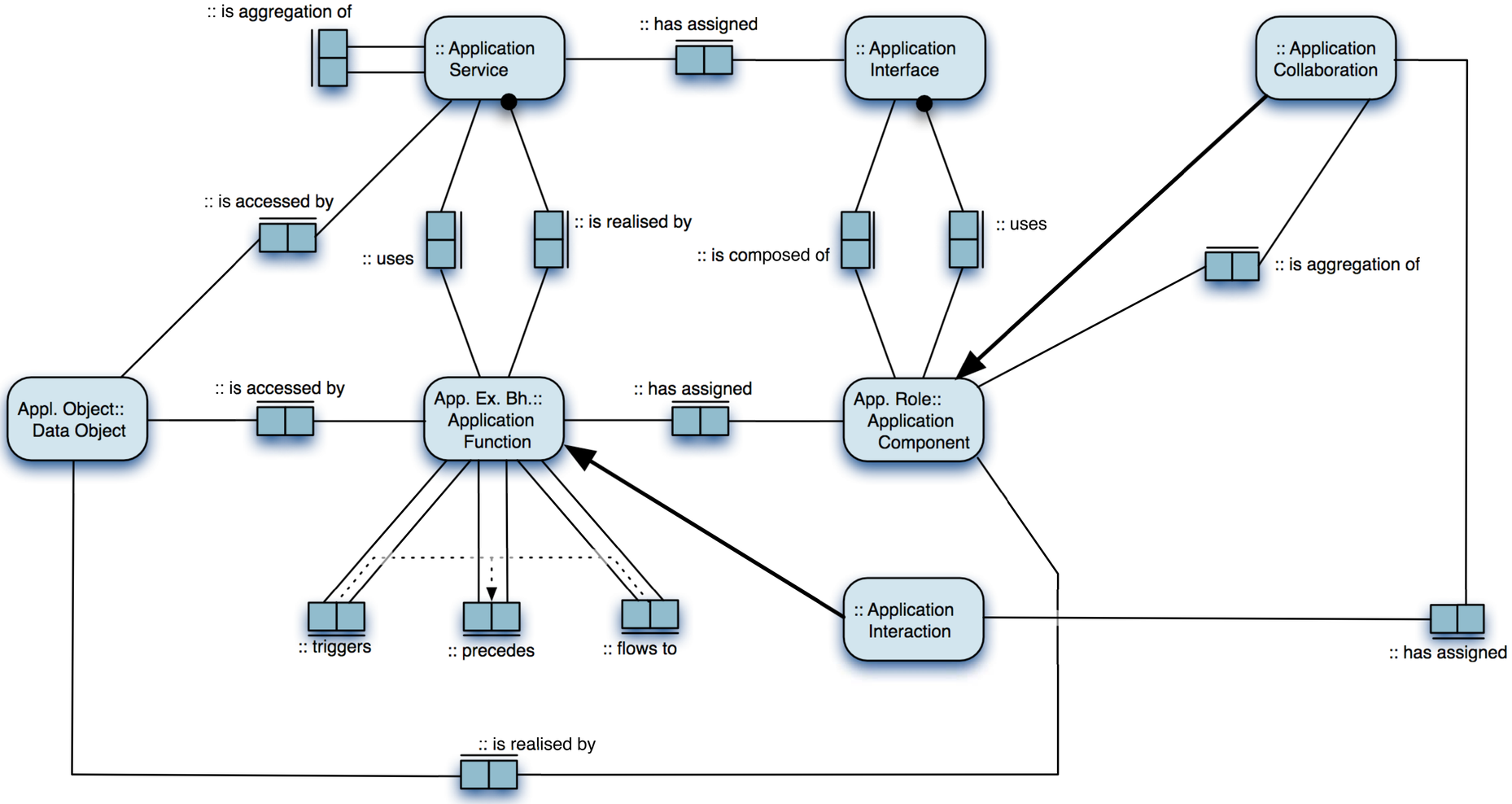






Selection of interpretation

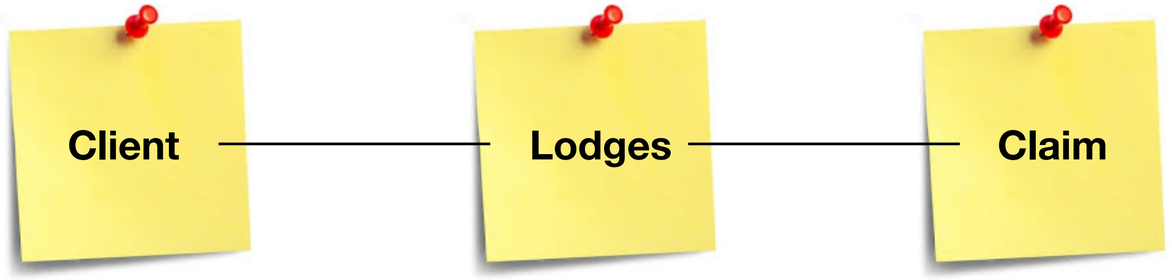
Selection of interpretation

Client

Lodges

Claim

Selection of interpretation



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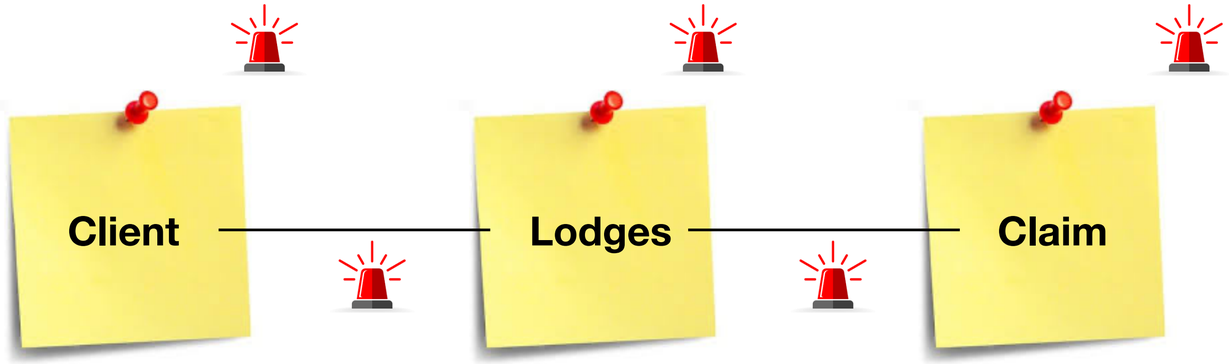

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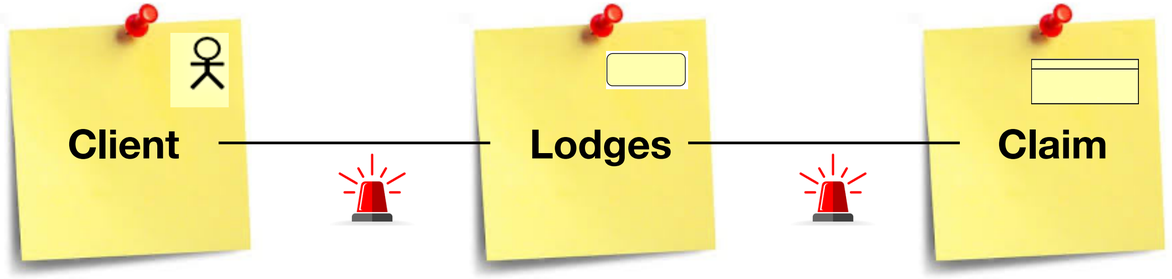

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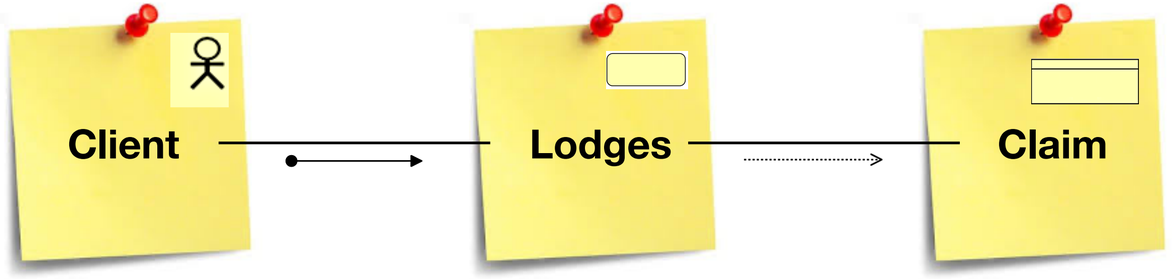

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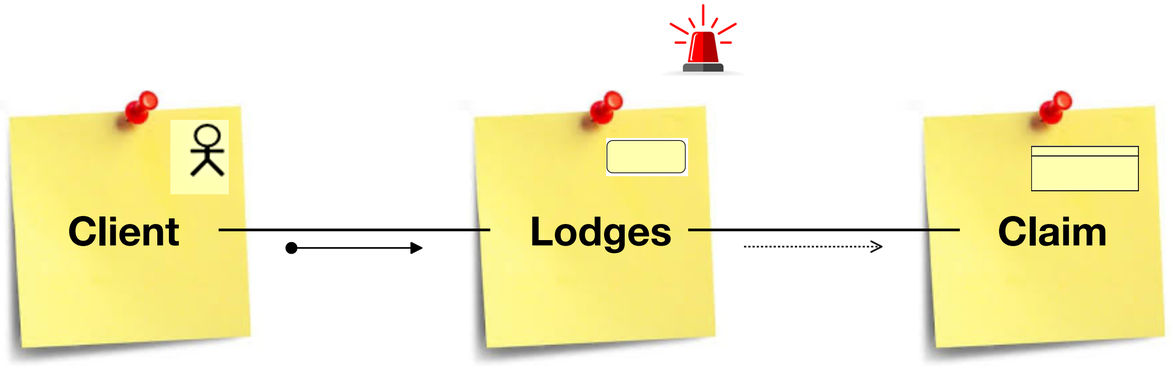

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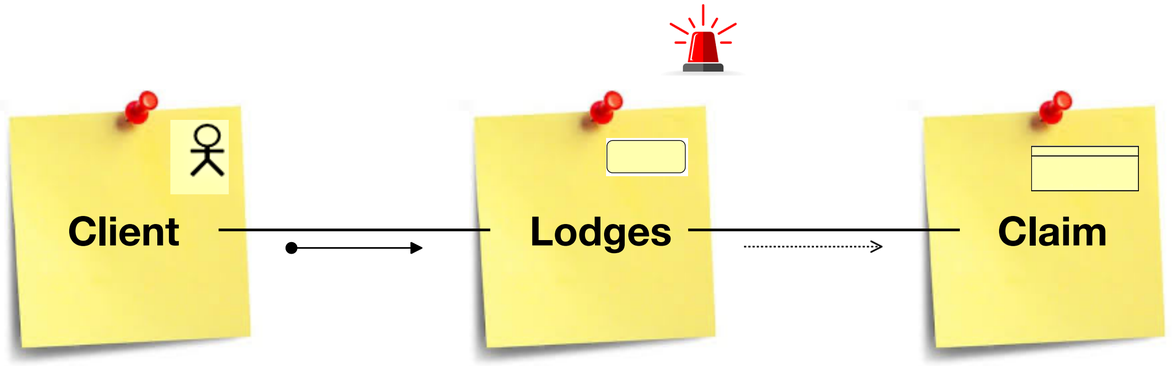
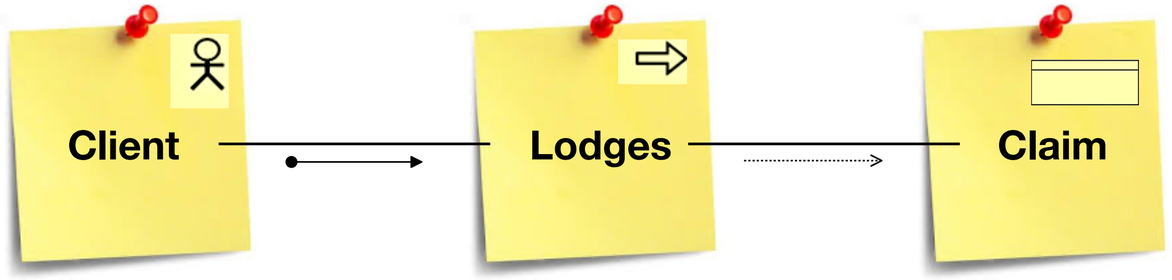


What kind of behaviour?

- Business process
- Business function
- Business interaction
- Business service
- Business event

Selection of interpretation



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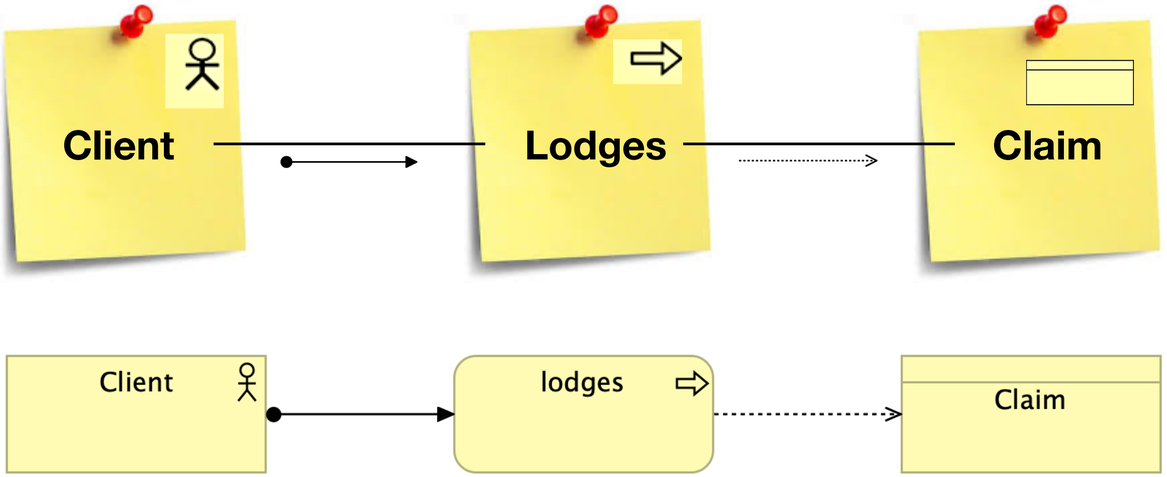

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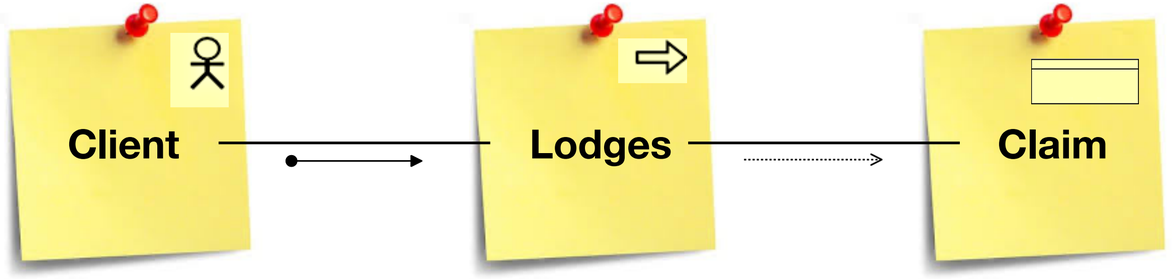

Three (iterative) modelling tasks

1. identify the relevant concepts and relations in the part of the enterprise that is to be modelled

2. interpret these in terms of the modelling concepts as offered by the used enterprise modelling language

3. complement this with additional constraints (if offered by the modelling language)

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Agenda

- [x] The problem
- [x] Selection of interpretation
- [ ] Towards reasoning
- [ ] Conclusion

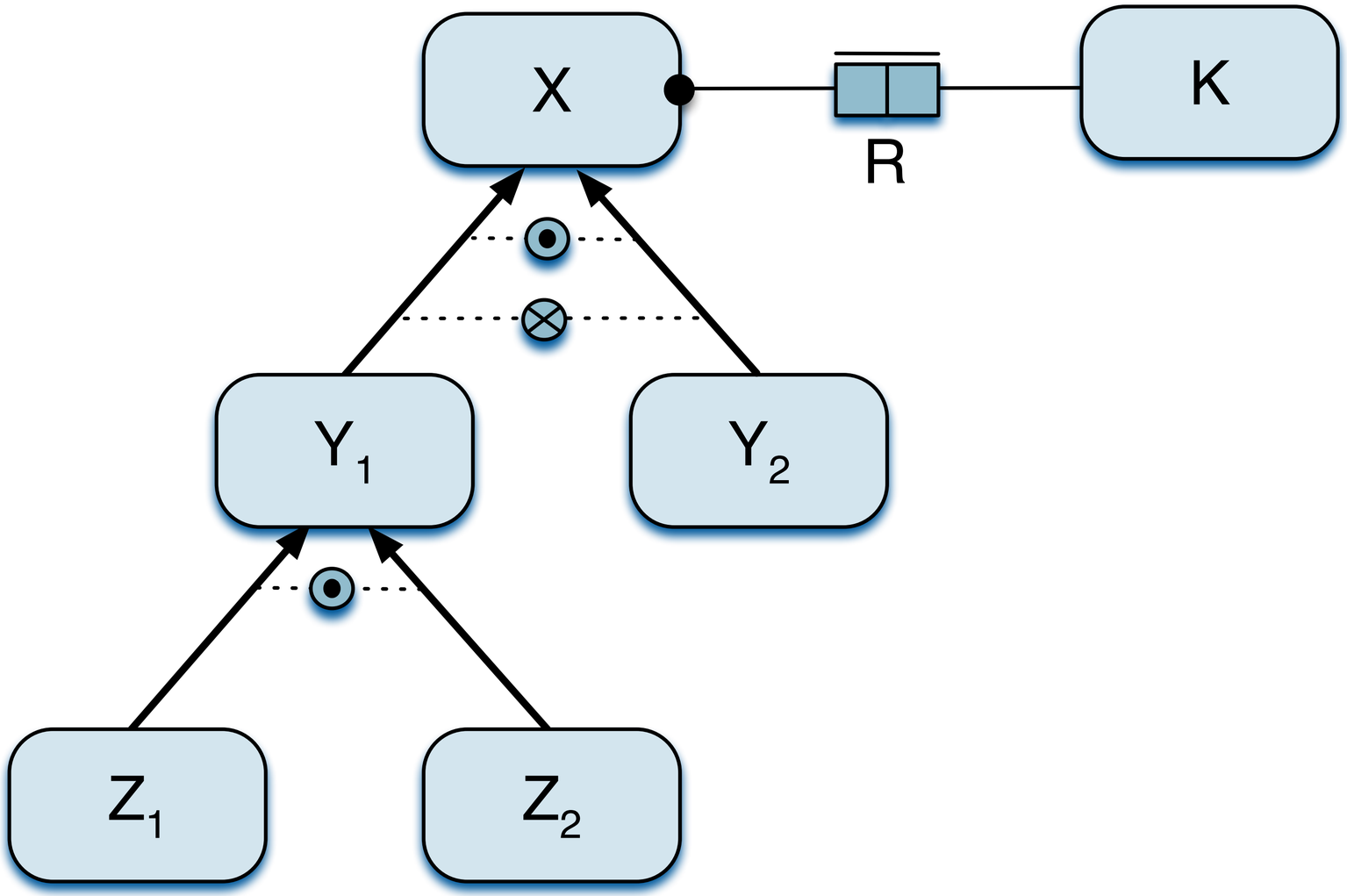
Context

Fresh PhD position at the University of Luxembourg on
"*AI Assisted domain modelling*"
CET: Erik Proper / Qin Ma / Leon van der Torre

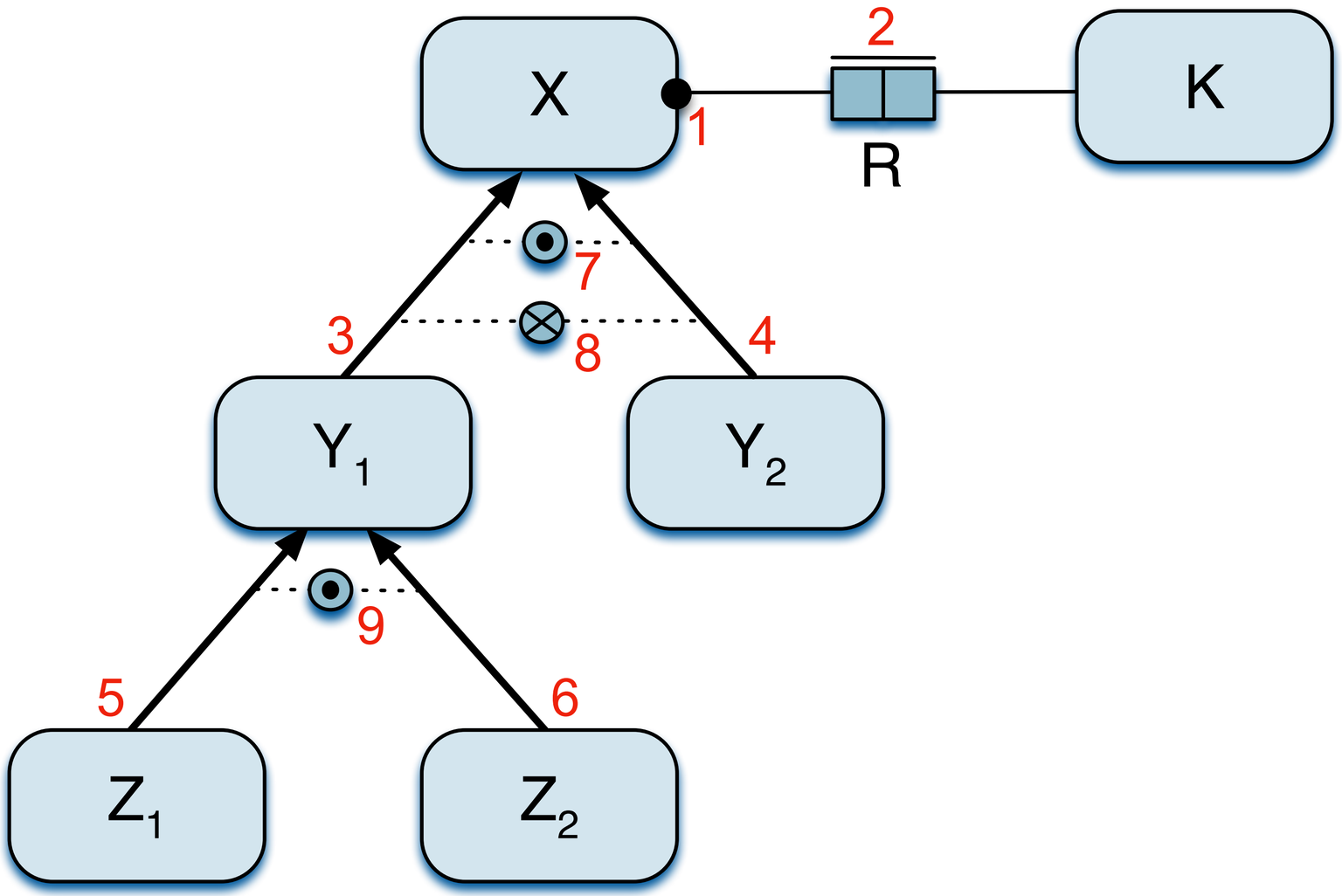
C. Feltus, Q. Ma, H. A. Proper, and P. Kelsen. Towards AI Assisted Domain Modeling. In I. Reinhartz-Berger and S. W. Sadiq, editors, Advances in Conceptual Modeling ER 2021 Workshops CoMoNoS, EmpER, CMLS, St. John's, NL, Canada, October 18-21, 2021, Proceedings, volume 13012 of Lecture Notes in Computer Science. Springer, Heidelberg, Germany, 2021. To be presented at the EmpER workshop during the ER conference in Conceptual Modelling. ISBN: 978-3-030-88357-7

Opportunity to also further elaborate the "Selection of interpretation" concept

Hierarchies in (meta) models



Hierarchies in (meta) models



1: $\mathsf{X}(a) \Rightarrow \exists_b[\mathsf{R}(a,b)]$

2: $\mathsf{R}(a,b) \Rightarrow \mathsf{X}(a) \wedge \mathsf{K}(b)$

3: $\mathsf{Y}_1(a) \Rightarrow \mathsf{X}(a)$

4: $\mathsf{Y}_2(a) \Rightarrow \mathsf{X}(a)$

5: $\mathsf{Z}_1(a) \Rightarrow \mathsf{Y}_1(a)$

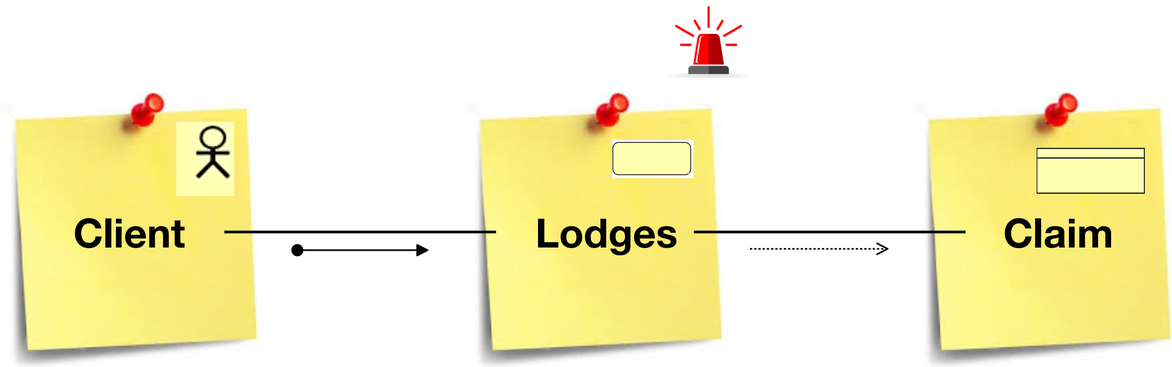
6: $\mathsf{Z}_2(a) \Rightarrow \mathsf{Y}_1(a)$

7: $\mathsf{X}(a) \Rightarrow \mathsf{Y}_1(a) \vee \mathsf{Y}_2(a)$

8: $\neg(\mathsf{Y}_1(a) \wedge \mathsf{Y}_2(a))$

9: $\mathsf{Y}_1(a) \Rightarrow \mathsf{Z}_1(a) \vee \mathsf{Z}_2(a)$

Nuanced conformance of models



What kind of behaviour?

- Business process
- Business function
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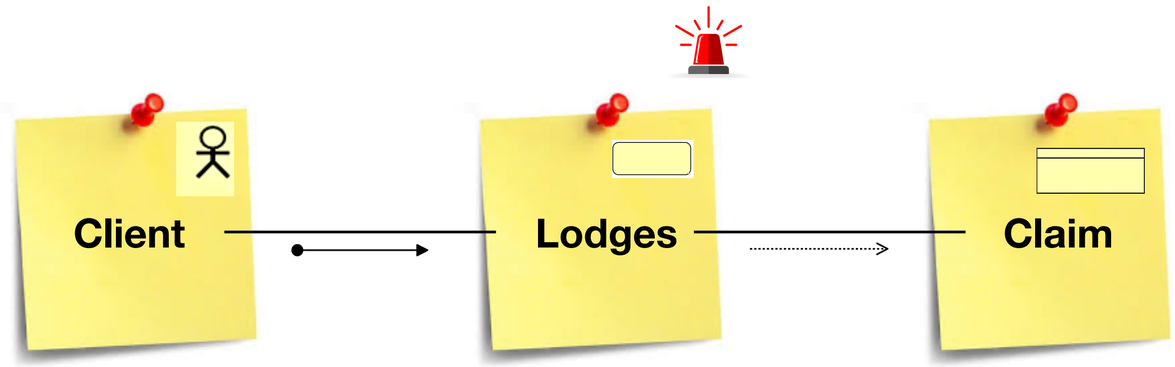
- Business event

Nuanced conformance of models

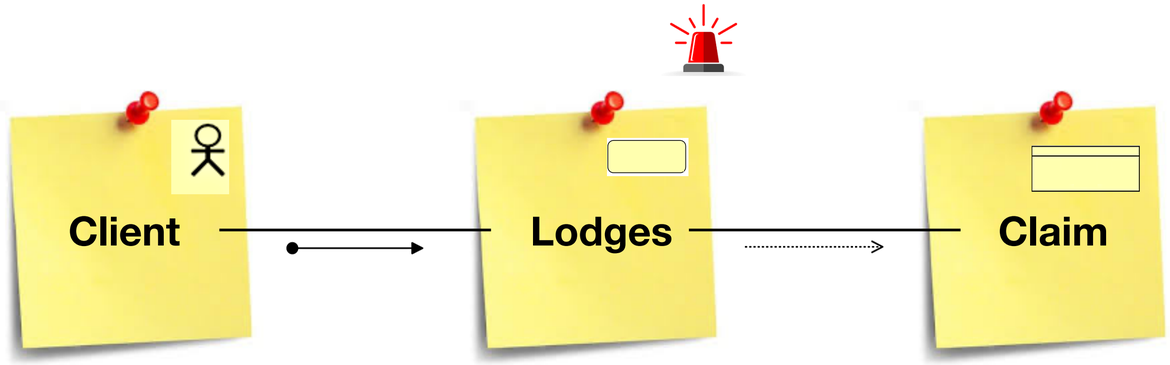


Traditional view:

Meta-model: $\mathcal{M} = \langle C, A \rangle$, with concepts (predicates) C and constraints (axioms) A

Conformance of model m to meta-model $\mathcal{M}$: $m \models \mathcal{M}$

Nuanced conformance of models



Nuanced view:

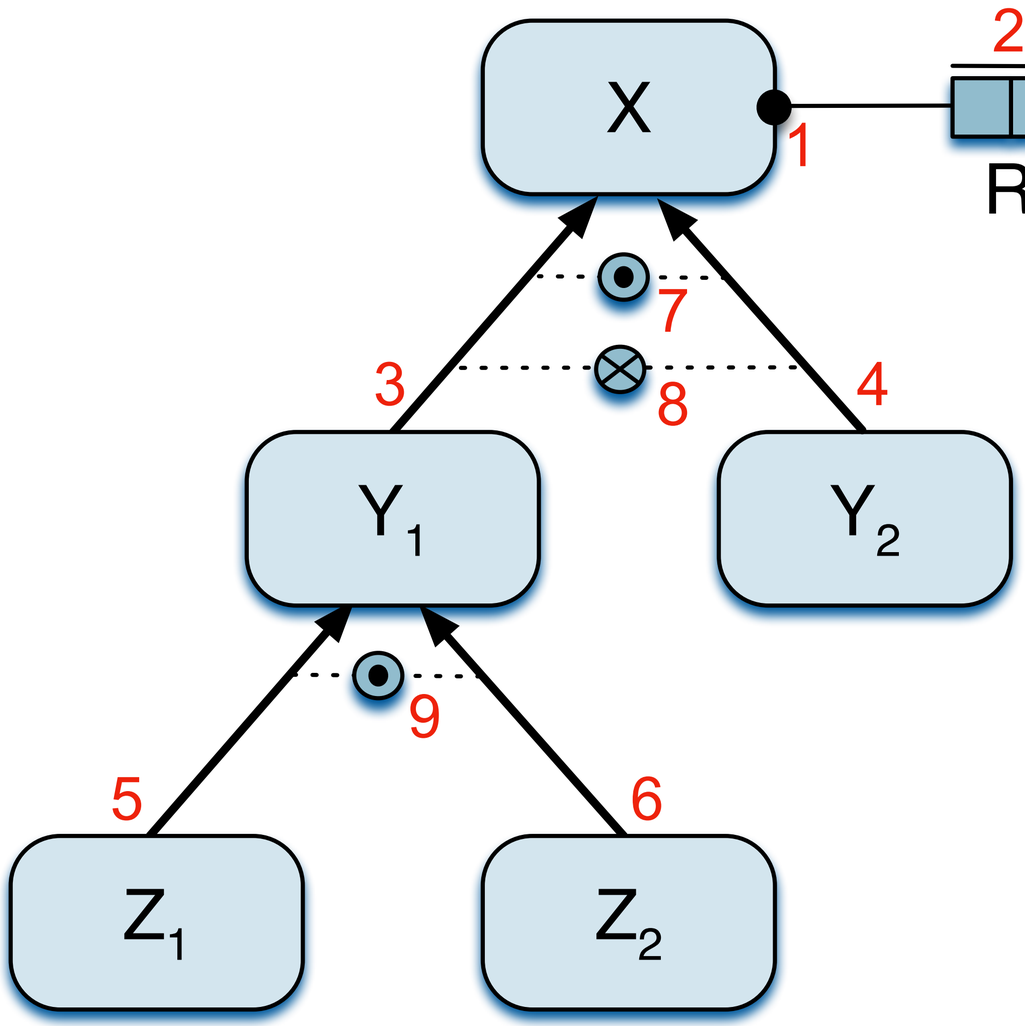
Meta-model: $\mathcal{M} = \langle C, A_i, A_d \rangle$, with concepts C, immediate constraints A_i, and deferred constraints A_d

Final conformance of models: $m \models \mathcal{M} \triangleq m \models \langle C, A_i \cup A_d \rangle$

Intermediate conformance, and 'work' $W \subseteq A_d$ that remains to be done:

$$m \models^{W} \mathcal{M} \triangleq m \models \langle C, A_i \cup A_d - W \rangle \text{ and } \forall_{V \subset W} [m \not\models \langle C, A_i \cup A_d - V \rangle]$$

Nuanced conformance of models



Immediate (derivations)

Deferred

1: $\mathsf{X}(a) \Rightarrow \exists_b[\mathsf{R}(a,b)]$

2: $\mathsf{R}(a,b) \Rightarrow \mathsf{X}(a) \wedge \mathsf{K}(b)$

3: $\mathsf{Y}_1(a) \Rightarrow \mathsf{X}(a)$

4: $\mathsf{Y}_2(a) \Rightarrow \mathsf{X}(a)$

5: $\mathsf{Z}_1(a) \Rightarrow \mathsf{Y}_1(a)$

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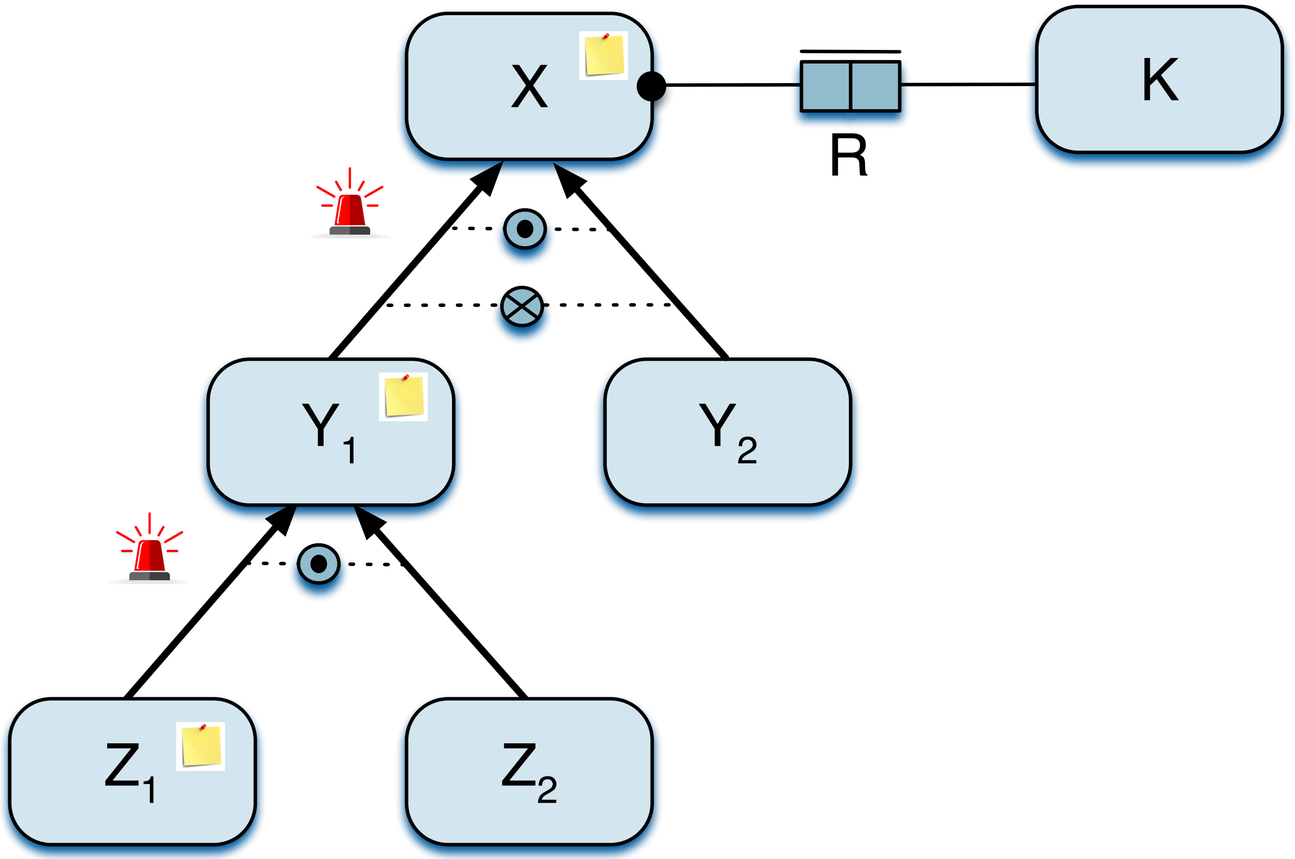
7: $\mathsf{X}(a) \Rightarrow \mathsf{Y}_1(a) \vee \mathsf{Y}_2(a)$

8: $\neg(\mathsf{Y}_1(a) \wedge \mathsf{Y}_2(a))$

9: $\mathsf{Y}_1(a) \Rightarrow \mathsf{Z}_1(a) \vee \mathsf{Z}_2(a)$

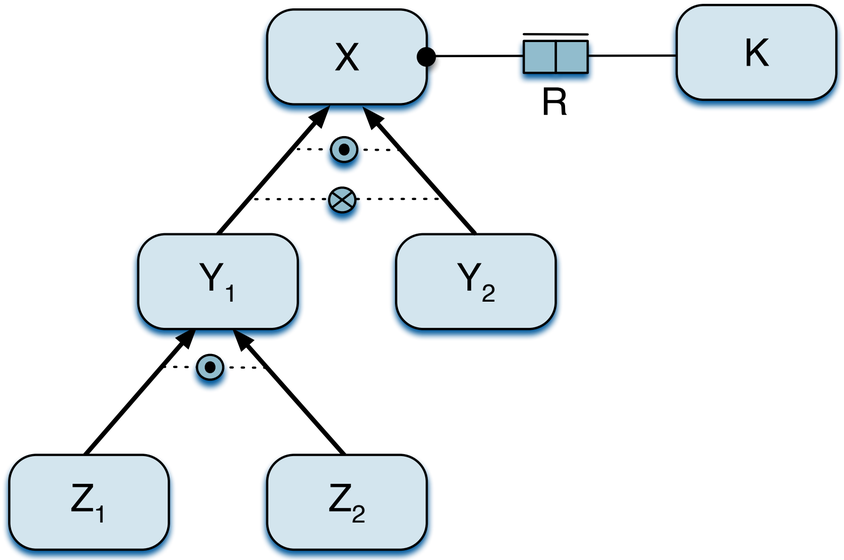
Utilise the type hierarchy



Utilise the type hierarchy

Meta-model: $\mathcal{M} = \langle C, A_i, A_d \rangle$, with concepts C, immediate constraints A_i, and deferred constraints A_d

More explicit knowledge about subtyping and constraints needed



Next steps

Utilise foundational ontologies and / or natural language processing to provide more guidance / suggestions in selecting interpretations

References

H. A. Proper and Th. P. van der Weide. Modelling as Selection of interpretation. In H. C. Mayr and H. Breu, editors, Modellierung 2006, 22.-24. März 2006, Innsbruck, Tirol, Austria, Proceedings, volume P82 of Lecture Notes in Informatics, pages 223-232, Bonn, Germany, March 2006. Gesellschaft für Informatik. ISBN: 3-88579-176-5

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Agenda

- [x] The problem
- [x] Selection of interpretation
- [x] Towards reasoning
- [ ] Conclusion

The problem

- Practitioners, and learners, find it difficult to select among the many concepts
- At the same time, the need for precision in terms of the specific concepts is appreciated

Towards a solution

- Ongoing work!
- Requires a nuanced view of conformity of models to the meta-model
- Support modellers by active reasoning regarding:
  - the constraints in the meta-model and compliance to the meta-model
  - compliance to (relevant) (foundational) ontologies

Context

Model-driven systems

Modelling infrastructures

Assisted domain modelling

Selection of interpretation

Advanced UIs

AI enabled

Low code; High model

Agenda

- ☑ The problem
- ☑ Selection of interpretation
- ☑ Towards reasoning
- ☑ Conclusion