

# Ontological Patterns and Anti-Patterns for the Modeling of Complex Enterprise Relations

Nicola Guarino<sup>1</sup>, Giancarlo Guizzardi<sup>2</sup>, Daniele Porello<sup>1</sup>

<sup>1</sup> ISTC-CNR Laboratory for Applied Ontology, Trento, Italy

`nicola.guarino@cnr.it`, `daniele.porello@cnr.it`

<sup>2</sup> Free University of Bozen-Bolzano, Italy

`giancarlo.guizzardi@unibz.it`

Enterprise modeling requires of course to pay attention to different kinds of business relationships. In many cases, we really need to talk about such relationships, for instance, when the contractual conditions that regulate them evolve in time, or when such conditions are violated. In terms of conceptual modeling, this means that relationships need to be *reified*, they need to be put in the domain of discourse.

In this tutorial, we shall first introduce the ontological basis of relationships reification, according to which relationships are construed as *truthmakers* of relational statements. We shall then illustrate different kinds of ontological patterns and anti-patterns based on the different nature of such truthmakers, by discussing concrete case studies related to enterprise modeling.

The material presented in the tutorial is based on a novel theory of relationships and reification that was first published in (Guarino and Guizzardi (2015, 2016)) and later used to evolve the Ontology-Driven Conceptual Modeling language OntoUML (Guizzardi et al. (2018)).

The theory has since then been successfully applied to model economic transactions (Guarino, Guizzardi, and Sales (2018)), legal relations (Griffo, Almeida, and Guizzardi (2018)), service contracts (Griffo, Almeida, Guizzardi, and Nardi (2017)), complex service life-cycles (Nardi et al. (2015)), preference relations in economics (Porello and Guizzardi (2018)), and strategic enterprise relationships (Sales, Porello, Guarino, Guizzardi, and Mylopoulos (2018)).

The approach to complex relation modeling by employing Ontological Design Patterns has been discussed in (Guarino, Sales, and Guizzardi (2018)); The approach for Anti-Pattern detection and systematic model rectification employed here has been discussed in (Guizzardi (n.d.)).

## References

- Griffo, C., Almeida, J. P. A., & Guizzardi, G. (2018). Conceptual modeling of legal relations. In *Conceptual modeling - 37th Int. Conf. ER 2018, Xi'an, China, October 22-25, 2018*. (pp. 169–183).
- Griffo, C., Almeida, J. P. A., Guizzardi, G., & Nardi, J. C. (2017). From an ontology of service contracts to contract modeling in enterprise architecture. In *21st IEEE Int Enterprise Distributed Object Computing Conf., EDOC 2017, Quebec City, QC, Canada, October 10-13, 2017* (pp. 40–49).
- Guarino, N., & Guizzardi, G. (2015). We need to discuss the relationship: Revisiting relationships as modeling constructs. In *International conference on advanced information systems engineering, caise 2015* (pp. 279–294).
- Guarino, N., & Guizzardi, G. (2016). Relationships and events: Towards a general theory of reification and truthmaking. In *AI\*IA 2016: Advances in artificial intelligence, Genova, Italy, November 29 - December 1, 2016* (pp. 237–249).
- Guarino, N., Guizzardi, G., & Sales, T. P. (2018). On the ontological nature of REA core relations. In *Proc. of the 12th int. workshop on value modeling and business ontologies, VMBO 2018, Amsterdam, The Netherlands, February 26th - 27th, 2018*. (pp. 89–98).
- Guarino, N., Sales, T. P., & Guizzardi, G. (2018). Reification and truthmaking patterns. In *Conceptual modeling - 37th international conference, ER 2018, xi'an, china, october 22-25, 2018*. (pp. 151–165).
- Guizzardi, G. (n.d.). Ontological patterns, anti-patterns and pattern languages for next-generation conceptual modeling. In *Conceptual modeling - 33rd international conference, ER 2014, Atlanta, GA, USA, october 27-29, 2014., pages = 13-27, year = 2014*.
- Guizzardi, G., Fonseca, C. M., Benevides, A. B., Almeida, J. P. A., Porello, D., & Sales, T. P. (2018). Endurant types in ontology-driven conceptual modeling: Towards ontouml 2.0. In *Conceptual modeling - 37th international conference, ER 2018, Xi'an, China, October 22-25, 2018*. (pp. 136–150).
- Nardi, J. C., de Almeida Falbo, R., Almeida, J. P. A., Guizzardi, G., Pires, L. F., van Sinderen, M., ... Fonseca, C. M. (2015). A commitment-based reference ontology for services. *Inf. Syst.*, *54*, 263–288.
- Porello, D., & Guizzardi, G. (2018). Towards an ontological modelling of preference relations. In *AI\*IA 2018 - Advances in Artificial Intelligence - 27th int conf of the Italian Association for Artificial Intelligence, Trento, Italy, november 20-23, 2018* (pp. 152–165).
- Sales, T. P., Porello, D., Guarino, N., Guizzardi, G., & Mylopoulos, J. (2018). Ontological foundations of competition. In *Formal Ontology in Information systems-proceedings of the 10th int. conf., FOIS 2018, Cape Town, South Africa, 19-21 september 2018* (pp. 96–109).