

On Capturing Legal Knowledge in Ontology and Process Models Combined

The Case of an Appeal Process

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Abstract. In this paper, we explore conceptual modeling as a means to improve the explicit representation of key aspects of a legal procedure. We employ in tandem an ontology-based structural conceptual model and a behavioral process model as complementary views on a legal subject matter. We examine as a case a specific type of appeal in the Brazilian legal system and establish a correspondence between elements in the models and fragments of the specific norms on which they are grounded. These correspondences are expressed with identifiers using the Brazilian LexML identification scheme.

Keywords. Legal process, Legal ontology, OntoUML, BPMN, LexML

1. Introduction

Given the importance of legal systems for many aspects of our lives, their functioning demands a much higher level of *transparency* than that which is required of other organizational environments (such as private enterprises). While legal institutions are created mostly through documented speech acts, there are a number of barriers for transparency. These include opaque aspects of legal jargon used in legal documents (including legislation), a number of procedural or operational aspects embodied in the practice that are not captured explicitly in legal documents, the complex nature of the legal system, and the inescapable ambiguity of natural language [4]. Lack of transparency in legal systems affects the access of citizens to justice as well as the design and operations of digital legal information systems, which are key to tame the scale of current societal demands.

In this paper, we report on ongoing work to explore conceptual modeling as a means to improve the explicit representation of key aspects of a legal procedure. The approach is based on the simultaneous development of structural ontology-based conceptual models and behavioral process models. In order to capture the structural aspects of this domain, we adopt OntoUML, an ontologically well-founded UML profile whose primitives reflect ontological distinctions of an underlying foundational ontology (UFO [7]); and to capture the behavioral (or dynamic) aspects of the domain, we adopt the Business Process Model

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and Notation (BPMN). Our OntoUML and BPMN diagrams share events and other UFO prescribed ontological entities (e.g., phases, qualities and modes) providing a better integration for the models [10,15]. Finally, we propose a procedure for grounding these models by aligning the classes and assertions used therein with corresponding fragments of a suitable normative description. In this case, such alignment is supported by the LexML identification scheme² which is the basis of a Brazilian open data system to identify and publicize legal documents [13]. We examine the representation of an specific type of appeal in the Brazilian legal system (a *Request for Standardizing the Interpretation of a Federal Law*) that is part of a highly specialized procedure in Federal Courts, and often considered verbose and nontransparent.

Several approaches in the literature address the combination of structural and dynamic viewpoints [14,16]. In some of these approaches, there is an explicit recognition that linking laws and models can increase the traceability between laws and processes, helping the law makers to elaborate models in collaboration with software developers and process engineers, and understand the impact of law or process changes to their counterparts. A common feature of [14,16] (and also other ontology-based approaches such as [3]) is the representation of the structural aspects of the domain using OWL-DL. OWL-DL (despite the name) is a logics offering no support for real ontological analysis, as well as for explicit representation of the result of these analyses. In contrast, OntoUML supports the modeler's analysis with rich theories of types, relations, events, as well as existentially dependent and independent endurants. In addition, it offers a system of modeling primitives and constraints that can explicit represent these notions. In particular, it allows for representation of contingent (i.e., dynamic) intrinsic and relational properties and the contingent types whose dynamic classification conditions are defined by them (roles, phases, rolemixins). This allows for direct connection points between elements in the structural viewpoint, and events, conditions and decision points in the dynamic/process model. Further, the semantics of events in OntoUML models and the constraints governing their connection to enduring entities improves the ontological consistency of the overall approach (e.g., w.r.t. to semantics of object identifiers, as well as interpretation of the modal properties of the respective types [9]). OWL, in contrast, being a monotonic language and having no built in notion of temporal modality is particularly limited in modeling dynamic aspects of the domain. Finally, OntoUML modelers can count on a rich ecosystem of tools for model construction, verification, OWL generation, validation and verbalization [5,11].

2. Towards Models for an Appeal Process

With the introduction of the new civil procedure code that came into force in 2015, Brazil is rapidly evolving into a system of *stare decisis*, adopting a normative model of formally binding precedents and, thus, changing from a predominantly *civil law* system to become a country with a hybrid system of *civil and common law* [17]. In this new context, cases are then to be decided according to consistent and principled rules so that similar facts will yield similar results. In practical terms, precedents set by appellate courts—the Federal Supreme Court (STF) and the Superior Court of Justice (STJ)—should be applied as

²<https://www.lexml.gov.br/>

binding precedents in future decisions. In the scope of the Federal Special Courts in Brazil, parties may challenge unfavorable Appellate Panel decisions by pointing to deviations from established precedents. In this case, they file a so-called *Request for Standardizing the Interpretation of a Federal Law* (henceforth RS). This request is analyzed by a federal judge for admissibility before it is sent for consideration of the *National Uniformization Panel (TNU)* (according to law nº 10.259/01, article 14). The focus of our models is on this type of request, its phases and the admissibility procedure.

In OntoUML, enduring entities (continuants, endurants) are classified into a system of *kinds* that are mutually disjoint and exhaust the entities in that particular sub-portion of the domain. In other words, all enduring entities considered belong to exactly one kind. Entities of different kinds can contingently play different *roles* in the scope of relational contexts, and contingently instantiate different *phases*. Phases are then types that entities instantiate contingently due to changes in their intrinsic properties. The so-called dispersive types (non-sortals) classify entities of multiple kinds. These types include *categories* and *role mixins* (roles played by entities of multiple kinds). These different types of types can classify both *objects* (independent enduring entities) as well as *qualities* (reified intrinsic characteristics), and *relators* (relational contexts formed by reified relational characteristics) [7,8]. Finally, enduring entities change phases and start playing roles by changing their intrinsic and relational properties, respectively. This is caused by occurrence of *events* [2]. These distinctions put forth by UFO are explicitly encoded in the syntax of OntoUML (with UML stereotypes). Figure 1 shows a fragment of the OntoUML produced, focusing on the REQUEST FOR STANDARDIZING (RS) and its phases. It identifies the various roles involved in the JUDICIAL PROCESS, the APPELLATE DECISION against which the RS is filed and the ADMISSIBILITY DECISION in which an RS is analyzed and ruled on.

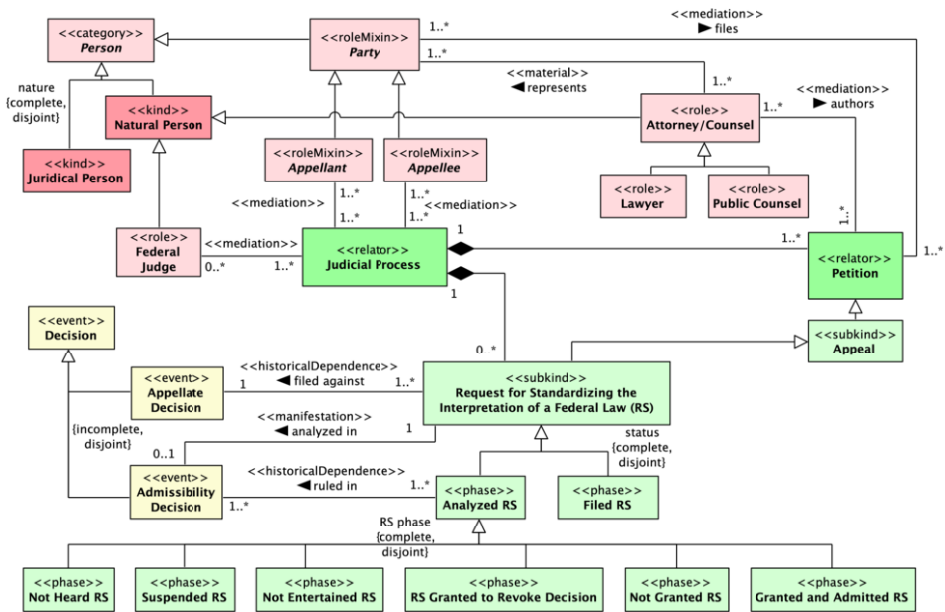


Figure 1. Request for Standardizing Legal Ontology

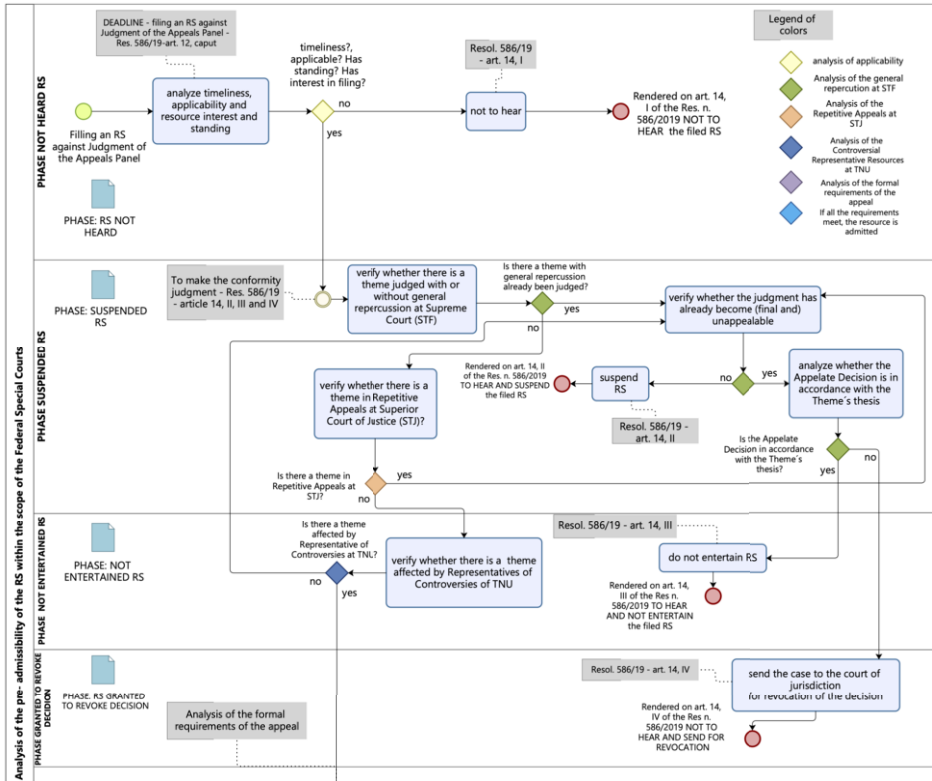


Figure 2. Analysis of the admissibility of the RS in a Federal Special Court, based on Res.n°586/19

The analysis of an RS’s admissibility is made in accordance to the aforementioned internal regulations of the TNU (Res n°586/19). The RS goes through different phases according to our process model, depending on the result of the analysis procedure (represented by the BPMN diagram in Figure 2). The same phases found in the ontology are represented here in the process model. We show only a fragment of the complete diagram³. The Superior Courts establishes/recognizes topics (‘themes’) of general repercussion (at the level of the Federal Supreme Court – STF), repetitive appeals when there are multiple appeals based on the same question of law (at the Superior Court of Justice – STJ), and RSs (at the TNU) as representatives of controversies. In order to bring greater legal certainty and uniformity across cases, the judgment of these themes must consider and be considered as binding precedents. If the APPELLATE DECISION is in accordance with a thesis of a ‘theme’ (a binding precedent) set by the STF, STJ or TNU, the appeal is NOT ENTERTAINED. But, in contrast, if diverges from the understanding of the supreme courts under the rules of general repercussion or of the resolution of multiple appeals on the same point of law, the case must be further analyzed by the proper court of jurisdiction for the possible revocation of the decision to adapt to the binding precedent, standardizing the understandings of the Brazilian courts on the same subject. If the RS meets the legal and regimental requirements, it must be GRANTED AND ADMITTED and forwarded to the

³See the complete document at <https://github.com/MelissaZor/JURIX2022>

National Uniformization Panel (TNU) and, if there are multiple appeals based on the same issue of law, it should be classified as representative of the controversy with the other SUSPENDED RSS, until the trial and final judgment of the pilot case occurs. This aims at standardizing decisions on the same subject in Federal Special Courts throughout the country: “*the task of determining the ratio decidendi, or rule of decision of a case, which raises similar issues of selection, characterization, and abstraction of case facts.*” [1].

2.1. Grounding Domain Classes in Norms

In order to ground the elements related to the admissibility of an RS that appear in the OntoUML and BPMN diagrams, we align these elements to the norms in force that constitute them. A small fragment of the result of this alignment is shown in Table 1. The table refers to the grounding norms including their LexML norm fragment identifiers, which can be resolved with hyperlinks to <https://normas.leg.br/>, revealing, when available in that database, the corresponding legal text. For example, we observe the definition of the APPELLATE DECISION event class in article 204 of the Civil Procedure Code, as well as the RS with a definition based on article 14 of federal law n° 10.259/01.

Model Element	Law/Norm	URN
JUDICIAL PROCESS	13.105/15-Art. 2°	urn:lex:br:federal:lei:2015-03-16;13105!art2
RS	10.259/01-Art. 14	urn:lex:br:federal:lei:2001-07-12;10259!art14
PUBLIC COUNSEL	Fed. Const.-Art. 131	urn:lex:br:fed:const:1988-10-05;1988!art131
APPELLATE DECISION	13.105/15-Art. 204	urn:lex:br:federal:lei:2015-03-16;13105!art204
JURIDICAL PERSON	10.406/02-Art. 41	urn:lex:br:federal:lei:2002-01-10;10406!art416
SUSPENDED RS	Res.n°586/19-Art. 14, III	urn:lex:br:cjf:res:2019-09-30;586!art14_inc3

Table 1. Validation of conceptual elements based on norms with LexML hyperlinks

3. Final Considerations

The transparent and expressive representation of legal systems has the potential to bring multiple benefits for these systems. In particular, representing the law in a well-founded diagrammatic manner can bring benefits in terms of the interpretability and explainability of legal texts [6]. This is particularly important for complex procedures such as those addressed in this paper. In complex modeling cases, viewpoint modeling has been used in many different areas as a mechanism for complexity management via separation of concerns [12]. In this paper, we explore some preliminary results of an approach for the multi-viewpoint conceptual modeling of the law that combines: a structural perspective modeled with an ontology-driven conceptual modeling language (OntoUML); (ii) with a dynamic perspective modeled in the BPMN notation. Specific ontological categories present in the OntoUML structural model provide for explicit alignment points through which the two models can be combined. This approach is applied in the modeling of *Requests for Standardizing the Interpretation of a Federal Law* in the Brazilian system.

In future work, we intend to investigate the cognitive benefits of the combined models in supporting the stakeholders of the modeled procedures. We also intend to elaborate on guidelines and semantically-motivated syntactic rules to establish the correspondence

between the structural and the behavioral views. The OntoUML tools already provide for a transformation into OWL, which can then be further employed for reasoning about the structural aspects. An investigation into suitable semantics for the BPMN model in terms of OWL and UFO-B may further support us in reasoning on the combined models. We will also examine the benefits of the availability of the conceptual models for automation of certain decisions in the analysis of admissibility of an RS. This will require us to formalize the content of the various decisions along the process model presented in this paper. We intend to extract and semantically-annotate data from judgments directly from the TNU portal.

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References

- [1] Ashley, K.D.: Precedent and legal analogy. *Handbook of Legal Reasoning and Argumentation* pp. 673–710 (2018)
- [2] Benevides, A.B., Bourguet, J.R., Guizzardi, G., Peñaloza, R., Almeida, J.P.A.: Representing a reference foundational ontology of events in SROIQ. *Appl. Ontology* **14**(3), 293–334 (2019)
- [3] Bourguet, J.R., Zorzanelli Costa, M.: About the exposition of brazilian jurisprudences. In: ONTOBRAS. vol. 1862, pp. 138–143 (2016)
- [4] Bourguet, J.R., Zorzanelli Costa, M.: Scoring judicial syllabi in Portuguese. In: JURIX. vol. 302, pp. 119–124 (2017)
- [5] Fonseca, C.M., Sales, T.P., Viola, V., Fonseca, L.B.R., Guizzardi, G., Almeida, J.P.A.: Ontology-driven conceptual modeling as a service. In: Proc. FOMI 2021. *CEUR Workshop Proceedings* (2021)
- [6] Griffo, C., Almeida, J.P.A., Guizzardi, G.: Conceptual Modeling of Legal Relations. In: *Conceptual Modeling - 37th International Conference, ER 2018*. pp. 169–183. Springer (2018).
- [7] Guizzardi, G.: *Ontological Foundations for Structural Conceptual Models*. CTIT PhD thesis series, Centre for Telematics and Information Technology, Telematica Instituut (2005)
- [8] Guizzardi, G., Botti Benevides, A., Fonseca, C.M., Porello, D., Almeida, J.P.A., Prince Sales, T.: UFO: Unified foundational ontology. *Applied ontology* **17**(1), 167–210 (2022)
- [9] Guizzardi, G., Guarino, N., Almeida, J.P.A.: Ontological considerations about the representation of events and endurants in business models. In: *Int. Conf. Business Process Mngmt*. pp. 20–36. Springer (2016)
- [10] Guizzardi, G., Wagner, G.: Conceptual simulation modeling with Onto-UML. In: *Proceedings of the Winter Simulation Conference. WSC '12, Winter Simulation Conference* (2012)
- [11] Guizzardi, G., Wagner, G., Almeida, J.P.A., Guizzardi, R.S.S.: Towards ontological foundations for conceptual modeling: The Unified Foundational Ontology (UFO) story. *Appl. Ontology* **10**(3-4) (2015)
- [12] Josey, A., Lankhorst, M., Band, I., Jonkers, H., Quartel, D.: An introduction to the archimate® 3.0 specification. White Paper from The Open Group (2016)
- [13] Lima, J.A.O., Passos, E.: LexML – visão unificada da informação legislativa e jurídica do brasil. *Cadernos de Informação Jurídica (Cajur)* **6**(1), 248–259 (jun 2019)
- [14] Palmirani, M., Governatori, G.: Modelling legal knowledge for GDPR compliance checking. In: JURIX. vol. 313, pp. 101–110 (2018)
- [15] Suchánek, M., Pergl, R.: Mapping UFO-B to BPMN, BORM, and UML activity diagram. In: *EOMAS 2019. LNBIP*, vol. 366, pp. 82–98. Springer (2019)
- [16] Weldemariam, K., Villaforita, A., Siena, A., Susi, A.: Enhancing law modeling and analysis: Using BPR-based and goal-oriented frameworks. *Int. Journal Advances in Security* **3**(3), 80–90 (2011)
- [17] Zaneti Jr, H.: O valor vinculante dos precedentes: teoria dos precedentes normativos formalmente vinculantes. *JusPodivm* (2021)