Formal Ontology. (Anti-)Patterns and Model Simulation

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ONTOLEG 2012
Earth Science Ontology Dialog
Situations represented by the valid specifications of language L

Admissible state of affairs according to a conceptualization C
Situations represented by the valid specifications of language L

Admissible state of affairs according to a conceptualization C

Ontology = structure + axiomatization
Situations represented by the valid specifications of language $L$

Admissible state of affairs according to a conceptualization $C$

Ontology = structure + domain independent axioms
Formal Ontology

A discipline that deals with formal ontological structures (e.g. theory of parts, theory of wholes, types and instantiation, identity, dependence, unity) which apply to all material domains in reality.
Ontological Distinctions among Types

**KIND**: Every instance of a KIND is necessarily an instance of that KIND (e.g., Person)

**ROLE** (e.g., Student):
- All instances of a given ROLE are of the same KIND (e.g., all Students are Person)
- All instances of a ROLE instantiate that type only contingently (e.g., no Student is necessarily a Student)
- Instances of a KIND instantiate that ROLE when participating in a certain RELATIONAL CONTEXT (e.g., instances of Person instantiate the Role Student when enrolled in na Educational Institution)
NO!

NO!

NO!

NO!

enrolled at

0..n

Educational Institution

Person

Student

Person

Student
«kind»
A

... 

«role»
B

enrolled at

C
m..n
m ≥ 1
\(\Box (\forall x \text{ Person}(x) \rightarrow \Box (\text{Person}(x)))\)

\(\Box (\forall x \text{ Student}(x) \rightarrow \Diamond (\neg \text{Student}(x)))\)

\(\Box (\forall x \text{ Student}(x) \rightarrow \text{Person}(x))\)

\(\Box (\forall x \text{ Student}(x) \rightarrow \exists y \text{ Educational Institution}(y) \land \text{Enrolled-at}(x,y))\)

...
Transplant

Person
(this/Donor, this/Donor, this/Donor)

hasSurgeon
hasDonor
hasDonee
Relation between Overlapping Sybtypes (ROS)
Relation Specialization (RS)
Sample of Ontologies Analyzed

1. A Conceptual Model that describes a Brazilian Health Organization
2. A Conceptual Model that describes the Organizational Structure of Brazilian Federal Universities
3. A Conceptual Model that describes a Domain of Online Mentoring Activities
4. An Ontology representing the domain of Transport Optical Network Architectures
5. An Ontology in the Biodiversity Domain
6. A Heart Electrophysiology Reference Ontology
7. An Ontology in the Domain of Normative Acts
8. An Ontology of Public Tenders
9. An Ontology in the Domain of Brazilian Federal Organizational Structures
<table>
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<th>#RBOS</th>
<th>#RS</th>
<th>#IA</th>
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<td><strong>66.67%</strong></td>
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Few modelers, however, have had the experience of subjecting their models to continual, automatic review. Building a model incrementally with an analyzer, simulating and checking as you go along, is a very different experience from using pencil and paper alone. The first reaction tends to be amazement: modeling is much more fun when you get instant, visual feedback. When you simulate a partial model, you see examples immediately that suggest new constraints to be added. Then the sense of humiliation sets in, as you discover that there’s almost nothing you can do right.

Daniel Jackson
References


