Thesis: Valid Time Rdf

Abstract: The Semantic Web aims at building a foundation of semantic-based data models and languages for not only manipulating data and knowledge, but also supporting decision making by machines. Naturally, time-varying data and knowledge are required in Semantic Web applications to incorporate time and further reason about it. However, the original specifications of Resource Description Framework (RDF) and Web Ontology Language (OWL) do not include constructs for handling time-varying data and knowledge. For simplicity, RDF model is confined to binary predicates, hence some form of reification is needed to represent higher-arity predicates. To this date, there are many proposals extending RDF and OWL for handling temporal data and knowledge. They all focus on the valid time. Some of these proposals stay within the standards whereas others add new constructs to RDF and its query language, SPARQL. Our first goal is to study these models in a comparative framework and develop a taxonomy for classifying them. On this basis, we propose a new temporal data model, Valid Time RDF, or VTRDF, that incorporates valid time explicitly into RDF. We define valid time resources as the building blocks of VTRDF. Our approach treats all resources in VTRDF uniformly, which is significant in that the need of RDF reification is eliminated. In particular, using VTRDF to handle temporal data and knowledge requires no additional triples or objects. We formally define valid time triples and graphs, which are subject to the Temporal Triple Integrity, and the formal semantics for the layered sets of VTRDF vocabularies. To query VTRDF triple databases, we design a query language, VT-SPARQL, that extends the standard SPARQL to handle valid time resources, time intervals, and temporal reasoning.

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