Algebraic Specification for RDF Models

Sergey Melnik
melnik@db.stanford.edu
Dept. of Computer Science, Stanford University
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Abstract
The following algebraic specification was derived from the RDF Model and Syntax specification (http://www.w3.org/Press/1999/RDF-REC). It represents an interpretation of RDF models as algebraic structures. The author is not aware of whether a similar formal representation was published by W3C.

An RDF model is an algebraic structure \( \mathfrak{M} = (U; R, L, S, P, Rf; \overline{K}) \) with the following properties:

1. \( U = R \cup L, R \cap L = \emptyset \) (resources and literals are disjunct)
2. \( \overline{K} = \{\text{Statement, Seq, Bag, Alt, type, predicate, subject, object, value}\} \cup \mathbb{N}' \) (properties are resources, ordinal numbers are basic properties)
3. \( \mathbb{N}' \subseteq P \subseteq R \) (properties are resources, ordinal numbers are basic properties), where \( \mathbb{N}' = \{1, \ldots, n\} \) or \( \mathbb{N}' = \emptyset \)
4. \( S \subseteq P \times R \times (R \cup L) \) (set of statements)
5. \( \forall a = (n, s, o) \in S : n \in \mathbb{N}' \land n > 1 \Rightarrow \exists d' \in R \cup L : (n - 1, s, d') \in S \) (ordered lists must have no "holes" and begin with 1)
6. \( \forall a = \text{(type, s, o)} \in S \Rightarrow o \in R \) (a resource cannot be typed using a literal)
7. \( \{\text{Statement, Seq, Bag, Alt}\} \subseteq R, \{\text{Statement, Seq, Bag, Alt}\} \cap P = \emptyset \) (constants for basic resources)
8. \( \{\text{type, predicate, subject, object, value}\} \subseteq P \) (constants for basic properties)
9. \( Rf \) is a partial one-to-one function \( Rf : S \rightarrow R \), which associates a statement \( a \) with a resource \( r \) that reifies that statement. Furthermore, \( Rf(a) = r \) with \( a = (p, s, o) \) holds iff:
(a) \((\text{type}, r, \text{Statement}) \in S\)

(b) \((\text{predicate}, r, p) \in S\)

(c) \((\text{subject}, r, s) \in S\)

(d) \((\text{object}, r, o) \in S\)

10. \((\text{type}, r, \text{Statement}) \in S \Rightarrow \text{there exist exactly one } s \in R, p \in P, o \in R \cup L \text{ satisfying (a)-(d) above}\)

The specification presented above is a request for comments.