Algebraic Specification for RDF Models

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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 $\mathfrak{M} = (U; R, L, S, P, \mathrm{Rf}; \overline{K})$ with the following properties:

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

(a) $(\mathrm{type}, r, \mathrm{Statement}) \in S$

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

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

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

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

The specification presented above is a request for comments.