

## Semantic Web Technologies

### RDFS Entailment

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## RDFS Interpretations

- ▶ A simple interpretation is an **rdfs-interpretation** if it satisfies:
  - ▶ The RDF axiomatic triples
  - ▶ The RDF semantic conditions
  - ▶ The RDFS axiomatic triples
  - ▶ The RDFS semantic conditions
- ▶ Axiomatic triples
  - ▶ Statements which must **always** be true
  - ▶ Define certain relationships (e.g. typing or subclassing) within the RDF and RDFS vocabularies
- ▶ Semantic conditions
  - ▶ Define additional properties of RDF and RDFS vocabularies (e.g. typing commutes over subclass)

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## RDFS Entailments

$S$  **rdfs-entails**  $E$ , denoted  $S \models_{\text{rdfs}} E$ , if every rdfs-interpretation which is a model of  $S$  is also a model of  $E$ .

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## RDFS Axiomatic Triples

$\langle \text{rdf:type, rdfs:domain, rdfs:Resource} \rangle$   
 $\langle \text{rdfs:domain, rdfs:domain, rdf:Property} \rangle$   
 $\langle \text{rdfs:range, rdfs:domain, rdf:Property} \rangle$   
 $\langle \text{rdfs:subPropertyOf, rdfs:domain, rdf:Property} \rangle$   
 $\langle \text{rdfs:subClassOf, rdfs:domain, rdfs:Class} \rangle$   
 $\langle \text{rdf:type, rdfs:range, rdfs:Class} \rangle$   
 $\langle \text{rdfs:domain, rdfs:range, rdfs:Class} \rangle$   
 $\langle \text{rdfs:range, rdfs:range, rdfs:Class} \rangle$   
 $\langle \text{rdfs:subPropertyOf, rdfs:range, rdf:Property} \rangle$   
 $\langle \text{rdfs:subClassOf, rdfs:range, rdfs:Class} \rangle$

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## RDFS Semantic Conditions on Ontology Vocabulary

Define class extension function  $ICEXT$ :  $ICEXT(c) = \{i \mid \langle i, c \rangle \in IEXT_{\text{type}}\}$

1.  $IR = ICEXT(IS(\text{Resource}))$
2.  $LV = ICEXT(IS(\text{Literal}))$
3.  $x$  is in  $IP$  if and only if  $\langle x, I(\text{Property}) \rangle$  is in  $IEXT(I(\text{type}))$   
Informally:  $\langle x, \text{rdf:type, rdf:Property} \rangle$
4. if  $\langle x, y \rangle \in IEXT(IS(\text{domain}))$  and  $\langle u, v \rangle \in IEXT(x)$ , then  $u \in ICEXT(y)$
5. if  $\langle x, y \rangle \in IEXT(IS(\text{range}))$  and  $\langle u, v \rangle \in IEXT(x)$ , then  $v \in ICEXT(y)$
6.  $IEXT(IS(\text{subPropertyOf}))$  is transitive and reflexive on  $IP$
7. if  $\langle x, y \rangle \in IEXT(IS(\text{subPropertyOf}))$ , then  $IEXT(x) \subseteq IEXT(y)$
8. if  $x \in ICEXT(\text{Class})$ , then  $\langle x, \text{Resource} \rangle \in IEXT(\text{subClassOf})$
9. if  $\langle x, y \rangle \in IEXT(IS(\text{subClassOf}))$ , then  $ICEXT(x) \subseteq ICEXT(y)$
10.  $IEXT(IS(\text{subClassOf}))$  is transitive and reflexive on  $ICEXT(\text{Class})$

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## Required reading

- ▶ Document "Resource Description Framework" on website:  
<http://www.debruijn.net/teaching/swt/rdf.pdf>
- ▶ RDF Semantics, Chapters 1, 2, 4: <http://www.w3.org/TR/rdf-mt/>

## Further reading

- ▶ J. de Bruijn and S. Heymans. Logical foundations of (e)RDF(S): Complexity and reasoning. In *Proceedings of the 6th International Semantic Web Conference (ISWC2007)*.
- ▶ J. de Bruijn, E. Franconi, and S. Tessaris. Logical reconstruction of normative RDF. In *OWL: Experiences and Directions Workshop (OWLED-2005)*, Galway, Ireland, November 2005.
- ▶ H. J. ter Horst. Completeness, decidability and complexity of entailment for rdf schema and a semantic extension involving the owl vocabulary. *Journal of Web Semantics*, 3(23):79115, 2005.

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