

Inferencing in the Semantic Web

Kunal Patel and Gopal Gupta

The web can reach its full potential only if it becomes a place where data can be shared and processed by automated tools as well as by people. For the Web to scale, tomorrow's programs must be able to share and process data even when these programs have been designed totally independently. The Semantic Web is a vision: the idea of having data on the web defined and linked in a way that it can be used by machines not just for display purposes, but for automation, integration and reuse of data across various applications.

Various markup languages like XML, RDF, DAML+OIL etc. have been designed to markup web documents so that more information can be automatically inferred from the documents. But a problem with any interchange format developed for the semantic web is that it has to be turned into an "executable" notation, so that new information that is logically implied by the information given in the document can be automatically inferred (computed). Turning a mark-up language into an "executable" entity usually requires writing a compiler like program that maps the language to a notation whose semantics is mathematical; information that is implied can then be inferred automatically from this mathematical semantics.

The project is about developing a systematic framework for rapidly translating semantic web formats to notations that are executable. The framework relies on Horn Logic and Denotational Semantics. Essentially, the denotational semantics of the mark up notation is written in Horn Logic. If the semantics is executable, the denotation of a document (i.e., the meaning assigned to the document by the semantics) written in that notation is also executable and can be used to infer information implied in that document. The interesting aspect about using Horn logic for specifying denotational semantics is that both the syntax as well as the semantic specification is executable. The syntax specification validates a document, while the semantic specification maps it to its executable mathematical semantics (called its denotation). The denotation of the document can then be employed for inferring implied information (i.e., querying the document). Since both the syntax and semantics are denotationally specified in Horn logic, they are declarative, and thus can be developed very rapidly.

As a result, as the mark-up language or a resource description notation rapidly evolves, its executable semantics can be developed with the same rapid pace. Thus, our framework can be used for computing the executable semantics of XML, RDF, as well as DAML. Providing automatic means of translating RDF descriptions into notations that are executable, not only specifies the meaning of the descriptions, but also produces a representation of the descriptions from which inferences can automatically be made using traditional automatic theorem provers, problem solvers, and other inference engines.

Reference: Kunal Patel and Gopal Gupta, "Semantically Processing the Semantic Web" in International Semantic Web Conference 2003.