

What is an upper ontology - And what do you do at the Summit?

On March 15, 2006 at its Gaithersburg, Maryland facilities, the National Institute for Standards and Technology (NIST) held the first Upper Ontology Summit during its Interoperability Week of scheduled presentations, events and meetings on the thorny topic of interoperability. Along with the Semantic Technologies Conference held a week earlier in San Jose, California, this marked what I opine is a watershed for the Semantic Web.

To answer the first part of my question, let me first qualify this effort as an attempt to give you an understanding of ontology from an informal viewpoint, though I must use a few formal concepts in the course of this effort.

While Ontology, with the capital "O" is defined by the more or less strict and often academic study of Philosophy, and includes the requirements of such formalisms as First Order Logic, we can start with the understanding that "upper" in this context refers to the general, as in the classic relationship of the general to the specific.

From our informal viewpoint, we can paraphrase the Wikipedia definition of upper ontology as a hierarchy of entities and associated rules (axioms, theorems and regulations) that describes a classification or ordered list of general entities that do not belong to a specific domain, such as medicine, and constitute the fundamental set of concepts on which the classifications of specific domains can be (and historically have been) built.

While this definition may be seen as incomplete even with the caveat that it is informal, it is intended to capture a starting point for the reader to begin understanding a complex set of concepts that are not easily summarized.

The most important understanding the reader can take away from this is that upper ontologies unify the multitude of domain-specific standard vocabularies with their associated data models.

They do this by associating those standards through domain-specific ontologies under an upper ontology standard. Once unified, these collections of standards can be used as a single, but distributed, knowledge base that can support inferencing, or reasoning, engines, and put that knowledge to work as needed in a much more comprehensive and practical way than is presently possible.

Additionally, as the Summit showed, there are several public upper ontologies, with their supporting organizations ready to cooperate as best they can, serving slightly different purposes, which will be referenced by hyperlinks.

These upper ontologies have heretofore been seen to be competing, and one purpose of the summit was to issue a Joint Communiqué stating the intent to find ways for these efforts to complement, rather than compete, with each other.

Because it is the heart of the Upper Ontology Summit, and the culmination of its purpose, as well having the indisputable virtue of being short and concise, the Joint Communiqué is presented here in its entirety, without the list of endorsers, which can be found in the document of record. The emphases in italics and boldface are this reporter's, and will be discussed briefly afterward to highlight some significant points that might otherwise be somewhat lost.

Upper Ontology Summit Joint Communiqué
March 15, 2006

[1] The theory and technology of knowledge representation, reasoning and conceptual modeling have advanced to a stage where meanings of terms can be formally specified in computer systems with great detail and precision.

[2] With the success and expansion of the Internet, the potential for achieving semantic interoperability across inter-connected applications has become widely recognized. The number of teams and individuals creating knowledge classifications of varying degrees of logical formality has dramatically increased. As this technology develops further, it will enable deployment of computer applications with increasing ability to make reliable knowledge-based decisions that currently require human effort. Programs with such enhanced capacity will increase the speed, efficiency and sophistication of automated information analysis and exploitation.

[3] Much recent emphasis has been focused on creating common syntactic formalisms for representing knowledge, but syntactic formalisms alone do not provide an effective way for describing what counts most: semantic content.

[4] The complementary technology for effectively representing the semantic content of complex widely used concepts is also available, but agreement on standardized conceptual building blocks has not yet been reached.

[5] The need for such agreement is increasing rapidly as many isolated projects of varying complexity have been initiated to capture knowledge in computer-interpretable formalisms. Without the means for specifying intended meaning using well-understood conceptual building blocks that are clearly related and contrasted with each other, the great potential for sharing knowledge usable for computer reasoning will not be realized.

[6] Several candidate upper ontologies are available, reflecting decades of research and development.

[7] Each upper ontology has an existing community of users, but each community only has access to a fraction of the total resources available.

[8] To promote interoperability and the exploitation of these upper ontologies, we intend to find a principled means of articulating the relationships (including differences) among them. As a result, this initiative will significantly enhance the value of the knowledge in each of the communities whose knowledge bases are linked to these inter-related upper ontologies.

[9] These upper ontologies are available and should be rigorously and independently evaluated. They must also be easy to use and assess by developers of domain ontologies and applications.

[10] For the foreseeable future, we anticipate there will be multiple upper ontologies. We will articulate the commonalities and the reasons for the major differences in the upper ontologies.

So, this is what you do at the Upper Ontology Summit. You agree to continue your efforts, while recognizing that those efforts will now be seen in a larger context. To a great extent, the cat is now fully out of the bag that an ontology, especially an upper ontology, will “enable deployment of computer applications with increasing ability to make reliable knowledge-based decisions that currently require human effort.”

This boils down to improved decision support, and once it is demonstrated to raise the ever-present bottom line for efficient data management, the widespread, if not ubiquitous, adoption of ontologically based semantic toolsets will be utterly unavoidable.

The conclusion is that, like it or not, today's data management mavens will necessarily be required to be up to speed for creating improved public perception of the field of semantics and its fundamental concept, ontology. The good news is that there is and will be a lot of help available.

Additionally, these upper ontology efforts, despite the fact that agreement on standardized conceptual building blocks has not yet been reached, will also now continue their development in the shadow of a carefully unstated goal of achieving seamless interoperability based on the fact that the clear intent of the Upper Ontology Summit's participants is ... “[to] promote interoperability and the exploitation of these upper ontologies, we intend to find a principled means of articulating the relationships (including differences) among them.” That intent will affect all these efforts and will necessarily act like a rising tide that both raises all boats, and also levels them in the sense of putting them on the same Upper Ontology plane.

Once on that plane, and with tools such as the Web Ontology Language (OWL) to provide a mechanism for the “principled means of articulating the relationships (including differences) among them,” we are very likely to see the beginnings of a unification of existing digital information technology standards based on the use of all of these upper ontologies for the fields in which they are most appropriate.

However, it is also important to remain aware that [for] the foreseeable future, we anticipate there will be multiple upper ontologies.

Yet, while we can expect these multiple upper ontologies to remain separate for a while, an eventual unification is almost inevitable, likely followed by the eventual unification of digital information technology standards as a whole, or perhaps as a result of that current and ongoing convergence.

I speculate that this unification of overall digital information standards will come about not because the proponents of various standards development organizations (SDOs) get together in ever more centralized summits to agree to common statements of goals as this

Upper Ontology Summit has done, but because the work started here will make it possible to harmonize and unify these standards without recourse to means other than using the principles of semantic interoperability expressed through succeeding versions or extensions of XML, RDF, WSDL, SOAP, OWL and other related standards.