

Including Topic Maps in the Ontology Definition Meta-model

Lewis Hart, Patrick Emery
AT&T Government Solutions, Inc.
LewisHart@att.com, PatEmery@att.com

Abstract - Topic maps have many similarities to RDF but are distinct historically, technically and in their main intended purpose. They started in the early 90s and were published as an ISO standard in 2000 while RDF started in the late 90's and was published as a W3C Recommendation in 2004. Each has it's own constraint language, data model, and set of syntaxes. Topic Maps define a knowledge representation language on par with RDF. While the ODM RFP does not require Topic Maps, they represent an additional, independently developed alternative URI based ontology language to the W3C's RDF and RDFS/OWL that strengthens the ODM.

I INTRODUCTION

Topic Maps are an alternative URI based ontology language to the W3C's RDF and RDFS/OWL. "Dubbed the 'GPS of the information universe', topic maps are a solution for organizing and accessing large and continuously growing information pools. They provide a 'bridge' between the domains of knowledge management and information management." [1] Topic Maps provide views of sets of information objects. These views are unconstrained; they may be object-oriented, relational, hierarchical, ordered, or unordered. Multiple views can be defined by overlaying multiple topic maps on a given set of information resources. Topic Maps main objective is to "Deliver the right information in the right context to the right person at the right time" [1]. It tries to achieve this lofty goal by modeling a purpose built indexing system such as those found in the back of a book.

The Topic Map Handbook gives the basic concepts of the topic map paradigm:

- Topics represent subjects and carry names
- Occurrences of a topic point to relevant resources.

- Associations connect related topics
- Topic classes, occurrence classes, and association classes help to distinguish different kinds of topics, occurrences, and associations respectively.

Beyond this, Topic Maps include concepts variant names, scopes, subject identifiers, and merging.

Subjects are what the Topic Map author is talking about. Subjects are similar to RDF's idea of a resource. A topic is created to represent the subject inside of the computer (regardless of whether the original subject was inside or outside of the computer). The topic reifies a subject making the abstract concept of the subject concrete.

Both topic maps and RDF are able to model complex metadata and Ontologies as graphs. Both have an XML interchange format. RDF is a general language meant for machine interchange and logical processing of metadata. Topic Maps attempt to solve a more specific problem in a more human readable format.

Several ISO standards define Topic Maps [5]. ISO 13250 specifies a Data Model and XTM Syntax; ISO 18048 defines the Topic Map Query language and ISO 19756 defines the Topic Map Constraint Language. Some of these pieces are works in process. The HyTime Syntax represents an SGML DTD based syntax from Topic Maps early days and has recently been dropped from the standards.

II POSITION

Topic Maps are being included as part of a joint submission in response to the OMG's Ontology Definition Metamodel RFP. We believe that the inclusion of Topic Maps into the ODM will produce

both a better OMG standard and provide benefit to the Topic Map user community.

Topic Maps have many similarities to RDF but are distinct historically, technically and in their main intended purpose. Historically Topic Maps started in the early 90s from work on managing indexes to documentation and was refined and later published as an ISO standard in early 2000 while RDF started in the late 90's and was published as a W3C Recommendation in early 2004. [6]

Two separate communities formed, developing their own family of standards. These communities developed their technologies with slightly different goals in mind. As Lars Marius Garshol states in *Living With Topic Maps* [3],

“While the technologies are clearly similar it is equally clear that they are intended for different purposes. Topic Maps were created to support high-level indexing of sets of information resources to make the information in them findable. RDF, on the other hand, was intended to support the vision of the semantic web through providing structured metadata about resources and a foundation for logical inferencing.”

Technically both technologies include similar concepts that are well understood but they took slightly different approaches in representing and dealing with them. The expressiveness of the current TM proposed standard is less than that of RDFS and OWL, and it has less formally defined semantics. If you need the expressive power for complex types or inferences, there currently is no way for this to be supported in TM. However, the standardization process is still underway, including the development of a constraint language (TMCL) and query language (TMQL), as noted previously.

Topic Maps have a presence in the business community and it was in fact the OMG Business Rules

SIG that suggested that TM be considered for inclusion into the ODM. The technology is also actively discussed and reported on by XML.org and OASIS. Providing TMs in the ODM supports the business community, which benefits the OMG.

Even though the ODM RFP does not require topic Maps and adding Topic Maps to the response adds complexity to the standard; as a standard the ODM would benefit from supporting as broad a range of standard ontology languages as feasible. Topic Maps represents an additional, independently developed approach to knowledge representation; A standard based on multiple examples is can be better than one based on a single example. (We consider RDF/RDFS/OWL so closely related that they are essentially one example.) By comparing two or more examples, commonalities are identified and differences highlighted. Inclusion of TM supports a better definition of these common concepts.

Several proposals for using UML as a notation for Topic Maps have been developed. The TM Data Model includes informative UML meta-model diagrams and TM design patterns have been captured in UML notation [6]. However, there is no coordinated activity in the TM community focused on developing a UML standard for TM. Including TM in the ODM benefits the TM and OMG communities by providing a standard TM-UML model.

III OVERVIEW OF THE TOPIC MAP META-MODEL

The meta-model for Topic Maps proposed for inclusion in the ODM is defined based primarily upon ISO 13250-2 Data Model (TMDM) and to a lesser degree ISO 13250-3 XML Syntax [5]. The TMDM provides the authoritative definition of the abstract syntax for TMs.

Some of the primary elements in the TM meta-model are shown in Figure-1. All first class elements are a sub-type of TopicMapConstruct and have an optional Locator. TopicMaps are composed of sets of Topics and Associations. The Associations define multi-way relations between the Topics.

Topics represent, or reify, a specified subject from a collection of information resources. Each Topic is about a single Subject. Subjects may be anything physical or conceptual. A machine addressable Subject will have a locator (e.g. a URL) while non-machine addressable subjects will have an indicator (e.g. the URL of a page about the subject

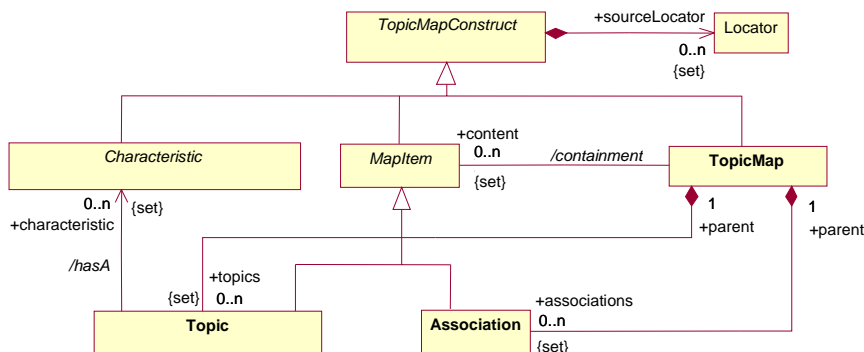


Figure-1 Top level constructs from the ODM Topic Map MOF Meta-Model.

or a URN). Topics are roughly equivalent to RDF Nodes, describing elements in a world of discourse. Note that this similarity does not include RDF Literal because literals in TMs are not normally considered Topics.

Each Topic has a set of Characteristics. Characteristics, as shown in Figure-2, include Association Roles, Occurrences and Topic Names.

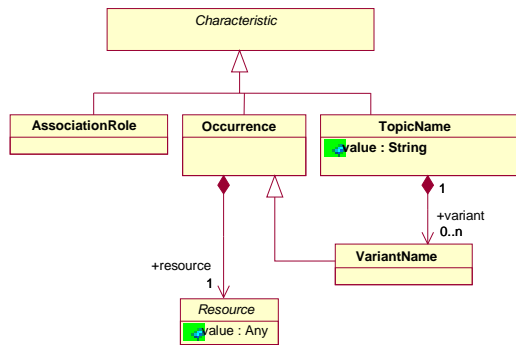


Figure-2. Characteristics from the ODM Topic Map MOF Meta-model.

A Topic in an Association plays a particular part or role in the Association. This is specified in an Association Role. The Association and Association Role construct is similar to UML Association or to an RDF Property.

An instance of Occurrence may represent any characteristic of a Topic. This includes an “occurrence”, or instance, of the subject, but is not limited to that application. The value of the characteristic is an instance of the abstract Resource class that holds a value of any data type, either by value or by reference. Occurrences are similar to UML Attributes.

Topic Names and Variant Names are human understandable labels for the Topic. While the primary Topic Name, termed a Base Name, is required to be a UNICODE string, variant names may include many data types not normally considered as ‘names’ such as icons, images or audio. VariantNames are specializations of Occurrence that are constrained to be used only in the context of a base TopicName.

IV CONCLUSION

One of the mandatory requirements in the ODM RFP specifies, “Submitters shall specify an Ontology Definition Meta-model using MOF 2 Core that shall

represent the semantics of ontologies including but not necessarily limited to OWL ontologies.” [4] The spirit of the RFP is that responses might capture a broader spectrum of Ontology languages, recognizing that there are more knowledge representation languages than just OWL.

Topic Maps are a useful inclusion in the ODM. Their inclusion will help the ODM represent a broader spectrum of ontology languages. They have many similarities to RDF but are distinct historically, technically and in their main intended purpose. Both have their own constraint language, data model, and syntaxes and can be used to specify knowledge representation Ontologies. While the ODM RFP does not require Topic Maps, their inclusion was deemed a valuable part of a joint ODM submission.

V REFERENCES

- [1] Rath, H. Holger; *The Topic Maps Handbook*, Empolis Arvato, Knowledge Management
- [2] Daconta, Michael C; Orbst, . Leo J, . and Smith, Kevin T.; *The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management*, Wiley Publishing Inc., 2003, ISBN 0471432571
- [3] Garshol, Lars Marius; *Living With Topic Maps*, [http://www.ontopia.net/topicmaps/materials/tmrdf.htm](http://www.ontopia.net/topicmaps/materials/tmrdmf.htm), 2003
- [4] Object Management Group, *Ontology Definition Metamodel Request For Proposal*, OMG Document: ad/2003-03-40, <http://www.omg.org/cgi-bin/doc?ad/2003-03-40>
- [5] ISO/IEC JTC 1/SC34/WG3 Recommendations of December 2003 Meeting of WG3 contains links to the most recent TM documents; <http://www.y12.doe.gov/sgml/sc34/document/0466.htm>
- [6] World Wide Web Consortium; Web Ontology Language (OWL) web site contains links to the most recent OWL documents; <http://www.w3.org/2004/OWL/>
- [7] Ahmed, K.; Techquila Web Site; *Topic Map Design Patterns For Information Architecture*; <http://www.techquila.com/tmsinia.html>