New OOR Use Cases and their Impact on the OOR Architecture

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Abstract

Recent Ontolog sessions, such as the Earth Sciences Ontolog series, have highlighted new use cases for the design and application of ontologies.

(1) Ontologies are modularized, with each module having different versions.

(2) Ontology module versions may shift from one representation language to another over time.

(3) Ontology modules may be in different locations (ideally, OOR instances), and one needs to map between them. For example, the same leaf concepts can be categorized in more than one way by different communities, and users want to select the categorization for their specific needs.

(4) Ontology elements are often mapped to domain-specific visualizations which may vary with their use.

Lessons learned from Earth Science

- Ontolog session on 9/6/2012 had these goals:

The **overall goal** is to bring together members of both communities (Earth Science and ontology/semantics) into a **meaningful dialog**.
• One goal of this session is to further a dialog on current status of **needs** and work of earth science **systems** with an eye to the application of semantic technology that can help.
• We want to build on Session 1 by getting a better idea of requirements, such as **improved vocabularies structured by use cases** that highlight earth science challenges and issues.
– What should ontologists understand about these issues?

http://ontolog.cim3.net/file/work/EarthScienceOntolog/2012-09-06_EarthScienceOntolog_session-2/EarthScienceOntolog_session-2_intro--GaryBergCross-NaicongLi_20120906.pdf

The Role of Taxonomy

- From the Richard Hooper presentation at the Earth Science session:

Is Taxonomy Important?

- No unique or 'correct' taxonomy
- Users more interested in controlled vocabulary and leaf concepts
- Any logical taxonomy is acceptable for navigation from broad to narrow term

http://ontolog.cim3.net/file/work/EarthScienceOntolog/2012-09-06_EarthScienceOntolog_session-2/Implementing-a-Community-Governed-Ontology-for-Water-Sciences--RichardHooper_20120906.pdf

The Role of Modularization

- The summary of the Peter Fox presentation:

In 2004 we set out to build a prototype and ended up with a production semantic data framework
– Languages and tools served us well
• Even with modest expressivity we challenged the tools of the time and made many compromises
• All along the way, we evaluated our ontology developments and implementations to gauge the benefits of semantics
• Maintainability, esp. modularization is driving new expressivity needs
• Xinformatics and a repeatable methodology is the key (information models) - we continue to need to bridge computer science and application communities ("It's the language stupid", i.e. semantics)

http://ontolog.cim3.net/file/work/EarthScienceOntolog/2012-09-06_EarthScienceOntolog_session-2/Lifecycle-Semantics-in-Earth-n-Space-Sciences--PeterFox_20120906.pdf

Scenario for using ontologies

- From the Santoro et al presentation:

Automatic query expansion
¤ the query keywords (the “what” constraint) are “expanded” with related concepts retrieved from the set of federated semantic services. A default expansion regards the multilinguality relationship;
¤ Based on the discovered concepts, a set of queries is created and submitted to the federated catalog services;
¤ The Broker performs a “smart” aggregation of the queries results and provides them back to the client

http://ontolog.cim3.net/file/work/EarthScienceOntolog/2012-09-06_EarthScienceOntolog_session-2/A-Semantic-Broker-for-Resource-Discovery--Nativi-Santoro-Fugazza-Craglia_20120906.pdf

Scenario for using ontologies

- From the Santoro et al presentation:

User assisted query expansion
- The user browses the federated semantic repositories and selects the concepts of interest;
- The Broker creates the set of geospatial queries based on the selected concepts and submits them to the federated catalog services;
- The Broker performs a “smart” aggregation of the queries results and provides them back to the client.

http://ontolog.cim3.net/file/work/EarthScienceOntolog/2012-09-06_EarthScienceOntolog_session-2/A-Semantic-Broker-for-Resource-Discovery--Nativi-Santoro-Fugazza-Craglia_20120906.pdf

Ontologies for Decision Making

- Naicong Li et al were concerned with workflows for decision making

From Ontologies (directly) to Computational Workflows

• Ontologies are not just for conceptual clarity (though we love that!) and for organizing things
• Decision support researchers and practitioners need them to create computational applications that deliver decision support for solving Grand Challenge planning and decision problems.

http://ontolog.cim3.net/file/work/EarthScienceOntolog/2012-09-06_EarthScienceOntolog_session-2/Ontologies-n-Spatial-Decision-Support--NaicongLi-PhilipMurphy-KrzysztofJanowicz_20120906.pdf

Ontologies as Software Artifacts

- Modularity
- Version control
- Import
- Configuration control
- Similar to software engineering but...
  - Ontologies are not the same as source code.
  - The next slides highlight the differences.

Version Control

- Ontologies have a formal declarative semantics, source code is only procedural.
  - Versions have (usually implicit) mappings to each other.
  - No consistent naming conventions for ontology versions.
- Different versions of the same ontology can use different representation languages.
  - Rarely the case for source code

Import

- Different kinds of import
  - Whole ontology (or module)
  - Selected part of an ontology
  - Individual concepts
- Cross-language import
  - Important in practice
  - Little support

Configuration Control

- Example scenario: leaf concepts with different taxonomies.
    - Taxonomies are generated by different communities.
- Example scenario: workflow generation for decision making.
    - Metadata can use different ontologies.

Visualization

- Mapping of concepts to visualization
  - Similar to a stylesheet
  - Necessary for languages such as CL that have no commonly accepted visualization
- Visualization plugins
  - Differ from a software component
    - User interaction
    - Display

Mapping Use Cases

- Ontologies on different OOR instances
- Ontology modularization and mapping
- Ontology versioning and mapping
  - Mappings can also have versions
- Leaf concepts may have multiple taxonomies
  - Well known for centuries in biology
  - Recent issue in earth sciences
  - The taxonomies are maintained by different communities (different OOR instances)

Summary

- New use cases are emerging as ontologies are being used by different communities.
- How can ontology repositories help support these use cases?