Enhancing Grid Usage through Semantic Metadata

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Introduction
The knowledge Base
The Semantic Grid System
Conclusion
Increasing amount of installed applications in Grid environments causes:

- Increasing difficulty of finding a desired application, but also...
- Increasing chances of software pieces interchange in response to a user application requirement;
- How to explore such reuse opportunities?
Definition of Grid Ontologies

- To improve the reuse, sharing, and integration of software and computational resources on the grid;
- Inference of information from axioms defined in ontologies.

The Semantic Approach

Vidal & Kofuji (UFMA-USP)

Semantic Grid Usage

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The Semantic Approach

- Definition of Grid Ontologies
  - Using the W3C-recommended OWL-DL description language;
  - Using the Pellet reasoner for inference tasks;
  - Protégé-OWL to ease ontology description;
  - The opportunistic grid middleware, InteGrade, is the base for a prototype implementation.
Defining the ontologies

- Set of related ontologies, connected between them through the OWL *import* mechanism;
  - *upper-level ontologies*
  - higher level of generality;
  - *ancillary ontologies*
  - auxiliary domain specific concepts;
  - *concrete grid ontologies*
  - grid environment specific concepts
Upper level ontology – Grid Base Ontology
Ancillary ontology – Platform Ontology

The Knowledge Base

Vidal & Kofuji (UFMA-USP)
Concrete ontology – Software Management Ontology

Semantic Grid Usage
Fundamental taxonomy encompassing the main concepts related to grid systems;
- Inference knowledge from previously defined axioms and incomplete information, e.g.:
  - subsumption inference in advance, in conformance with an intelligent policy;
- query languages and mechanisms;
- SPARQL;
- OWL-QL
Extending the ontologies

- **Ancillary Ontology**
  - PlatformOntology

- **Upper Level Ontology**
  - GridBaseOntology

Specific ontologies should be mapped to improve scalability.

- **Cluster Specific Ontology - 1**
  - Grid Software Ontology
  - Grid Resource Ontology

- **Cluster Specific Ontology - 2**
  - Grid Software Ontology
  - Grid Resource Ontology

- **Cluster Specific Ontology - n**
  - Grid Software Ontology
  - Grid Resource Ontology
New inferred subsumed hierarchies to obtain new inferred knowledge;

Ontology-based applications can be built around the KB to cover different domain problems;

More efficient query results from inferred class hierarchies;

improve application and grid resource matching.