Semantic Reasoning Support for SCEC

Thomas Russ and Hans Chalupsky

Information Sciences Institute, University of Southern California

Semantic GRID Matchmaker

Stefan Decker, Andreas Harth, Hongsuda Tangmunarunkit

Problem: Matching Jobs with Resources

- Many of the simulation codes used by SCEC researchers are compute-intensive.
- The computational GRID provides resources that can handle large and time-consuming jobs, using supercomputers and computing clusters.
- How can appropriate resources be found to allow the jobs to execute?

Existing Approach (Condor [1])

- Exact match of attributes required. "Linux" does not match "Unix".
- Flat space of keywords for specifying both jobs and computational resources
- Inflexible and difficult to extend to new characteristics and concepts.

Semantic Matchmaker [2]

- Declarative model encoded in a standard semantic web ontology language (RDFS) [5].
- Semantic matching of requests and resources by reasoning over the ontology using XSB [3]. For example Linux fulfills a requirement for Unix

☆ **Highlighted at SCEC mid-term review**.

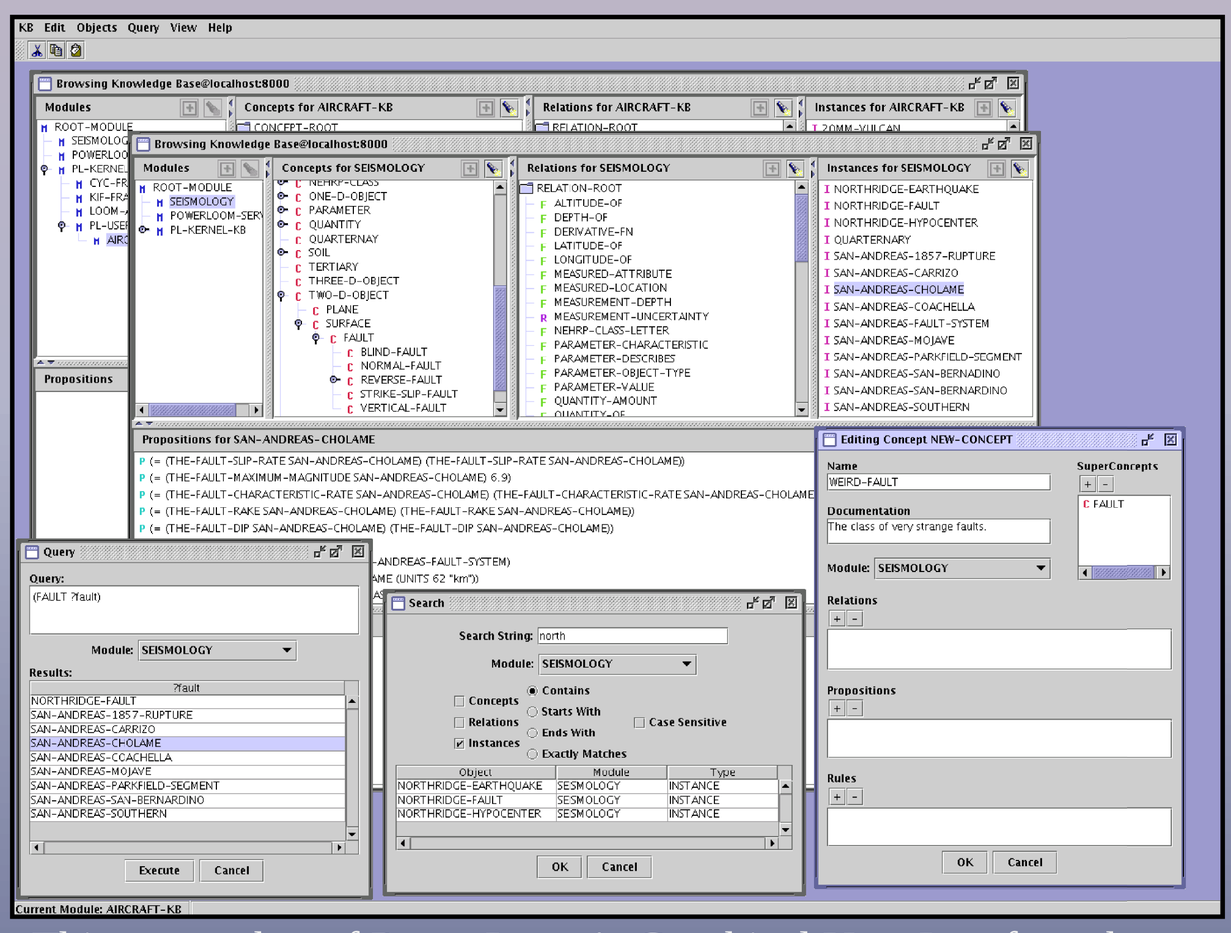
Recent Developments

- Changed reasoning engine from XSB to PowerLoom [4] to improve performance
- Designed bi-directional subsumption-based matching strategy: Jobs specify *classes of resources* which match against machine instances. Resources specify *classes of jobs* they will accept which match job requests.

PowerLoom Graphical User Interface

Making Ontology Development Accessible

- PowerLoom ontologies are encoded in a logical formalism that is powerful and expressive, but also obscure to non-specialists
- But ontologies need to be developed by domain experts who will not have the time or interest in becoming logic and representation specialists
- The graphical interface to PowerLoom makes ontology development more accessible to domain experts.
- Provides structured views which preserve the semantics but provide a more intuitive presentation of the information. The interface is similar to object-oriented programming environments.
- Deployed to SCEC/CME in the June 2004 build and available via Java Webstart.



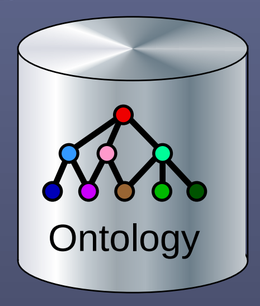
This screenshot of PowerLoom's Graphical User Interface shows the seismology ontology. Windows provide an outline overview of the concepts, relations and instances in the ontology, and provide interactive services for specifying queries, searching based on names, and creating new concepts, relations and instances.

PowerLoom Extensions for SCEC

- Integration with **Tomcat** web server
- Support for **semantic web** languages including RDF, RDFS and DAML+OIL [5]. This was used in moving the GRID matchmaker to PowerLoom.

Units and Dimensions Support Extended.

- Better integration with ontologies
- More meta-information available:
  Joules = mass * distance^2 / time^2
- Dimensional analysis is now supported.



References.

[1] Condor: A workload management system for compute-intensive jobs http:/ / www.cs.wisc.edu/ condor/

[2] H. Tangmunarunkit, S. Decker, C. Kesselman, "Ontology-based Resource Matching in the Grid---The Grid meets the Semantic Web" (extended version), In Proceedings of the Second International Semantic Web Conference. October 2003.

[3] XSB: Logic Programming and Deductive Database system. http://www.cs.sunysb.edu/~sbprolog/xsb-page.html

[4] PowerLoom: http://www.isi.edu/isd/LOOM/PowerLoom/

[5] * DAML+OIL: DARPA Agent Markup Language + Ontology Inference Layer. http://www.w3.org/TR/daml+oil-reference
* RDF: Resource Description Framework. http://www.w3.org/RDF/
* RDFS: Resource Description Framework Schema. http://www.w3.org/TR/rdf-schema/