Semantic MOBY Overview

Gary Schiltz, NCGR
gss@ncgr.org

October 27, 2004

W3C workshop on Semantic Web for Life Sciences

NATIONAL CENTER FOR GENOME RESOURCES
What is MOBY?

- An effort to facilitate the integration of web-based bioinformatics resources

- Name is from an acronym (MOBY-DIC): Model Organism Bring Your own - Database Interconnectivity Conference

- Two complementary open source projects
  - MOBY Services (web services oriented)
  - Semantic MOBY (semantic web oriented)
What is Semantic MOBY?

- An architecture and set of conventions for building and deploying distributed, web-based software applications [in the field of bioinformatics]

- A prototype reference implementation of the major architectural components
  - A discovery server to enable consumers of bioinformatics resources to programmatically find such services
  - A set of Java classes to facilitate building repeating architectural components
  - A brokering service to enable end users (biologists) to use web browsers to query the discovery server, engage appropriate services, and display results
**Semantic MOBY components (roles)**

- *Ontology Providers* define shared RDF classes and properties
- *Service Providers* perform data transformation and retrieval
- *Service Consumers* engage service providers to gain access to their services
- *Discovery Servers* discover shared ontologies and service providers, and match requests from service consumers with service providers
- *Invocation Brokers* provide browser-based interfaces to search for and engage providers
**Ontology Providers** define RDF classes and properties

- Definitions retrieved via HTTP GET of “slash-style” URL

Example: [http://brebiou.cshl.org/ontologies/Panel](http://brebiou.cshl.org/ontologies/Panel)

(N3, prefixes omitted)

```n3
@prefix cshlterms: <http://brebiou.cshl.org/ontologies/terms#> .

cshlterms:Panel
  a owl:Class .
```

Example: [http://www.semanticmoby.org/ontologies/core/Provider](http://www.semanticmoby.org/ontologies/core/Provider)

```n3
@prefix moby: <http://www.semanticmoby.org/ontologies/core#> .

moby:Provider
  a owl:Class ;
  rdfs:subClassOf [a owl:Restriction ;
    owl:onProperty moby:operatesOn ;
    owl:minCardinality "1"^^xsd:nonNegativeInteger]
  .
```
Service Providers perform data transformation and retrieval services

- Provider description graph is an RDF graph that defines the provider
  - Retrieved by HTTP GET of “slash-style” URL
  - Canonical graph structure [see next slide] defines allowable inputs and outputs in context of larger graph structure

- Service is engaged by HTTP POST of modified provider description graph to provider’s URL
Service Providers (cont.)

Canonical Structure of Provider Description Graphs

- Defines providers that are compliant with architecture
- Facilitates writing tools to parse graph into higher-level objects that define associative relationships (“mappings”)
- Identifies inputs and outputs in context or larger graph structure

The “provider node” - an HTTP GET on this URL should return this graph as RDF/XML

Properties of Subject nodes, with blank nodes as values, are inputs

Properties of Object nodes, with blank nodes as values, are outputs
Example: [http://brebiou.cshl.org:8080/get-individuals](http://brebiou.cshl.org:8080/get-individuals)
Service Consumers make use of service providers

- Engage by filling “input” blank nodes in provider graph and sending to provider URL by HTTP POST
- Provider reads inputs from graph, performs its action, fills blank nodes, returns modified graph as POST result

![Diagram of Service Consumers interaction]
Discovery Servers

Discovery Servers index shared ontologies and service providers, and match requests from service consumers with service providers.

*In the prototype reference implementation:*

- Graphs are stored using Jena2
- Queries for matching graphs are expressed as RDF graphs
- Discovery server converts queries to RDQL
  - Blank nodes become RDQL variables
  - Query is executed
  - Each result set binding is used to create a copy of the query graph as a member of the set of query results
Invocation Brokers provide browser based interfaces to search for and engage service providers.

In the prototype reference implementation:

- When a provider graph is discovered, its Provider, Subject, and Object nodes are examined for other rdf:type properties; any moby:keyword properties of the classes are associated with the provider graph.

- The user can search for providers by keyword by Provider, Subject, and Object.

- For each matching provider, a link to the Semantic MOBY invocation service is provided:
  - Selecting providers with a valid moby:inputURI redirects to that URI for collecting necessary inputs to the provider.
  - Selecting providers without a valid input URI generates an input GUI on the fly [not yet implemented].
Semantic MOBY Architecture

Service Consumers
- S-MOBY Core and Client API Classes

Discovery Servers
- S-MOBY Core and Server Classes

Engage Providers

Service Providers
- S-MOBY Core and Provider API Classes

Retrieve Definition Graphs

Ontology Providers
- RDF Classes & Properties

Retrieve and store RDF

Search for providers that match query graphs

Retrieve and store graphs
Semantic MOBY Current Status

- Reference implementation prototype completed
- Java API for working with graphs is currently read only; must use Jena API to modify graphs
- A few bugs to fix :-)
- Little funding remains :-) :-) 
- Distributed under Perl Artistic License - see www.biomoby.org
- MOBY Autumn 2004 meeting in Santa Fe – see www.semanticmoby.org/meeting