Geophysical Research Abstracts
Vol. 13, EGU2011-13469-4, 2011
EGU General Assembly 2011

RESTful Services for Sensor Data

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Data collected from sensors and sensor networks are increasingly becoming available online through web portals, web services or consumer web sites. Growing interest in sharing such data are driving the need for programmatic access to allow re-use and re-purposing in manners never before imagined. The Linked Open Data philosophy is evidence of this. However, there remain significant issues with access and discovery of more complex scientific data.

The Representational State Transfer (REST) architectural style has largely guided and defined the current state of the World-Wide Web (WWW). Through the Hypertext Transfer Protocol (HTTP) and Uniform Resource Identifier (URI) standards, REST defines how a distributed hypermedia system such as the WWW operates. REST has been adapted to the design of online services and while REST is interpreted at different levels, some services may be judged more 'RESTful' than others. Foundational concepts that frame a REST data service include:

- Resource design and entry point URIs
- Relationships between resources
- Media types
- Supported HTTP idioms

Whereas the Open Geospatial Consortium's (OGC) Sensor Observation Service (SOS) uses the ISO19156 standard for Observations & Measurements (O&M) to shape the signature of a message-based XML (SOAP, Plain XML) service, the standard interface is specified using the RPC idiom.

In this work we explore the design of a RESTful service for accessing observational data based on the abstract O&M model. This simplifies implementation and understanding of such services, resulting in more transparent service interaction and allowing sensor observation data to be easily re-used in mainstream web applications (e.g. in web mash-ups).

At its core, O&M is a connection point of related resources that form the event of an observation (a feature, procedure, observed property and result). O&M provides domain level links and link semantics that facilitate the use of hypermedia as the engine of application state (HATEOAS). The result is a set of resources and relationships that match many observation scenarios. For example, the relatedObservation relationship allows the linking of related observations through different relationship semantics, as captured by the role element. Such constructs are native to the REST hypermedia principle.

To test the design, a prototype service has been built to serve sensor data encoded using WaterML2.0 (an application profile of O&M for hydrological data). The service has been implemented using Python, Django, GeoDjango, PostgreSQL, PostGIS and the Cheetah templating engine, resulting in a compact code base. The prototype service provides data encoded using an eXtensible Mark-up Langauge (XML) schema based on WaterML2.0 but also supports other encoding types such as the Java Simple Object Notation (JSON) and Comma-Separated Variables (CSV).

WaterML2.0 is based on a Unified Modelling Language (UML) conceptual model. The UML model has a direct mapping to XML through GML encoding rules. JSON and CSV formats are manually derived from the conceptual model but the intention is to automate the way this is done. WaterML2.0 restricts the number of possibilities for supported data types, so further work is required to support the full set of requirements that the SOS currently addresses. The use of a common model ensures the semantics of the terms in all encodings are consistent.