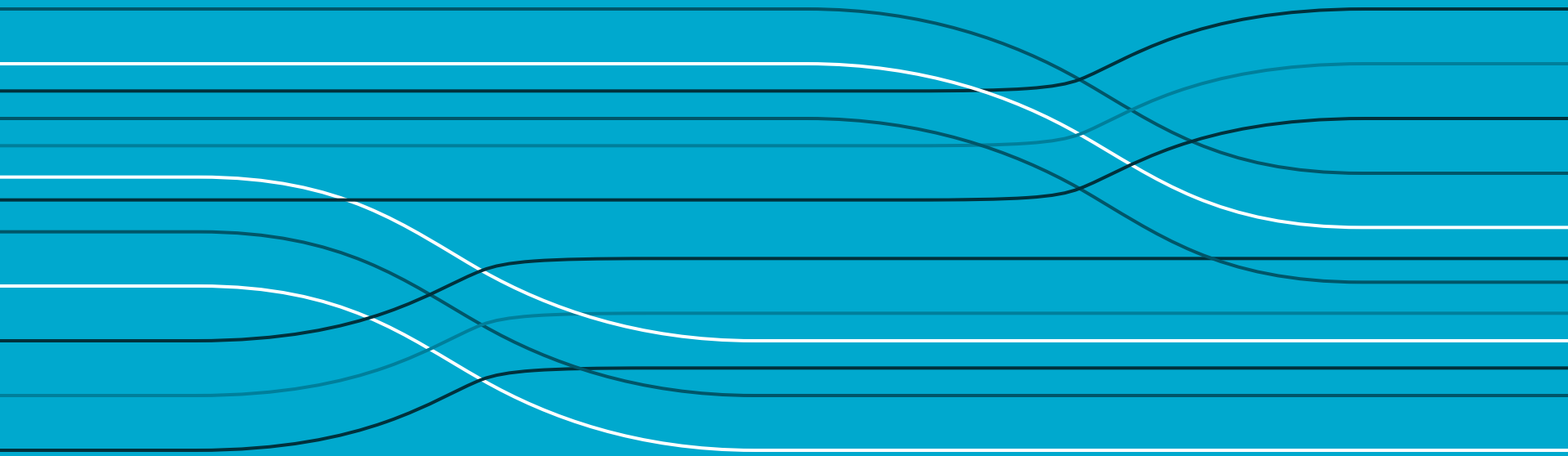

Hands-on Guide To Linked Data Applications

Tutorial at ISWC 13

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Tutorial Goal

Provide a practical introduction into building Linked Open data (LOD) applications using open data sets and existing tools.

Content

- LOD Basics
- LOD Application Development Workflow
  - Generic steps and tools to build an application
- Hands-on example of LOD Application
  - Linking Tasmania Geo-spatial Environmental Features

Tutorial Assumptions

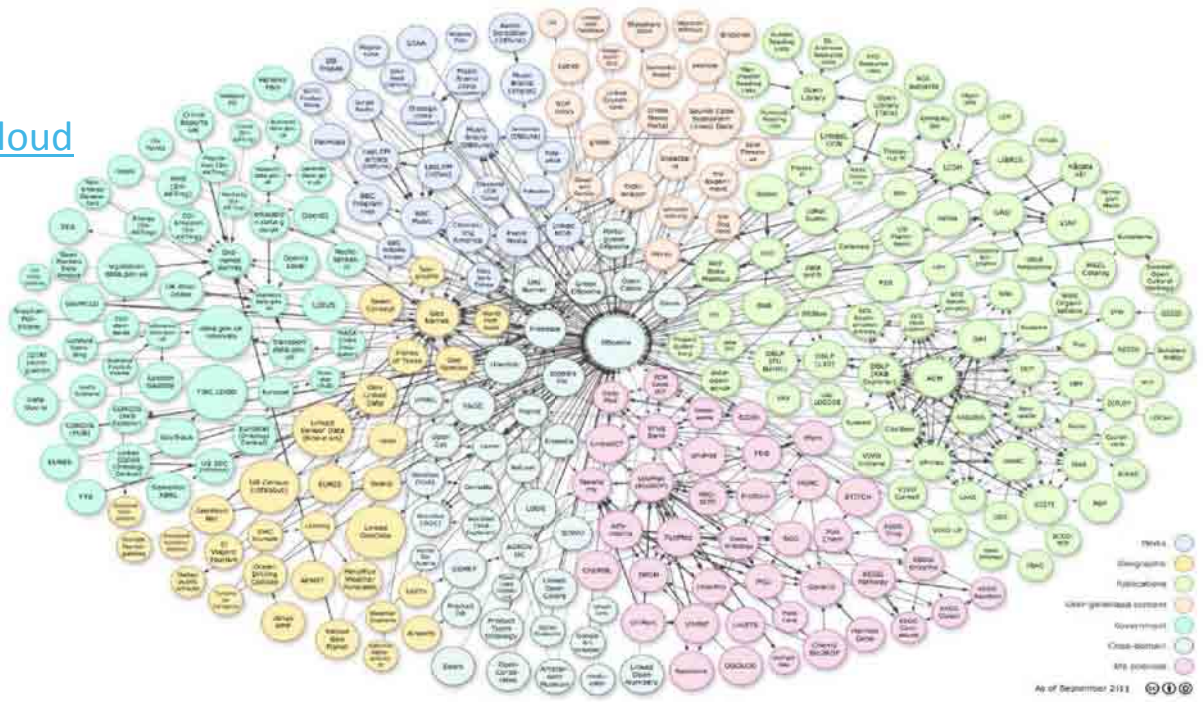
- Attendees will have a basic knowledge of RDF
- Attendees will have a basic knowledge of the Linked Open Data (LOD) principles and the LOD cloud
- Only a incomplete number of (free to use) tools will be suggested for application development. Example will be based in a few selected ones.

LOD Basics

Linked Open Data

It is about linking data on the Web. A term used to describe a recommended best practice for exposing, sharing, and connecting pieces of data, information, and knowledge on the Semantic Web using URIs and RDF.[Wikipedia]

The Linked Open Data Cloud
http://linkeddata.org
http://datahub.io/group/lodcloud



Linked Data Principles

RDF

http://www.w3.org/TR/2004/REC-rdf-primer-20040210/

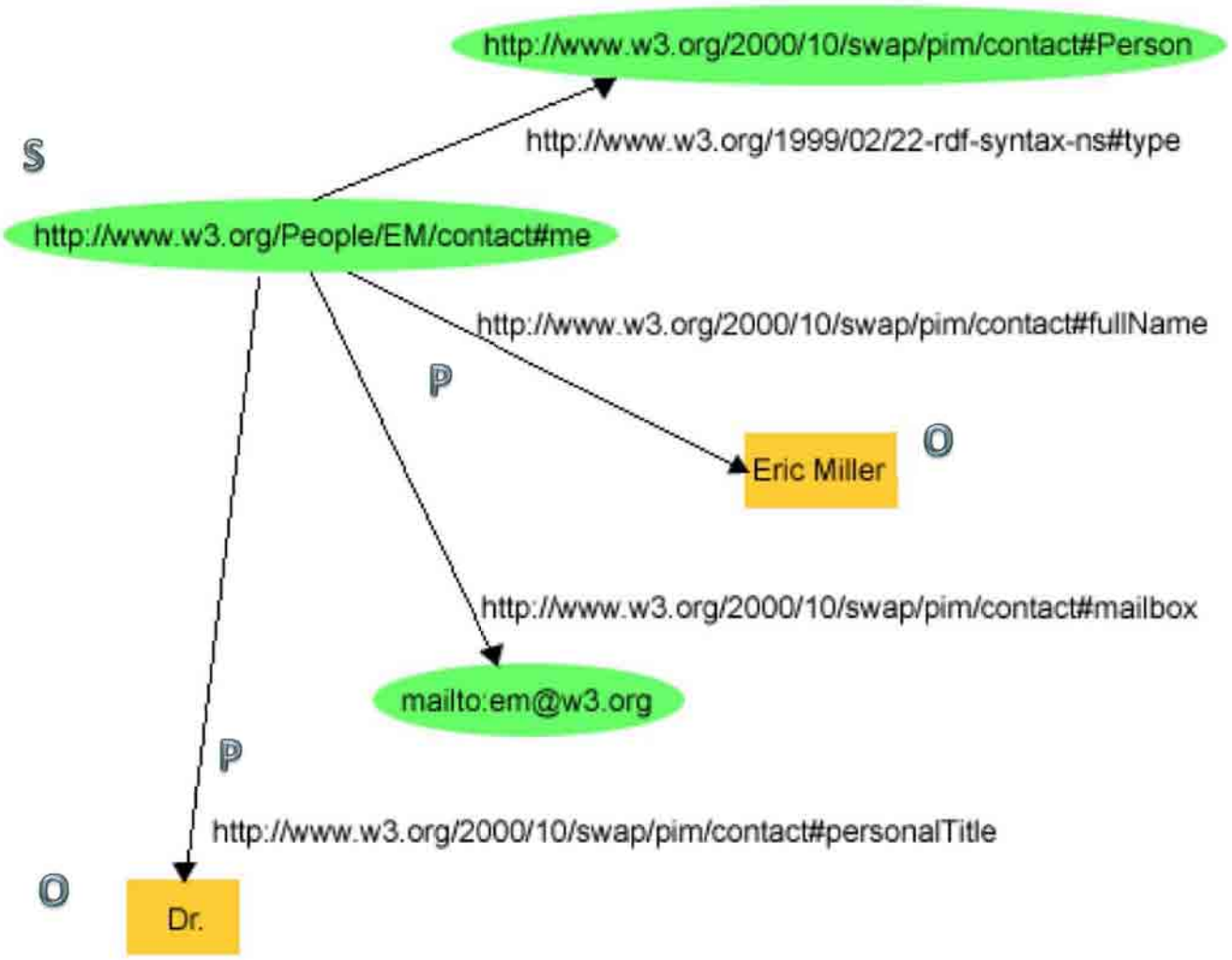


Figure 1: An RDF Graph Describing Eric Miller

RDF

Triple: <Subject, Predicate, Object>

Figure 1 illustrates that RDF uses URIs to identify:

S
P
P
O

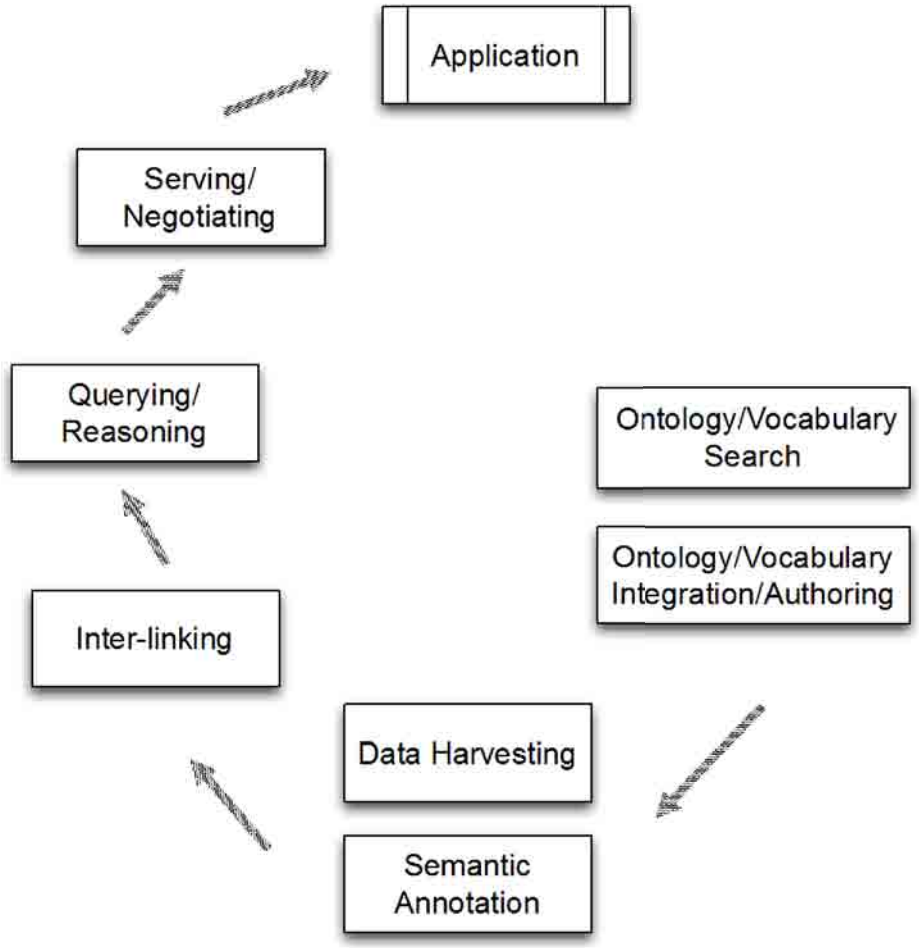
- individuals, e.g., Eric Miller, identified by `http://www.w3.org/People/EM/contact#me`
- kinds of things, e.g., Person, identified by `http://www.w3.org/2000/10/swap/pim/contact#Person` O
- properties of those things, e.g., mailbox, identified by `http://www.w3.org/2000/10/swap/pim/contact#mailbox`
- values of those properties, e.g. `mailto:em@w3.org` as the value of the mailbox property (RDF also uses character strings such as "Eric Miller", and values from other datatypes such as integers and dates, as the values of properties)

Ontology examples

- **Ontology for DBpedia (Wikipedia)**
  - http://wiki.dbpedia.org/Ontology
  - http://dbpedia.org/ontology/
  - http://mappings.dbpedia.org/server/ontology/classes/
  - http://dbpedia.org/sparql
- **Friend-of-a-friend (FOAF) Vocabulary**
  - http://xmlns.com/foaf/spec/
- **Ontology for E-commerce**
  - http://www.heppnetz.de/ontologies/goodrelations/v1
- **Ontology for Academic conferences**
  - http://data.semanticweb.org/ns/swc/ontology
- **Ontologies from Semantic.org**
  - http://semanticweb.org/wiki/Ontology

LOD Application Development Workflow

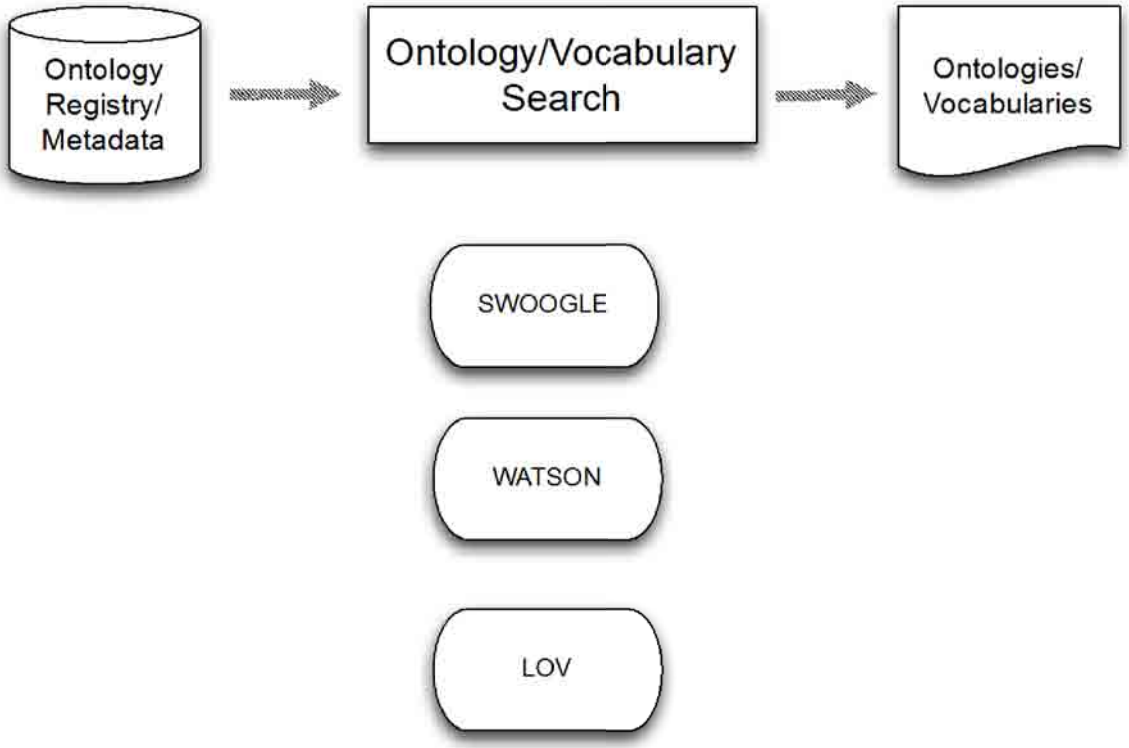
LOD Application Development Workflow



LOD Application Development Workflow

- We present a loose set of activities that a software developer will perform, not necessarily in sequence, and sometimes more than once to build an application.
- For each activity, we present inputs and outputs along with a list of suggested tools.
- The tools are used to complete part of an activity. Further setup, cleaning or programming may be needed.
- Some tools (suite) can be used in more than one activity
- The use of tools depend on the nature of the application and complexity of source data sets.

Ontology/Vocabulary Search



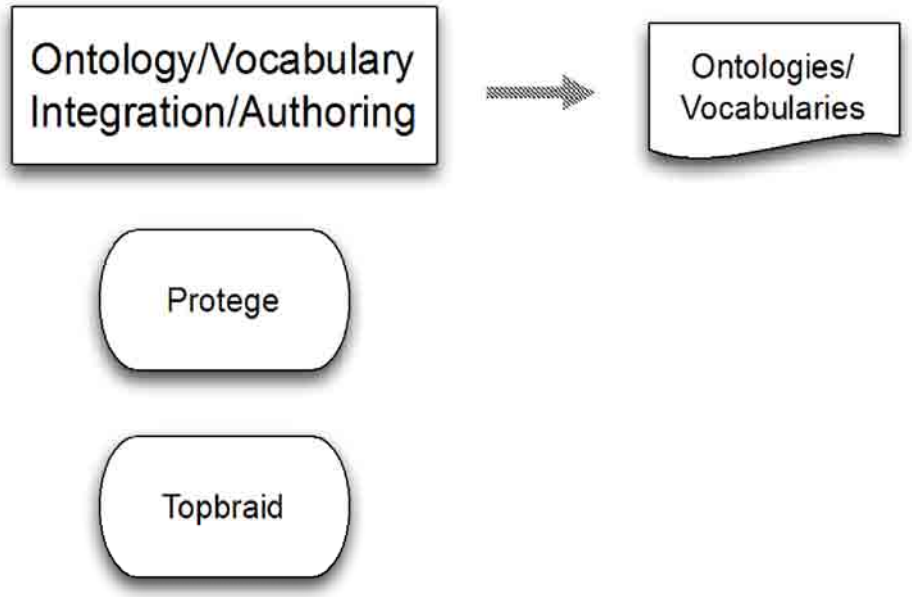
Ontology/Vocabulary Search

- Tools for ontology/vocabulary search provide:
  - A registry of vocabulary metadata
  - A search mechanism
  - Output is a list of metadata and URLs to ontologies or related concepts, which match the search input against registered ontologies.

Ontology/Vocabulary Search

- SWOOGLE
  - http://swoogle.umbc.edu
- Watson
  - http://watson.kmi.open.ac.uk/WatsonWUI/
- LOV
  - http://lov.okfn.org/dataset/lov/

Ontology/Vocabulary Integration/Authoring



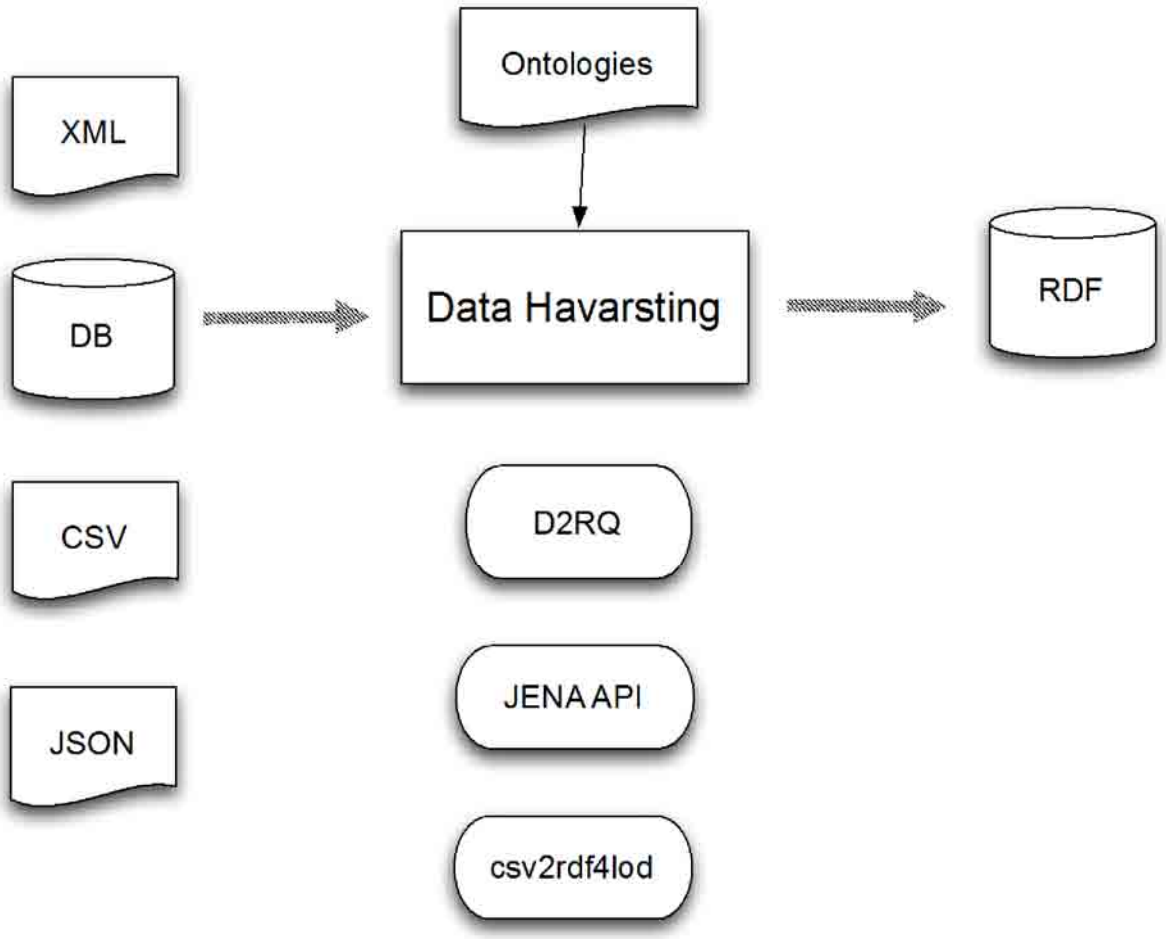
Ontology/Vocabulary Integration/Authoring

- Tools for vocabulary authoring provide an environment for:
  - Editing, validating, instantiating ontologies
  - Importing existing ontologies
  - Transforming schemas (e.g. XML) and other formalisms into ontologies
- Output is an ontology with a defined namespace

Ontology/Vocabulary Integration/Authoring

- TopBraid Composer
  - http://www.topquadrant.com/products/TB_Composer.html
- Protege
  - http://protege.stanford.edu

Data Harvesting



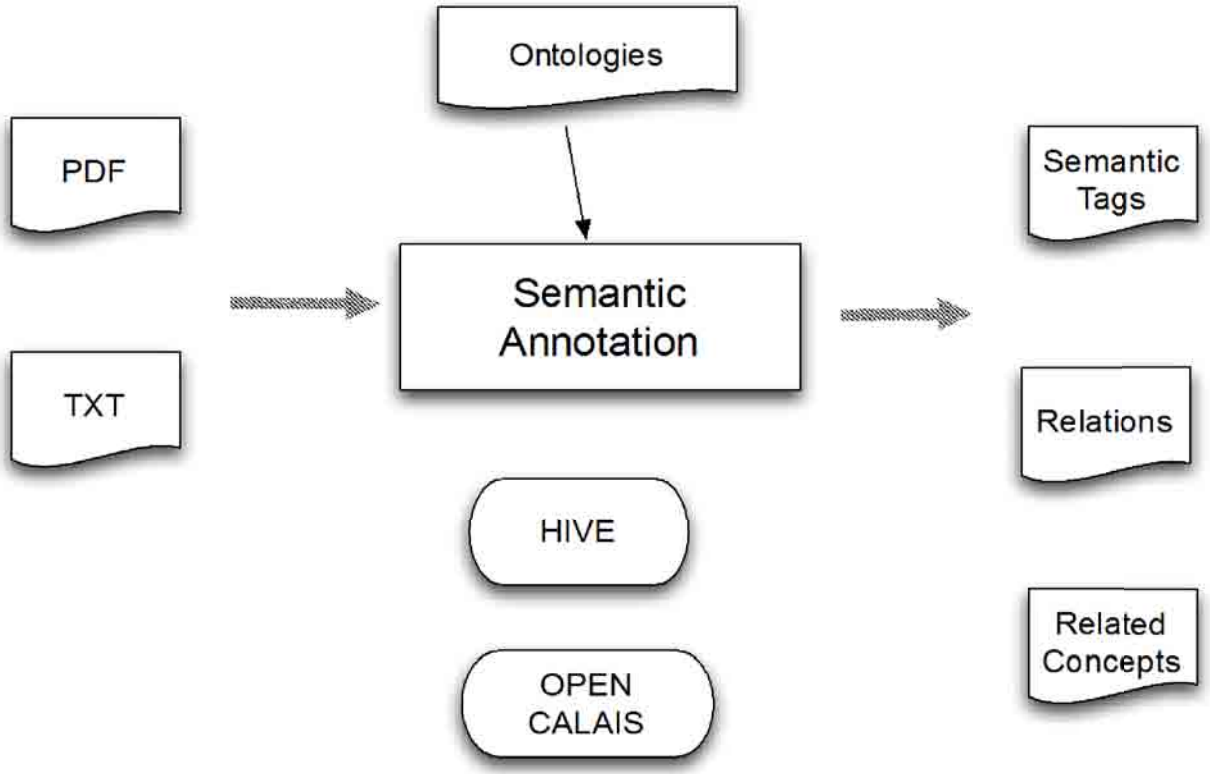
Data Harvesting

- Data harvesting tools :
  - Have as input structured documents, whose structure can be mapped to ontology concepts and relations, and data can be instantiated according to given ontologies
  - Provide a mapping mechanism
    - Can be based on a standard language such as R2RML
      - http://www.w3.org/TR/2012/REC-r2rml-20120927/#overview
  - Can be part of a Database plugin for automated RDF generation and query rewriting, for example as in
    - Virtuoso (http://virtuoso.openlinksw.com/rdf-quad-store/),
    - AllegroGraph (http://www.franz.com/agraph/allegrograph/).
- Output is RDF data according to input documents, which can be stored/dumped into a RDF triple store (e.g. SESAME)

Data Harvesting

- D2RQ
  - http://d2rq.org
- JENA RDF API
  - http://jena.apache.org
- CSV2RDF4LOD
  - https://github.com/timrdf/csv2rdf4lod-automation/wiki

Semantic Annotation



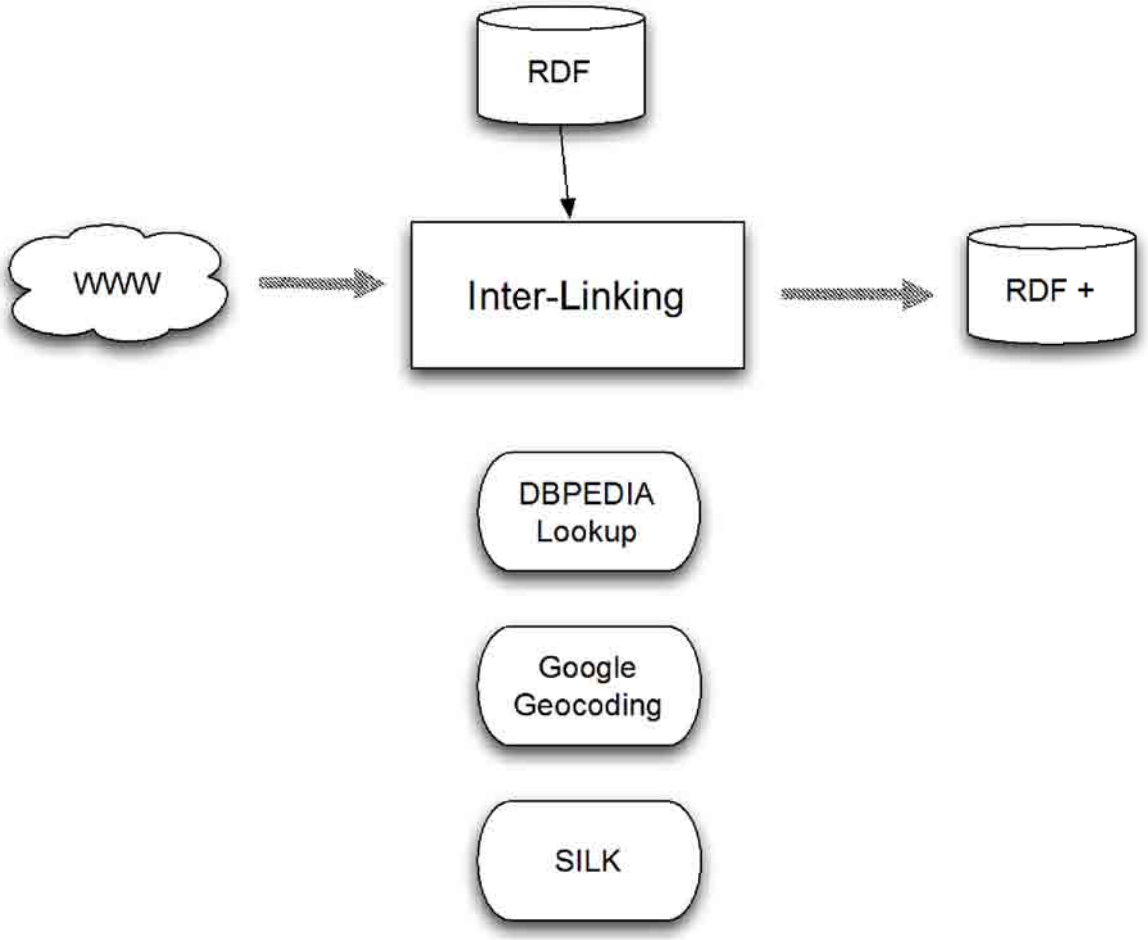
Semantic Annotation

- Semantic annotation:
  - Have as input un-structured documents.
  - Provide a similarity matching algorithm, which must be trained with specific ontologies, for example
    - KEA (http://www.nzdl.org/Kea/description.html)
- Output is a list of semantic tags or semantic relationships expressed in terms of a given ontology (e.g. SKOS).

Semantic Annotation

- HIVE
  - https://code.google.com/p/hive-mrc/
  - http://hive.nescent.org/home.html
- Open Calais
  - http://www.opencalais.com/about

Inter-linking



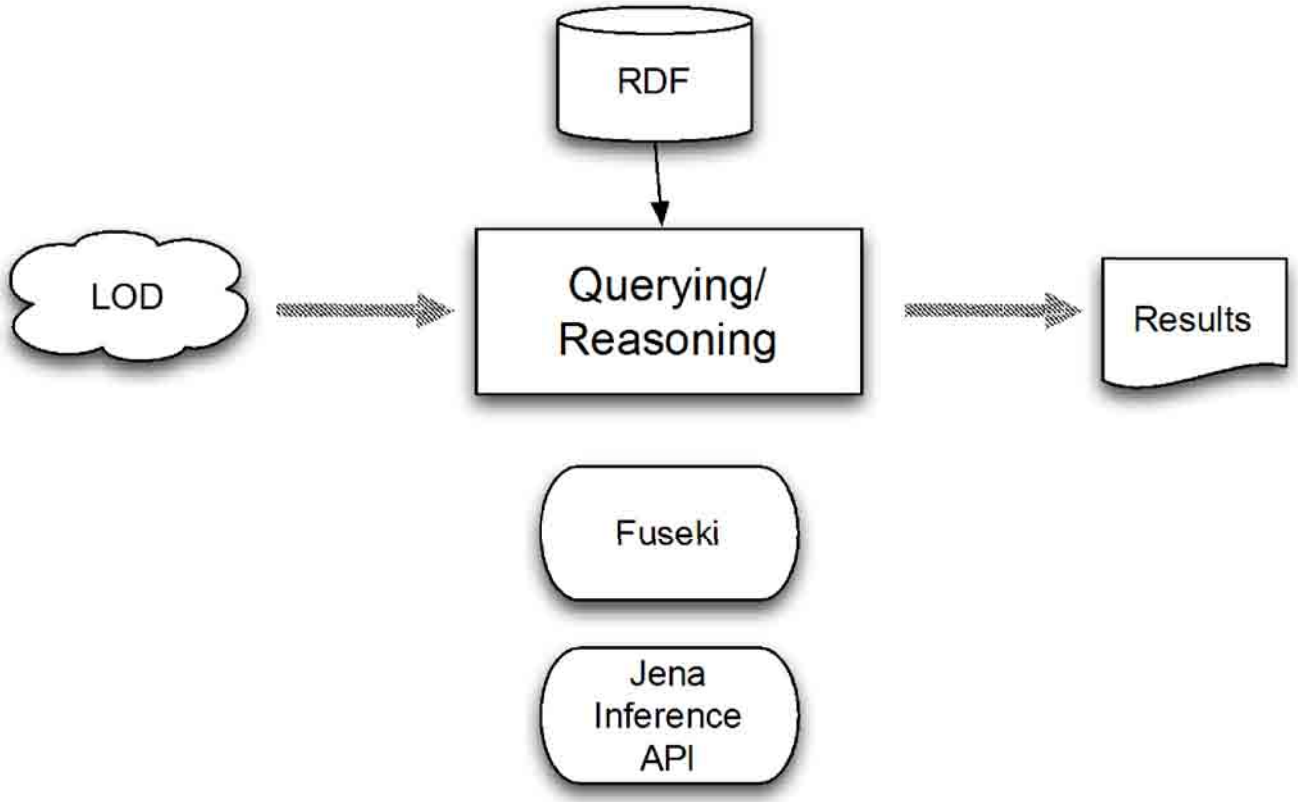
Inter-linking

- Interlinking tools can provide:
  - Lookup functions over a dataset.
  - Similarity matching algorithms to find degrees of relationship such as equality (e.g. same as), inclusion (e.g. broader) between resources
- Output is a set of new relations, which link existing subjects to external resources.

Inter-linking

- DBPedia Lookup
  - https://github.com/dbpedia/lookup
- Google Geocoding
  - https://developers.google.com/maps/documentation/geocoding/
- SILK
  - http://wifo5-03.informatik.uni-mannheim.de/bizer/silk/

Querying/Reasoning



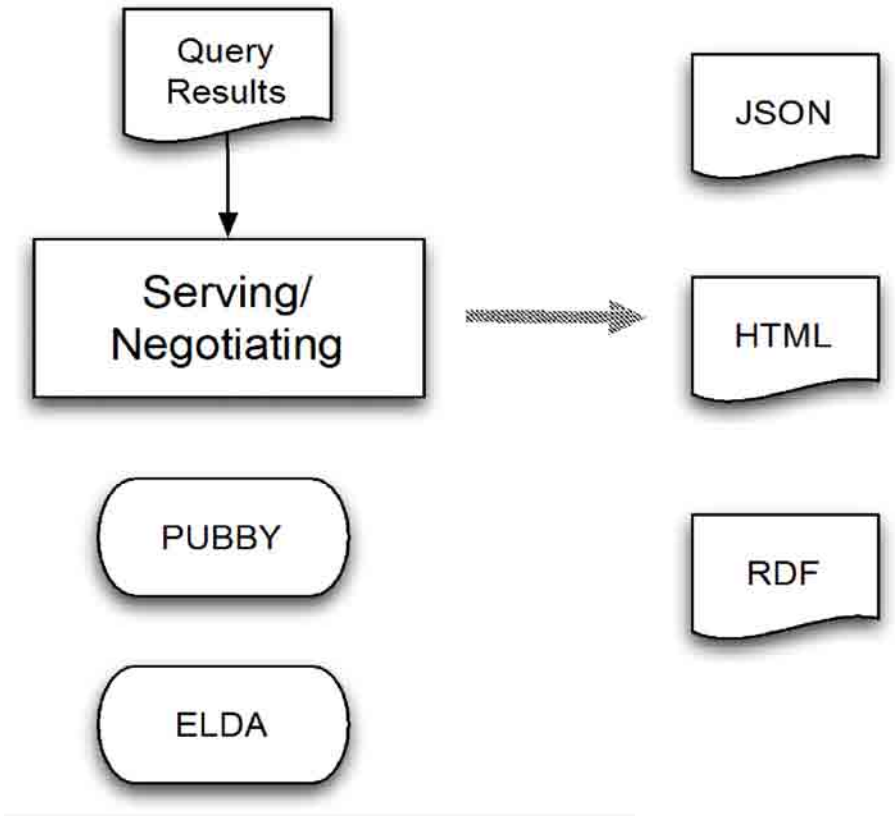
Querying/Reasoning

- Any tool that uses SPARQL
  - It can be part of another tool, e.g. Snorql over D2RQ
- Any tool that uses OWL/RDF reasoners
- Output is a table with results of the query, which can be converted to different formats (e.g. JSON)

Querying/Reasoning

- Fuseki
  - http://jena.apache.org/documentation/serving_data/
- Jena Inference API
  - http://jena.apache.org/documentation/inference/index.html

Serving/Negotiating



Serving/Negotiating

- Tools that serve or negotiate RDF provide:
  - A Web Server
    - Content negotiation provides access to data in different formats
  - Defined namespace
  - SPARQL endpoint
  - A dataset that can be exposed to the LOD Cloud following LOD principles
    - All elements have a URL that can be dereferenced
  - It can be part of another tool, e.g. D2RQ

Serving/Negotiating

- Pubby
  - http://wifo5-03.informatik.uni-mannheim.de/pubby/
- ELDA
  - http://code.google.com/p/elda/

LOD Application Example

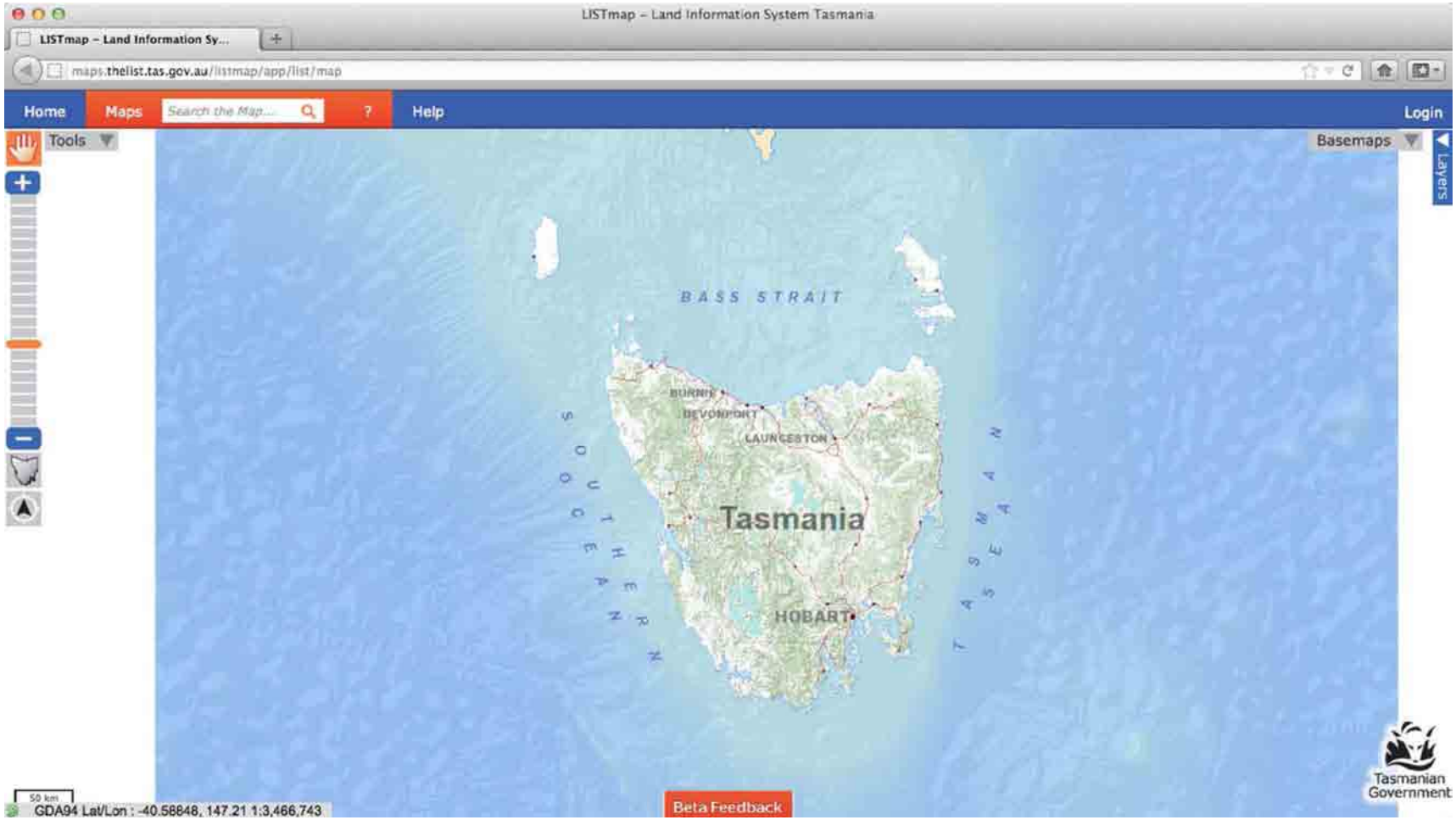
Linking Tasmania Geo-spatial Environmental Features

- Goal:
  - Access environmental features about Tasmania from Geo-spatial infrastructures and create an LOD dataset
  - Create an application that will provide integrated information
- Geo-spatial infrastructures provide:
  - Access to a registry of geographic content (e.g. ArcGIS)
  - Mapping services – Maps according to geo location
  - Feature services – Features according to geo location
  - Standards for naming and interoperability

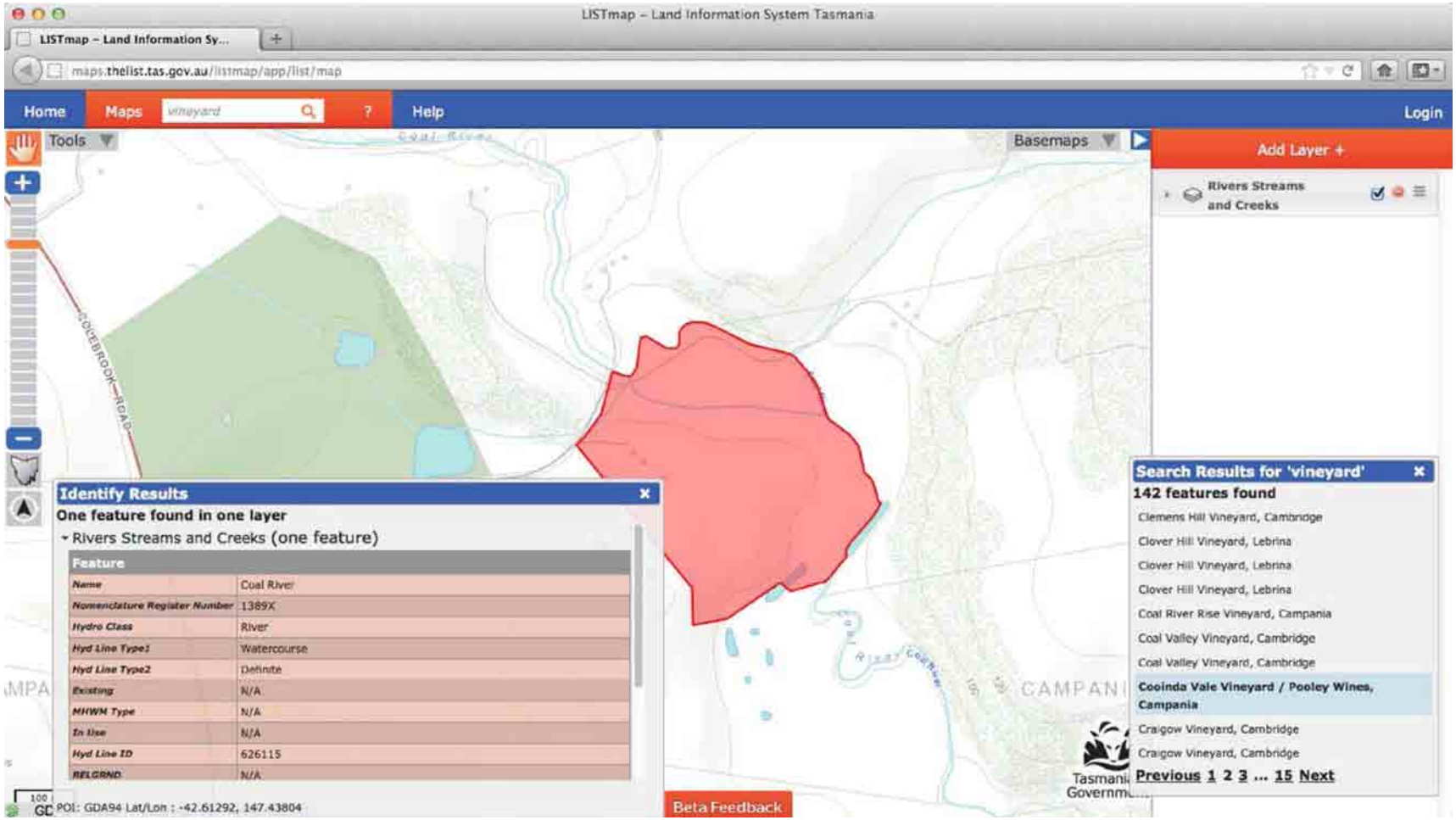
Linking Tasmania Geo-spatial Environmental Features

- Examples of geo-spatial applications:
  - The List – Tasmania Government
    - http://www.dpiw.tas.gov.au/inter-nsf/WebPages/LBUN-59H3DY?open
    - http://maps.thelist.tas.gov.au/listmap/app/list/map
    - http://services.thelist.tas.gov.au/geoserver/web/?wicket:bookmarkablePage=:org.geoserver.web.demo.MapPreviewPage
  - Gazetteer Australia
    - http://www.ga.gov.au/search/index.html#/
    - http://www.ga.gov.au/darwin-gazetteer/index.xhtml

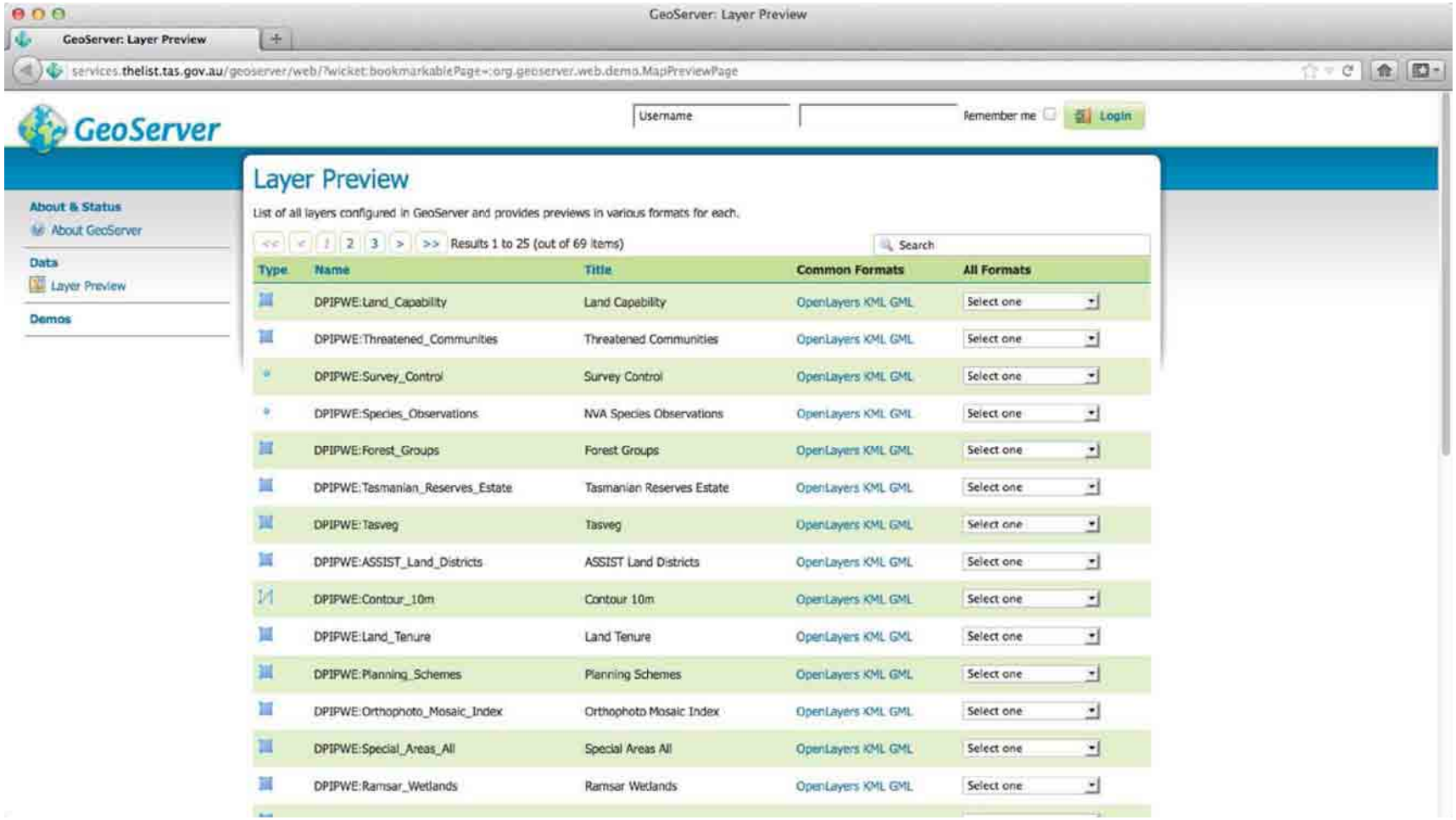
The List – Tasmania Maps and Features



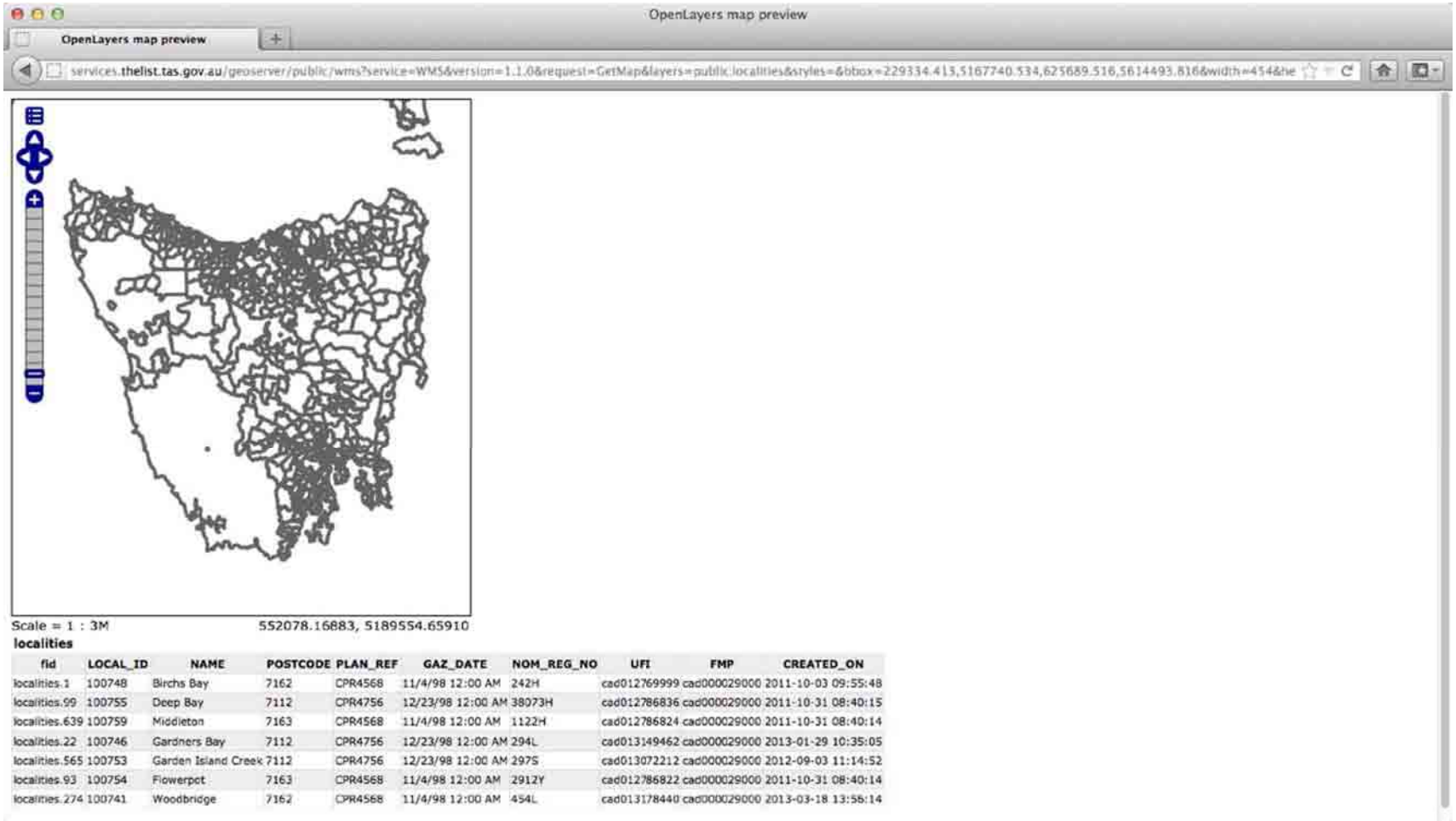
The List – Tasmania Maps and Features



The List services – Tasmania Maps and Features



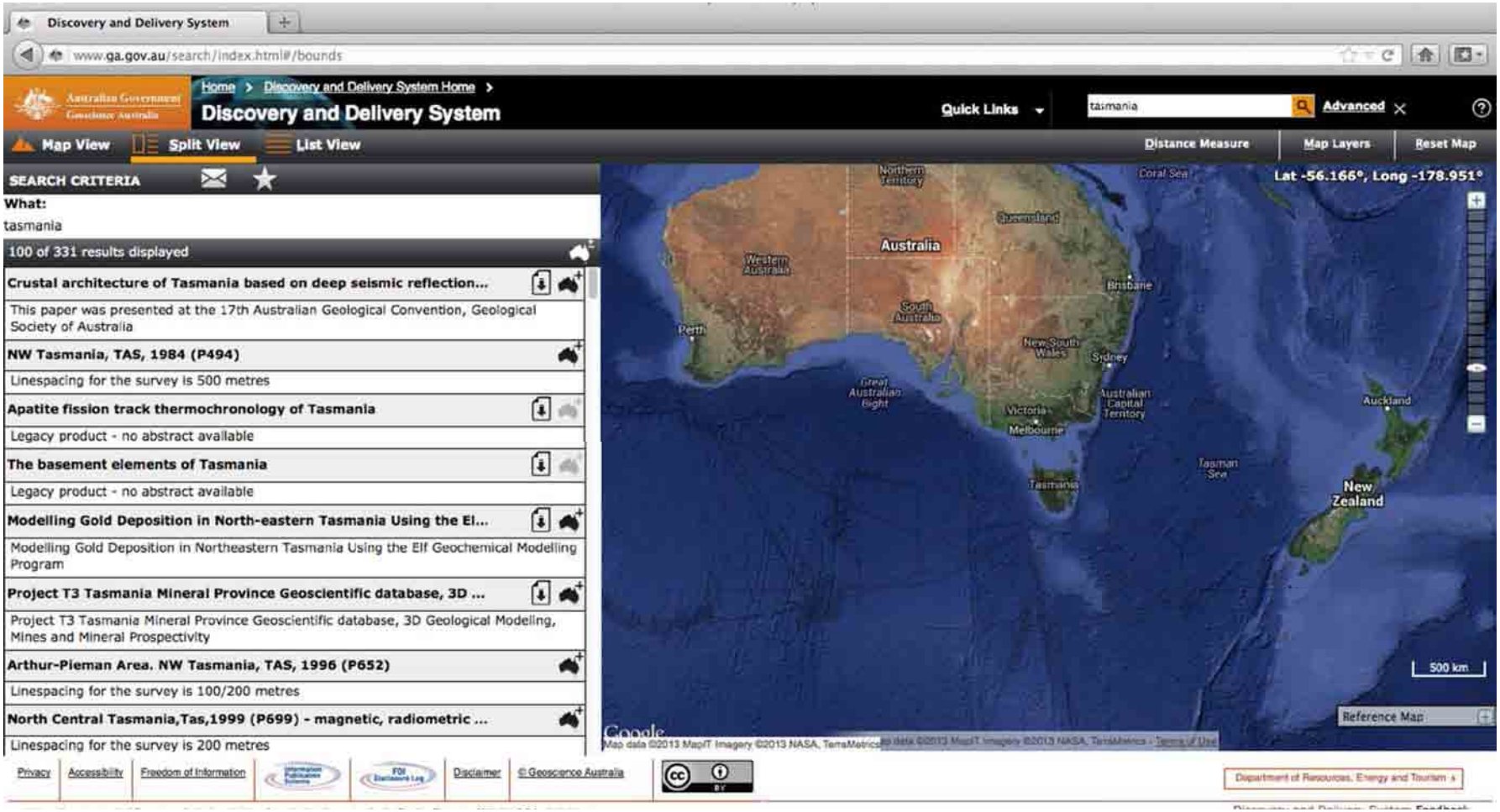
The List services – Tasmania Maps and Features



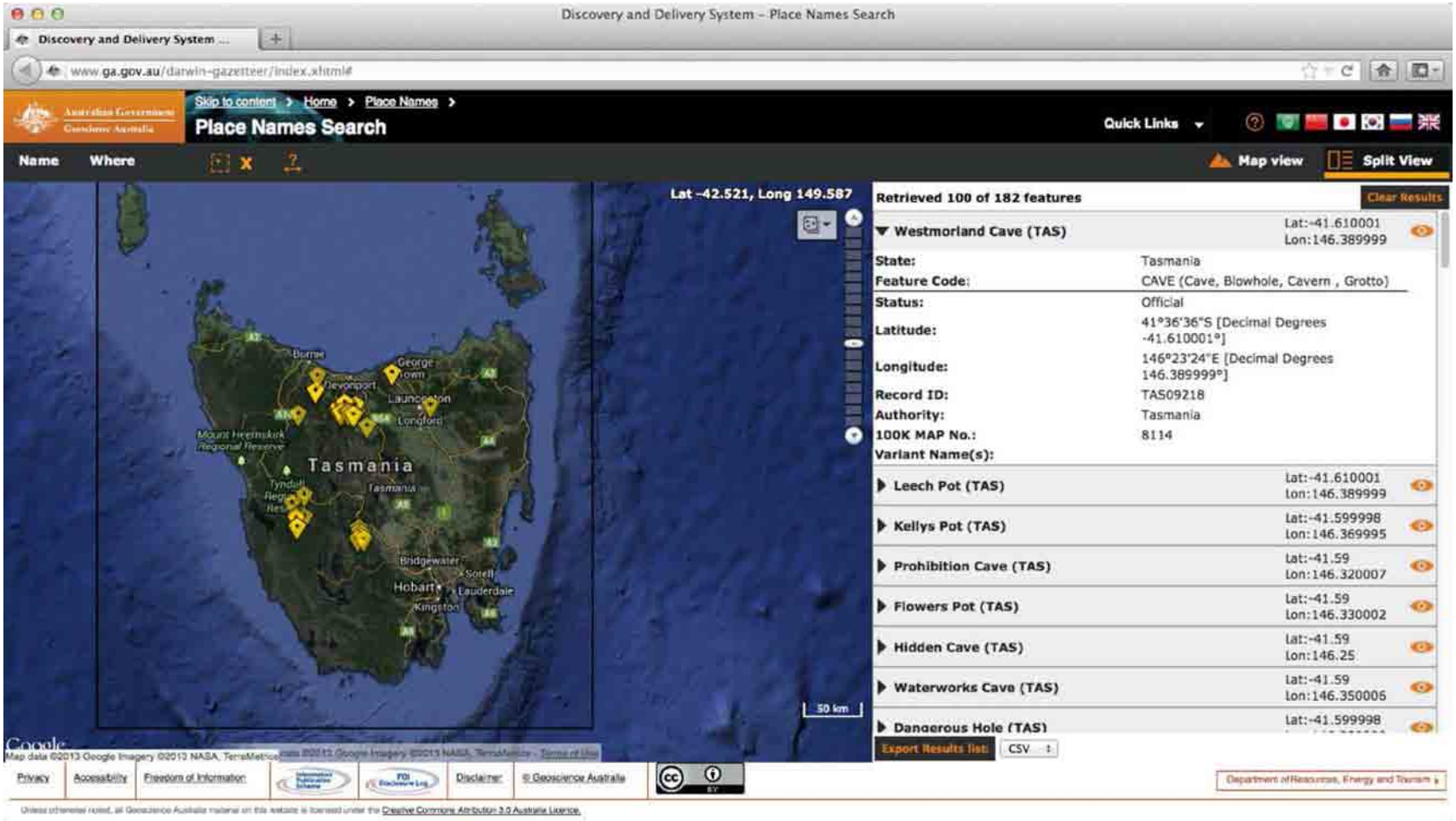
localities

fid	LOCAL_ID	NAME	POSTCODE	PLAN_REF	GAZ_DATE	NOM_REG_NO	UFI	FMP	CREATED_ON
localities.1	100748	Birchs Bay	7162	CPR4568	11/4/98 12:00 AM	242H	cad012769999	cad000029000	2011-10-03 09:55:48
localities.99	100755	Deep Bay	7112	CPR4756	12/23/98 12:00 AM	38073H	cad012786836	cad000029000	2011-10-31 08:40:15
localities.639	100759	Middleton	7163	CPR4568	11/4/98 12:00 AM	1122H	cad012786824	cad000029000	2011-10-31 08:40:14
localities.22	100746	Gardners Bay	7112	CPR4756	12/23/98 12:00 AM	294L	cad013149462	cad000029000	2013-01-29 10:35:05
localities.565	100753	Garden Island Creek	7112	CPR4756	12/23/98 12:00 AM	297S	cad013072212	cad000029000	2012-09-03 11:14:52
localities.93	100754	Flowerpot	7163	CPR4568	11/4/98 12:00 AM	2912Y	cad012786822	cad000029000	2011-10-31 08:40:14
localities.274	100741	Woodbridge	7162	CPR4568	11/4/98 12:00 AM	454L	cad013178440	cad000029000	2013-03-18 13:56:14

Gazetteer Australia – Feature discovery



Gazetteer Australia – Search - Tasmania (caves)



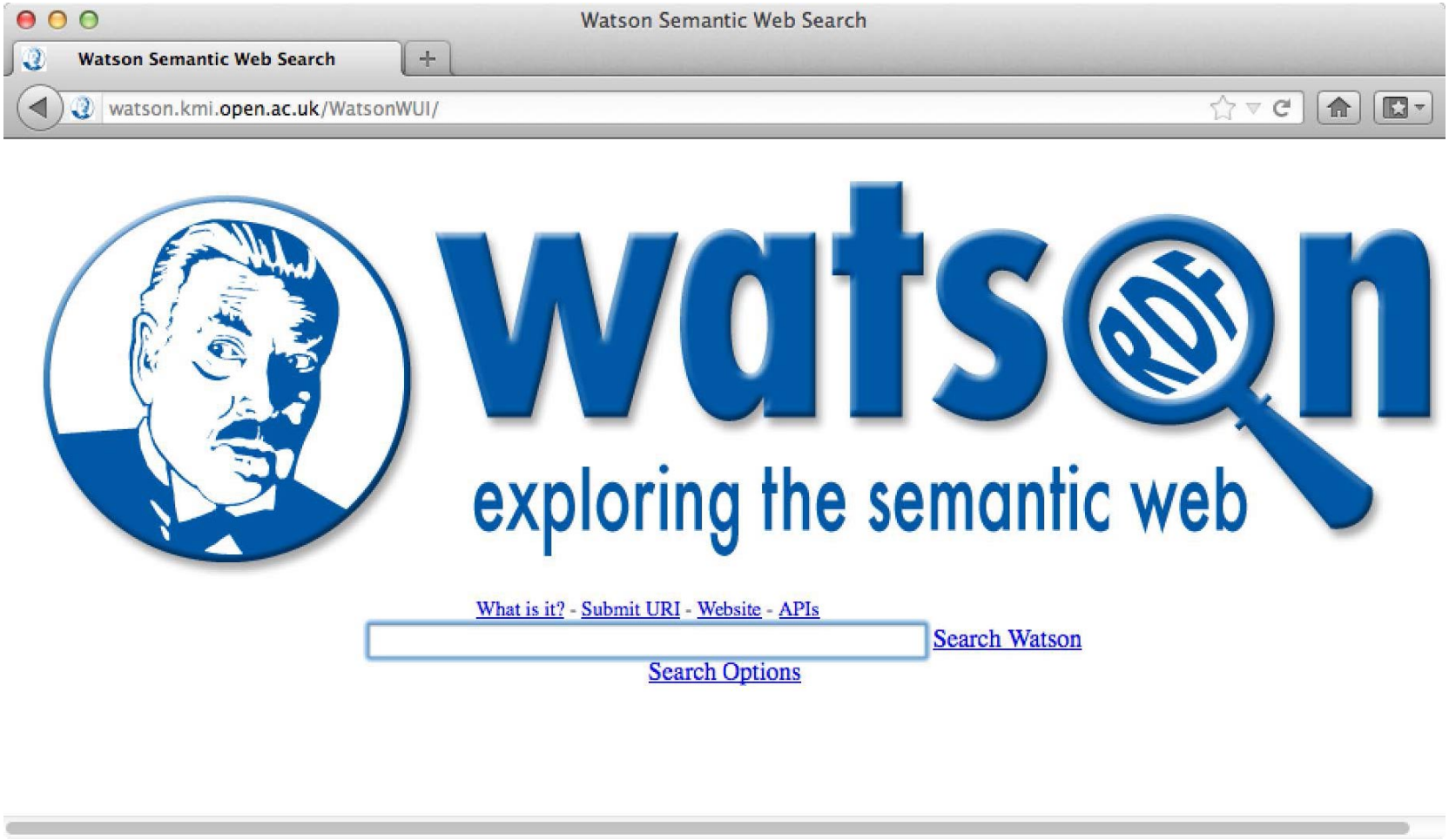
Linking Tasmania Geo-spatial Environmental Features

- Dataset Sources:
  - Gazetteer Australia
    - http://www.ga.gov.au/darwin-gazetteer/index.xhtml
      - Parks & Reserves; Caves; Landmarks
  - Public Toilets
    - http://data.gov.au/dataset/national-public-toilet-map
  - Tasmanian Devil Sightings
    - http://biocache.ala.org.au/occurrences/search?taxa=Sarcophilus+harrisii#tab_recordsView

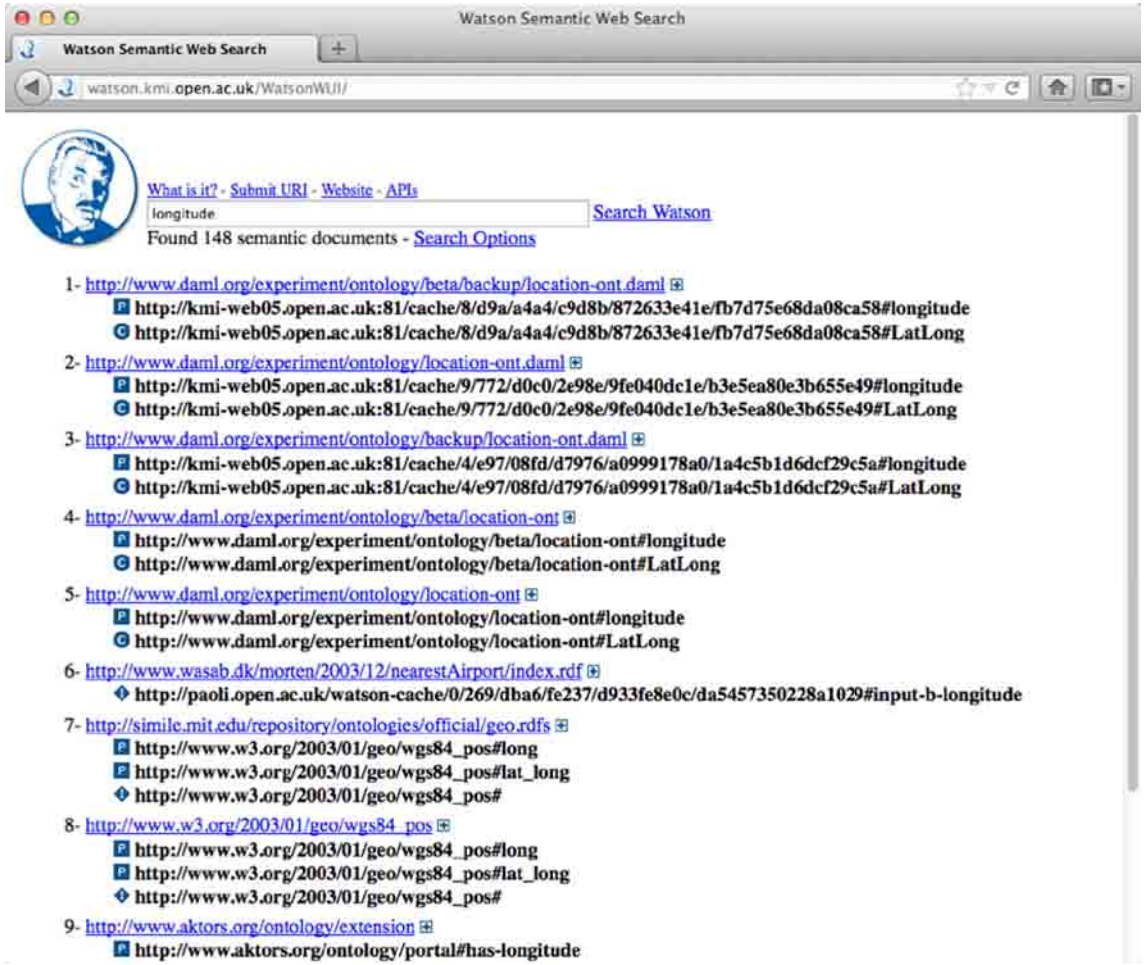
Development Steps – Ontology Search

- From Watson page
  - http://watson.kmi.open.ac.uk/WatsonWUI/
  - Type ‘geonames’
  - Select http://www.geonames.org/ontology
    - http://www.geonames.org/ontology/ontology_v2.0_Lite.rdf
  - Type ‘longitude’
  - Select http://www.w3.org/2003/01/geo/wgs84_pos

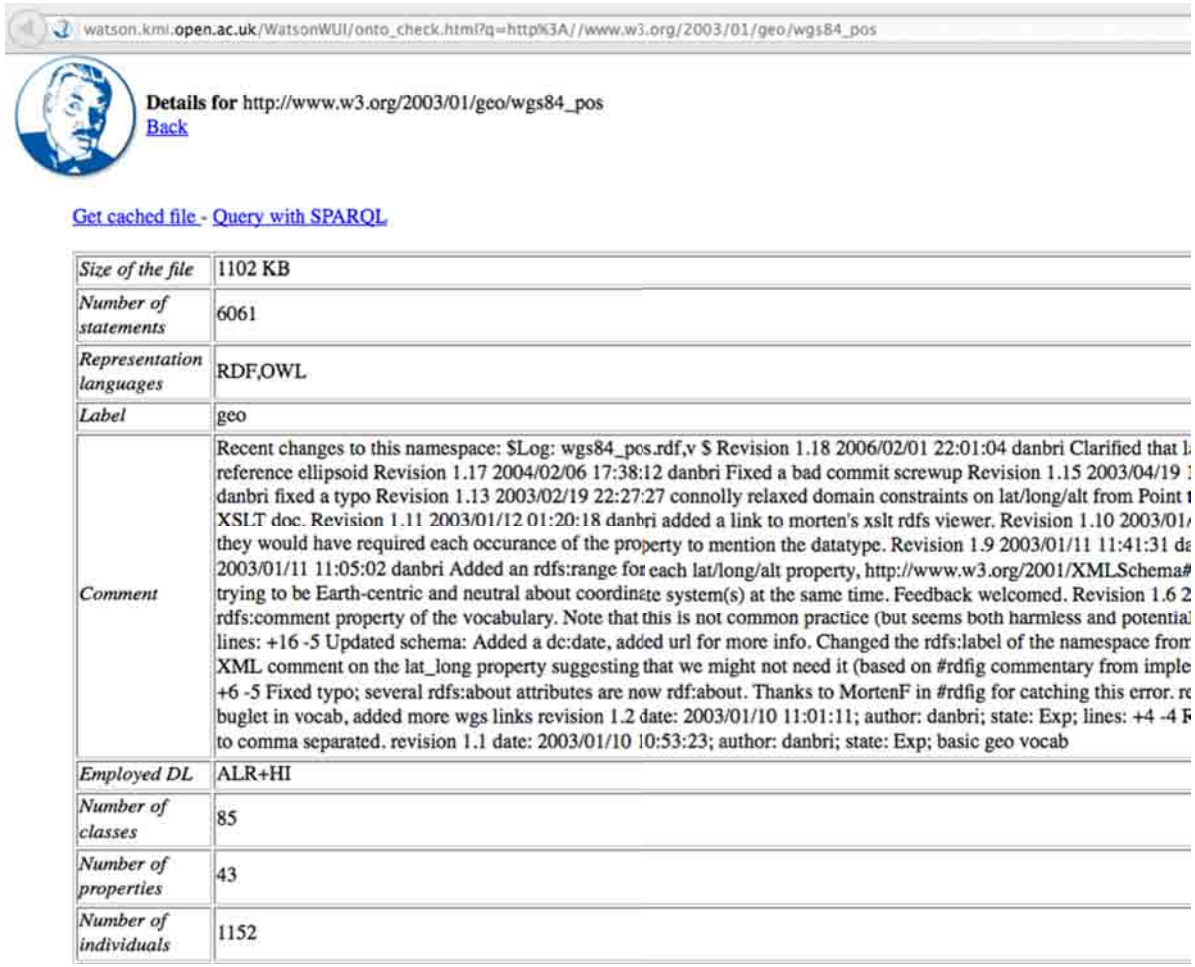
Development Steps – Ontology Search



Development Steps – Ontology Search



Development Steps – Ontology Search

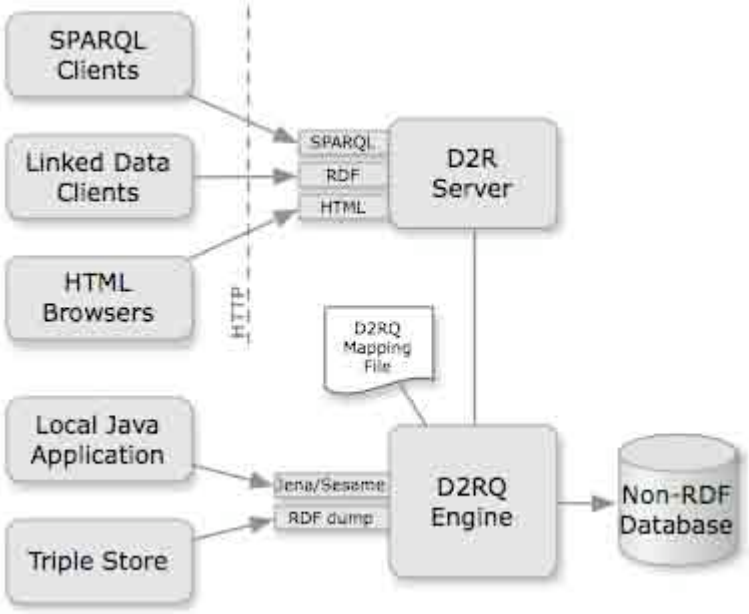


Development Steps – Data Harvesting

- From the Gazetteer Australia (Place names search)
  - http://www.ga.gov.au/darwin-gazetteer/index.xhtml
  - Go to 'Where' link and select 'Tas' as location
  - Go to 'Name" link (leave name blank)
    - Select features (parks&reserves, caves, landmarks)
  - Download CSV (by feature)
- Setup a relational database (Postgres)
  - Import CSV into tables
- Setup D2RQ
  - Generate default mappings
  - Modify mappings using selected ontologies

D2RQ

- System for accessing relational databases as RDF (query or dump).
- D2RQ platform consist of:
  - Language mapping database schema to RDFS vocabularies or OWL ontologies.
  - Engine to rewrite Jena API calls to SQL queries.
  - HTTP server that provides a Linked Data view and a SPARQL endpoint.



http://d2rq.org

Load data into DB (Postgres) - example

```
CREATE TABLE landmarks (
  Record_ID VARCHAR(16) NOT NULL,
  Name VARCHAR(64) NOT NULL,
  Authority VARCHAR(64) NOT NULL,
  State_ID CHAR(3) NOT NULL,
  Feature_code VARCHAR(32) NOT NULL,
  Status CHAR(1) NOT NULL,
  Longitude DOUBLE PRECISION NOT NULL,
  Latitude DOUBLE PRECISION NOT NULL,
  Class_code CHAR(1) NOT NULL,
  Classification VARCHAR(32) NOT NULL,
  PRIMARY KEY(Record_ID)
);

COPY landmarks(
  Record_ID,Name,Authority,State_ID,Feature_code,Status,
    Longitude,Latitude,Class_code,Classification
) FROM 'LANDMARKS-TAS.csv' WITH DELIMITER ',';
```

D2RQ – Mapping Language

- Declarative language for describing the relation between a relational database schema and RDFS vocabularies or OWL ontologies.
- Mappings are RDF documents written in Turtle syntax.
- Generate manually or automatically.

```
generate-mapping -u <user> -p <pwd> -o <out-file>
-d <driver, e.g., org.postgresql.Driver> url (e.g.
jdbc:postgresql://localhost:5432/tutorial)
```

http://d2rq.org/d2rq-language

D2RQ – Mapping Language (cont.)

LANDMARKS

Record ID	Name	State	Feature	...
TAS19510	Octopus Tree	TAS	TREE	...
TAS09412	Richards Monument	TAS	MONU	...
...	...	...	...	...

```
map:landmarks a d2rq:ClassMap;
        d2rq:dataStorage map:database;
        d2rq:uriPattern "landmarks/@@landmarks.record_id|urlify@@";
        d2rq:class vocab:landmarks;
        d2rq:classDefinitionLabel "landmarks";
        .
map:landmarks_record_id a d2rq:PropertyBridge;
        d2rq:belongsToClassMap map:landmarks;
        d2rq:property vocab:landmarks_record_id;
        d2rq:propertyDefinitionLabel "landmarks record_id";
        d2rq:column "landmarks.record_id";
```

D2RQ – Mapping Language (cont.)

LANDMARKS

Record ID	Name	State
TAS19510	Octopus Tree	TAS
TAS09412	Richards Monument	TAS
…	…	…

Represents a class or a group of similar classes of an OWL ontology or RDFS schema. A class map defines how instances of the class are identified.

```
map:landmarks a d2rq:ClassMap;
        d2rq:dataStorage map:database;
        d2rq:uriPattern "landmarks/@@landmarks.record_id|urlify@@";
        d2rq:class vocab:landmarks;
        d2rq:classDefinitionLabel "landmarks";
        .
map:landmarks_record_id a d2rq:PropertyBridge;
        d2rq:belongsToClassMap map:landmarks;
        d2rq:property vocab:landmarks_record_id;
        d2rq:propertyDefinitionLabel "landmarks record_id";
        d2rq:column "landmarks.record_id";
```

D2RQ – Mapping Language (cont.)

LANDMARKS

Record ID	Name	State	Feature	...
TAS19510	Octopus Tree	TAS		
TAS09412	Richards Monument	TAS		
...	...	...		

Relates a database column to an RDF property. Property bridges are used to attach properties to the RDF resources created by a class map.

```
map:landmarks a d2rq:ClassMap;
        d2rq:dataStorage map:database;
        d2rq:uriPattern "landmarks/@@landmarks.record_id|urlify@@";
        d2rq:class vocab:landmarks;
        d2rq:classDefinitionLabel "landmarks";
        .
map:landmarks_record_id a d2rq:PropertyBridge;
        d2rq:belongsToClassMap map:landmarks;
        d2rq:property vocab:landmarks_record_id;
        d2rq:propertyDefinitionLabel "landmarks record_id";
        d2rq:column "landmarks.record_id";
```

Mappings to selected ontologies (example 1)

```
@prefix geonames: <http://www.geonames.org/ontology#> .
@prefix geo: <http://www.w3.org/2003/01/geo/wgs84_pos#> .

map:caves a d2rq:ClassMap;
        d2rq:dataStorage map:database;
        d2rq:uriPattern "caves/@@caves.record_id|urlify@@";
        d2rq:class geonames:Feature;
        d2rq:classDefinitionLabel "caves";

map:caves_longitude a d2rq:PropertyBridge;
        d2rq:belongsToClassMap map:caves;
        d2rq:property geo:long;
        d2rq:propertyDefinitionLabel "caves longitude";
        d2rq:column "caves.longitude";
        d2rq:datatype xsd:double; x
```

Mappings to selected ontologies (example 2)

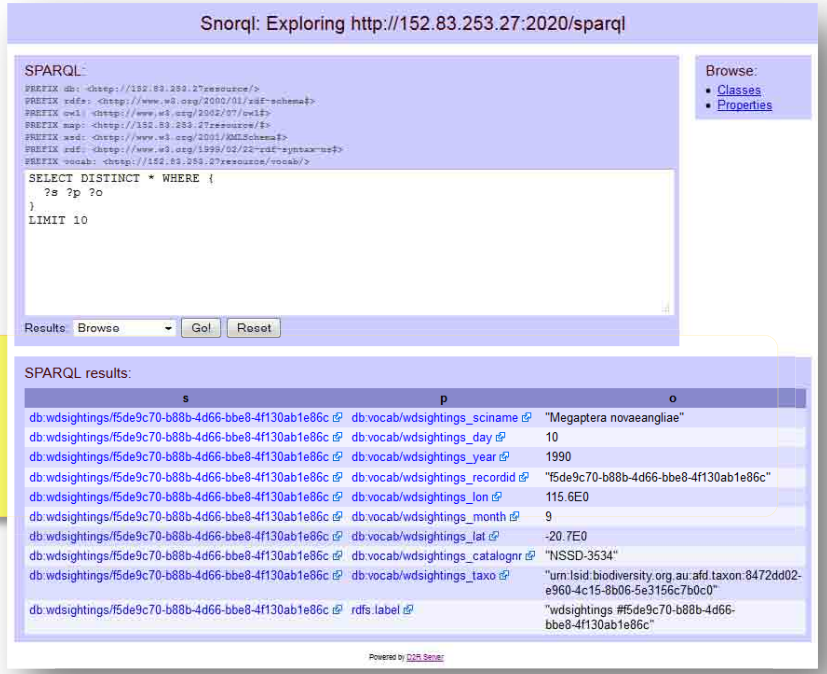
```
map:parks a d2rq:ClassMap;
        d2rq:dataStorage map:database;
        d2rq:uriPattern "parks/@@parks.record_id|urlify@@";
        d2rq:class geonames:Feature;
        d2rq:classDefinitionLabel "parks";

#Landmarks - Caves - Nearby
map:landmarksCavesNearby a d2rq:PropertyBridge;
   d2rq:belongsToClassMap map:landmarks;
   d2rq:property geonames:nearby;
   d2rq:refersToClassMap map:caves;
   d2rq:join "landmarks.record_id <= landmarks_caves_nearby.landmark";
   d2rq:join "landmarks_caves_nearby.cave => caves.record_id";
```

D2RQ – Getting Started

- Start D2RQ server:

```
d2rq-server <mapping-file>
```



- Generate RDF dump:

```
dump-rdf <mapping-file> -o <out-file>
```

http://d2rq.org/getting-started

D2RQ – Linked Data Support

Resolvable URIs

Following the Linked Data principles, D2R Server assigns a URI to each entity that is described in the database, and makes those URIs resolvable – that is, an RDF description can be retrieved simply by accessing the entity's URI over the Web.

http://d2rq.org/d2r-server

Development Steps – Interlinking

- Linked features:
  - Parks nearby Landmarks
  - Parks nearby Caves
  - Landmarks nearby Parks
  - Caves nearby Parks
  - Parks seeAlso towns nearby
  - Caves seeAlso towns nearby
  - Parks seeAlso devils nearby
  - Parks seeAlso toilets nearby
  - Landmarks seeAlso toilets nearby
  - Caves seeAlso toilets nearby

Development Steps – Interlinking

- ‘geoname:nearby’ relation linking
  - Use geo:lat and geo:long of features to calculate the vector distance between features (e.g. SQL join).
  - Link feature to nearby feature using the ‘geoname:nearby’ relation
- ‘rdfs:seeAlso’ relation linking:
  - Use Google Geocoding to find nearest place names of features given their latitude and longitude
  - Query Dbpedia for towns in Tasmania with retrieved place name
  - Link feature to place name using ‘rdfs:seeAlso’ relation
- Link feature to nearby devil (URL) using ‘rdfs:seeAlso’ relation
- Link feature to nearby toilet (URL) using ‘rdfs:seeAlso’ relation

- Homework: Which relations could replace rdfs:seeAlso?

Development Steps – Interlinking

- Reverse Geocoding
  - Use Latitude and Longitude to retrieve nearest place name:
    - http://maps.googleapis.com/maps/api/geocode/json?latlng=-42.77000046,147.0700073&sensor=false
  - Parse JSON document to retrieve place name
  - Query DBPedia for towns in Tasmania with given name

```
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX schema:<http://dbpedia.org/class/yago/>

SELECT DISTINCT ?uri WHERE{
  ?uri rdf:type schema:TownsInTasmania;
    rdfs:label ?label .
    FILTER (regex(?label,'New Norfolk'))
}
```

Development Steps – Querying

- We use SPARQL to query the data
- D2RQ offers a SPARQL tool (Snorql)
- The RDF Dataset produced from D2RQ was dumped into a Sesame repository
  - Namespace created: http://www.csiro.au/issl/holdt/
- We query the data using SPARQL from the Sesame Workbench
- In the example (next) we ask for all features nearby to another feature and their latitude and longitude

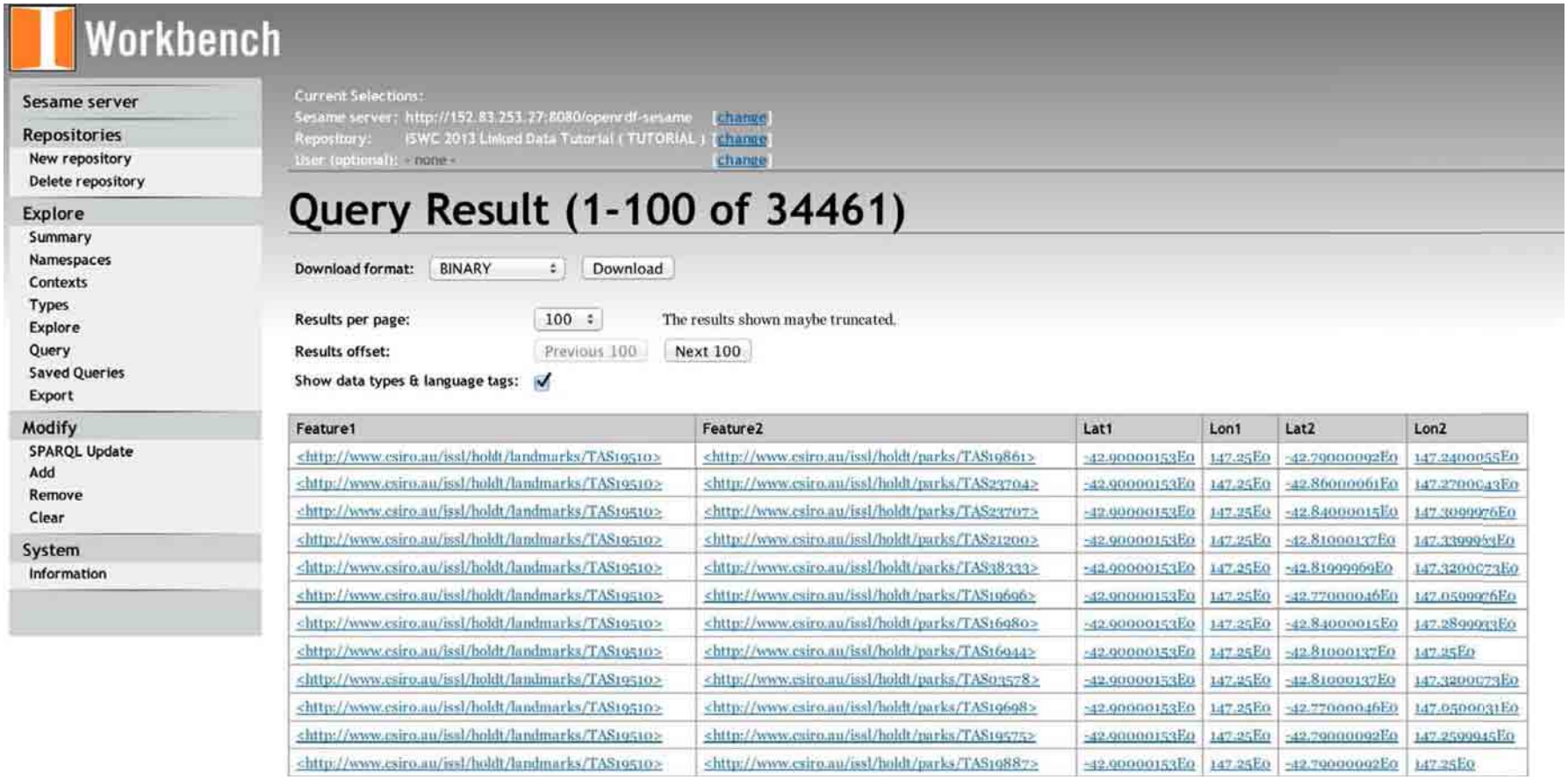
Development Steps – Querying

- SPARQL Query example (Sesame repository)

```
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX geo: <http://www.w3.org/2003/01/geo/wgs84_pos#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX vocab: <http://www.csiro.au/issl/holdt/vocab/>
PREFIX geonames: <http://www.geonames.org/ontology#>

SELECT DISTINCT ?feature1 ?feature2 ?lat1 ?lon1 ?lat2 ?lon2 WHERE {
  ?feature1 a geonames:Feature .
  ?feature1 geonames:nearby ?feature2 .
  ?feature1 geo:lat ?lat1 .
  ?feature1 geo:long ?lon1 .
  ?feature2 geo:lat ?lat2 .
  ?feature2 geo:long ?lon2 .
}
```

Development Steps – Querying



Feature1	Feature2	Lat1	Lon1	Lat2	Lon2
<http://www.csiro.au/issl/holdt/landmarks/TAS19510>	<http://www.csiro.au/issl/holdt/parks/TAS19861>	-42.90000153E0	147.25E0	-42.79000092E0	147.2400055E0
<http://www.csiro.au/issl/holdt/landmarks/TAS19510>	<http://www.csiro.au/issl/holdt/parks/TAS23704>	-42.90000153E0	147.25E0	-42.86000061E0	147.2700043E0
<http://www.csiro.au/issl/holdt/landmarks/TAS19510>	<http://www.csiro.au/issl/holdt/parks/TAS23707>	-42.90000153E0	147.25E0	-42.84000015E0	147.3099976E0
<http://www.csiro.au/issl/holdt/landmarks/TAS19510>	<http://www.csiro.au/issl/holdt/parks/TAS21200>	-42.90000153E0	147.25E0	-42.81000137E0	147.3399963E0
<http://www.csiro.au/issl/holdt/landmarks/TAS19510>	<http://www.csiro.au/issl/holdt/parks/TAS38333>	-42.90000153E0	147.25E0	-42.81999969E0	147.3200073E0
<http://www.csiro.au/issl/holdt/landmarks/TAS19510>	<http://www.csiro.au/issl/holdt/parks/TAS19696>	-42.90000153E0	147.25E0	-42.77000046E0	147.0599976E0
<http://www.csiro.au/issl/holdt/landmarks/TAS19510>	<http://www.csiro.au/issl/holdt/parks/TAS16980>	-42.90000153E0	147.25E0	-42.84000015E0	147.2899933E0
<http://www.csiro.au/issl/holdt/landmarks/TAS19510>	<http://www.csiro.au/issl/holdt/parks/TAS16944>	-42.90000153E0	147.25E0	-42.81000137E0	147.25E0
<http://www.csiro.au/issl/holdt/landmarks/TAS19510>	<http://www.csiro.au/issl/holdt/parks/TAS03578>	-42.90000153E0	147.25E0	-42.81000137E0	147.3200073E0
<http://www.csiro.au/issl/holdt/landmarks/TAS19510>	<http://www.csiro.au/issl/holdt/parks/TAS19698>	-42.90000153E0	147.25E0	-42.77000046E0	147.0500031E0
<http://www.csiro.au/issl/holdt/landmarks/TAS19510>	<http://www.csiro.au/issl/holdt/parks/TAS19575>	-42.90000153E0	147.25E0	-42.79000092E0	147.2599945E0
<http://www.csiro.au/issl/holdt/landmarks/TAS19510>	<http://www.csiro.au/issl/holdt/parks/TAS19887>	-42.90000153E0	147.25E0	-42.79000092E0	147.25E0

Development Steps: Serving

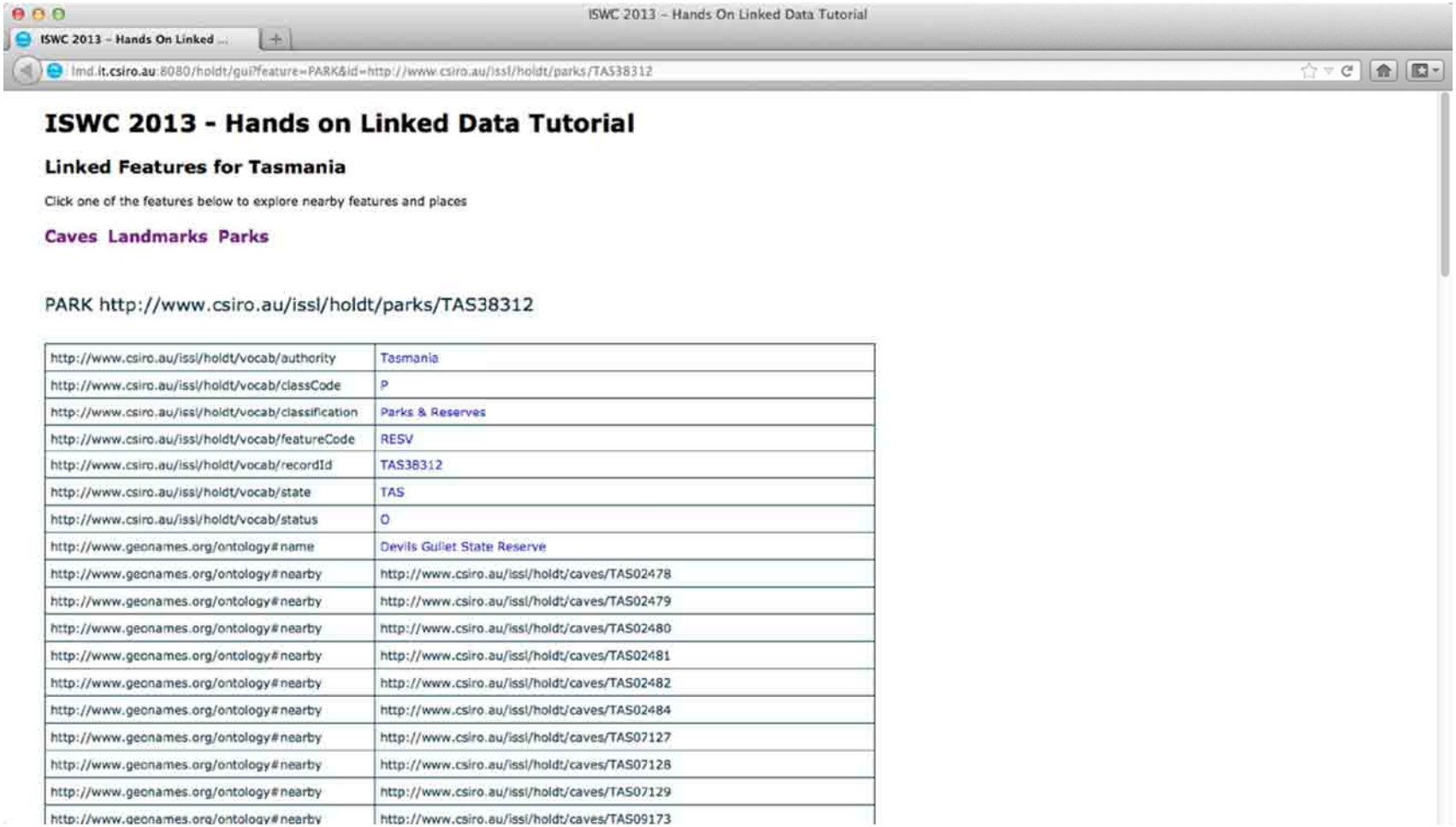
- The dataset (Sesame endpoint) has not been published (it is just for the tutorial!)
  - Thus, elements cannot be dereferenced on the Web

- Homework: How to publish the dataset in the LOD Cloud?

Development Steps: Application

- Linking Tasmania Geo-spatial Environmental Features
- Available at http://lmd.it.csiro.au:8080/holdt/gui
- The purpose is to explore the linked features for Tasmania
- The features (caves, landmarks, parks) are natural environments, which are frequently visited.
- We link the nearby features to each other.
- We link these features to the nearest cities/towns.
- We link these features to sites where Tasmanian devils have been seen and to toilets! (data is available with lat, long!)
- Application uses Sesame API (Java) to display the data

Application: http://lmd.it.csiro.au:8080/holdt/gui



http://www.csiro.au/issl/holdt/vocab/authority	Tasmania
http://www.csiro.au/issl/holdt/vocab/classCode	P
http://www.csiro.au/issl/holdt/vocab/classification	Parks & Reserves
http://www.csiro.au/issl/holdt/vocab/featureCode	RESV
http://www.csiro.au/issl/holdt/vocab/recordId	TAS38312
http://www.csiro.au/issl/holdt/vocab/state	TAS
http://www.csiro.au/issl/holdt/vocab/status	O
http://www.geonames.org/ontology#name	Devils Gullet State Reserve
http://www.geonames.org/ontology#nearby	http://www.csiro.au/issl/holdt/caves/TAS02478
http://www.geonames.org/ontology#nearby	http://www.csiro.au/issl/holdt/caves/TAS02479
http://www.geonames.org/ontology#nearby	http://www.csiro.au/issl/holdt/caves/TAS02480
http://www.geonames.org/ontology#nearby	http://www.csiro.au/issl/holdt/caves/TAS02481
http://www.geonames.org/ontology#nearby	http://www.csiro.au/issl/holdt/caves/TAS02482
http://www.geonames.org/ontology#nearby	http://www.csiro.au/issl/holdt/caves/TAS02484
http://www.geonames.org/ontology#nearby	http://www.csiro.au/issl/holdt/caves/TAS07127
http://www.geonames.org/ontology#nearby	http://www.csiro.au/issl/holdt/caves/TAS07128
http://www.geonames.org/ontology#nearby	http://www.csiro.au/issl/holdt/caves/TAS07129
http://www.geonames.org/ontology#nearby	http://www.csiro.au/issl/holdt/caves/TAS09173

Other Considerations

- Size of datasets
- Access to datasets (e.g. Rest)
- Frequency of updates
- Types of relationships

Thank you

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