OpenSearch GeoSpatial-Time and Earth Observation Extensions

Heterogeneous Mission Accessibility for Science
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The technology: OpenSearch

- OpenSearch started in an effort built around Amazon's A9.com and now maintained in a community process at opensearch.org

- Search engines have a description document used by client applications and allows syndication of search results

- OASIS Search Web Services group is publishing searchRetrieve Operation with Bindings for SRU 1.2 and OpenSearch
  http://docs.oasis-open.org/search-ws/
The technology: OpenSearch

- OpenSearch is flexible, results can be returned as HTML interfaces or in ATOM, XML/RDF, KML, WKT, JSON….
- Directly integrated in Web Browsers
- Includes result’s paging
OpenSearch Description

• Provides metadata about the contents along with a set of URL Templates which illustrate the parameters accepted by the service and the variety of output formats in which results can be obtained

• The OpenSearch request interface is simple, consisting of a description of a HTTP GET request with a series of optional key-value parameters that can be used to constrain the search

• `<Url type="text/html" template="http://example.com/?q={searchTerms?}&amp;pw={startPage?}"/>

http://www.google.com/?q=question
http://www.google.com/?q={searchTerms}`
<?xml version="1.0" encoding="UTF-8"?>
<OpenSearchDescription xmlns="http://a9.com/-/spec/OpenSearch/1.1/">
  <ShortName>Web Search</ShortName>
  <Description>Use Acme.com to search the Web.</Description>
  <Tags>example web</Tags>
  <Contact>admin@acme.com</Contact>
  <Url type="application/rss+xml" template="http://acme.com/?q={searchTerms}&amp;pw={startPage?}&amp;format=rss"/>
</OpenSearchDescription>
<?xml version="1.0" encoding="UTF-8"?>
<OpenSearchDescription xmlns="http://a9.com/-/spec/OpenSearch/1.1/">
  <ShortName>Web Search</ShortName>
  <Description>Use Acme.com to search the Web.</Description>
  <Tags>example web</Tags>
  <Contact>admin@acme.com</Contact>
  <Url type="application/atom+xml" template="http://acme.com/?q={searchTerms}&amp;pw={startPage?}&amp;format=atom"/>
  <Url type="application/rss+xml" template="http://acme.com/?q={searchTerms}&amp;pw={startPage?}&amp;format=rss"/>
  <Url type="text/html" template="http://acme.com/?q={searchTerms}&amp;pw={startPage?}"/>
  <LongName>Example.com Web Search</LongName>
  <Image height="64" width="64" type="image/png">http://acme.com/websearch.png</Image>
  <Image height="16" width="16" type="image/vnd.microsoft.icon">http://acme.com/websearch.ico</Image>
  <Query role="example" searchTerms="cat"/>
  <Developer>Acme.com Development Team</Developer>
  <Attribution>Search data Copyright 2005, Acme.com, Inc., All Rights Reserved</Attribution>
  <SyndicationRight>open</SyndicationRight>
  <AdultContent>false</AdultContent>
  <Language>en-us</Language>
  <OutputEncoding>UTF-8</OutputEncoding>
  <InputEncoding>UTF-8</InputEncoding>
</OpenSearchDescription>
GeoSpatial Extension

• Specify a series of parameters that can be used to spatially constrain search results

• Provision is made to filter results by:
  • A bounding box
  • A geometry using Well Known Text
  • Within a certain radius from a given latitude-longitude point
  • Having a certain containment relation (within, overlaps, disjoint) with a geographic constraint
  • Matching a geographic name

• All geographic information in EPSG 4326 (WGS84)
GeoSpatial Extension Elements

- **geo:box** -> Geographic bounding box. The box is defined by "west, south, east, north" coordinates of longitude, latitude, in EPSG:4326 decimal degrees.

- **geo:geometry** -> Geographic area (geometry). The polygon is defined using the Well Known Text standard for geographic shapes, using EPSG:4326.

- **geo:lat, geo:lon, geo:radius** -> The latitude, longitude of a given point with a given radius.

- **geo:relation** -> Spatial relation to result set, Character String; One of "overlaps", "contains", "disjoint" (default is "overlaps").

- **geo:name** -> A string describing the location to perform the search.

The current namespace of the OpenSearch Geo Extension is:
http://a9.com/-/opensearch/extensions/geo/1.0/
Time Extension Elements

- Defines the temporal range request

- **time:start**
  Start of the temporal interval to search (RFC-3339)

- **time:end**
  End of the temporal interval to search (RFC-3339)

- RFC-3339 Example: 2008-01-01T23:43:23.00Z

- Namespace of the OpenSearch Time Extension is:
  http://a9.com/-/opensearch/extensions/time/1.0/
A search service with

```xml
<Url type="text/html" template="http://example.com/xml/?q={searchTerms?}&amp;start_date={time:start?}&amp;stop_date={time:end?}&amp;bbox={geo:box}"
```

The geospatial extension allow to formulate geospatial requests e.g. point-plus-radius, a bounding box, or a polygon

```xml
bbox={geo:box?}
```

Together with the Time extension, OpenSearch can specify time start, finish, and slices for searching data.

```xml
start={time:start?}&stop={time:end?}
```

http://example.com/xml/?bbox=6.73,36.73,18.45,47.07&start=2011-01-10&end=2011-01-12T23:59:5
ATOM Response Mappings

- Usage of ATOM elements
- GEORSS for spatial attributes
- dc:date for time ranges
- Resource linkage with the atom:link element
  - atom:link[@rel='alternate'] for metadata
  - atom:link[@rel='enclosure'] for data access services
  - atom:link[@rel='related'] to link related resources
Earth Observation Extension

- Earth observation (EO) products have specific characteristics like the orbit number, processing center and acquisition station that follow a specific logic inherent to the EO community of users of satellite datasets.

- EO product contains information regarding the:
  - Platform or satellite from where it originates (e.g. SPOT, ENVISAT)
  - The Satellite number (if exists)
  - The sensor used to acquire the data
  - The specific dataset identifier
  - The center, date and software used for the processing
Earth Observation Extension

• Focus on collection and product metadata
  • platform
    
    http://example.com/?q={searchTerms}&pw={startPage?} &platform={eop:platform?}
  • sensorType
    
    http://example.com/?q={searchTerms}&pw={startPage?} &sensor={eop:sensorType?}

  ...

  • orbitNumber, acquisitionStation, processingCentre, processingSoftware, processingDate

• Focus on dataset cross-relations
  • interferometry and correlation searches
EO Cross-Relation Searches
OGC CSW 3.0

• Must support OGC 10-032 regardless of profile (or even without)

• Provides an OpenSearch description document link in the Capabilities document (mapping the CSW query parameters that the implementation supports to the OpenSearch parameters defined in OGC 10-032)

• Implements the ATOM-Response conformance class

• The canonical response to an OpenSearch query is an ATOM document as described in OGC 10-032
Integration using ATOM
ATOM Feed and atom:link

Direct Link to the data URL using the relation "enclosure"
Current Adoption

- SEADATANET, EMSO
- ESA GRID - G-POD Catalogue
- NASA Earth Observing System Clearinghouse (ECHO)
- ESIP Federation (NASA, NOAA and USGS)
- GEO Geohazards Supersite
- GEO Web Portal with Search context passing
- Software: Geocommons, GeoNetwork, OpenLayers
- ngEO – GMES next generation of user services for EO
HMA-S Tasks

• WP4100 - Geo-Time Extensions Specifications
  • Finalize the adoption of OGC 10-032
  • Define and propose Earth Observation Extension to the OGC
    • Collection and Dataset level
    • Dataset Correlated search (including interferometry master/slave)

• WP4200 - Geo-Time Extensions Tests
  • ATS and ETS for OGC TEAM engine
  • Normative RELAX-NG schemas and Schematrom rules for OpenSearch Description and response payload
    • Informative XSD files
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