ESIP Federated Search

ESIP Federated Search Cluster

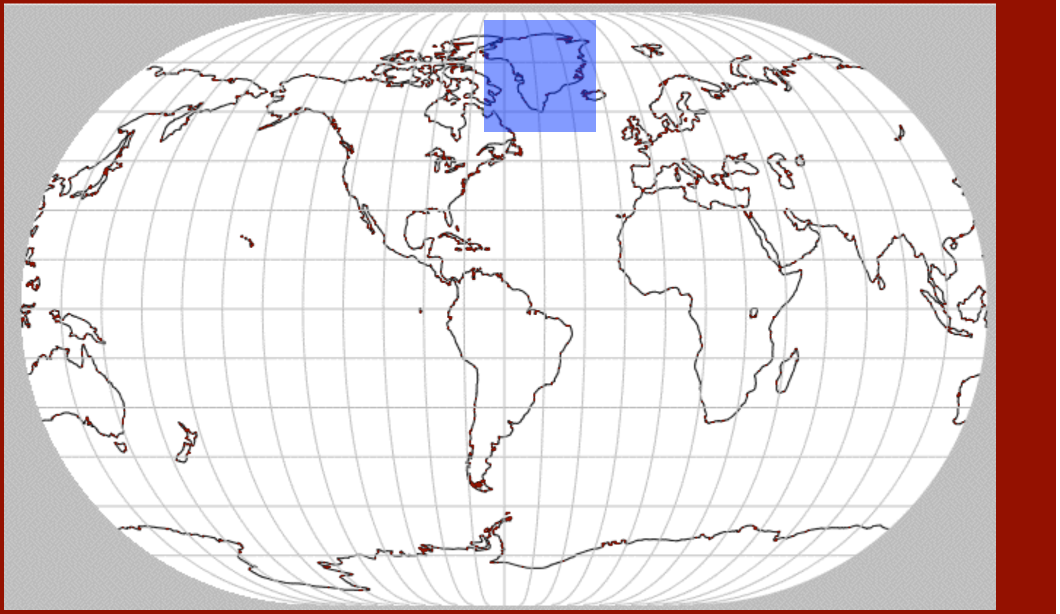
Outline

- Finding Earth science data: why so difficult???
- Space-Time Query with OpenSearch
- Client and server developments

Finding Earth science data: why so difficult???

Many phenomena require space-time searches for distributed data

- E.g., Effect of Arctic Oscillation on precipitation in Greenland
  - GC-Net station data
  - AO indices
  - AIRS atmospheric profiles
  - ECMWF model output
  - NCEP model output, etc.
- Potential data providers:
  - Large data centers
  - Universities
  - Data collection sites
  - Value-added providers
  - Individual investigators



Obtaining satellite data today is tedious, hit-or-miss

Step 1: Search through multiple directories for the right datasets

- "Did I find them all?"

Steps 2-N:

```
Foreach data_provider
    Learn_search_interface()
    Search_for_data_files()
    Fetch_data_files()
    Load_data_into_analysis_tool()
End foreach
```

Ideally, you would want your analysis tool to find and fetch data based on the current work context

Space-Time Data Query with OpenSearch

OpenSearch is a simple, extensible, embeddable, machine-callable convention

- www.opensearch.org
  - "a collection of simple formats for the sharing of search results"
- OpenSearch Description Document (XML)
  - Describes a search engine so that it can be used by search clients (incl. Firefox and IE)
  - Specifies syntax for URL-based queries
  - Extensions proposed for Geospatial and Time queries

OpenSearch templates provide the keys to querying heterogeneous search engines

- OpenSearch Description Document includes URL template:

```
<os:Url type="application/atom+xml"      template="http://
   mirador.gsfc.nasa.gov/cgi-bin/mirador/
   granlist.pl?dataSet=AIRS2RET.005&amp;page=1&amp;
   maxgranules={count}&amp;
   pointLocation={geo:box}&amp;
   endTime={time:end}&amp;startTime={time:start}&amp;
   format=atom">
```

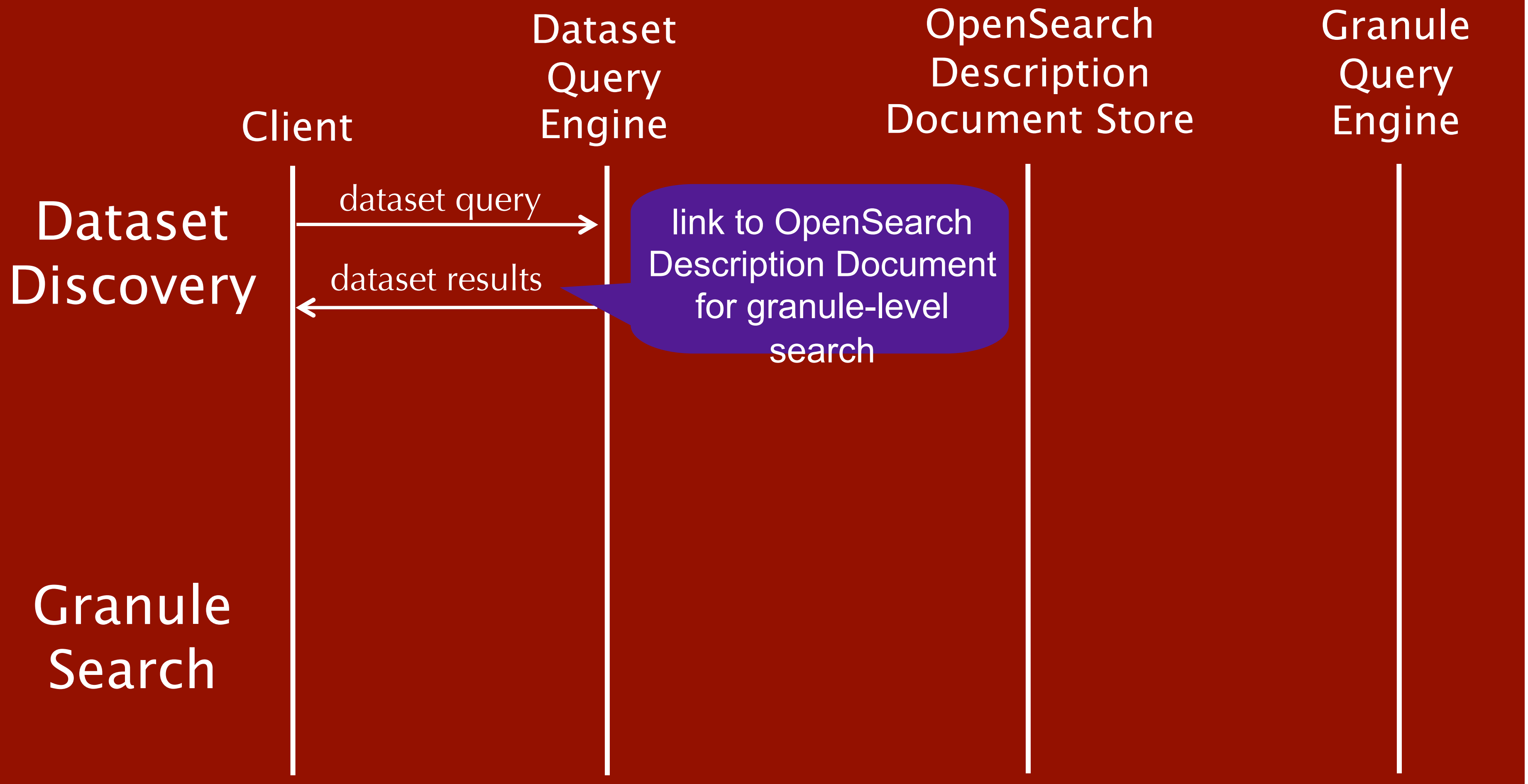
- Just replace placeholders with search criteria and fetch the URL

Data query with space and time works better as a 2-step process

- Search for datasets then granules (files) within <u>selected</u> datasets
- Most dataset-level queries have
  - small results set (dozens)
  - low precision: precision = desiderata / total
- Space-time granule queries <u>for a given dataset</u> have
  - large results set (tens of thousands)
  - high precision
- Combining both in one step would produce
  - enormous results set (dozens * tens of thousands)
  - with low precision

OpenSearch Description Documents provide a path to a recursive two-step search

Recursive OpenSearch begins with a dataset discovery phase



Client

Dataset Query Engine

OpenSearch Description Document Store

Granule Query Engine

Dataset Discovery

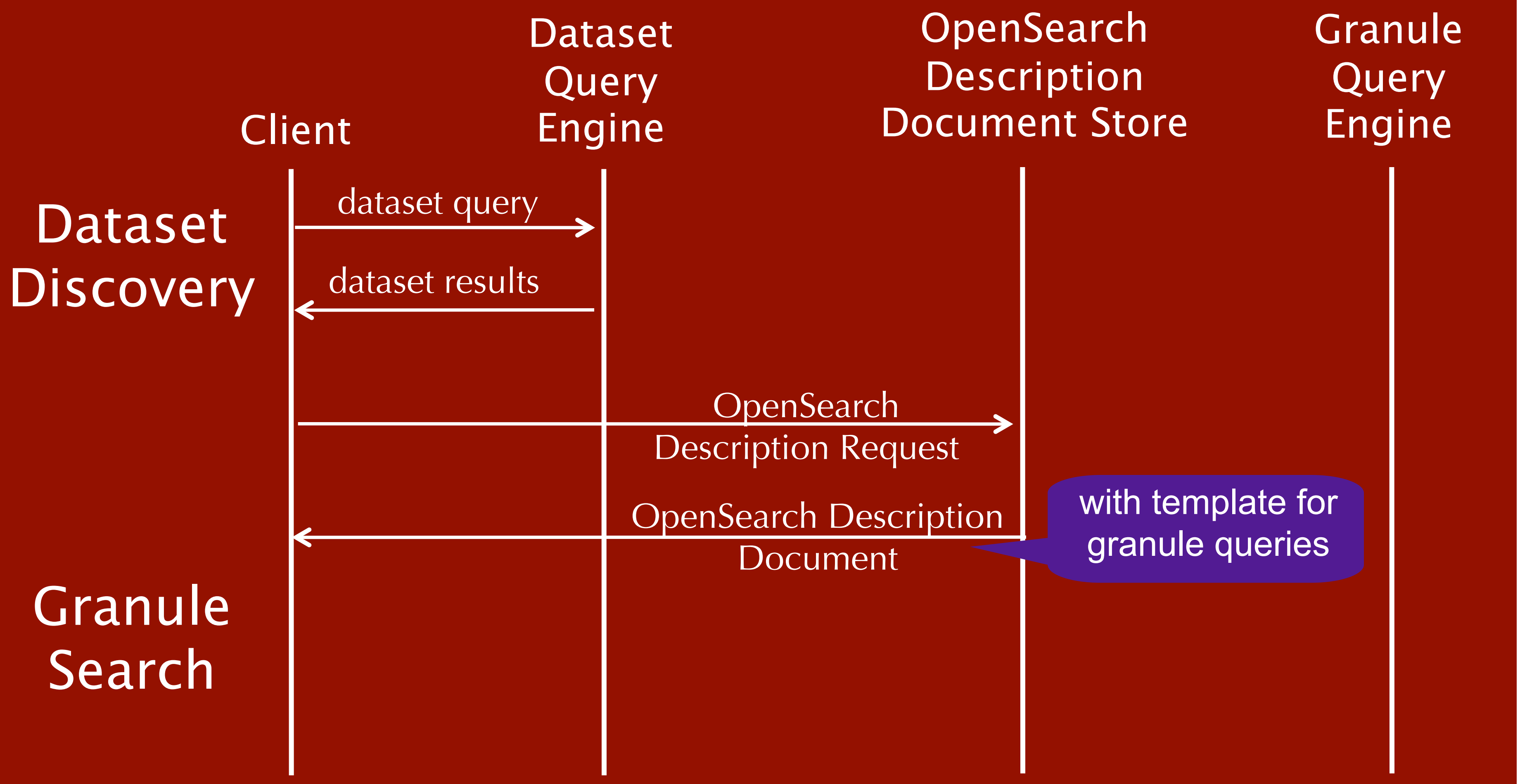
dataset query

dataset results

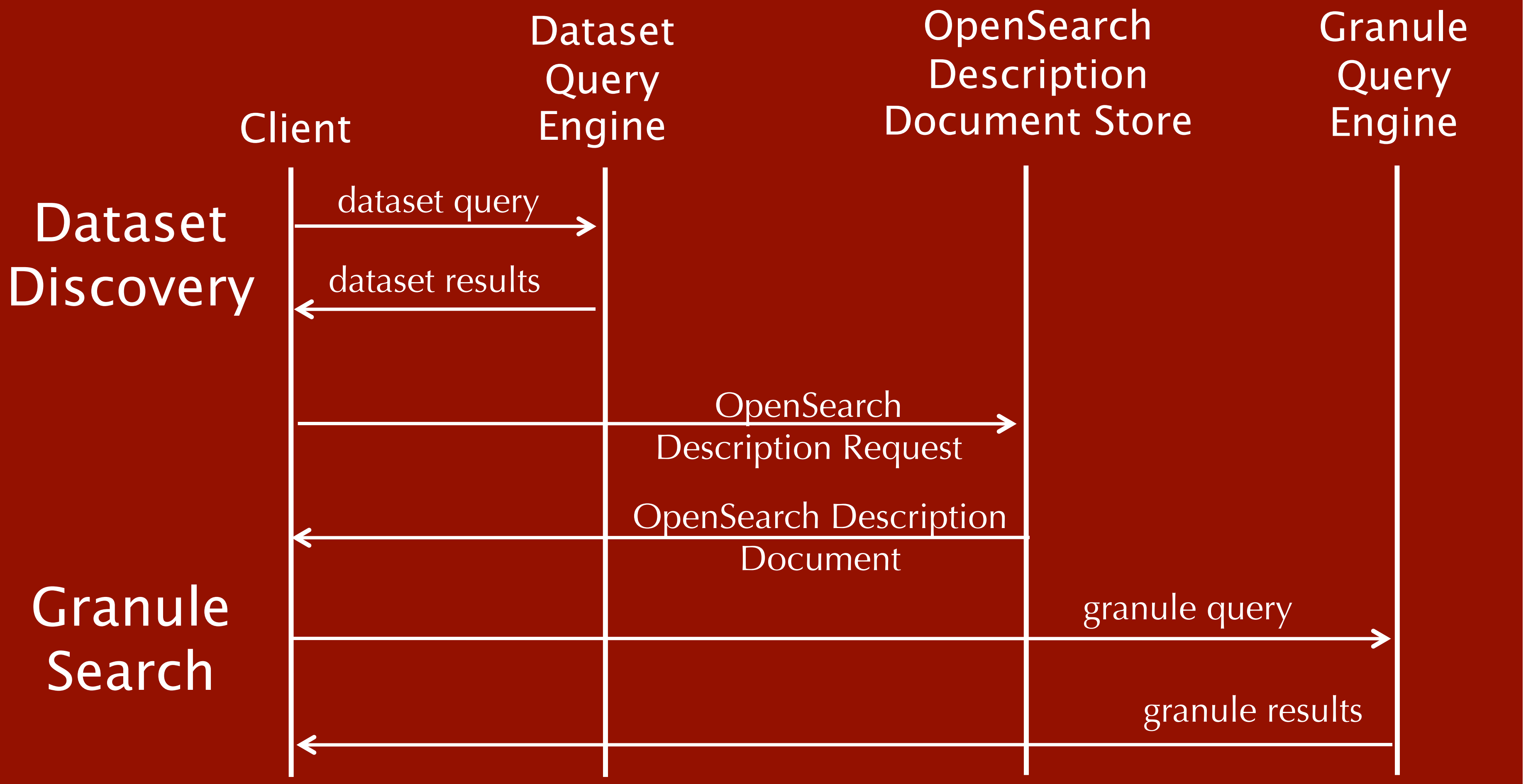
link to OpenSearch Description Document for granule-level search

Granule Search

Dataset results link to OpenSearch Description documents


Client
Dataset Query Engine
OpenSearch Description Document Store
Granule Query Engine
Dataset Discovery
dataset query
dataset results
OpenSearch Description Request
OpenSearch Description Document
with template for granule queries
Granule Search

Templates from OpenSearch Description Documents enable granule query construction



Client

Dataset Query Engine

OpenSearch Description Document Store

Granule Query Engine

Dataset Discovery

dataset query

dataset results

OpenSearch Description Request

OpenSearch Description Document

Granule Search

granule query

granule results

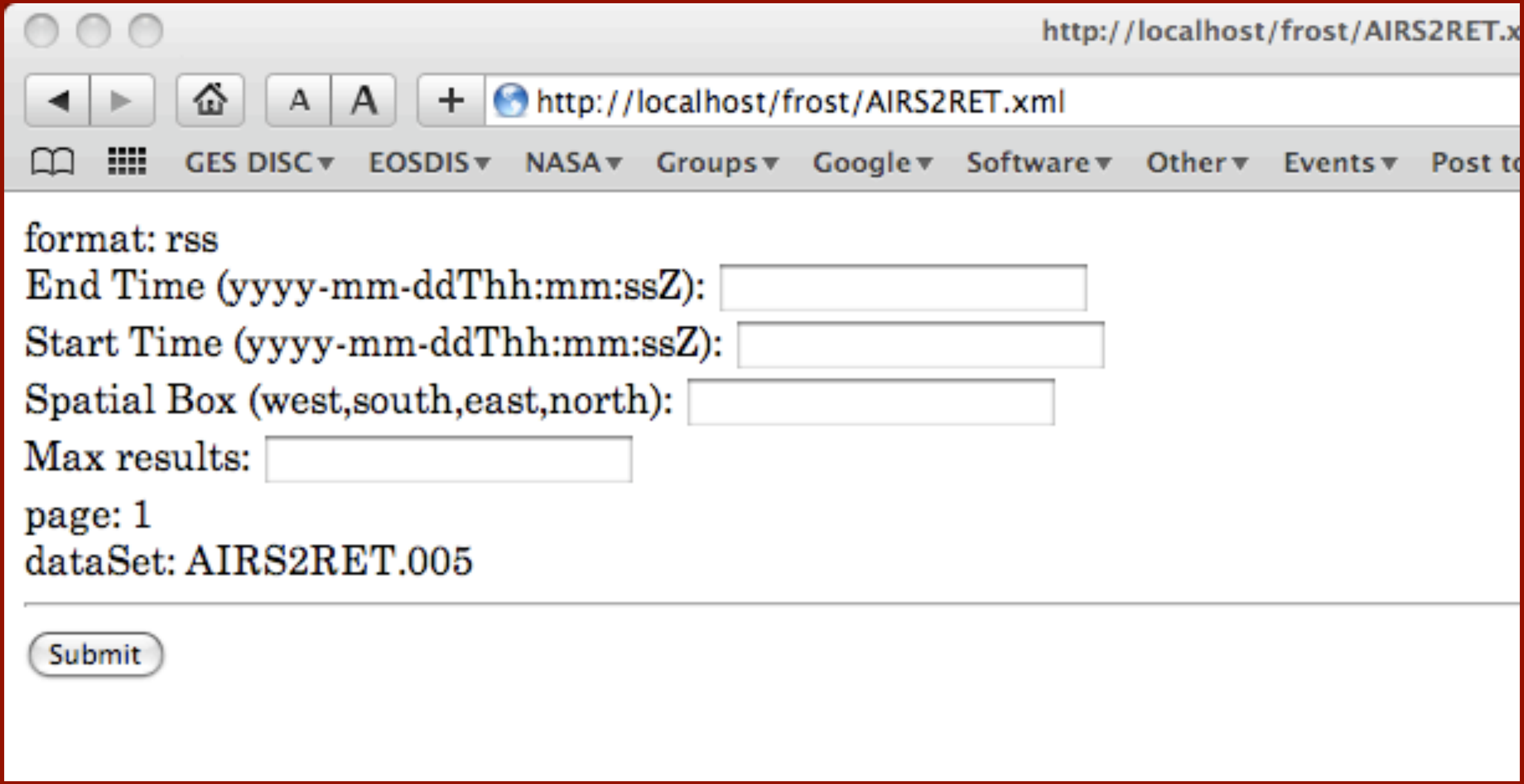
Client and Server Developments

Federated OpenSearch aspects make adoption easier

- Simple / lightweight
- Standards-based, but extensible
- Embeddable
  - In web pages, documents, workflows, analysis tools…

A client can be as simple as an XSLT

- Attach a stylesheet to the OpenSearch Description Document
  - Renders the document in the browser as a search form



format: rss
End Time (yyyy-mm-ddThh:mm:ssZ):
Start Time (yyyy-mm-ddThh:mm:ssZ):
Spatial Box (west,south,east,north):
Max results:
page: 1
dataSet: AIRS2RET.005

Several groups are developing servers and clients

Servers

- ACCESS-NEWS
- EOS Clearinghouse (ECHO)
- Global Hydrology Resource Center
- Goddard Earth Sciences Data and Information Services Center (GES DISC)
- MODIS Adaptive Processing System
- National Snow and Ice Data Center

Clients

- Mirador (GES DISC)
- Talkoot (University of Alabama--Huntsville)
- Reference implementation / test script (GES DISC)
- ECHO

Future Plans

- Develop / recruit clients
- Support access to Web Services
  - Format conversion, subsetting, OPeNDAP, OGC
  - Servicecasting
    - Atom-based approach to advertising services for ESIP data
- Shrink-wrapped toolset for deploying Recursive OpenSearch servers?

Conclusion

Federated space-time query can be

- lightweight
- inexpensive
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