GALEON
(Geo-interface to Atmosphere, Land, Earth, Ocean netCDF)

Interoperability Experiment Report

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Overview

IUB's commited goal in the GALEON Interoperability Experiment (IE) was to set up a WCS 1.0.0 server on data provided as netCDF files, however stored in a relational database.

WCS Server

The architecture chosen consists of the rasdaman[1] middleware which maps multi-dimensional raster data of unlimited size to standard relational tuples, offering query language access through a raster-extended variant of standard SQL.

The service itself is implemented using JSP; the servlet's core task, then, is to map a WCS request to a rasdaman query, and to forward the result to the client. The WCS implements both HTTP and SOAP bindings.

On the input side, an import facility has been developed to import netCDF data into a database object; notably piecemeal object construction is possible, i.e., many netCDF files can contribute to a single large database object.

The project status at the time of this reporting is a demonstrator based on a small dataset, not yet suitable for production use. IUB intends to further develop, stabilize, and complete WCS, also shifting to WCS 1.1 as soon as stable and released.

WCS Client

A simple command line client has been implemented for testing purposes. Normally, however, one would resort to one of the GALEON partners' Web-based, interactive client.

Sample WCS Requests

* The core URL of the service, leading to an overview page, is:

  http://mango.eecs.iu-bremen.de:8000/~galeon

* GetCapabilities request:

  ```
  <?xml version="1.0" encoding="UTF-8" ?>
  ```

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[1] www.rasdaman.com

```xml
<GetCapabilities xmlns="http://www.opengeospatial.net/wcs"
   xmlns:ows="http://www.opengeospatial.net/ows"
   xmlns:gml="http://www.opengis.net/gml" service="WCS" version="1.0.0"
   />
```

- GetCoverage request on 2-D data:

```xml
<?xml version="1.0" encoding="UTF-8" ?>
- <GetCoverage xmlns="http://www.opengeospatial.net/wcs"
   xmlns:ows="http://www.opengeospatial.net/ows"
   xmlns:gml="http://www.opengis.net/gml"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="http://www.opengeospatial.net/wcs
   getCoverage.xsd" service="WCS" version="1.0.0">
   <sourceCoverage>tosFile2VARtos</sourceCoverage>
- <domainSubset>
  - <spatialSubset>
    - <Envelope>
        <pos>1 -78</pos>
        <pos>359 89</pos>
      </Envelope>
    - <Grid dimension="2">
      - <limits>
        - <GridEnvelope>
            <low>0 0</low>
            <high>320 120</high>
          </GridEnvelope>
        </limits>
        <axisName>X</axisName>
        <axisName>Y</axisName>
      </Grid>
    </spatialSubset>
  - <temporalSubset>
    - <timePeriod>
        <beginPosition>20</beginPosition>
        <endPosition>20</endPosition>
      </timePeriod>
    </temporalSubset>
  </domainSubset>
- <output>
    <format>jpeg</format>
  </output>
</GetCoverage>
```

Conclusion

In summary, IUB's rasdaman WCS is a WCS 1.0 implementation which is able to leverage netCDF and other input data using standard relational database technology.

Unfortunately the service has been completed only towards the end of the project, hence tests with other clients could not be performed to the extent desired.

Problems encountered mainly were due to shortcomings in the WCS 1.0 specification, which made it hard to come up with a compatible and semantically adequate implementation. This in particular as IUB's participants are "pure Computer Science" and, hence, not always know the underlying silent assumptions made by geo service developers. It looks like WCS 1.1 will improve greatly in making such assumptions explicit.

To further this, a list of issues and change requests has been prepared and made available to the OGC's WCS Revision Working Group. Main item, which is to become a separate section (10.4) in WCS 1.1, is an (informal, though) semantics specification for the coverage response contents – as of WCS 1.0. only the metadata are described, but not the pixel/voxel/cell contents.

IUB's Participation in GALEON is part of the strive for demonstrating rasdaman's enabling features for integrated earth system data management, involving 1-D measurement data, 2-D EO data, 3-D x/y/t EO time series and x/y/z geophysics data, and 4-D x/y/z/t climate models. To this end, the GALEON service will be enhanced and extended.

Acknowledgement