THREDDS Data Server: OPeNDAP and Other Tales from the Server-Side

Sean Arms
UCAR/UCP/Unidata
2016-12-08 ESGF F2F
What is THREDDS?

THREDDS is a project

Thematic Real-time Environmental Data Distributed Services

NSF #0121623 Division Of Undergraduate Education (DUE) and GEO
September 15, 2001
What is THREDDS?

• Historically consisted of a server (TDS) and client (netCDF-Java)
  • New additions
    • Rosetta (Server Based Data Translation, Java)
    • Siphon (Client, Python)

• THREDDS 5.0
  • Next release of netCDF-Java and TDS
THREDDS Developers at Unidata

- Sean Arms
  *Boundary Layer Meteorology*
- Christian Ward-Garrison
  *Comp Sci, Hydrology*
- Dennis Heimbigner
  *Comp Sci*
- Ryan May
  *Radar Meteorology*
- Ethan Davis
  *Physics*
External THREDDS Developers/Contributors

- John Caron: Chemistry, CS
- Tom Kunicki, Bob Simons, Rich Signell, Marcos Hermida, msdsoftware, barronh, danfruehauf, and 16+* others
- Maybe you?

* Only counts registered users on github, many other not registered or recognized by SVN -> Git commit messages
TDS

- Long-standing demonstration server at Unidata
  [http://thredds.ucar.edu/thredds/catalog.html](http://thredds.ucar.edu/thredds/catalog.html)
- Source code on GitHub:
  [https://github.com/unidata/thredds/](https://github.com/unidata/thredds/)
- Dockerized (container on dockerhub)
  [https://hub.docker.com/r/unidata/thredds-docker/](https://hub.docker.com/r/unidata/thredds-docker/)
  [https://github.com/Unidata/thredds-docker](https://github.com/Unidata/thredds-docker)
The configuration catalogs and internal state of the TDS extensively reworked to scale to large numbers of catalogs, datasets, and internal objects
TDS v5.0 Services

- No major changes outside of bug fixes and porting to Coverage (replaces GeoGrid)
  - HTTPServer
  - OPeNDAP (DAP2)
  - WCS
  - nclso*
TDS v5.0 Services

- **DAP4**
  - New protocol jointly developed by Unidata and [OPeNDAP.org](http://OPeNDAP.org)
  - Significantly enhanced data model
  - Array concept from DAP2 has been replaced with a "Map" concept (variable <-> coordinate variables)
  - The on-the-wire protocol has better error handling capabilities.
TDS v5.0 Services

- **DAP4**
  - Separate DDS and DAS combined into single XML document
  - Client can negotiate with a server to utilize alternate (to XML) meta-data encodings: JSON, Protobuf, etc.
TDS v5.0 Services

- NetcdfSubsetService
  - Request spatial, temporal, variable subset of CDM file (geophysical space)
    - Grid, Point, **GridAsPoint**
    - netCDF3, netCDF4, CSV, **GeoCSV**, XML, WaterML - maybe **CovJSON**?
  - End-points changed a bit in 5.0 - minor
TDS v5.0 Services

- ncWMS
  - New version based on edal-java
  - Supports UGRID
  - Can return CovJSON
  - Minimal TDS code (no longer maintain our own fork)
  - Includes new Godiva3 client
TDS v5.0 Services

- CMDRemote, CDMRemoteFeature
  - Google Protobuff
  - Can result in faster access than DAP2
  - CDMRemote "Drop-in" replacement for DAP2
    - Siphon (has a pure Python client)
  - CDMRemoteFeature
    - Serialized Java Objects
    - Python client in the works
- Access to CoordSys information
## TDS v5.0 - Service Status

<table>
<thead>
<tr>
<th>Service</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTTPService</td>
<td>Complete</td>
</tr>
<tr>
<td>OPeNDAP (DAP 2)</td>
<td>Complete</td>
</tr>
<tr>
<td>CDMRemote</td>
<td>Complete - with python client</td>
</tr>
<tr>
<td>CDMRemoteFeature</td>
<td>Complete - python client in the works</td>
</tr>
<tr>
<td>ncWMS (and Godiva3)</td>
<td>New version, supports UGRID</td>
</tr>
<tr>
<td>nclso (iso, ncml, UDCC ACDD)</td>
<td>Same as ncISO in 4.x, update</td>
</tr>
<tr>
<td>DAP 4</td>
<td>Java &lt;-&gt; C iteration</td>
</tr>
<tr>
<td>NetcdfSubsetService</td>
<td>GridAsPoint</td>
</tr>
<tr>
<td>WCS</td>
<td>Same as WCS in 4.x</td>
</tr>
<tr>
<td>ncSOS</td>
<td>New addition to bundled services</td>
</tr>
</tbody>
</table>
TDS v5.0 Super-duper Experimental

- **TDS Jupyter Notebook Kernel**
  - Adds Jupyter as a new service for TDS alongside existing services
  - Demonstrated using IPython kernel and Python implementation
    - could work with any Jupyter-compatible execution kernel (R, C/C++, NodeJS, Matlab, IDL, ...)
  - Achieves server-side processing with no writing of Java code
THREDDS 5.0 - Timeline

Server available for testing: thredds-test.unidata.ucar.edu

Alpha netCDF-Java/Beta TDS available: Jan 2017

Target release: Mid-to-late Spring 2017
THREDDS - Final Thoughts

- It’s been a crazy year
- Supporting 4.x while pushing forward 5.x
  - Please ping us with request if you encounter silence - GitHub is best!
- Unidata 100% committed to THREDDS
Unidata is one of the University Corporation for Atmospheric Research (UCAR)'s Community Programs (UCP), and is funded primarily by the National Science Foundation (Grant NSF-1344155).