

Unidata/THREDDDS Data Server Project Update

U.S. IOOS 2025 DMAC Annual Meeting
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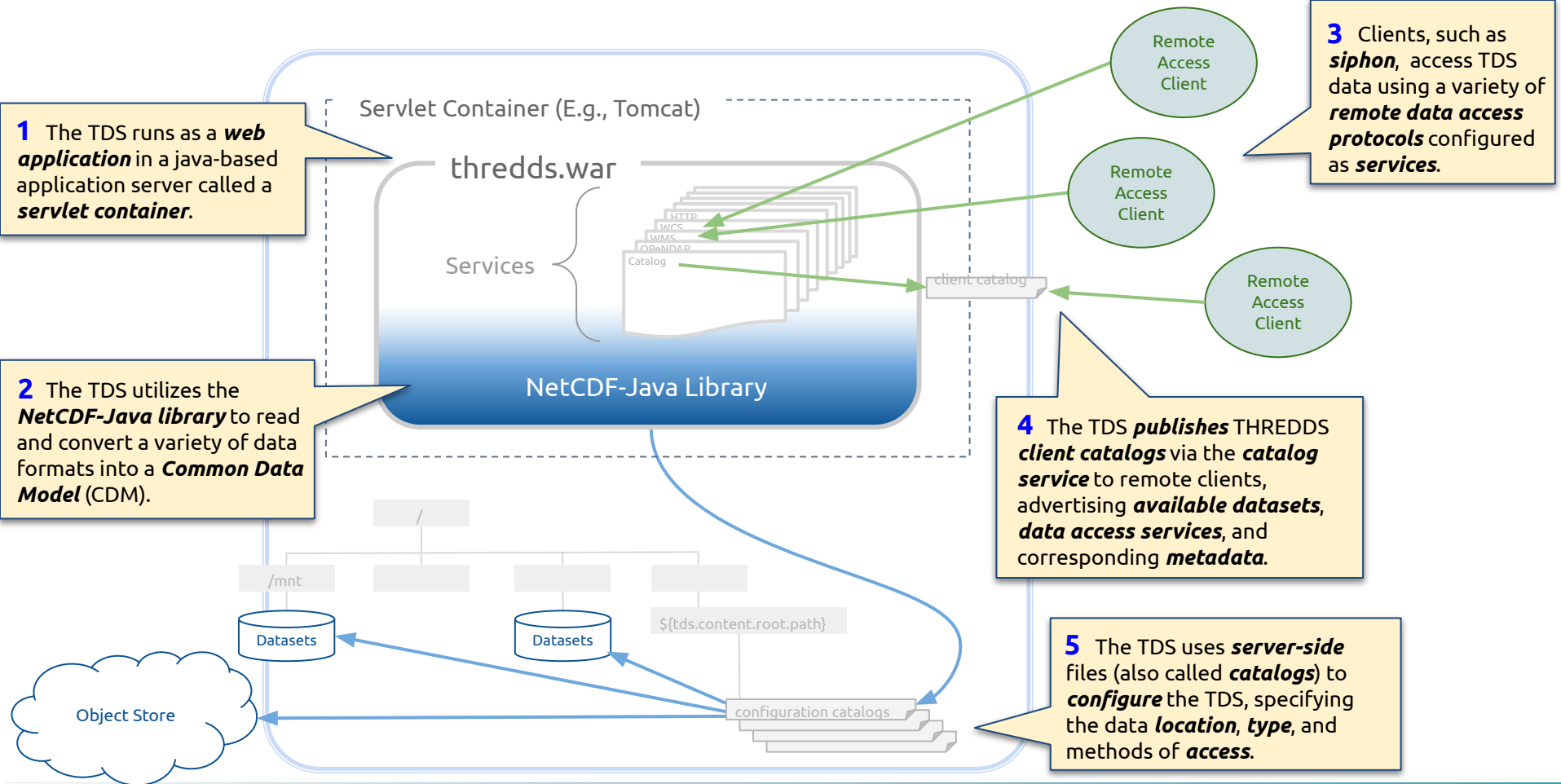
THREDDS

THREDDS is a project:

Thematic **R**real-time **E**Environmental **D**Distributed **D**Data
Services

[NSF-0121623](#) Division Of Undergraduate Education (DUE)
and GEO (September 15, 2001)

Client (netCDF-Java)/Server (THREDDS Data Server)



NetCDF-Java Object Storage Status

- NetCDF-java can read/aggregate traditional data formats stored in object storage
 - Improving read strategies to reduce cloud costs
- Tested Object Stores:
 - AWS S3, Google Cloud Storage, Microsoft Azure Blob Storage, Open Science Data Cloud (Ceph), ActiveScale (NCAR on-prem), MinIO, Spectra Vail

cdms3:bucket-name?super/long/key.nc4

cdms3://profile_name@aws/bucket-name?super/long/key.nc4

NetCDF-Java Object Storage Status

Support for Zarr, NCZarr

- limited to Zarr v2
- compressors and filters somewhat limited
- work in progress

[Zarr documentation](#)

[cdms3 URI documentation](#)

TDS Object Storage Status

- All TDS *services* (OPenDAP, cdmremote, WMS, etc.) work with object storage based datasets

- Single granule:

```
<datasetRoot path="s3-root" location="cdms3:thredds-bucket"/>  
<dataset name="S3 Dataset" ID="S3Dataset"  
  urlPath="s3-root/key/data.nc"/>
```

- datasetScan

```
<datasetScan name="Test object storage dataset scan"  
  ID="testDatasetScan"  
  path="s3-dataset-scan"  
  location="cdms3:thredds-bucket?long/key/#delimiter="/>  
  <serviceName>myServices</serviceName>  
</datasetScan>
```

TDS Object Storage Status

- Aggregation: works with or without the scan element

```
<aggregation dimName="time" type="joinExisting">
  <scan location="cdms3:thredds-bucket?long/key/#delimiter=/"
    dateFormatMark="yyyyMMDD_HHHH"
    numericTimeSettings="int seconds since 2025-03-28T11:30:00Z"
    regExp=".*nc" />
</aggregation>
```
- Not yet supported:
 - featureCollection

TDS Object Storage

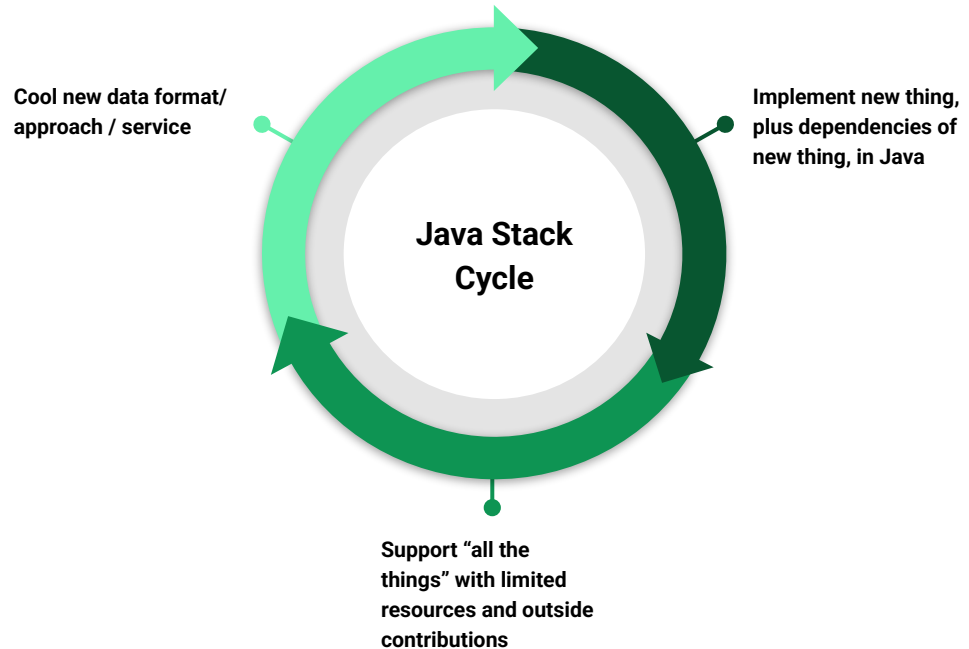
Still much work to be done to take full advantage of object storage and cloud functionality



This material is based upon work supported by NSF Unidata under award #2403649 from the U. S. National Science Foundation. Any opinions, findings and conclusions or recommendations expressed in this material do not necessarily reflect the views of the NSF.

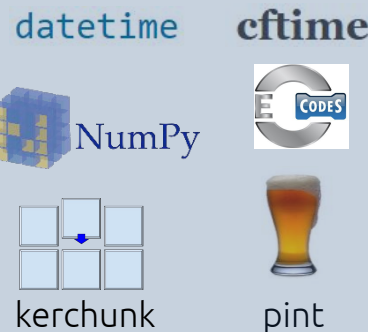
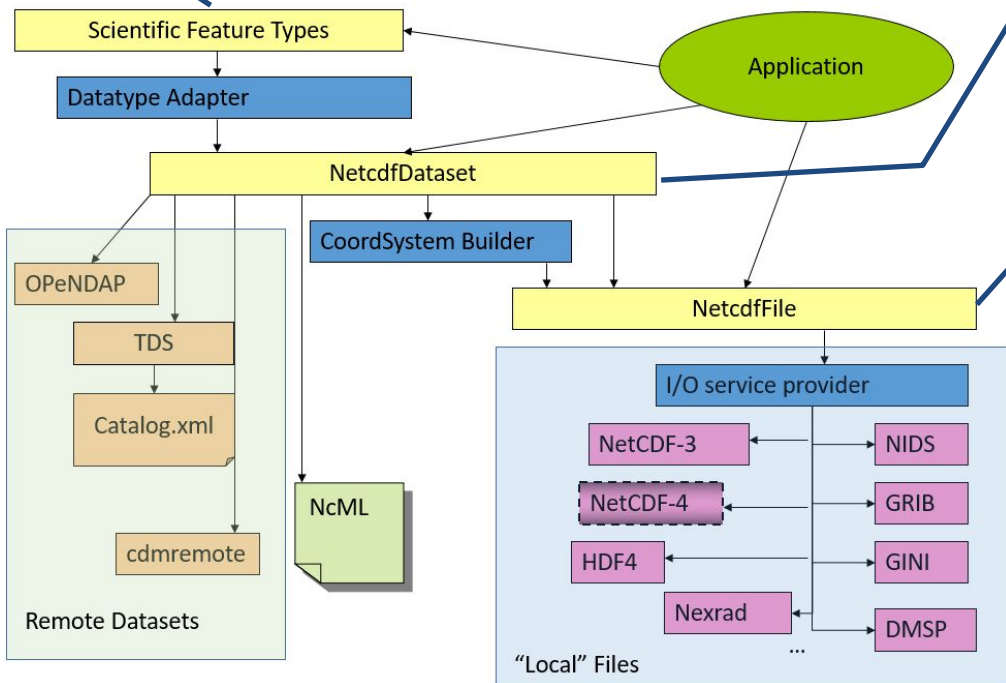
Future Direction

- Historical project approach not sustainable
- Need to embrace innovation and open source excitement present in non-Java ecosystems
- Maintain as much backwards compatibility as possible





netCDF-Java

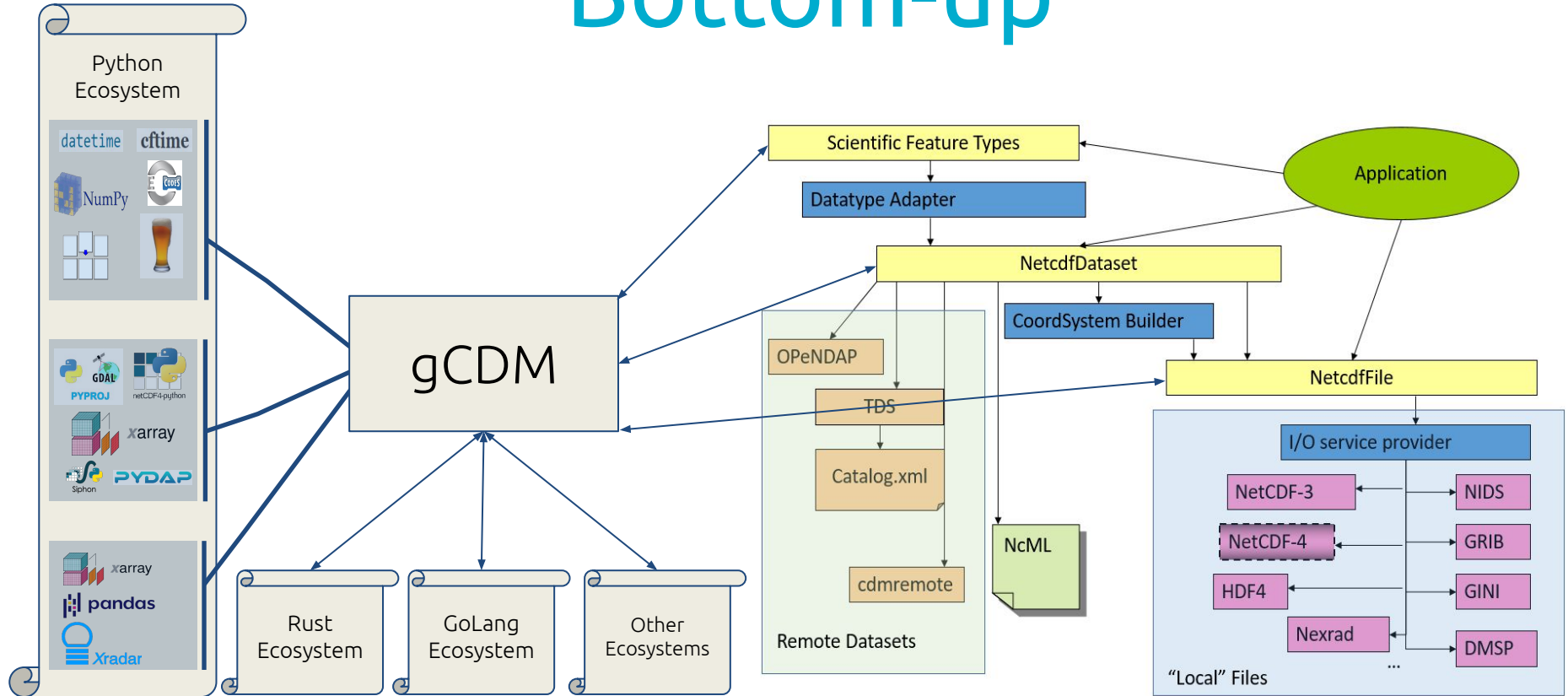


Cross-language TDS

Two phases: bottom-up and horizontal-out

- Bottom-up: replace / enhance netCDF-Java layer with cross language capabilities:
 - Cross-language communication that works on the CDM level (dimension/group/variable/attribute/etc)
 - gCDM - "gRPC CDM", where gRPC is a recursive acronym that stands for "gRPC Remote Procedure Calls.
 - Beyond proof of concept stage, will begin utilizing at Unidata in the next few months

Bottom-up



Cross-language TDS

Two phases: bottom-up and horizontal

- Bottom-up: replace / enhance netCDF-Java layer with cross language capabilities:
 - gCDM stands for "gRPC CDM", where gRPC is a recursive acronym that stands for "gRPC Remote Procedure Calls."
 - Beyond proof of concept stage, will begin utilizing at Unidata in the next few months
- Horizontal: replace / enhance TDS services
 - Currently investigating options (Apache SDAP, EarthMover, xpublish, WIS 2.0 (wis2box), pygeoapi, pycsw)

Questions

NSF Unidata is one of the University Corporation for Atmospheric Research (UCAR)'s Community Programs (UCP), and is funded primarily by the National Science Foundation ([AGS-2403649](#)).