National Science Data Fabric: data democratization at a national level

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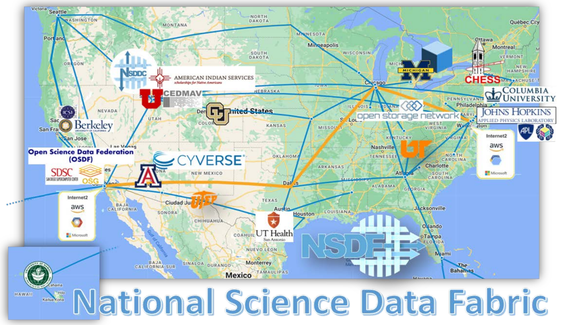
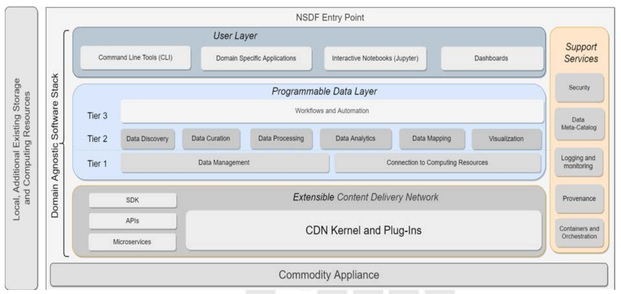
National Science Data Fabric

- *Democratized access* to scientific data
- Trans-disciplinary approach for integrated data delivery and access to shared storage, networking, computing, and educational resources
- **VISION**: globally connected science infrastructure
- **MISSION**: scalable solutions and community training to facilitate deployment on commodity hardware, cloud computing, and HPC resources
- **EXAMPLE**: fulfill the OSTP Guidance to Make Federally Funded Research Freely Available Without Delay



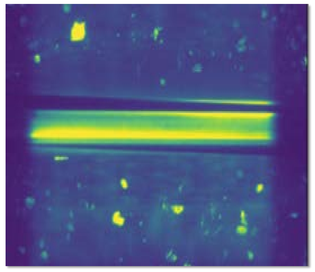
NSDF SOFTWARE STACK

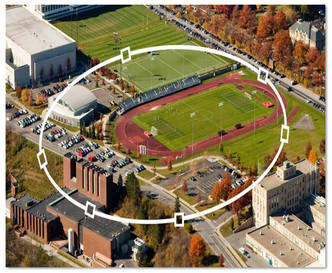
- catalog of best practices for configurations of servers, clients, middleware
- metadata transformation services
- *curation*: functionalities to describe, clean, enhance, and preserve data
- *Automation*: automate processes and speed up delivery of resources on a self-service basis.
- **Interactive** notebooks and dashboards
- data **access patterns** to optimize data sharing

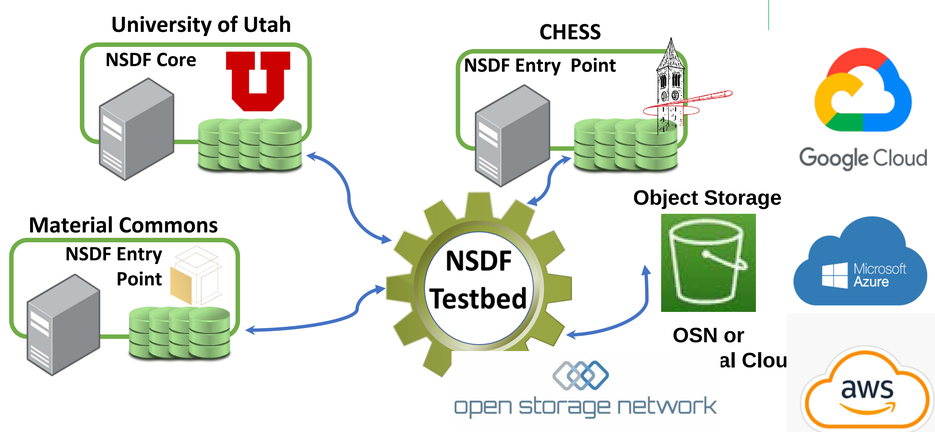


CHESS

- Cornell High Energy Synchrotron Source
- X-Ray user facility, 7 active state-of-the-art beam lines
- **~400TB** of raw data per year
- Serves 250 on-campus users and 1000 visitors yearly
- Stores ~2 petabytes of data

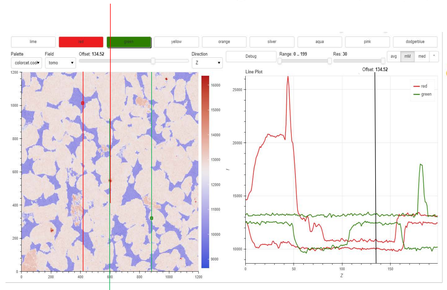


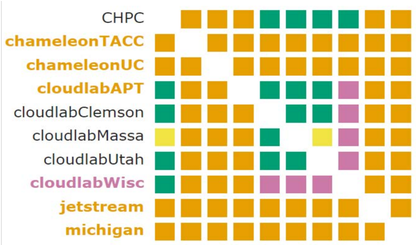




NSDF ENTRYPOINT@CHESS

- Scientific Linux 7 OS install
- **131TB** RAID6 from twelve 16TB drives
- Data accessed locally over NFS, transferred between sites using Globus
- Two INTEL XEON GOLD 6252N 2.3GHZ processors
- 512GB PC4-23400 2933MHz memory
- 25GbE network connection - 10Gb connection to CLASSE
- Accessible through firewall (https, ssh, sftp, and scp)



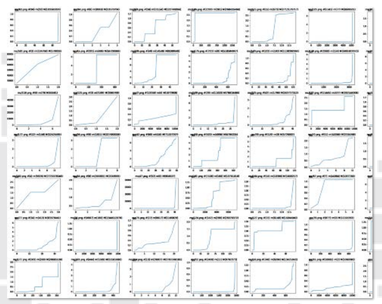


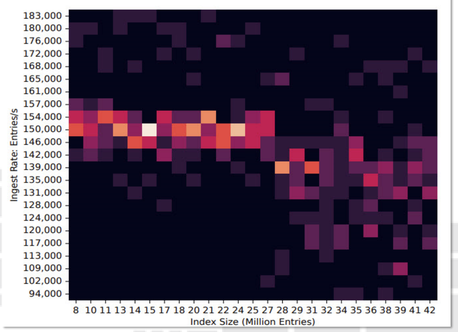
NSDF CATALOG

- multi-federation catalog **1.59 billion** records
- **68 community repositories**
- Answers at scale
- real-time search over 75 petabytes of data
- How many objects are tagged X in Repository Y
- What is the most used file format in all catalogs
- How much “scientific data” is available
- What is the file size distribution of objects in the X catalog
- Are repositories democratic and FAIR

NSDF SERVICES@CHESS

- Publish on-site storage capacity to external users
- Software libraries, tools etc. to handle large datasets from x-ray diffraction, scattering, microscopy, and tomography experiments
- *stream services* for on-the-fly access and fast feedback for experimenters during **remote data acquisition**
- as soon as a beamline produces data, remote users can access it without delay
- exploring large imaging datasets in real time without the need for bulk data transfer
- **GOAL**: streamline workflows by leveraging investments in NSF and open-science CI.





TAKE AWAY MESSAGE

NSDF helps science teams improve **data access performance** and match the resources available with the requirements of their teams and workflows.

Find out more about NSDF on nationalsciencedatafabric.org

NSDF FEDERATED DATA

- Chameleon Cloud
- CloudLab
- CHPC (Center For High Performance Computing)
- PRISM Center UMich
- Open Science Data Federation
- Open Storage Network
- Globus
- SciServer JHU
- Material Commons
- Virtual Data Collaboratory

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