# BNL Box

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# Concept

- All of us need the convenient method to transfer or access data in different systems
  - Users might need to copy their analysis scripts and the data between their workstations and central analysis farm separated by different network and firewalls
  - System administrators might need to transfer custom software packages to their systems for installations.
- In BNL RACF, AFS has been the storage of choice for moving small amount of data in/out of various systems.
- AFS limitation
  - Being phased out
  - Not really universally accessible.
  - Not easiest one to use in various platform.

- Commercial cloud storage seems to be popular among some of users and sys-admins.
  - Dropbox, Box,  Amazon Cloud Drive, Google Drive, MS OneDrive, etc…
  - Advantages of commercial cloud storage
    - Already available for use
    - Easy to use.  All of then provide https-based access.
    - Free (up to some level)
    - Available in various platforms.
  - Limitations
    - Size/Cost/Performance.
    - Archive
    - Not really meant to stream data

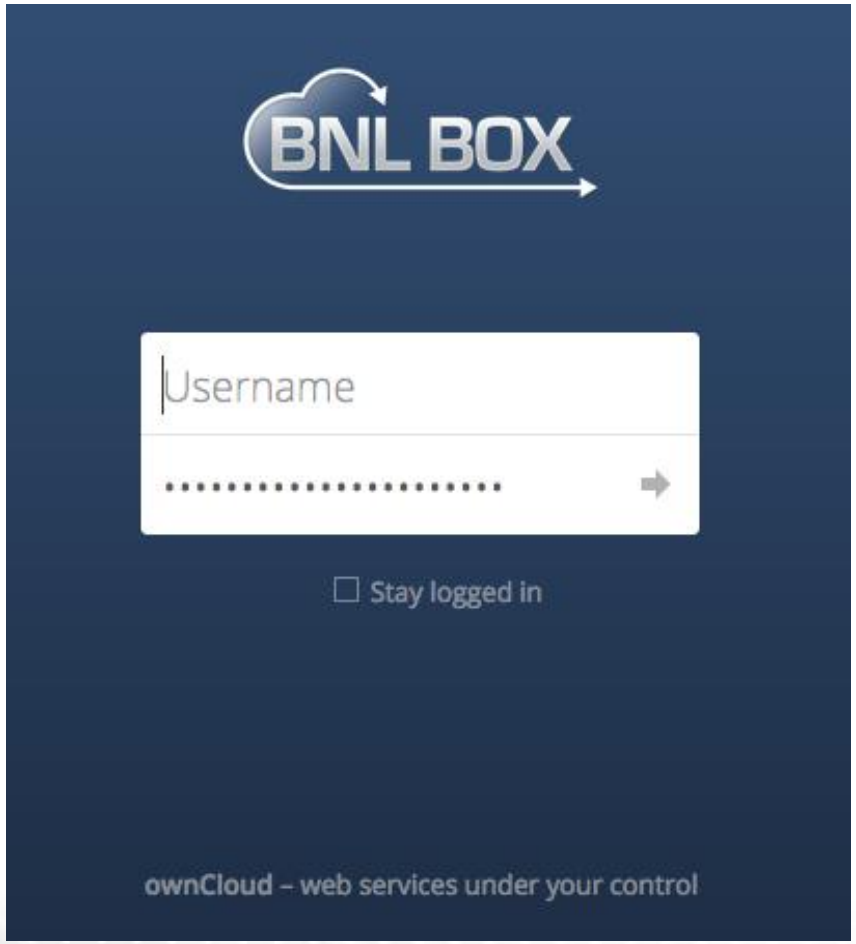
# Target users

- All users of BNL
  - HEP/Nuclear physics comminities
  - Sys-admins
  - Users from different science domains than HEP
    - NSLS-II (National user facility)
      - Massive data producers for many beamlines by many users.
    - Nano Center (National user facility)
      - Another large data producers.
    - Chemistry
    - Biology
    - Etc…

# Target usage

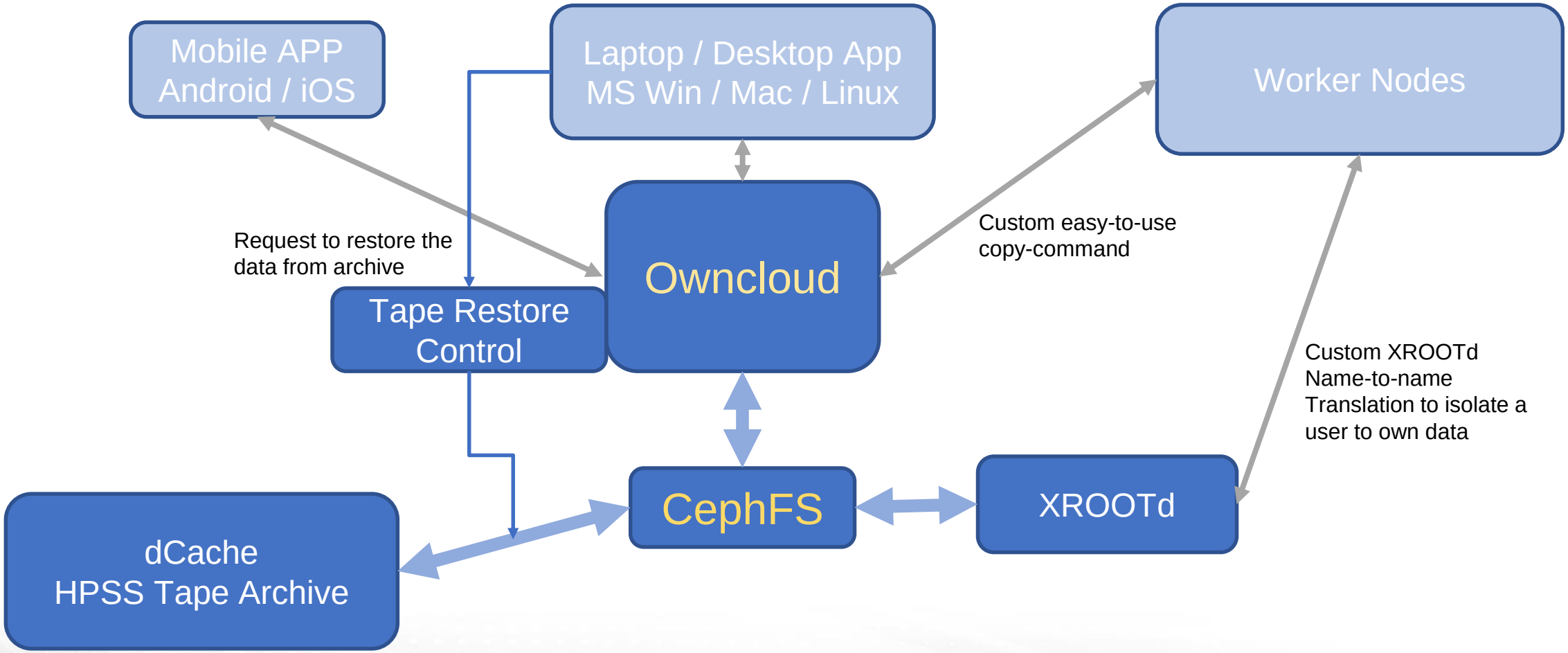
- Transfer small data in & out of BNL between central interactive farms, workstations, laptops, and tablets/smart phones.
- Transfer large data in & out of BNL between detector data stores, central storage, remote storage of users.
- Access data to/from analysis computing farm
  - Copy to scratch
  - Stream data
- Archive data

# BNL BOX




- Owncloud Software
  - Clients are available in many popular platforms; Linux, Mac OS, MS Win, Android and IOS
  - Extremely easy to use.
    - Synchronize data automatically
    - NOTE: Requires the same amount of storage in local and remote storage.
  - Quota for each users
  - Users can share data
- Ceph Storage
  - Currently Infernalis.  Targeting Kraken.
  - Reliability
  - CephFS
  - 3.8PB Raw -> 7.5PB by the end of 2017
  - Performance
    - 40Gbps for BNL Box

# Diagram


Mobile APP
Android / iOS
Laptop / Desktop App
MS Win / Mac / Linux
Worker Nodes
Request to restore the
data from archive
Owncloud
Custom easy-to-use
copy-command
Tape Restore
Control
Custom XROOTd
Name-to-name
Translation to isolate a
user to own data
CephFS
XROOTd
dCache
HPSS Tape Archive

# WebDAV access and Sync

- Default sync app seems to synchronize data at the top rate of about 100MB/s per client. (100MB/s = 360GB/Hr = 8.6TB)
  - Sufficient for small data ~ less than TB.
    - Most users won't need or physically have higher throughputs in their systems.
      - Spinning DiskIO on desktop(~100MB/s).
      - Wifi N (max 300Mbps~40MB/s)
      - LAN (1Gbps=120MB/s)
      - Disks are not much larger (currently max at about 10TB)
- High demand users require higher throughput.
  - 10TB or more.
  - Owncloud supports standard WebDAV protocol
    - Easy to write a custom copy tool.
      - Easily achieve 150MB/s per single file transfer.
      - Concurrent multiple transfer of files will results in obtaining desired throughputs.
      - NOTE: Different SSL library seem to impact the observed throughput of WebDAV command. For an example, "curl" in RHEL 7 is compiled with NSS. This version of "curl" produces 1/5 of throughput of "curl" using OpenSSL.

# Stream Access

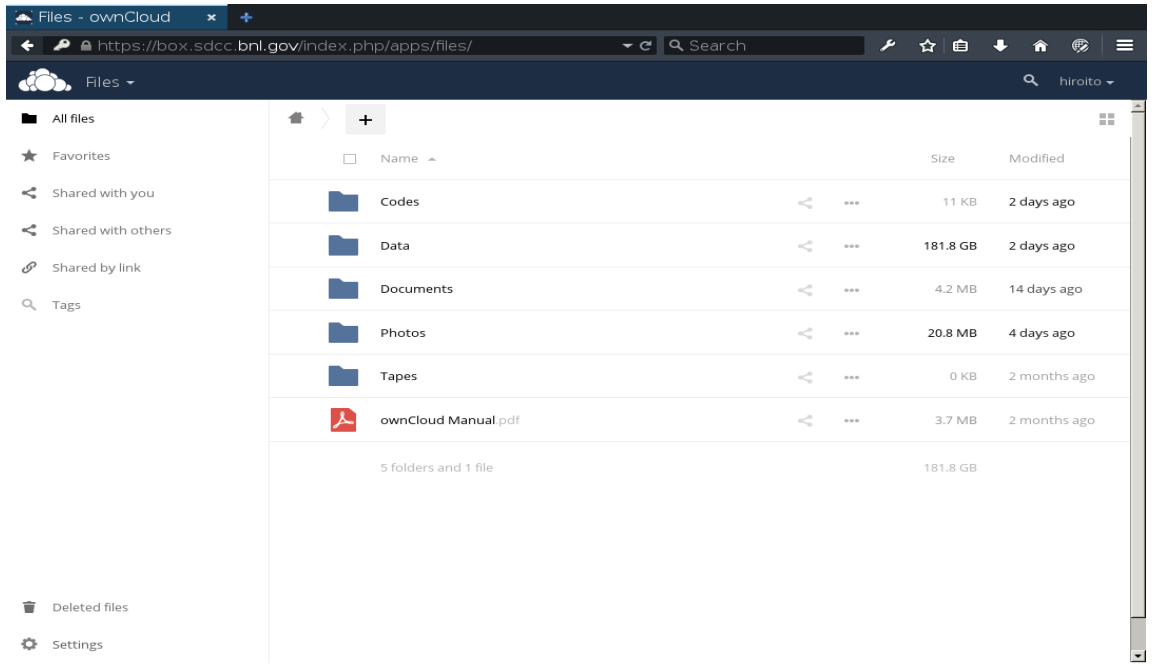
- XROOTd and WebDAV can stream data
- Would like to separate the data-sync operations from the data-read access as much as reasonably possible.
- XROOTd can cleverly map user data in BNL Box in a very simple way.
  - Owncloud web URL maps a user data by https://host/owncloud/index.php/apps/files/MYDATA
  - This is different from how Owncloud physically stores user data in its storage as /base-directory/**username**/files/MYDATA
  - XROOTd can clervery hide “username” of physical files by providing access by root://host/files/MYDATA
    - Courtesy of Andrew Hanushevsky from XROOTd

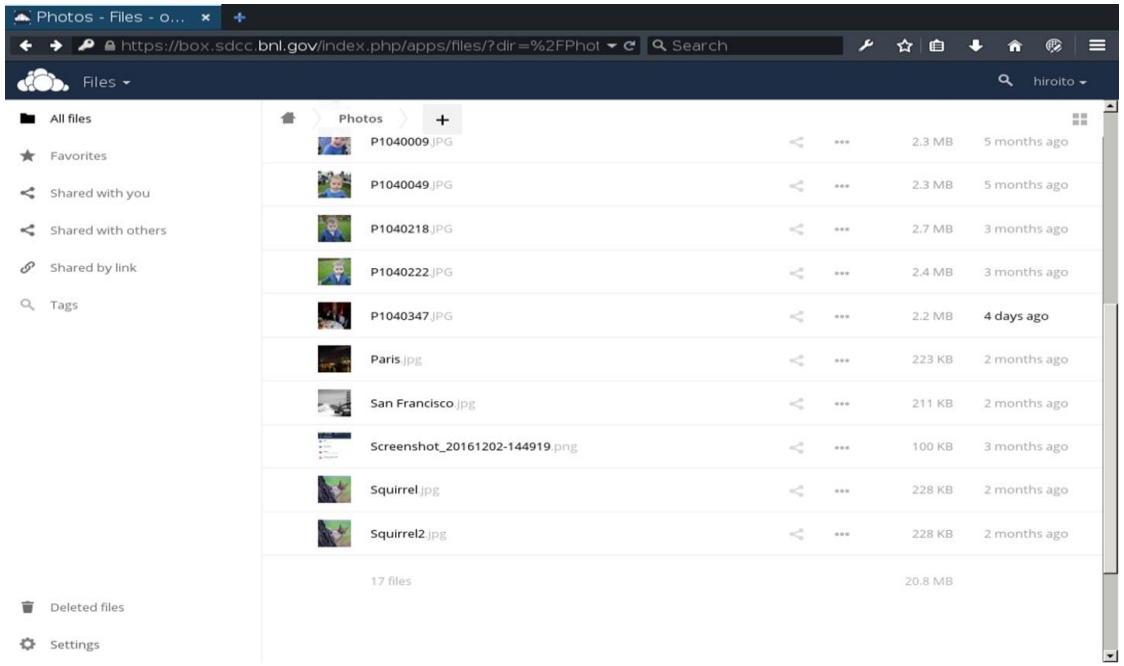
# Archive data

- Some users would like to archive or store data in the tape system.
  - Will the data be read again?
- Difficulties
  - Efficiency
  - Read throughput
  - Reading small fraction in many different tapes will results in low throughput.
    - Seek is slow.
    - Mounting a tape is very slow.
- Must write in a particular way to produce the good read-IO.

- Rule
  - “/Tapes/” directory will be used to indicate data to be stored to the tape system.
  - Files small than certain size (1GB) will be tarred to produce a large file
  - Tar files smaller than 1GB will be archived to tape only after certain period.
  - Once files are transferred to the archival system, they will be removed from “/Tapes/” directory.
    - Reduce the usage of quota.
    - Create index or individual local catalog file to record the data in the archival system.
    - The above index will be synchronized by the owncloud to their local machine.
    - Also update the central catalog for archived data
  - Restore requests will be made through Web interface.
    - Data will be restored to different directory.

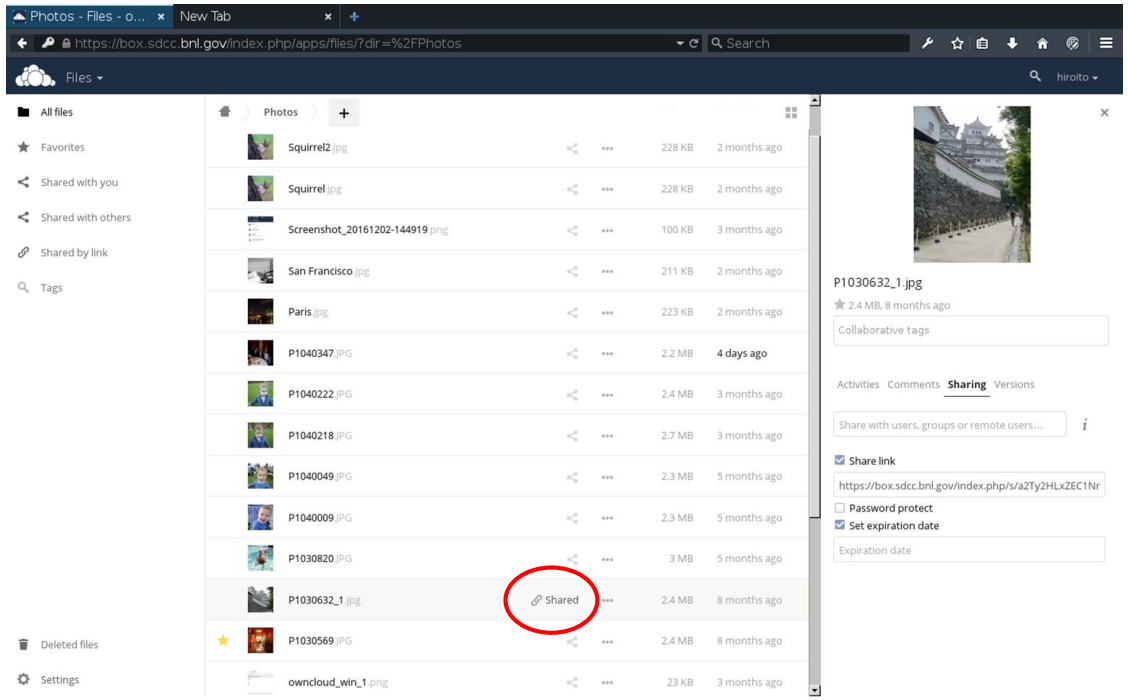
# Sample images

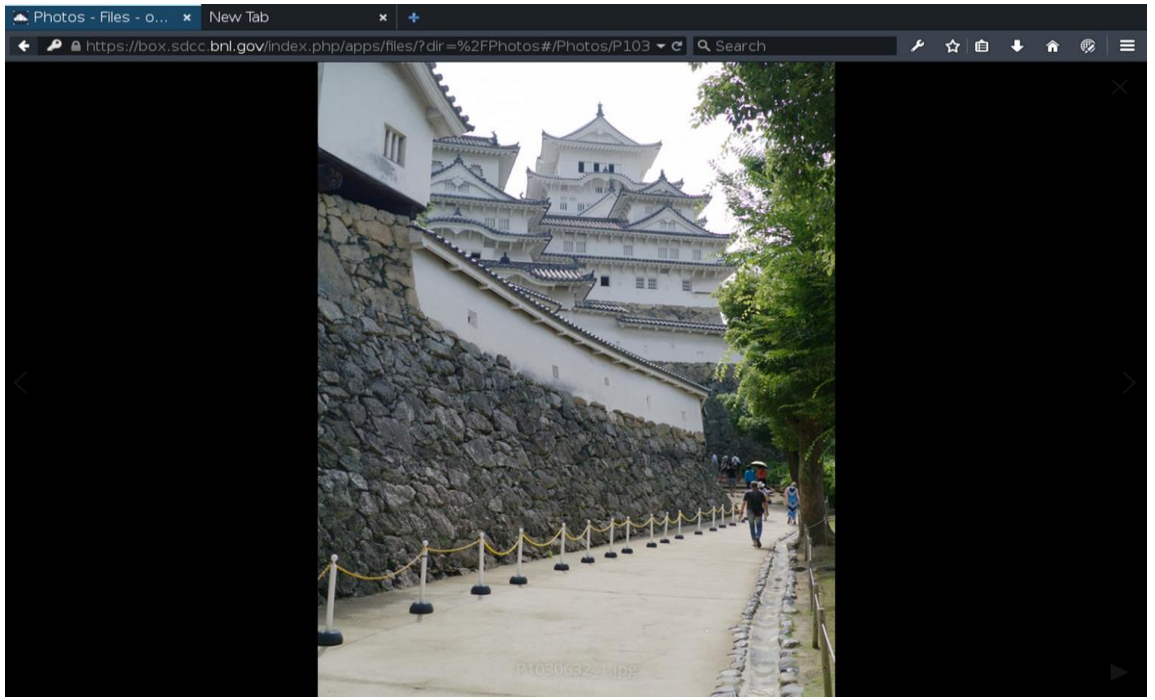



- Users only see their own directory.

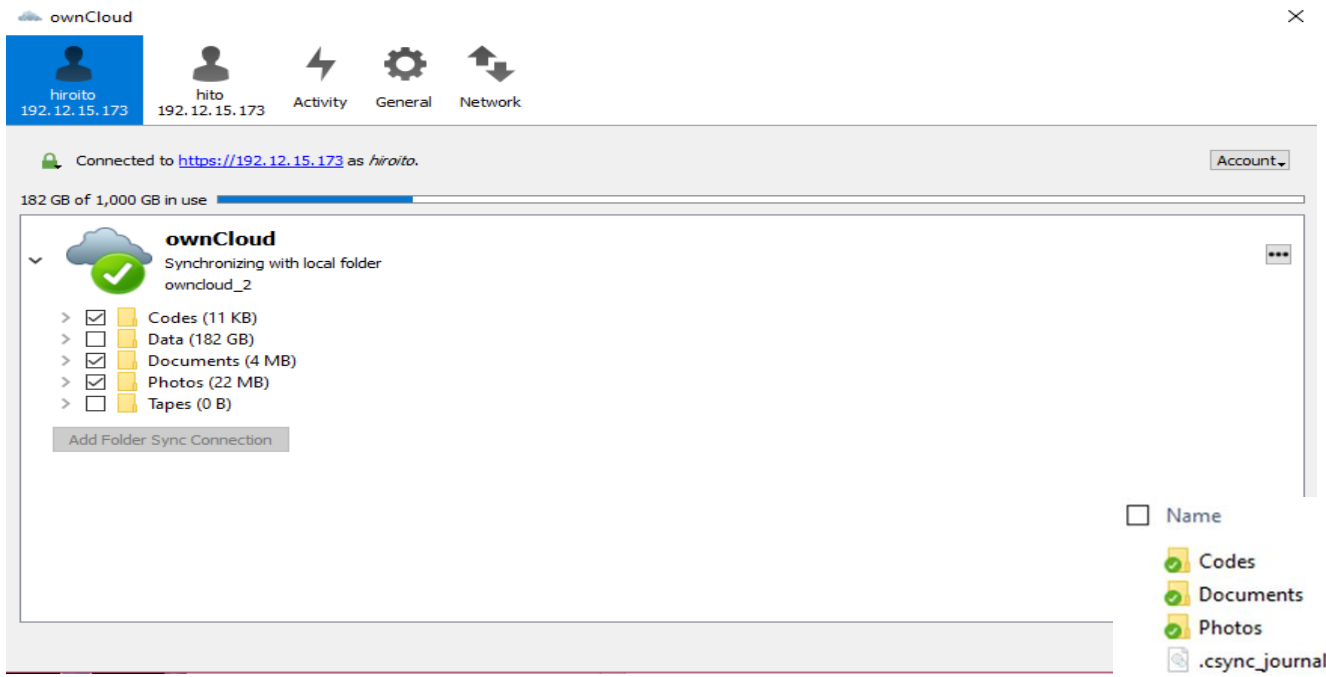
# Share data

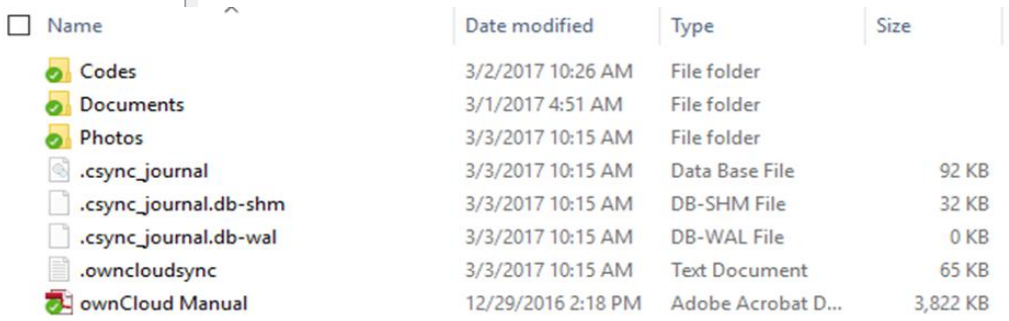



- Users can share their data publicly or privately with password.

# Users decide what to sync




Using the provided app, users can decides what to sync automatically.
For an example

- Data and Tapes directories are not synchronized.
- Codes, Documents, Photos directories are synchronized automatically.

Desktop/Laptop apps are available in MS Win, Mac and Linux.
The performance seems to be limited to the maximum of 100MB/s.

# Conclusion

- Cloud storage could be potentially useful for data intensive scientific communities.
- BNL Box will provide our users with ability to store and access their data anywhere by the easy-to-use applications on various platforms.
- BNL Box allows the owners of the data to share with anyone without involvement of the system administrator.