Transferring Data to and from NERSC

Yushu Yao
• Structure of NERSC Systems and Disks
• Data Transfer Nodes
• Transfer Data from/to NERSC
  – scp/sftp
  – bbcp
  – GridFTP
• Sharing Data Within NERSC
# Systems and Disks

<table>
<thead>
<tr>
<th>System</th>
<th>Hopper</th>
<th>Franklin</th>
<th>Carver</th>
<th>Euclid</th>
<th>Data Transfer Node</th>
<th>PDSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Home ($HOME)</td>
<td>✔️</td>
<td>✔️</td>
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<tr>
<td>Global Scratch ($GSCRATCH)</td>
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<tr>
<td>Project Directory</td>
<td>✔️</td>
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<tr>
<td>Local Non-shared Scratch</td>
<td>✔️</td>
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</tbody>
</table>

**Data transfer nodes** can access most of the disks, suggested for transferring data in/out NERSC

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• **Two Servers Available Now:**
  – dtn01.nersc.gov and dtn02.nersc.gov
  – Accessible by all NERSC users

• **Designed to Transfer Data:**
  – High speed connection to HPSS and NGF (Global Home, Project, and Global Scratch)
  – High speed ethernet to wide area network
  – Various tools such as scp, bbcp, GridFTP, hsi

• **Suggested For Transferring Data to/from NERSC**
**SCP/SFTP**

- **Suggested for:**
  - Small files (<10GB)

- **Requirements:**
  - Unix-like: ssh and scp commands (Available Everywhere)
  - GUI Clients: WinSCP(Windows), Fugu(Mac), etc
    - Drag and Drop, easy to use, will not demonstrate here

- **Pros:**
  - Easy to find client, easy to use
  - Data Encrypted

- **Cons:**
  - No parallel transfer, no tuning options, slow
• Get a File From Data Transfer Node:
  
  scp user_name@dtn01.nersc.gov:/remote/path/myfile.txt /local/path

• Send a File to Data Transfer Node:
  
  scp /local/path/myfile.txt user_name@dtn01.nersc.gov:/remote/path
If you have many small files, sometimes it is easier to use tar with ssh pipe:

- **Get a Directory From Data Transfer Node:**
  
  ```sh
  ssh user_name@dtn01.nersc.gov tar cz /remote/path/directory | tar zxv -C /local/path
  ```

- **Send a Directory to Data Transfer Node:**
  
  ```sh
  tar cz /local/path/directory | ssh user_name@dtn01.nersc.gov tar zxv -C /remote/path
  ```
BaBar Copy (bbcp)

• **Requirements:**
  – Unix-like Only: Need to Download The Client
  – NIM Account and Password

• **Pros:**
  – Parallel Transfer, Tuning Options, Fast
  – Use SSH for Encrypted Authentication (Data is not encrypted)

• **Cons:**
  – Client not widely available, no windows/GUI
• Available on all NERSC Systems

• On the other end, download the pre-compiled executables from its website:
  – http://www.slac.stanford.edu/~abh/bbcp/
• Get a File From Data Transfer Node:

```
bbcp -S "ssh -x -a -oFallBackToRsh=no %I -l %U %H /usr/common/usg/bin/bbcp" "user_name@dtn01.nersc.gov:/remote/path/file" /local/path
```

• Send a File to Data Transfer Node:

```
bbcp -T "ssh -x -a -oFallBackToRsh=no %I -l %U %H /usr/common/usg/bin/bbcp" /local/path/file "user_name@dtn01.nersc.gov:/remote/path/"
```

Note the “-S” option for source and “-T” option for target.
Initiating Transfer from A NERSC Host

• Get a File From A Remote Host:

```
bbcp -S "ssh -x -a -oFallBackToRsh=no %I -l %U %H /path/to/bbcp/on/remote/host" "user_name@remote.host.com:/remote/path/file" /local/path
```

• Send a File to A Remote Host:

```
bbcp -T "ssh -x -a -oFallBackToRsh=no %I -l %U %H /path/to/bbcp/on/remote/host" /local/path/file "user_name@remote.host.com:/remote/path/
```

Note the “-S” option for source and “-T” option for target.
Use the “-s” option to change the number of streams, default is 4 (recommended for most cases)

• Get a File From Data Transfer Node:
  bbcp -s 8 -S "ssh -x -a -oFallBackToRsh=no %I -l %U %H /usr/common/usg/bin/bbcp" "user_name@dtn01.nersc.gov:/remote/path/file" /local/path

• Send a File to Data Transfer Node:
  bbcp -s 8 -T "ssh -x -a -oFallBackToRsh=no %I -l %U %H /usr/common/usg/bin/bbcp" /local/path/file "user_name@dtn01.nersc.gov:/remote/path/"
Sometimes your local firewall causes problem in transferring, e.g. error message like below:

```
bbcp: Accept timed out on port 5031
bbcp: Unable to allocate more than 0 of 8 data streams.
Killed by signal 15.
```

- You can add the -z option and try again.
- Get a File From Data Transfer Node:
  ```
  bbcp -z -S "ssh -x -a -oFallBackToRsh=no %I -l %U %H /usr/common/ussg/bin/bbcp" "user_name@dtn01.nersc.gov:/remote/path/file" /local/path
  ```
- Send a File to Data Transfer Node:
  ```
  bbcp -z -T "ssh -x -a -oFallBackToRsh=no %I -l %U %H /usr/common/ussg/bin/bbcp" /local/path/file "user_name@dtn01.nersc.gov:/remote/path/"
  ```
GridFTP

• Requirements
  – Need Client Tool
  – Need Grid Certificate

• Pros
  – Parallel Transfer, Many Tuning
  – Fast and Reliable

• Cons
  – Complicated Grid Infrastructure
  – Steep learning curve
  – Additional administrative hoops
• **Basic Procedure:**
  – Obtain Grid Certificate
  – Setup Grid Certificate
  – Call globus-url-copy
  – Details in the NERSC Website

• **Globus Online (Next Talk) is an alternative to the above which is much simpler**
• Round-robin based DNS load balancing on login nodes may cause problems for bbcp and GridFTP

• We have “Grid” nodes to solve that:
  – franklingrid and hoppergrid
  – Access local scratch with bbcp/GridFTP
  – i.e use franklingrid.nersc.gov instead of franklin.nersc.gov
### Comparing Your Options

<table>
<thead>
<tr>
<th>Method</th>
<th>Requirements</th>
<th>Simple To Use</th>
<th>Parallel Transfer</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>scp/sftp</td>
<td>Any SSH/SFTP Client</td>
<td>Simple</td>
<td>NO</td>
<td>Slow</td>
</tr>
<tr>
<td>bbcp</td>
<td>bbcp client (no windows support)</td>
<td>Simple With Instructions</td>
<td>YES</td>
<td>Moderate-Fast</td>
</tr>
<tr>
<td>GridFTP</td>
<td>GridFTP Client</td>
<td>Less Simple, multiple steps needed</td>
<td>YES</td>
<td>Fast</td>
</tr>
</tbody>
</table>

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• **With Yourself NERSC Systems**
  – Global Home ($HOME)
    • Everywhere except PDSF
  – Global Scratch ($GSCRATCH)
    • Everywhere except Franklin and PDSF
    • Note: inactive data will be purged

• **With Other NERSC Users**
  – Project Directories
    • By request, email consult@nersc.gov
Performance Tuning

- Performance of the default settings are hard to beat, but not unbeatable
- More Information about Performance Tuning:
  - http://www.psc.edu/networking/projects/tcptune/
  - http://fasterdata.es.net/
• Create scientific communities around data sets
  – NERSC HPSS, NGF accessible by broad community for exploration, scientific discovery, and validation of results
  – Increase value of existing data

• Science gateway: custom (hardware/software) to provide remote data/computing services
    • Discovered 36 supernovae in 6 nights during the PTF Survey
    • 15 collaborators worldwide worked for 24 hours non-stop
  – GCRM – Interactive subselection of climate data (pilot)
  – Gauge Connection – Access QCD Lattice data sets
  – Planck Portal – Access to Planck Data

• New models of computational access
  – Projects with mission-critical time constraints require guaranteed turn-around time.
  – Reservations for anticipated needs: Computational Beamlines
  – Friendly interfaces for applications and workflows
Questions?

National Energy Research Scientific Computing Center