جامعة نيويورك أبوظبي

NYU | ABU DHABI

Getting Started with *Dalma*

High Performance Computing NYUAD

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Storage: Quota

When storage is shared among many users rules must be set to prevent users to consume disk space excessively at the expense of others. For this purpose HPC systems enforce disk quotas to users and groups of users.

On Dalma disk quotas are enforced on /home and /scratch (not /archive or /fastscratch). There are two quota constraints: the total amount of disk space and the total number of files. Once you reach a quota limit your jobs may be killed. So it is a good practice to check your quota before submitting a job that will generate a lot of data.

myquota (Dalma specific) will show your storage utilisation and your limits.

```
benoit — ssh -Y benoit@dalma.abudhabi.nyu.edu — 88×11
[login-0-3.local 1: myquota
Disk quotas for benoit (uid 1028):
                                DISK SPACE                  # FILES (1000's)
          filesystem        size      quota              number      quota
                      -------------------------     -------------------------
               /home       13GB      107GB (12%)            3         500 ( 1%)
        /fastscratch        0KB        0KB (-nan%)           0           0 (-nan%)
            /scratch      309GB     5261GB ( 6%)          319        2000 (16%)
            /archive      419GB     5261GB ( 8%)           11         500 ( 2%)
```

Storage: Policies

The following data policies are enforced on Dalma:

1. Backup: there is no backup performed by our staff, each user is responsible to archive his/her data.

2. Files count: no user is allowed to have more than 1'000 files per directory on /scratch, /home, and /fastscratch, and 500 on /archive. We periodically inspect storage devices and block user accounts if needed.

3. Files which have not been used for more than 90 days on /scratch and /fastscratch may be deleted. Users will be notified and given a chance to archive their data if they wish.

Storage: Archiving

Backup VS Archive

- A backup is an operation where a disk's contents is automatically copied to tape
- Archiving is an operation where a disk's contents is manualy moved to a long-term storage device

archive: manually **MOVE** data to long-term storage (tape or other)

backup: automatically & periodically **COPY** data to tape

Storage: Archiving

Dalma's Archiving Components

Storage: Archiving

What `/archive` does

- DMF (**D**ata **M**igration **F**acility) is an automatic data archiving tool
- It buffers data to a disk cache before copying it (eg migration) to the tape drive
- Old data on disk cache is eventually removed to make room for more data
- Once removed from disk cache files still appear in cache – file hierarchy remains, but not data
- Accessing such files automatically triggers their migration back to the disk cache
- Migration to tape drive actually makes two tape copies
- One copy is periodically sent to an outside data recovery site
- The tapes have a data retention of 30+ years
- Each time you modify a file on the disk cache two new copies of the latest version are made to tape
- There are no limits on how many file versions that can be made
- There is no disk quota for the amount of space used on tape or disk cache

Storage: Archiving

DO NOT MISUSE `/archive`

- Don't archive directories with more than 500 files
- Don't archive files that aren't meaninful
- Don't move files in and out
- Don't use it to backup your work weekly / monthly
- Don't request a file restore unless absolutely necessary
- Don't use /archive as a way around your /scratch disk quota

Storage: Archiving

CORRECT DISK USAGE `/archive`

- Periodically clean your /scratch & /fastscratch space
- Once a project is completed move the data over to /archive
- Use tar files to archive directories with large file count
- Use "git" or similar versioning tool to keep track of changes in source code
- Remove any data from /archive which you are sure will not be used ever again

Storage: Archiving

List /archive files

- dmfls
- Same options to "ls"
- "-l" option display state of file

REG	File not managed by DMF
MIG	Migrating
ARC	Archiving
DUL	Dual-state (both on tape and disk cache)
OFL	Offline
UNM	Unmigrating
NMG	Nonmigratable file
PAR	Partial-state file
N/A	DMF can't determine state
INV	Invalid state

```
> dmfls -l /archive/zidane/
total 16
drwxrwxr-x  112 apps    apps        4096 2015-04-30 08:25 (REG) builds
-rw-rw-r--    1 apps    apps      693985 2015-06-22 12:49 (OFL) eigen-intel14.tar.gz
-rw-rw-r--    1 apps    apps    10546302 2015-06-22 12:46 (OFL) eigensoft-intel14.tar.gz
-rw-rw-r--    1 apps    apps     2438932 2015-06-22 12:40 (OFL) fftw2-intel14.tar.gz
-rw-rw-r--    1 apps    apps     7921210 2015-06-22 12:40 (OFL) fftw3-intel14.tar.gz
-rw-rw-r--    1 apps    apps     2730147 2015-06-22 12:43 (OFL) gsl-intel14.tar.gz
-rw-rw-r--    1 apps    apps    25386040 2015-06-22 12:42 (OFL) hdf5-intel14.tar.gz
drwxrwxr-x    3 apps    apps          26 2015-02-08 08:39 (REG) jags
-rw-rw-r--    1 apps    apps      223502 2015-06-22 12:46 (OFL) mpiblacs-intel14.tar.gz
-rw-rw-r--    1 apps    apps    10244400 2015-06-22 12:44 (OFL) mvapich2-intel14
-rw-rw-r--    1 apps    apps     7083606 2015-06-22 12:45 (OFL) netcdf-c-intel14.tar.gz
-rw-rw-r--    1 apps    apps    33848579 2015-06-22 12:44 (OFL) openmpi-intel14.tar.gz
-rw-rw-r--    1 apps    apps    10295250 2015-06-22 12:48 (OFL) scalapack-intel14.tar.gz
drwxrwxr-x   67 apps    apps        4096 2016-01-21 09:08 (REG) scripts
drwxrwxr-x    2 apps    apps        4096 2016-01-21 09:02 (REG) tars
drwxrwxr-x    3 apps    apps          24 2015-02-05 10:16 (REG) toolshed
-rw-rw-r--    1 apps    apps      147937 2015-06-22 12:43 (OFL) zlib-intel14.tar.gz
```

NOTE: all paths to archive must be absolute (eg /archive/...)

Storage: Archiving

Remove /archive files

- dmfrm
- Similar options to "rm"

Remove a file:

```
> dmfrm /archive/beckham/myfile
```

Remove a directory:

```
> dmfrm -r /archive/beckham/mydir
```

NOTE: deleted files can be recovered within two weeks

Storage: Archiving

Show /archive disk use

- dmfdu
- Similar options to "du"

blocks used by a directory / file:

```
> dmfdu /archive/ronaldinho
27567617  /archive/ronaldinho/WIEN2K
27567617  /archive/ronaldinho
```

Human readable (-h) and grand total (-c):

```
> dmfdu -ch  /archive/ronaldinho
27G /archive/ronaldinho/WIEN2K
27G /archive/donaldinho
27G total
```

Storage: Archiving

Transfer files to /archive

- dmfput
- Copy data to /archive
- Usage: dmfput <source> <destination>
- Audit of directories before archiving
- If destination directory exists then only synchronize with new source content (rsync)

```
> dmfput /scratch/neymar/mydir /archive/neymar

> dmfput /scratch/neymar/myfile /archive/neymar/dir1

> dmfput /scratch/neymar/dir1/myfile /archive/neymar/dir1/myfile

> dmfput /scratch/neymar/mycrazydir /archive/neymar
Auditing /scratch/neymar/mycrazydir
Directory /scratch/neymar/mycrazydir has too many entries (1000 max=500)
Archiving terminated on account of directories failing to meet limits
```

Storage: Archiving

Retrieve files from /archive

- dmfget
- Copy data from /archive
- Usage: dmfget <source> <destination>

```
> dmfget /archive/ibrahimovic/dir1/fileX /scratch/ibrahimovic/dir2
```

Storage: Archiving

Archiving directories with large number of files

- Very wasteful of resources
- Very very slow to scan (eg "ls", "find", etc)
- **DO NOT ATTEMPT TO ARCHIVE SUCH DIRECTORIES**
- Create "compressed tar files" of them instead and archive those tar files

```
> tar -czf mycrazydir.tgz mycrazydir

> rm -fr mycrazydir

> dmfput /scratch/messi/mycrazydir.tgz /archive/messi
```

Storage: Archiving

Archiving several versions of the same directory

- Write the data into individual directories

```
> dmfput /scratch/ronaldo/mydir /archive/ronaldo/mydir.20170822
```

some *time later...*

```
> dmfput /scratch/ronaldo/mydir /archive/ronaldo/mydir.20170905
```