Getting Started with DUNE's Software and Computing

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Young Dune

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Web Documentation

- I set my web browser's home page to the DUNE at Work page:

https://web.fnal.gov/collaboration/DUNE/SitePages/home.aspx

It is linked on the main public page

http://www.dunescience.org

in case you need to find it on a borrowed computer and cannot remember the DUNE at Work link (like me!)

So far, DUNE's web documentation is *public*. Some meetings and some notes are password-protected, but software is not, and documentation is not. You are encouraged to share your work publicly too at this stage. In the future, results preparation will likely require some privacy.

Getting Computer Accounts

- Getting computer accounts at Fermilab:
  - You must be a member of DUNE first. The phone list is at:

https://dune.bnl.gov/people

  - Contact your Institutional Board (IB) representative to join. The IB list is also at the above link. The IB representative tells Maury Goodman (deputy spokesman) to add DUNE members.
  - Three member lists: Author list, Collaborator list, Member list.
- Once you are a member, apply for DUNE accounts at:
- https://web.fnal.gov/collaboration/DUNE/SitePages/Getting%20Computer%20Accounts%20at%20Fermilab.aspx
- Both of these links are on the DUNE at Work Page (or subpages)
- To get physical access to Fermilab for more than a few-day meeting, get an ID card. Signup is on the same page.

Computer Accounts at Fermilab

You can list me (Tom Junk) as your Fermilab contact, or a Fermilab person with whom you work.

You will receive (if you don't have already...)

- A Fermilab ID number (sign in with the Users' Office and get a badge with Key and ID if you plan on staying at Fermilab longer than for just a meeting). It's always good to check with the Users' Office first
- A Fermilab Services Account (web services: Service Desk, Redmine, and the electronic control-room logbook)
- A Kerberos principal (= your username)
- A Fermilab e-mail address (Kerberos_Principal@fnal.gov)
- An FNALU account, and a home directory on nashome
- A DUNE interactive account
- Membership in the DUNE VO (for submitting batch jobs)

Logging in with Kerberos

- How to log in: Use Kerberos

https://fermi.service-now.com/kb_view_customer.do?sysparm_article=KB0011308

https://cdcvs.fnal.gov/redmine/projects/dune/wiki/Interactive_Computing_Resources

- My usual routine:
  - kinit <kerberos_principal>@FNAL.GOV
  - ssh dunegpvm0x.fnal.gov
- You may have to update /etc/krb5.conf to make sure Fermilab's KDC's are in it
- And your ~/.ssh/config file with default login options, like delegating credentials (so you have a ticket on the remote machine and can submit jobs and log in from there to elsewhere too, and transfer files), and allowing X window tunneling.

Certificates

- Needed to sign in to some web-based services
  - DocDB has a certificate access method – you may be able to see some documents in some protection groups only with a certificate. Apply for access on the DocDB page
  - A CILogon Certificate with one year of validity can be had obtained at: https://web.fnal.gov/collaboration/DUNE/SitePages/Get%20a%20CI%20Logon%20Certificate.aspx
- Special certificates used for production work (raw data processing, MC challenges, etc.) Talk to Tom if you need these.
- Short-duration certificates obtained with kx509 for use in batch job submission. Used to be KCA, now CILogon.

Computing Resources at Fermilab

- https://cdcvs.fnal.gov/redmine/projects/dune/wiki/Interactive_Computing_Resources
- Ten dunegpvm<nn>.fnal.gov nodes for interactive logins. <nn>=01 through 10. They run SLF6, and have four cores and 12 GB of memory apiece.
- Storage: home areas, collaboration-wide shared BlueArc application and data space, dCache and tape. Subsequent slides.
- Batch computing: DUNE has an allocation of 1000 batch slots on GPGrid, Fermilab's general-purpose grid computing facility (FIFEBatch). We often use more than that.
- We share GPGrid with NOvA, MINOS, MINERvA, g-2, mu2e, and many other experiments. Conference season can be crunch time for both CPU and storage!

Computing Resources at Fermilab

- dunesl7gpvm01.fnal.gov: Interactive test node running Scientific Linux 7
- dunebuild01.fnal.gov 16 cores. SLF6. For building code only (do not run programs on it, even to test built code). It has a couple of TB of scratch space, but since we are not running programs on it, it's hard to use this space.
- gpgtest.fnal.gov – configured like a grid node. For testing/debugging, not for development or running jobs. Not quite like a grid node in that it has /nashome mounted.

Getting Computing Access at CERN

- You may also need computer accounts at CERN to work on the ProtoDUNE experiments. Links with instructions are available at

https://cdcvs.fnal.gov/redmine/projects/dune/wiki/Interactive_Computing_Resources#CERN

You will need to identify your institution's Team Leader, or find someone who is willing to sign up to be that person, and your institution needs to join NP02 or NP04 (dual-phase or single-phase ProtoDUNE experiments).

I had to send a copy of my passport – Fermilab's PII rules say you shouldn't keep such things on your computer however.

- The link above contains links that describe computing resources available at CERN for DUNE use.

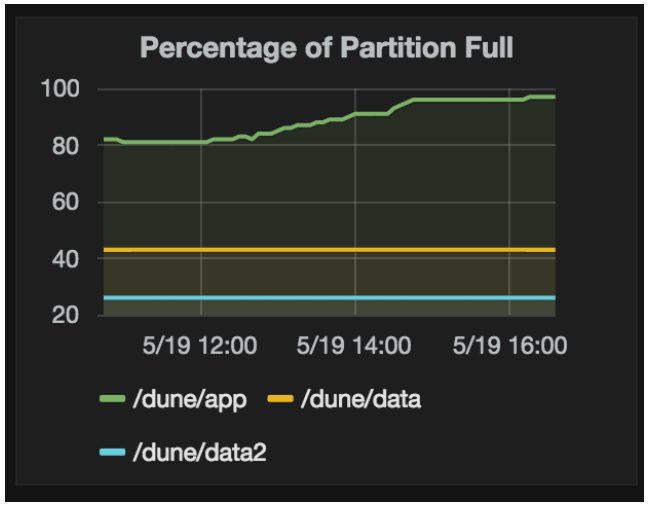
Home areas at Fermilab

- Home directories: /nashome/<u>/<username>
  - Snapshot backups taken 3x daily (Did you mistakenly delete a file? No problem! Look in: /nashome/.snapshot)
  - Not mounted on grid worker nodes
  - Migrated away from AFS Spring 2016.
  - Standard UNIX file protections apply now (AFS had its own). Default protections: your collaborators cannot see your files unless you set the protections yourself (a change from AFS home directories)
  - Larger quotas: 2 GB
- Web areas: /web/sites/<address> -- dunegpvm01 and flxi02 access only. Each web site has a user access list – submit a service desk ticket if you want rw access to the files in a web area.
- Professional web areas: /publicweb/<u>/<username>

Request one via the service desk. URL: http://home.fnal.gov/~username

Read and follow the acceptable use policy.

BlueArc Shared Disk



- Applications:
  - /dune/app/users/<make_your_own_directory>
  - 3 TB total size
  - Mounted on Fermilab grid worker nodes, as well as interactive nodes
  - Do not store data on the application disk!!!!!
  - snapshotted: /dune/app/.snapshot
  - Quotas: 100 GB/user.
- Data:
  - /dune/data/users/<makeyourowndirectory> (30 TB)
    /dune/data2/users/<makeyourowndirectory> (30 TB)
  - Mounted no-execute (scripts and programs on it will not run)
  - Not mounted on grid worker nodes. Use **ifdh cp** to transfer data from a grid job to bluearc data disk. Do not force use of cpn, let it use another protocol like gridftp
  - Quotas: 200 GB per user per disk

dCache – Much more Disk Space and Access to Tape

- **/pnfs/dune/scratch/users/<makeyourowndirectory>** -- No limit, but only **One Month** file lifetime
- **/pnfs/dune/persistent/users/<makeyourowndirectory>** -- 139 TB total size. Shared disk space with /pnfs/lbne/persistent. No user quotas yet, we may need to enforce them as it has filled up.
- **/pnfs/dune/tape_backed** – other directories in there are backed up on tape. Used for storing experiment data, MC, and backing up tarballs of configuration and other miscellaneous data. Files don't stay on disk long – they appear in /pnfs but access may be slow as they are staged off of tape.
- scratch and persistent files do not go to tape! Other directories do
- The mv gotcha: mv'ing files from one area to another keeps the retention policy. Use cp to make sure you get the new one.
- NFS is now protected against mv's from areas with different retention policies. I haven't tried hard links across retention policy zones yet. Some old files however sneaked past this protection and are now being deleted.

dCache Best Practices

- Do not put many files in the same directory (keep it to under 2000). Otherwise the nameserver slows down and response can be slow.
- ls –l can take a lot longer than just ls, especially if there are many files.
- Tape-backed areas now have automatic Small File Aggregation. Files under 200 MB are collected into packages to be written to tape. Grouped by entry date, not by anticipated access pattern.
- Small-file aggregation is not on by default! It needs to be configured (we haven't configured it yet).
- Small-file recovery can be slow. Can be optimized if you put a lot of small files you want to access together into a tarball.

dCache Best Practices

- NFS access to dCache is somewhat fragile
  - writing files with just plain cp can get "stuck"
  - I've not had problems reading files however
  - Most of the time if a copy or a write fails, you get an error message. But "Silent Corruption" has been observed. dCache experts recommend checking checksums.
  - xrdcp may be more reliable, and has a checksum option, xrdcp –cksum
  - Or do this
    - xrdadler32 <source file>
    - cat "/pnfs/path/.(get)(<dest copy file>)(checksum)"
    - compare checksums and retry

Storage Summary

E. Berman

	Quotas/ Space	Retention Policy	Tape Backed?	Retention Policy	Use for	pnfs
Persistent dCache	No/140 TB (+50 TB on the way)	Managed by Experiment	No	Till manually deleted	Files with longer lifetime needs	/pnfs/dune /persistent
Scratch dCache	No/no limit	LRU eviction – least recently used file deleted	No	Approx 30-60 days	Files with short lifetime needs	/pnfs/dune /scratch
Tape backed dCache	No/~(O) 200 TB on tape	LRU eviction	Yes	Greater than 200 days	Long-term archive	/pnfs/dune /tape_bac ked
BlueArc /dune/app	Yes/3TB/ 2.8TB used	Managed by Experiment	No	Till manually deleted	Storing and compiling programs	---
BlueArc /dune/data	Yes/30TB /14TB used	Managed by Experiment	No	Till manually deleted		---
BlueArc /dune/data2	Yes/30TB /8TB used	Managed by Experiment	No	Till manually deleted		---

Fermilab Service Desk

http://servicedesk.fnal.gov

- Very responsive. Make sure you pick the experiment in the drop-down as DUNE E-1071
- Undergoing a rearrangement of the Service Catalog.
- Best to use the entries in the Service Catalog if they match your need, but there are also general requests, and incidents.
- Try to diagnose your problem as much as you can first – collect error messages, simplify the problem for ease of reproduction, be descriptive.

Mailing Lists

- Please sign up for as many as even remotely interest you!
- https://web.fnal.gov/project/LBNF/SitePages/LBNF%20and%20DUNE%20Mailing%20Lists.aspx
- Linked on the DUNE at Work page.
- Contains a list of DUNE mailing lists, short descriptions, and pointers to how to subscribe.
- You don't need to involve a list owner to subscribe or unsubscribe – just send a mail to listserv@fnal.gov with no subject and the line SUBSCRIBE mylist (no@fnal.gov needed)
- Check list archives at http://listserv.fnal.gov Not all lists are archived.
- Sign up for dune-computing-news

DUNE DocDB

- The main DocDB – use this!
  - https://docs.dunescience.org
- The old LBNE DocDB: Write-protected (no new LBNE documents are allowed!)
  - http://lbne2-docdb.fnal.gov
- LBNF documents go in the DUNE DocDB for now.
- Public access – documents are by default not public
- Password access – Ask a DUNE collaborator for the username and password to access most documents
- Certificate access – need to apply for this.
- You're not listed on the author list? No problem! Add yourself to it. Everyone can. But not everyone can add a new institution.
- More info:
  - https://web.fnal.gov/collaboration/DUNE/SitePages/How%20to%20access%20and%20use%20DocDB.aspx

Indico

- https://indico.fnal.gov/
- Getting an account – a current indico user has to invite you.
- I do this by adding a non-indico user as a speaker in a meeting, and the add page has an option to send an e-mail to sign up a new user.
- Navigate to Experiments→DUNE
  - https://indico.fnal.gov/categoryDisplay.py?categId=443
- Search utility is very useful.
- Mostly intuitive. Online help is useful.

Redmine

- https://cdcvs.fnal.gov/redmine
- Fermilab's interface to
  - code repositories
    - git
    - svn
    - cvs
  - Easy-to-edit wiki pages
  - Other features:
    - issue tracker
    - Document storage (use DocDB or indico!)
    - Calendar, News, Acvitity, Gantt charts

The Top Page of FNAL Redmine

Need docs for editing Wikis?
It's here.

Use your Fermilab Services Username and Password to Sign In (to all Redmine projects)

https://cdcvs.fnal.gov/redmine

Home Projects Help Sign in

Fermilab Redmine

Search:

Home

This is the Fermilab Redmine site on cdvcs.fnal.gov, a software project management toolset. Fermilab affiliated users may login with their "Services" password.

New to Redmine? See the Introduction Pages

Subversion connection troubles? see this wiki page

Please see the Fermi Redmine project wiki for details on creating projects, repositories, etc. on this site.

Note that this toolset is to be used for bug tracking, feature planning, etc. but not for incident management; for that we recommend the site Servicedesk .

Latest projects

- Google Cloud Testing (09/07/2016 09:28 AM)
- Regression Testing (09/06/2016 10:37 AM)
  Regression Testing
- Project Reporting (09/06/2016 10:36 AM)
  Location to hold Project Reporting information
- FROIC01 (08/31/2016 03:53 PM)

Redmine Projects

- https://cdcvs.fnal.gov/redmine/projects
- One per repository.
- LArSoft has many (not all listed here. See Erica's talk)
  - larsim
  - larreco
  - lardata
  - larana
- DUNE has several (not all listed)
  - dunetpc
  - dunelbl
  - dunebsm
  - dunendk
  - HighLAND
  - dunefgt

In order to get permission to edit a wiki or check in code, you need Developer (or Manger) permissions in Redmine for that project.

You can always check out code, even with no permission.

But you get the git remote without push permissions. Once you get developer access, you need to either clone the repo again, or change the remote.

Ask the managers for this permission. They are listed on the Overview page.

There is a larsoft_users group which grants developer access to larsoft projects and dunetpc.

Some Tricks

- Repositories may or may not have doxygen or lxr code browsers. All have Redmine's repository browser.
- I sometimes don't know what repository in LArSoft contains something I want (say I'm looking for an example of how to use something, or I want to look for all instances of something):

mrb g larsoft_suite

mrb g larsoftobj_suite

in a test release will check out the development head of all of larsoft code.

grep -r -i sought_string *

will look in the current directory and subdirectories for sought_string, ignorning case. You may have to grep the output to select those matches of most interest to you.

Working Groups and Projects

- On DUNE we have, along with contact info
  - FD Sim/Reco: Redmine: dunetpc, duneutil, larsoft projects
    - Tingjun Yang, Xin Qian
  - ND WG's: Redmine: DUNE NDTF, dunegft, dunetpc
    - Steve Brice, Tyler Alion, Sarah Lockwitz, Georgios Christodoulou
  - ProtoDUNE: Redmine: dunetpc
    - Flavio Cavanna, Robert Sulej, Dorota Stefan ... others
  - Beam Simulations: Redmine: LBNF Beam Simulations
    - Laura Fields, Alberto Marchionni, Alfons Weber
  - Long-Baseline Physics WG: Redmine: dunelbl
    - Mayly Sanchez, Matt Bass, Silvia Pascoli
  - BSM Physics: Redmine: dunebsm
    - Alex Sousa, Filip Jediny, Jae Yu
  - Nucleon Decay: Redmine: dunendk
    - Jen Raaf, Michel Sorel

github

- https://github.com/DUNE
- We use it for DUNE and computing document authoring
  - DUNE CDR
  - DUNE TDR
  - ProtoDUNE TDR
  - Computing Documents

Batch Jobs

- Submit them with jobsub client!

https://cdcvs.fnal.gov/redmine/projects/dune/wiki/Submitting_Jobs_at_Fermilab

- Monitoring: use FIFEMON (also monitors disk usage)

http://fifemon.fnal.gov

Sign in with your Fermilab Services Username and Password

Select DUNE as your experiment, and look at "Experiment Batch Details"

n.b. Use DUNE resources for DUNE work and not other experiments – yearly accounting is done and we must request resources for DUNE.

Batch Job Resource Requests

- Resources: memory size, disk space, CPU time, number of cores, need to be specified on the jobsub_submit line
- Jobs that exceed their resource limits will be held
- query with:

  jobsub_q –hold

  to find out what went wrong.
- When you **submit jobs** and use the **--memory** option you can give units in both MB and GB. jobsub_submit interprets 1 GB as 1024 MB, not 1000 MB. So --memory=2GB is equivalent to --memory=2048MB, not 2000MB.
- Get your logfiles with jobsub_fetchlog. They come as a gzipped tarfile. tar -xzf <filename> will unwind it. Logfiles are truncated – first and last 5 mbytes are saved.

Using the OSG

- More CPU is available on the OSG than at Fermilab
- Code should be built and installed in CVMFS
- Not all OSG sites support everything Fermilab supports
  - no /grid/fermiapp
  - no /dune/app
  - sometimes no X libraries!
  - sporadic user mapping errors – some sites are better than others. See Laura Fields's talk in the S&C parallel session at SDSMT in May 2016 and DUNE DocDB 1173

FIFE, *art*, and LArSoft Workshops

- I just google them: Search for Fermilab FIFE Workshop 2015 and 2016
- https://indico.fnal.gov/conferenceDisplay.py?confId=9737
- https://indico.fnal.gov/conferenceDisplay.py?confId=12120
- Lots of good tips, tricks, and best-practices info. Lots of behind-the-scenes this-is-how-it-works talks.

- LArSoft Usability Workshop June 22-23, 2016

https://indico.fnal.gov/conferenceDisplay.py?confId=11857

- *art* Users' Workshop June 17 2016

https://indico.fnal.gov/conferenceDisplay.py?confId=12068

DUNE Data Catalog

- Visit

http://dune-data.fnal.gov

- Monte Carlo Challenges 5, 6, and 7 cataloged here
- Some files being migrated to tape since persistent dCache filled – to modify the pointers here. analysis ntuples already in SAM.
- 35-ton data file list and SAM access tips listed on this web site.