



Getting Started with CISL Facilities and Support

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CISL's Mission for User Support

CISL will provide a balanced set of services to enable researchers to utilize community resources securely, easily, and effectively.

CISL Strategic Plan

CISL also supports special colloquia, workshops and computational campaigns; giving users special privileges and access to facilities and services above normal service levels.



NCAR



CISL Facilities Overview

Navigation and usage of the facilities require a basic familiarity with a number of the functional aspects of the facilities.

- Computing Systems
 - Bluefire (Mesa)
 - Lynx (Mesa)
 - Janus (CU)
 - Yellowstone (NWSC)
- Data Analysis and Visualization
 - Mirage and Storm
 - Geyser and Caldera (NWSC)
- Data Archival
 - HPSS
 - GLADE
- Allocations and Security
- User support
- Training

Working with Bluefire



Computing System - Bluefire

- **IBM clustered Symmetric Multi-Processing (SMP) system**
 - Operating System: AIX (IBM-proprietary UNIX)
 - Batch system: Load Sharing Facility (LSF)
 - File system: General Parallel File System (GPFS)
- **127 32-way 4.7 GHz nodes**
 - 4,064 POWER6 processors
 - SMT enabled (64 SMT threads per node)
 - 76.4 TFLOPS
- **117 compute nodes (70.4 TFLOPS peak)**
 - 3,744 POWER6 processors (32 per node)
 - 69 compute nodes have 64 GB memory
 - 48 compute nodes have 128 GB memory
- **10 other nodes**
 - 2 interactive sessions/login nodes (256 GB memory)
 - 2 debugging and share queue nodes (256 GB memory)
 - 4 GPFS/VSD nodes
 - 2 service nodes

Compilers on Bluefire

- **Fortran 77 and Fortran 90/95 compilers:**

- xlf, xlf_r, xlf90, xlf90_r
- mpixlf, mpixlf_r, mpixlf90, mpixlf90_r

- **C and C++ compilers:**

- xlc, xlc_r, xlc, xlc_r
- mpcc, mpcc_r, mpCC, mpCC_r

- **The _r versions are thread safe**

- We recommend them over the non _r versions.

- **Compile your source code**

- xlc_r hello_world.c -o hello_world_c.exe
- xlf90_r hello_world.f -o hello_world_f.exe

- **More information**

<http://www2.cisl.ucar.edu/docs/bluefire/compiling-and-optimization>

Login to Bluefire with Yubikey

- **Security Shell(SSH)**

- Cygwin, Putty, Terminal, etc.

- **Using your Yubikey token**

- When you log in Bluefire,

`ssh your_logon@bluefire.ucar.edu`

your screen displays a response:

`Token_Response:`

- Enter your PIN number on the screen (**do not hit enter**), then touch the yubikey button. This will insert a new one-time password (OTP) and a return.
- The yubikey is activated by the **warmth of your finger** not the pressure in pushing the button.

- **More information of Yubikey:**



- <https://www2.cisl.ucar.edu/docs/enabling-your-yubikey-token>

A Job Script on Bluefire

```
#!/bin/csh
```

```
# LSF batch script to run an MPI application
```

```
#BSUB -P 12345678 # project number (required)
```

```
#BSUB -W 1:00 # wall clock time (in minutes)
```

```
#BSUB -n 256 # number of MPI tasks
```

```
#BSUB -R "span[ptile=64]" # run 64 tasks per node
```

```
#BSUB -q workshop # queue setting: use 'workshop' queue this week
```

```
#BSUB -J myjob # job name
```

```
#BSUB -o myjob.%J.out # output filename
```

```
#BSUB -e myjob.%J.err # error filename
```

```
mpirun.lsf /usr/local/bin/launch ./MyProg.exe
```

For more examples, see the /usr/local/examples directory.

- # Submit, Delete, and Monitor Jobs on Bluefire
- **Job submission**
 - `bsub < script`
 - **Monitor jobs**
 - `bjobs`
 - `bjobs -u all`
 - `bjobs -q regular`
 - `bhist`
 - `bhist -n 0 jobid`
 - **Delete a job**
 - `bkill jobid`



Module Utility on Bluefire

Modify environment to find alternative compilers or software

- To show all available module files
`module av`
- To see which modules are in force
`module list`
- To load a new module (e.g. ImageMagick)
`module load ImageMagick-6.5.3-10`

<https://www2.cisl.ucar.edu/docs/bluefire/getting-started?tab=3>

"Big 3": Get a Better Performance

- **Simultaneous Multi-Threading(SMT)**
 - a second, on-board "virtual" processor
 - 64 virtual cpus in each node
- **Multiple page size support**
 - 64-KB page size when running the 64-bit kernel
 - Large pages (16 MB) and "huge" pages (16 GB)
- **Processor binding**
<http://www2.cisl.ucar.edu/docs/bluefire/running-jobs?tab=3>

Lynx



Computing System – Lynx

Single-cabinet Massively Parallel Processing Supercomputer

- Operating system: Cray Linux Environment
 - Compute Node Linux (CNL) – based on SuSE Linux SLES 10
- Batch System:
 - MOAB workload manager
 - Torque (aka OpenPBS) resource manager
 - Cray's ALPS (Application Level Placement Scheduler)
- File system: Luster file system

Computing System – Lynx

- 76 compute nodes (**8.026 TFLOPS peak**)
 - 12 processors per node, 912 compute processors
 - Two hex-core AMD 2.2 GHz Opteron chips
 - Each processor has 1.3 GB of memory and totaling 1.216 TB of memory in the system.
- 10 I/O nodes
 - A single dual-core AMD 2.6 GHz Opteron chip and 8 GB of memory
 - 2 login nodes, 4 nodes reserved for system functions
 - 4 nodes are for external Lustre file system and GPFS file system testing

Compilers on Lynx

- **Available compilers**
 - PGI Programming Environment
 - EKOPATH ("PathScale") Compiler Suite
 - Intel Compiler Suite
 - GNU Compiler Collection
- **Load the corresponding PrgEnv-xxx module to change compilers**
 - ftn: Fortran programs
 - cc: C programs
 - CC: C++ programs
- **More information**
 - <https://www2.cisl.ucar.edu/docs/lynx/compilers>

A job script on Lynx

```
#!/bin/bash  
#PBS -q workshop  
#PBS -l mppwidth=60      ###Number of Processors  
#PBS -l walltime=01:30:00  
#PBS -N example  
#PBS -e testrun.$PBS_JOBID.err  
#PBS -o testrun.$PBS_JOBID.out  
  
cd $PBS_O_WORKDIR  
aprun -n 60 ./My_Prog.exe
```


Submit, Delete, and Monitor Jobs on Lynx

- **Submit a job**
 - `qsub batch_script`
- **Check job status**
 - `qstat -a`
 - `showq`
- **Delete a job**
 - `qdel jobid`

HPSS



HPSS Introduction

- High Performance Storage System (12+ PB of data)
- Hierarchical Storage Interface (HSI) is the primary interface supporting for data transfer to/from HPSS along with metadata access and data management.
- HPSS Tape Archiver (HTAR) is used to package files on your file system to a single archive file and then send it to HPSS.
- HPSS files have NO expiration date. They remain in the archive until they are explicitly deleted. Once deleted, they cannot be recovered.

Hierarchical Storage Interface (HSI)

- **POSIX like interface**
- **Different ways to invoke HSI**
 - Command line invocation
 - **hsi** cmd
 - **hsi** cget hpssfile (from your default dir on HPSS)
 - **hsi** cput myfile (to your default dir on HPSS)
 - Open an HSI session
 - hsi to get in and establish session; end, exit, quit to get out
 - restricted shell-like environment
 - hsi "in cmdfile"
 - File of commands scripted in "cmdfile"
- **Navigating HPSS while in HSI session**
 - pwd , cd, ls, cdl
 - <http://www2.cisl.ucar.edu/sites/default/files/HSI-command.pdf>

Data Transfer

- **Writing data – cput command**

- `[HSI]/home/user1> cput file.01`
- `[HSI]/home/user1> cput file.01 : new.hpss.file`

- **Reading data – cget command**

- `[HSI]/home/user1-> cget file.01`
- `[HSI]/home/user1-> cget file.01 : hpss.file`

GLADE centralized file service

- **The Globally Accessible Data Environment :**
- **High performance shared file system technology**
- **Shared work spaces across CISL's HPC resources**
- **Multiple different spaces**
 - /glade/home/username 10 TB
 - /glade/users/username 80 TB
 - /glade/scratch/username 204 TB
 - /glade/proj* 555 TB

GLADE centralized file service

A centralized file service (Bluefire, Lynx, Mirage)

- **User home directory :**
 - /glade/home/username
 - 10 GB quota per user
 - Backup
- **Scratch (temporary computational space):**
 - /glade/scratch/username
 - 2 TB quota per user
 - NO Backup

Data Analysis and Visualization

- **Data Analysis and Visualization**
 - High-end servers available 7 x 24 for interactive data analysis, data-post processing and visualization
- **Data Sharing**
 - Shared data access within the lab
 - Access to the NCAR Archival Systems and NCAR Data Sets
- **Remote Visualization**
 - Access to visual computing platforms from the convenience of your office using tcp/ip based remote image delivery service
- **Visualization Consulting**
 - Consult with CISL staff on your visualization problems

Working on Mirage/Storm

- **Log on to 'mirage'**
 - `ssh -X -l username mirage[0-2].ucar.edu`
 - One-time password using CryptoCard or Yubikey
 - Use 'free' or 'top' to see if there is currently enough resources
- **Development environments**
 - Intel C, C++, F77, F90
 - GNU C, C++, Fortran, Tools
- **Software tools**
 - VAPOR, Paraview
 - NCL, NCO, NCARG, IDL
 - Matlab, R
 - ImageMagick

Yellowstone Environment

- **Petascale computing resource**
NCAR-Wyoming Supercomputing Center in Cheyenne, Wyoming
- **Production computing operations is expected to begin in summer/fall 2012.**
 - Computing resources: 30 times the workload throughput of NCAR's current Bluefire supercomputer
 - New centralized file system and data storage system (GLADE): 15 times the sustained I/O bandwidth and 12 times the capacity of CISL's current GLADE system
 - Combined data analysis and visualization (DAV) systems (Geyser and Caldera): 20 times increase in CISL's dedicated DAV resources
 - High Performance Storage System (HPSS): expanded more

Future Reference

- Bluefire User Guide
<http://www2.cisl.ucar.edu/docs/bluefire-user-guide>
- Lynx User Guide
<http://www2.cisl.ucar.edu/docs/lynx-user-guide>
- Mirage/Storm User Guide
<http://www2.cisl.ucar.edu/docs/mirage-storm>
- Glade File System
<http://www2.cisl.ucar.edu/resources/glade>
- HPSS User Guide
<http://www2.cisl.ucar.edu/docs/hpss>

User Support

- **CISL Homepage:**
 - <http://www2.cisl.ucar.edu/>
- **CISL Consulting Services**
 - NCAR Mesa Lab Area 55, Floor 1B
- **CISL HELP**
 - Call (303)497-2400
 - Email to cislhelp@ucar.edu
 - Submit an extraview ticket