Introduction to UNIX

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Presented by Nancy Rowe

The Minnesota Supercomputing Institute for Advanced Computational Research

www.msi.umn.edu/tutorial/
UNIX

- UNIX is the operating system of choice for engineering and scientific workstations.
- The variant of UNIX found at MSI and most widely in use around the world is GNU/Linux.
- MSI currently uses CentOS Linux. There are many other distributions (RedHat, Ubuntu, Debian)
- MSI has largely standardized on x86/x86_64 hardware (Intel/AMD microprocessors)
UNIX

• Originally developed in the late 1960s.
• Unix is flexible, secure and based on open standards.
• Programs are often designed ‘to do one simple thing right’.
• Unix provides ways for interconnecting these simple programs to work together and perform more complex tasks.
• Most MSI systems are actually “Unix-Like”, or “*nix” systems – includes UNIX, IRIX, Linux, etc.
What’s the difference between Linux and UNIX?

• Linux is a UNIX clone
• Linux is an operating system kernel
• UNIX is a certification for operating systems
• UNIX is a trademark
• The terms are often used interchangeably
UNIX

- **Kernel**
  - The OS core (memory management, cycle scheduling, enforcing permissions, security)

- **Shell**
  - Our interface to the computer. At MSI you will use the BASH shell, but there are others

- **Utilities**
  - A set of tools for accomplishing universal functions like editing and viewing files, sorting data, compiling code, and much, much more.
UNIX

- UNIX is a development environment.
  - compilers (GNU, Intel, Pathscale, PGI)
  - interpreters (Python, Perl, Ruby)
  - text editors (VI, emacs, nedit, gedit)
  - batch capabilities (PBS, scripts)
  - multiuser capabilities
  - command line driven
Getting Started

- MSI account.
- Open a terminal while sitting at the machine.
- A shell provides an interface for the user to interact with the operating system.
- BASH is the default shell at MSI.
- Alternatively, see the following links for information concerning remote access from your machine.

www.msi.umn.edu/labs/remote.html
FAQ

Most of the commonly asked questions can be answered through our FAQ located at

www.msi.umn.edu/support/faq
Accessing machines while at MSI

- `ssh [options] machine`
  - `[options]`
    - `-X` set up environment to port graphics
    - `-Y` for Macs
  - `machine`
    - `itasca, koronis, calhoun, etc`
- User
- Examples:
  - `ssh –Y rowe@itasca.msi.umn.edu`
  - Encrypted login to remote machines
  - `$ man ssh`
  - See the MSI home page for a full listing of lab and core machines
Remote Login from outside MSI

Login to the bastion host

\texttt{login.msi.umn.edu}

Use isub or ssh to connect to other machines

- isub is an MSI specific command
- Expects bash shell
- Syntax:
  \begin{verbatim}
  ssh [-X][-Y] [user@]host1
  \end{verbatim}
- Examples:
  \begin{verbatim}
  ssh -Y rowe@login.msi.umn.edu
  isub
  or
  isub --noprofile
  \end{verbatim}

Use NX

- Remote graphical connection
- Expects bash shell
- Download client

\url{https://www.msi.umn.edu/support/nx/3.5}

*Users cannot launch software directly on login.msi.umn.edu*
isub

The command isub is a wrapper to ssh and qsub, designed specifically for interactive use. Isub is unique to MSI.

Example:

```bash
isub -n nodes=1:ppn=4 -m 16GB -w 24:00:00
```

Check [https://www.msi.umn.edu/isub](https://www.msi.umn.edu/isub) for more details.

Whether you are connecting through nx.msi or login.msi, you cannot run any software directly on that node.
qsub

#!/bin/bash -l
#PBS -l nodes=1:ppn=1,mem=1gb,walltime=01:00:00
#PBS -m abe
cd /home/msi/username/Testpbs
module load intel
./test < input.dat > output.dat

Submit job: qsub script.pbs
Check status: showq -u username

More details can be found at https://www.msi.umn.edu/labs/pbs
MSI File System

Full path is /home/support/chityala
The Anatomy of a Command

% ls –alrth /scratch

ls (command or utility name)

-alrth (options – modify behavior of the command)

/scratch (argument – what is being operated on)
Basic Commands

ls (-l, -rt, -h)
mkdir
cd
man
info
cp (-r)
mv
ssh (-X, -Y)
scp (-r)
w, uptime
rmdir
rm (-r,-f)

Note that “rm –rf *” is one of the most dangerous commands in the universe.

list contents of the directory
make a new directory
change into a directory
open the manual
open the documentation
copy a file
move or rename a file
login remotely
copy files to/from a remote machine
find who else is logged in
remove a directory
remove a file
Text editing

- vi
- emacs
- nedit, gedit – graphical, work similar to Notepad or TextEdit
Get help on a command

- man ls
  - CTRL+F pages forward
  - CTRL+B pages back
- The ‘up’ and ‘down’ arrows allow finer grain control
- “:q” quits the help file
- apropos
Command Completion

• **TAB**
• Finishes the current command, filename, directory or shows any of the above that match the current string.
• Learn to use **TAB** often!
Running software

• Modules
  – module load software
  – module avail software

  – Example of running software:
    module load avizo
    avizo
Stay Organized

• Keep your files arranged
  – System studied
  – File Type
  – Date
  – Program used
• Make directories, subdirectories, subsubdirectories, subsubsubdirectories and so on.
• Name your files carefully. **Avoid use of spaces in file names** – it’s usually allowed but requires extra work to use, in practice.
Caveats

• If you delete a file, it’s GONE! There is no “Recycle Bin” step. The file may be able to be recovered from a backup by contacting help@msi.umn.edu.

• If you overwrite a file it has been changed forever.

• Home directories are backed up nightly.

• The scratch spaces are not backed up.
Physical access to labs

- Every lab needs card access
- Contact help@msi.umn.edu for more information
File transfer

• Files can be transferred to MSI Linux storage using SCP or SFTP or RSYNC

  ```
  scp [[user@]host1:]filename1[[user@]host2:]filename2
  scp temp.ps login.msi.umn.edu:/scratch/temp.ps
  ```

• Files can be transferred to MSI Windows machines using options in remote desktop connection
Data storage

- Home directories in labs and HPC systems
- Scratch directories in labs and HPC systems
- Lustre file system in Itasca
- **shared** space for group collaboration
- **public** space for world access
Wrap up Questions

• Your feedback is extremely important to us. Is there a topic you would like to see covered in this or another workshop?
For help

- By email
  help@msi.umn.edu
- Web
  www.msi.umn.edu
- Phone
  612-626-0802
- By appointment
END
Make Directory

```
mkdir sandbox
mkdir sandbox/scratch
```
Copy

cp [options] existing_file new_file

cp file1 file2

cp sandbox sandbox2 (does not work)

cp –r sandbox sandbox2
Change Directory

```
  - cd project2
  - cd ..
  - cd project2/quantum
  - cd ../..
  - cd ~
  - cd
  - cd .
```
Permissions

- Each of the 10 bits are either ‘True’ or ‘False’
- directory
  - owner Read, Write, eXecute
  - group Read, Write eXecute
  - others Read, Write eXecute
  - Read = 4, Write = 2, eXecute = 1
chmod

cchmod [options] mode file1 …

• rwx – read, write, execute
• ugo – user, group, others
• ls –l to see rwx permissions for the user, group, and others
• chmod +x, -x, +r, -r, +w, -w
• chmod 777, 755, 700, 500
Permissions (rwx)

- `ls -l` to see rwx permissions for the user, group and others.

```
% -rw-r--r-- 1 pratik staff 342016 Jan 24 14:30 TCL.xls
```

```
% chmod [options] mode filename
```

```
ugoa    755
+-=      
```

```
755
```

http://catcode.com/teachmod/try_1.html
http://catcode.com/teachmod/numeric2.html
Questions?

- Basic commands, options, arguments, permissions, chmod
Configuration Files

.bashrc is sourced each time you login

module load schrodinger
alias ll “ls -lrth”
Regular Expressions

- Character or set of characters that define a pattern.
  - `?` single character wild card
  - `*` wild card, any number of characters
  - `~` home directory of current user
  - `~name` home directory of user *name*
  - `.` current directory
  - `..` parent directory (one up)
  - `[0-9]` any single digit
tar, gzip, bzip

• tar: creating one file from many, does not automatically suggest compressed
• zip: compressing files
• bzip, gzip: compression algorithms

tar –czvf new.tar.gz file1 file2 directory1
tar –xzvf new.tar.gz
grep

- Search for a string
- Can be used on files, or have input piped.
Redirects and Pipes

- >  Output re-direction, overwrite.
- >> Output re-direction, append.
- <  Input re-direction.
- |  Pipe output to a new command.
Open Office

• At the command line, type
  – oowriter (word processor)*
  – oocalc (spreadsheet)*
  – gimp (image manipulation program)
  – acroread – (read PDF files)

* part of ooffice