Linux Workshop

What is Linux?

- The 1st Unix OS was Developed at Bell laboratories in Murray Hill, New Jersey, in 1969.
  - Macintosh OS (1979)
  - DOS - Disk Operating System (1980, Tim Paterson)
  - Linux (1991, Linus Torvalds)
- Linux is a popular operating system
  - Stable, Fast, Secure and Powerful
  - Designed for multi-user and multi-tasking
  - Easy to share data and programs securely
- Command line is not user friendly
  - "Unix is user friendly, it is just particular about who its friends are."
- Available for almost all hardware.
- Common Linux Operating Systems
  - Ubuntu, Fedora Core, Centos, Red Hat, SUSE, etc
Shared Resources

- CPU (Central Processing Unit) - Allocation to a process based on a priority scheme
- Memory
  - RAM (Random Access Memory): Used for fast access to data of a program
  - SWAP: Slower because the program needs to read/write the data needed from the hard drive. Swapping refers to moving entire processes in and out of main memory to disk.
  - `free` is a Linux command to show memory availability
- Disk (Hard Drive(s))
  - On small systems, the user normally has access to the entire disk space available in the home and scratch partitions.
  - On larger systems, the user is limited to the disk space allocated to users via a quota system.

Setting up an account

- Username/User ID - unique name on a machine - often your TAMU netid
- Password – 8 or more characters that must contain a number or special character or both
- Shell - a program that lets the user communicate with the Linux kernel.
  - Great information about shells: [www.linfo.org/shell.html](http://www.linfo.org/shell.html)
  - **Bash shell (bash)** - most commonly used shell on Linux systems
  - Bourne shell (sh) – often used for system administration.
  - C shell (csh)
    - T-shell (tcsh) - historically, most commonly used shell on UNIX systems
  - Kourne shell (ksh) – most commonly used on IBM/AIX systems
  - See [http://www.freebsd.org/ports/shells.html](http://www.freebsd.org/ports/shells.html) for a long list of shells (zsh, ash, dash, fish, mudsh, etc)
Directives used in this Lecture

- **Bold** words should be entered explicitly
- *Italicized* words are variable depending on the information that the utility needs
- \_ symbol is used to represent a space
- \_\_ symbol is used to represent the enter/return key

Bash Shell Control

- **Prompting**
  - Bash prompt can be defined by the PS1 variable:
  - `PS1="\[\u@\h \W\] : "`
  - `# [username@hostname folder] :`
  - `# [mouse@terra Linux] :
  - An active prompt means that the shell is ready for you to type a command.

- **Command Interpretation and Execution**
  - When a command is typed at the prompt, the Shell processes the command and sends it to the Linux kernel.
  - example: `[mouse@terra ~] : ls .`
  - `[mouse@terra ~] :` is the prompt and `ls` is the command
  - `ls` is a command to list all the files in the current directory
  - more about commands later…
  - Each shell has its own scripting language

A scripting language is a programming language that supports scripts: programs that automate the execution of tasks that could alternatively be executed command line. Scripting languages are often interpreted (rather than compiled).
Customizing the Environment

- Two important files for customizing your Bash Shell environment
  - `.bashrc` (prounced dot bashrc)
    - contains aliases, shell variables, paths, etc.
    - executed (sourced) upon starting a non-login shell.
  - `.bash_profile` (dot bash_profile)
    - also can contain aliases and shell variables
    - normally used for terminal settings
    - executed (sourced) upon login
    - if `.bash_profile` doesn't exist, the system looks for `.profile` (dot profile)
- `_.bashrc` (or `source _.bashrc`)
  - Executes the commands in the `.bashrc` file
  - The `_` character will be used to represent a space

```
# Settings for an interactive shell
if [ ! -z "$PS1" ]; then  # test to see if the variable PS1 is set
  PATH="$PATH:$HOME/bin:.
  # change what the prompt looks like
  PS1="\u@\h [ \v ]: 
  # mouse@terra [123]:
  fi

# personal aliases
alias h= "history | more"
alias m="more"
alias ll= "ls -la"
alias ls= "ls -CF"
alias rm= "rm -i"
alias cp= "cp -i"
alias mv= "mv -i"
alias x="chmod u+x"
alias vmd= "/apps/vmd/vmd-1.9.2/bin/vmd"

# A line that begins with a # is a comment
```

PATH variable is a list of folders. When you type in a command, the operating system has to find that command. The OS searches for the command in each folder that you list in your PATH variable in the order that they appear. This is true on Windows and Mac.
.bashrc file contents (variables and functions)

# Syntax to set a local variable
#  varname=value
# Syntax to set a global variable
#  export varname=value
# Syntax to set an alias
#  alias name="value"
# Syntax to create a function
#  function name(){command;}

# Settings for the variables for the quantum code Gaussian09
export g09root=/usr/local/g09
  . $g09root/g09/bsd/g09.profile
# the previous line executes
#  . /usr/local/g09/g09/bsd/g09.profile
# because g09root is set to /usr/local/g09

function cc() { awk -f cc.awk "$@".log>"$@".cc ; }
# If you type cc test at the prompt, the following command will be executed:
#  awk -f cc.awk test.log > test.cc

Simple Utilities

- **Bold** words should be entered explicitly
- *Italicized* words are variable depending on the information that the utility needs
- _ symbol is used to represent a space
-  symbol is used to represent the enter/return key
- `man command` or `info command`
  - displays manual entry for command
- `man-k keyword` or `apropos keyword`
  - lists all manual entries that contain your keyword
- `passwd` - sets or changes your password
  - if passwd doesn’t work, check the documentation for the machine and then ask the administrator for assistance.
Simple Utilities

- **logout** or **exit** - closes a terminal or ssh session
- **date** - displays the current date and time (not necessarily the correct date or time)
- **clear** - clears your screen
- **hostname** - prints the hostname to the screen
- **whereis** _command_ - find a program
- **locate** _command_ - find a file (program, dir, file, etc)
- **ctrl-c** (^c) - interrupts a process (avoid this as it can leave garbage/temporary files on the system)
- **^z** (ctrl-z) - Stops a process, but does NOT terminate it
  - **bg** - puts the suspended process into the background
  - **fg** - puts the suspended process into the foreground

File System Hierarchy

```
Root Directory (/)
```

```
<table>
<thead>
<tr>
<th>bin</th>
<th>home</th>
<th>tmp</th>
<th>usr</th>
</tr>
</thead>
<tbody>
<tr>
<td>many more</td>
<td>many more</td>
<td></td>
<td>many more</td>
</tr>
<tr>
<td>directories</td>
<td>directories</td>
<td></td>
<td>directories</td>
</tr>
<tr>
<td>training</td>
<td>mouse</td>
<td></td>
<td>local</td>
</tr>
<tr>
<td>many more</td>
<td>many more</td>
<td></td>
<td>g09</td>
</tr>
<tr>
<td>directories</td>
<td>directories</td>
<td></td>
<td>many more</td>
</tr>
</tbody>
</table>

```

```
/home/mouse
```

```
/home/mouse/Project1
/home/mouse/Project2
```
File System Hierarchy

- **pwd**: prints your current working directory
- **cd**: changes to your home directory (change directory)
- **cd name**: change directory to name
  - absolute pathnames (start with a forward slash /)
    - cd/home/mouse/Project1
  - relative pathnames (do NOT start with a /)
    - current directory
    - parent directory
    - home directory
- **cd../tmp**
- **cd..**
- **cd~**
- **cd~/Project1**
- **cd~/training**

Managing Files & Directories

- **Editors**
  - Graphical text editors: gedit, nedit, xemacs, kedit, ...
  - Command driven (non-graphical) text editors: vi, emacs, ...
    - powerful and fast editors that may be used at any interface, but they are not user friendly.

- **File and Directory Names**
  - Do NOT use spaces (use _ or - instead but don't start a filename with -), meta, special or reserved characters
  - No, no, no, and no: * ? $ / \ { } [ ] ; : ' ` " & Tabs ! @ ( ) < >
  - A file cannot have the same name as the directory where it resides.

- searching for a file or directory
  - **whereis filename**
  - **locate filename**
  - **find -name 'search string' -print**
    - **find -name '*test1*' -print**
    - searches for any file or directory with the string test1 in it from the current directory and down the hierarchy (-iname makes the search case insensitive)
Managing Files & Directories

- Printing directory contents to the screen
  - `ls` - lists contents of working directory
  - `ls_dirname` - lists the contents of the directory specified by `dirname`
  - `ls` (flags)
    - `-a` print hidden files
    - `-l` print long listing
    - `-F` print a special character after special files
    - use `man ls` to find all possible flags
  - `tree` - recursive directory listing

- Printing file contents to the screen
  - `cat filename`, `less filename`, `more filename`, `page filename`
  - `head` `-n filename` (where `n` is an integer)
  - `tail` `-n filename`
  - `tail` `-f filename`
  - Display the last 10 lines of a file and waits for new lines – `ctrl-c` (\^c) to exit.

Managing Files & Directories/Folders

- Making a directory (dir)
  - `mkdir dirname` (creates a directory in the current dir)
  - `mkdir tmp` (creates the directory `tmp` in the current dir)
  - `mkdir ~/tmp` (creates the directory `tmp` in your home dir)
  - `mkdir /home/mouse/tmp` (created the directory `tmp` in `/home/mouse`)

- Renaming a file
  - `mv oldfilename newfilename` (note: new cannot be a directory name) You need to specify the location of `oldfilename` and `newfilename`. This command specifies the `oldfilename` and `newfilename` are in the current directory because there is nothing in front of the names.

- Move a file into a new directory
  - `mv filename dirname` (note: `dirname` must be a directory that already exists.)
  - retains the filename but moves it to the directory `dirname`
  - You can rename the file while moving it to a new directory: `mv oldfilename dirname/newfilename`

- Rename a directory
  - `mv olddirname newdirname`

- Safe `mv`
  - `mv -i oldfilename newfilename`
  - `-i` is a flag that modifies the way `mv` behaves. In this case `-i` tells the command to prompt you for permission if you are about to overwrite a file.
Wildcards (globbing)

- * matches any number of characters
- ? matches any single character
- [ ] matches a single character for a specified range of characters given in the brackets
- {} matches a list of patterns separated by a comma within the curly brackets

Examples:
- `mv_.proj1*~/Project1` moves all files beginning with proj1 into dir Project1
  - Note: the dir Project1 must already exists in your home dir
- `ls_proj?.log.` lists all files where ? can be any one character
- `mv_enzyme[12].com_enzyme.` moves enzyme1.com and enzyme2.com into dir enzyme
- `mv project{*.com,*.log,*.txt}~project1-5` moves all files that start with project and end with .com, .log, or .txt to the directory project1-5 that already exists.

Managing Files & Directories

- Making a copy of a file
  - `cp_oldfilename_newfilename` makes a copy of the file named oldfilename and names it newfilename in the current directory
  - Note: newfilename cannot be the name of a directory

- Copying a file to a new directory
  - `cp_filename_dirname` makes a copy of the file named filename to the directory named dirname
  - Note: dirname must already exist

- Copying a directory
  - `cp-R_olddirname_newdirname` makes a complete copy of the directory named olddirname including all of its contents, and names it newdirname in the current directory
  - Note: newdirname cannot be the name of a directory that already exists

- Safe copy
  - `cp-i_oldfilename_newfilename` will prompt you if you are about to overwrite a file named newfilename
Managing Files & Directories

- Deleting a file
  - `rm filename`
  - Deletes the file named `filename` forever!

- Deleting a directory
  - `rmdir dirname`
    - Deletes an empty directory named `dirname`
    - `rm -r dirname`
      - Removes the directory named `dirname` and all of its contents forever!

- Safe delete
  - `rm -i filename`
    - Will prompt you for confirmation before deleting `filename`

- Warning! Once a file is deleted or overwritten it is gone. Be VERY careful when using wildcards. `rm -r *` will remove everything from that directory and down the directory hierarchy!

Searching File Contents

- `grep search-pattern filename`
  - Searches the file `filename` for the pattern `search-pattern` and shows the results on the screen (prints the results to standard out).

- `grep "Energy" run1.out`
  - Searches the file `run1.out` for the word `Energy`
  - `grep` is case sensitive unless you use the `-i` flag

- `grep "Total Energy" *.out`
  - Searches all files in that end in `.out`
  - You must use quotes when you have blank spaces. This example searches for `Total Energy` in every file that ends in `.out` in each directory of the current directory

- `grep -- recursive Project1`
  - Searches recursively all files under `Project1` for the pattern `Total Energy`
Searching File Contents

- `egrep` \( ^\text{pattern1}|\text{pattern2}|\text{etc} $\) filename
  - searches the file filename for all patterns (\textit{pattern1}, \textit{pattern2}, etc) and prints the results to the screen.
  - The \( | \) character is called a pipe and is normally located above the return key on the keyboard.
  - `egrep` \( ^\text{Energy}|\text{Enthalpy}*$\).out
  - searches for the word Energy or Enthalpy in every file that ends in \textit{.out} in the current directory.

File Attributes

```bash
ls -l
```

- lists the files in the dir in long format
  - Note: the flag is the letter \texttt{l} and not the number \texttt{1}

```
-rwxr-xr-- 1 training lms 30 Oct 28 13:16 Molden
```

- \texttt{1} hard link count
- \texttt{training} file owner
- \texttt{lms} group ID
- \texttt{30} file size
- Oct 28 13:16 time the file was last modified
- Molden filename
Permissions

- To change the read, write and executable permission for users (u), group (g), others (o) and all (a)
- `chmod_u+x_filename` (or `dirname`)
  - adds executable permission for the user
- `chmod_og-r_filename` (or `dirname`)
  - remove read permission for group and others
- `chmod_-R_u+x_filename` (or `dirname`)
  - give everyone read and executable permission
    from `dirname` and down the hierarchy
- `chmod_u=rwx_filename` (or `dirname`)
  - sets the permission to rwx for the user
- `chmod_g=filename` (or `dirname`)
  - sets the permission to --- for the group
- You can also use numbers
- `r = 4, w = 2, and x = 1, - = 0`
- `chmod_755_filename` (result `-rwX-xr-x`)
- `chmod_600_filename` (result `-rwx---`)

Example:
```
-rwxr-xr--  1 training  lms  30 Oct  28  13:16 Molden
```
- `User` has read, write and executable permission
- `Group` has read and executable permission but not write permission
- `Other` has read permission but not write or executable permission
Ownership/Groups

- To change the group
  - `chgrp _groupname_filename`, (or `dirname`)
  - Changes the group for `filename` or for `dirname` but not for the files contained within `dirname`
  - `chgrp -R _groupname_dirname`
  - Changes the group for all of the files and directories down the hierarchy from `dirname`
  - Example: `chgrp -R lms_training`

- Change owner
  - `chown _username_filename`, (or `dirname`)
  - Changes the owner of `filename` or `dirname` but not for the files contained within `dirname`
  - `chown -R _username_dirname`
  - The `chown` and `chgrp` command is not allowed for users by default on many Linux OS's

- Change owner and group
  - `chown _username:groupname_filename`
  - `chown _username:groupname_filename`

Managing Disk Usage

- Most large machines impose a quota system for users
  - Displays your disk allotment and usage: `quota -v` and/or `mmlsquota`
- `df -h`
  - Displays the available file systems in the easiest readable unit.
  - `mouse@lms12[1000]$: df -h`
    - `Filesystem` `Size` `Used` `Avail` `Use%` `Mounted on`
    - `/dev/nvme0n1p3` 50G 12G 39G 23% /
    - `devtmpfs` 7.8G 0 7.8G 0% /dev
    - `/dev/nvme0n1p7` 152G 346M 152G 1% /scratch
    - `/dev/nvme0n1p5` 10G 33M 10G 1% /tmp
    - `/dev/nvme0n1p6` 10G 2.5G 7.6G 25% /var
    - `/dev/sda1` 233G 51G 183G 22% /work
    - `/dev/nvme0n1p2` 497M 277M 221M 56% /boot
    - `/dev/nvme0n1p1` 200M 18M 183M 9% /boot/efi
    - `license:/home` 20T 13T 7.6T 62% /home
    - `license:/apps/lms` 392G 347G 26G 94% /apps
    - `tmpfs` 1.6G 16K 1.6G 1% /run/user/42
- Disk starting with `/dev` should indicate that it is "local" disk (reasonably fast access disk)
- Disk starting with a network address indicates that it is network mounted disk (slow/slower access)
- `du -sh` prints your disk usage
Compressing Files

- Compressing files
  - `gzip filename`
    - zips-up filename and creates filename.gz
  - `gzip -v filename`
    - zips-up filename in a verbose manner (tells you % compression)
  - `gzip -r dirname`
    - zips-up all files down the hierarchy from dirname
  - `gunzip filename.gz`
    - unzips filename.gz and creates filename
  - `bzip2 filename`
    - zips-up (compresses) filename and creates filename.bz2 (or .bz or .bzip2)
  - `bunzip2 filename.bz2`
    - unzips filename

Archiving Files/Directories

- `tar -cpvf filename.tar filenames` (or `dirnames`)
  - Archives filenames and/or dirnames into the file filename.tar
  - It is best to zip-up your files before archiving them.
- `tar -xpvf filename.tar`
  - Extracts the contents of filename.tar

- some of the tar flags
  - -c creates a new archive
  - -x extract files and/or directories form the archive
  - -p preserve protection information
  - -v verbose
  - -f working with files
  - -t lists the table of contents for an archive
Redirecting Input and Output

- Redirecting output
  - `>` symbol redirects output
  - `command>outputfilename`
  - `ls -al>list-of-files.txt`
  - `>>` symbol appends to the end of the file instead of overwriting it.
  - `ls -al>>list-of-files.txt`

- Redirecting input
  - `<` symbol redirects input
  - `program<inputfilename`
  - `g09<run1.com`
  - output would go to standard out (ie monitor)

- Redirecting input and output together and running in the background
  - `program<inputfilename>outputfilename&`
  - `g09<run1.com>run1.log&`

Pipes

- Pipes `|`
  - takes the output of one command and sends it to another
  - `ls | more` or `ls | less`
  - List the files one page at a time
  - `grep _Energy_ run1.out | grep _HF_`
  - `grep _Energy_ run1.out | grep _HF > HF_output.txt`
  - Searches a file named run1.out for the word Energy and then searches for the word HF in the lines that have the word Energy. The resulting information is then sent to a file named HF_output.txt
history, !, ↑, ↓, & tab completion

- **history**: (usually aliased to h-)
  - The history command will list your last n commands (n = integer).
- **!!**: repeats your last command
- **!n**: repeats the nth command
  - You can find the number of the command using history
- **!name**: repeats the last command that started with name
  - You can use the up (↑) and down (↓) arrow keys to scroll through previous commands
- **Tab**: will try to complete the rest of the file/directory name you are typing
  - If you have three files that start with x (xrun15 xrun16 and xrun17) then typing x and then tab will result in xrun1 at the prompt and you would have to type in the last character. On some systems, if you hit the tab key twice it will result in xrun1 at the prompt and list the 3 files that match.

Managing Processes

- **top**: shows all processes in a table
  - **q**: will exit the top process
  ```
top - 22:26:17 up 89 days,  5:25,  1 user,  load average: 8.00, 8.01, 6.92
Tasks: 279 total,  9 running, 270 sleeping,  0 stopped,  0 zombie
Cpu(s): 98.9%us,  1.1%sy,  0.0%ni,  0.0%id,  0.0%wa,  0.0%hi,  0.0%si,  0.0%st
Mem:  24728124k total,  2533328k used, 22194796k free,   166776k buffers
Swap:  4095996k total,        0k used,  4095996k free,  1549420k cached

PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
26469 mouse 20  0 15.9g 363m 6196 R 100.4  1.5   3:08.78 l502.exe
25404 mouse 20  0 15.9g 363m 6196 R 100.1  1.5  30:27.45 1502.exe
26468 mouse 20  0 15.9g 363m 6196 R 100.1  1.5  30:08.77 1502.exe
26470 mouse 20  0 15.9g 363m 6196 R 100.1  1.5  30:08.72 1502.exe
26471 mouse 20  0 15.9g 363m 6196 R 100.1  1.5  30:08.77 1502.exe
26472 mouse 20  0 15.9g 363m 6196 R 100.1  1.5  30:08.74 1502.exe
26473 mouse 20  0 15.9g 363m 6196 R 100.1  1.5  30:08.64 1502.exe
26474 mouse 20  0 15.9g 363m 6196 R 99.7  1.5  30:08.40 1502.exe
26621 mouse 20  0 15160 1380  952 R  0.0  0.0  0:00.02 top
```
Managing Processes

- `ps -u username` (list all of the processes for username)

```
[mouse@vici ~]$ ps -u mouse

PID TTY          TIME CMD
26780 ?        00:00:00 sshd
26781 pts/6  00:00:00 bash
27756 pts/6  00:00:00 nedit
28362 pts/6  00:00:00 ps
32432 ?        00:00:00 sshd
32433 pts/3  00:00:00 bash
32626 pts/3  00:00:00 vim
```

- `kill pid` kills the process with pid (process id number (PID)) nicely
- `kill -9 pid` kills the process with pid without remorse – not nice or clean…
- To kill the nedit process: `kill 27756`
- Check to see if it is gone (ps -u mouse) and if it is not, use: `kill -9 27756`

Computer Networking

- Secure Shell (ssh) - Used to access a remote machine through a secure protocol
  - `ssh username@remotehostname` (username is different on the remote machine)
  - `ssh remotehostname` (username is the same on the local and remote machines)
    - `ssh ada.tamu.edu`
    - `ssh ada`
    - `ssh mouse@ada.tamu.edu`
    - `ssh mouse@ada`
    - The first time that you ssh to a machine from the local host, it will ask you for permission. You must type `yes` to continue (`y` will not work).
    - You will be prompted for your password
Graphics Across the Network

- If you are using ssh and need to run a graphical application remotely, you may need to try the commands and/or settings in the following order until one of them works.
  - `ssh -X username@remotehostname`
  - On older machines, you may need to use:
    - `ssh -Y username@remotehostname`

Secure File Transfer Protocol (sftp)

- sftp is used to transfer files between unix/linux machines
- `sftp remotehostname` or `sftp username@remotehostname`
  - sftp will ask you for your password and the first time you sftp to a machine it will ask you for permission. You must type `yes` to continue (`y` will not work).
- commands used in the sftp session
  - `get filename` - copies filename from the remote machine to the local machine
    - Wildcard usage: `get * .out` gets all of the files that end in .out automatically.
  - `put filename` - copies filename from the local machine to the remote machine.
    - Wildcard usage: `put * .out` puts all of the files that end in .out automatically.
  - `ls` - list the contents of the remote machine directory
  - `lls` - list the contents of the local machine directory
  - `cd dirname` - changes the remote machine directory
  - `lcd localdir` - change the local machine directory
  - `mkdir dirname` - makes a dir dirname on the remote machine
  - `lmkdir dirname` - makes a dir dirname on the local machine
  - `pwd` - prints the working directory of the remote machine
  - `lpwd` - prints the working directory of the local machine
  - `bye` or `quit` - exits an sftp session.
  - `!command` - executes a local shell command (i.e. hostname)
Secure copy (scp)

- `scp filename_username@remotehostname:remopath`:
  - `scp run1.out mouse@ada.tamu.edu:`
    - Makes a copy of run1.out located on the local machine to your home directory on ada
  - `scp run1.out ada.tamu.edu:/scratch/mouse/`
    - Makes a copy of run1.out to /scratch/mouse instead of the home directory. This syntax assumes that your username is the same on both machines
- `scp username@remotehostname:filename_localpath`
  - Copies a file from the home directory on the remote host to the current directory on the local machine
- `-r` recursively copy an entire directory (not suggested)
  - `scp -r dirname remotehostname`
    - copies the entire directory heirarchy of dirname to the home directory on the remote machine. Links (ie shortcuts) will cause problems.

Useful flags:
- `-v` debugging/verbose printing
- `-p` preserve modification time, access times and modes

rsync

- rsync finds files that need to be transferred using a “quick check” for files that have changed in certain attributes (size, last-modified time, etc).
- `rsync -avu -e ssh dirorfilename(s) username@remotehostname:remopath`:
  - `rsync Project1 mouse@ada.tamu.edu:`
    - Makes a copy of the directory Project1 located on the local machine to your home directory on ada with the name Project1
  - `-a` archive (preserve permissions, group, owner, and time stamp, copy symbolic links, and copies recursively)
  - `-v` verbose
  - `-u` doesn’t transfer a file if it is newer on the receiving end
  - `-e ssh` use ssh protocol
vi editor

- vi\_filename.\|- opens (creates) a file using vi
- vi\_-R\_filename.\|- opens a file using vi in read-only mode
- view\_filename.\|- same as vi\_-R\_filename.\|

Two modes
  - insert mode
    - for typing in text
    - all keystrokes are interpreted as text
    - i one of the commands that initiates insert mode
  - command mode
    - for navigating the file and editing
    - all keystrokes are interpreted as commands
    - Esc returns the user to command mode

%vi filename.\|
| ~
| ~
| ~

“filename”
starts in command mode
Typing :set\_showmode\ to display in the lower right hand corner what mode you are in (it doesn’t always work properly...)
vi commands

To exit a file or save

- ZZ or :wq or :x - save the file and exit
- :w filename - save the file with the name filename
- :w! - force save
- :q! or :q - quit without saving
- :q quits a file when there have been no changes
- :q! quits the file regardless of changes

Moving around in the file

- h, l (or space), j and k - left, right, down and up
- G - Move to end of file
- ^f (^ = Ctrl-key) Scroll down a full screen
- ^b Scroll up a full screen
- 0 (zero) Move to start of current line
- nG Go to line n

vi commands

- w move forward one word
- b move back one word
- e move to the end of the word

Text Editors

Commands that take you into insert mode

- i insert text to the left of the cursor
- I inserts text at the beginning of the line
- a insert text to the right of the cursor
- A insert text at the end of the line
- o open a line below the cursor
- O open a line above the cursor
- R overwrite text to the right of the cursor
vi commands

- Editor commands that keep you in command mode
  - x deletes a character (the character the cursor is on)
  - dd deletes a line (the line the cursor is on)
  - n/dd deletes n lines
  - dw deletes a word
  - dG deletes to the end of the file
  - D deletes to the end of the line
  - r,a replaces current character with a (a = character, number, etc.)
  - u undo last command (only 1 undo on most unix machines. Most new versions of vi (vim) have multiple undo and redo (Ctrl-r) capability)
  - nyy yank n (n is a number) lines to memory
  - p put the yanked lines below the cursor
  - P put the yanked lines above the cursor

- Editor commands that put you in insert mode
  - cw changes a word to the text that you type it - you have to have the cursor at the beginning of the word

- Miscellaneous commands
  - /name, search forward for name
  - ?name, search backward for name
  - :1,$/pattern1/pattern2/g, from line 1 to the bottom find and substitute pattern1 for pattern2
  - you could also use :%s//pattern1//pattern2//g,
    - % and 1,$ mean the entire file
  - the g means that all occurrences of pattern1 will be substituted in a line and not just the first one
  - :e filename, exits to the file filename
  - ma - marks that line and stores the position in the variable a
  - :a,.y,x,. yanks the lines between the mark a and where the cursor is (.) and stores it in the variable x
  - :pu,x, puts the lines stored in x into the file where the cursor is
  - :r filename, insert the file filename into the current file.
  - :set_all, lists all of the settings
  - :set_number, displays line numbers
Obtaining an Account

- Contact the System Administrator
  - University Machines (terra, ada, curie, and crick at High Performance Research Computing (HPRC) at TAMU)
    - http://hprc.tamu.edu/
  - LMS and/or Chemistry Departmental machines
    - http://lms.chem.tamu.edu/
  - Brazos Cluster
    - http://brazos.tamu.edu
  - Whole System Genomics Initiative (WSGI)
    - https://genomics.tamu.edu/bioinformatics-workspace

Useful Websites and Books

- http://lms.chem.tamu.edu/
- http://hprc.tamu.edu/
- http://www.lynda.com/
- Safari Books Online
  - You must be behind the TAMU Firewall or logged in through the TAMU Library system.
  - http://proquest.safaribooksonline.com/
- Books
  - The O’Reilly series of books are quite good http://linux.oreilly.com/
    - Linux in a Nutshell
    - Essential System Administration
    - sed & awk
    - Programming in Perl
    - and many more