CSE 391
Lecture 3

bash shell continued:
processes; multi-user systems; remote login; editors

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http://www.cs.washington.edu/391/

Lecture summary

- A bit more on combining commands
- Processes and basic process management
- Connecting to remote servers (`attu`)
  - multi-user environments
- Text editors

Review: Redirection and Pipes

- ***command*** **>** ***filename***
  - Write the output of ***command*** to ***filename*** (>> to append instead)
- ***command*** **<** ***filename***
  - Use ***filename*** as the input stream to ***command***
- ***command1*** **|** ***command2***
  - Use the console output of ***command1*** as the input to ***command2***
- ***command1*** **;** ***command2***
  - Run ***command1*** and then run ***command2***
- ***command1*** **&&** ***command2***
  - Run ***command1***, if completed without errors then run ***command2***

Tricky Examples

- Amongst the top 250 movies in movies.txt, display the third to last movie that contains "The" in the title when movie titles are sorted.

- The wc command can take multiple files: wc names.txt student.txt
  - Can we use the following to wc on every txt file in the directory?
    - `ls *.txt | wc`

- Find the disk space usage of the man program
  - Hints: use `which` and du...
  - Does `which man | du` work?

Answers posted in lecture_commands.txt after lecture

Command Substitution

command1 `$(`***command2***`)`

- run ***command2*** and pass its console output to ***command1*** as a parameter;
- best used when ***command2***'s output is short (one line)

- Finish the example!
  - `du $(which man)`

xargs

command	description
`xargs`	run each line of input as an argument to a specified command

- `xargs` allows you to repeatedly run a command over a set of lines
  - often used in conjunction with `find` to process each of a set of files

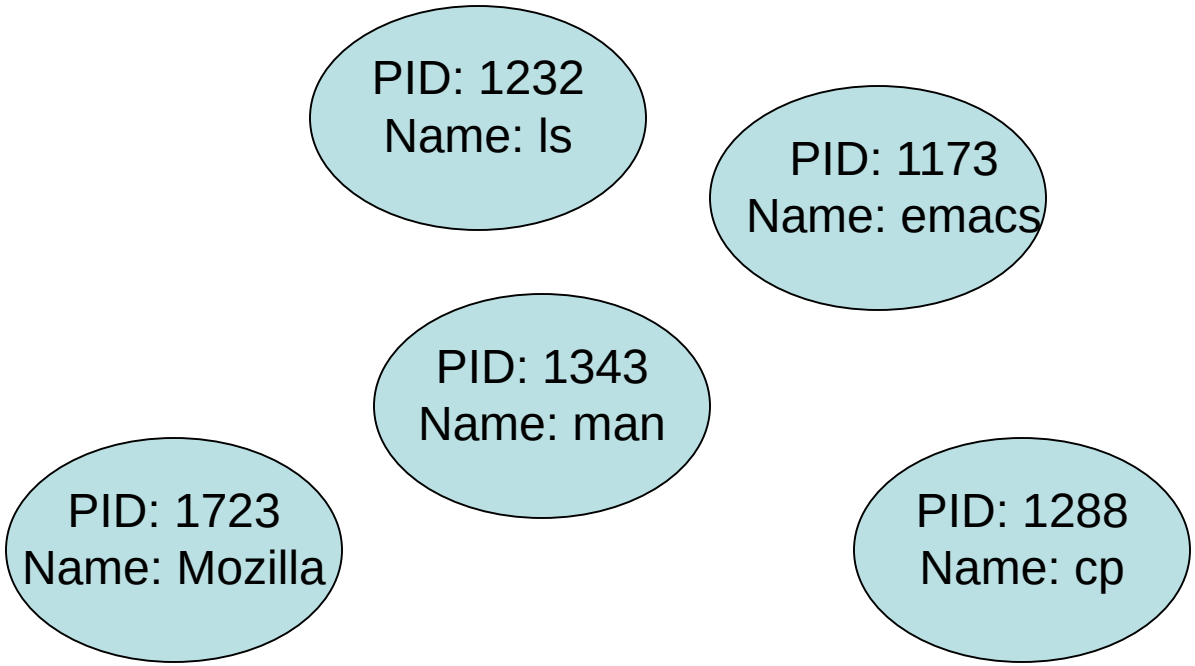
- Example: Remove all my .class files.

```
find ~ -name "*.class" | xargs rm
```

- Find the disk usage of `man` using `xargs`
  - `which man | xargs du`

Processes

- **process**: a program that is running (essentially)
  - when you run commands in a shell, it launches a process for each command
  - Process management is one of the major purposes of an OS



Process commands

command	description
`ps or jobs`	list processes being run by a user; each process has a unique integer id (PID)
`top`	show which processes are using CPU/memory; also shows stats about the computer
`kill`	terminate a process by PID (sometimes –KILL is needed)
`killall`	terminate several processes by name

- use `kill` or `killall` to stop a runaway process (infinite loop)
  - similar to ^C hotkey, but doesn't require keyboard intervention

Background processes

command	description
`&`	(special character) when placed at the end of a command, runs that command in the background
`^Z`	(hotkey) suspends the currently running process
`fg , bg`	resumes the currently suspended process in either the foreground or background

- On the VM, if you run a graphical program like `gedit` or `emacs` from the shell, the shell will lock up waiting for the graphical program to finish
  - instead, run the program in the background, so the shell won't wait:

    ```
    $ emacs homework1.txt &
    ```

  - if you forget to use & , suspend emacs by hitting `^Z` at the TERMINAL (NOT in emacs), then run bg from the terminal
  - lets play around with an infinite process…

Connecting with ssh

command	description
ssh	open a shell on a remote server

- Linux/Unix are built to be used in multi-user environments where several users are logged in to the same machine at the same time
  - users can be logged in either locally or via the network
- You can connect to other Linux/Unix servers with ssh
  - once connected, you can run commands on the remote server
  - other users might also be connected; you can interact with them
  - can connect even from other operating systems

The CSE attu server

- `attu` : The UW CSE department's shared Linux server
  (only available to CSE majors)
- Connect to `attu` by typing:

```
ssh attu.cs.washington.edu
```

(or `ssh username@attu.cs.washington.edu` if your Linux system's user name is different than your CSE user name)

Students with EE accounts may use their departmental servers

All UW students may use UW Linux servers. (how to activate your account)

- Note: There are several computers that respond as attu (to spread load), so if you want to be on the same machine as your friend, you may need to connect to attu2, attu3, etc.

Multi-user environments

command	description
`whoami`	outputs your username
`passwd`	changes your password
`hostname`	outputs this computer's name/address
`w` or `finger`	see info about people logged in to this server
`write`	send a message to another logged in user

- *Exercise* : Connect to `attu`, and send somebody else a message.

Network commands

command	description
`links or lynx`	text-only web browsers (really!)
`ssh`	connect to a remote server
`sftp or scp`	transfer files to/from a remote server (after starting sftp, use get and put commands)
`wget`	download from a URL to a file
`curl`	download from a URL and output to console
`alpine, mail`	text-only email programs

Text editors

command	description
`pico or nano`	simple editors
`emacs`	More advanced text editor
`vi or vim`	More advanced text editor

- you cannot run graphical programs when connected to `attu` (yet)
  - so if you want to edit documents, you need to use a text-only editor

- **most advanced Unix/Linux users learn `emacs` or `vi`**
  - I would recommend you try to pick up the basics of one of these.
  - Your choice!

Aliases

command	description
`alias`	assigns a pseudonym to a command

`alias` ***name=command***

- must wrap the command in quotes if it contains spaces
- **Do not put spaces on either side of the =**

- Example: When I type `q` , I want it to log me out of my shell.
- Example: When I type `ll` , I want it to list all files in long format.

```
alias q=exit
alias ll="ls -la"
```

- *Exercise* : Make it so that typing `q` quits out of a shell.
- *Exercise* : Make it so that typing `woman` runs `man`.
- *Exercise* : Make it so that typing `attu` connects me to `attu`.

Answers posted in lecture_commands.txt after lecture

Mounting remote files

command	description
`sshfs`	mount and interact with remote directories and files

- An alternate usage model to remotely connecting to servers is mounting remote directories and files and work on them locally
  - once mounted, use remote directories and files as if they were local

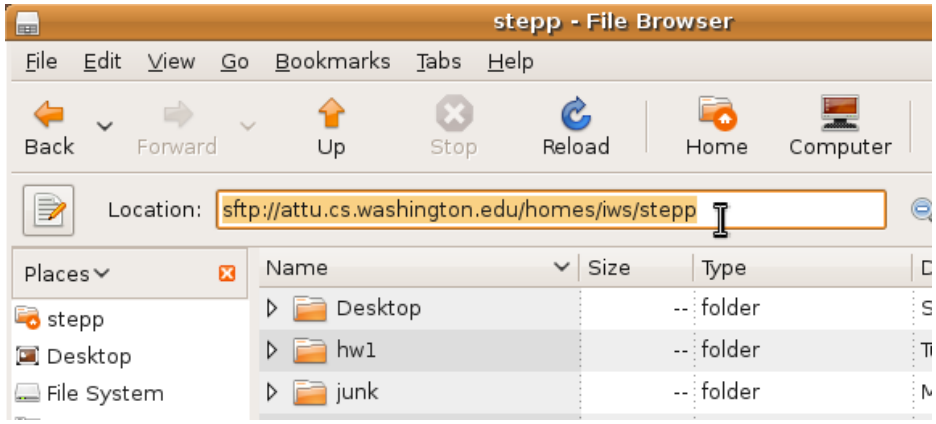
Mounting cse homedir on VM

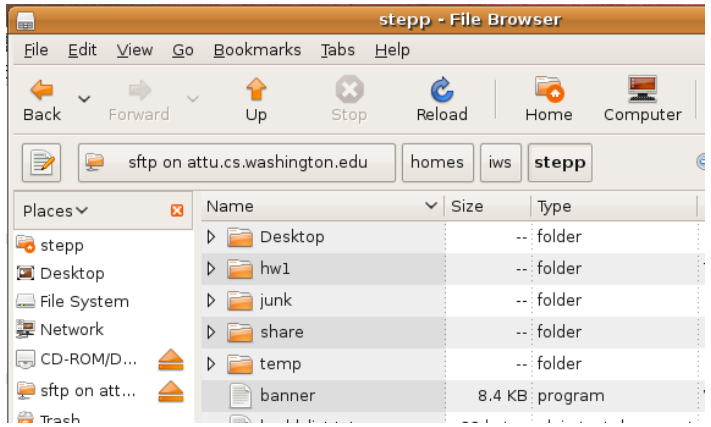
For CSE majors: you can access your home dir on attu from the VM as follows:

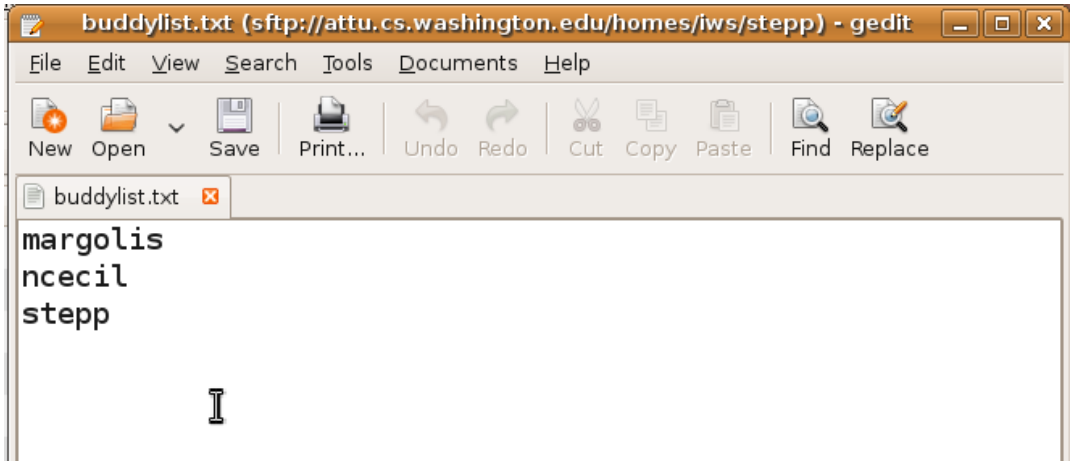
- Create a directory on the VM in your home directory, called csehomedir:
  - cd
  - mkdir csehomedir
- Now to use that directory as a “link” to your CSE files on your VM:
  - sshfs username@attu: ~/csehomedir **OR**
  - sshfs username@attu.cs.washington.edu:/homes/iws/username ~/csehomedir/
- It is a good idea to back up your files from your VM regularly.
  - Actually keep your files on your CSE home directory
  - Regularly move files from your VM to another location
  - If you need to get a fresh VM image, you can save the files from your old VM using this procedure: **"My VM Seems Broken. How Do I Recover?"**

Remote editing

- Gnome's file browser and `gedit` text editor are capable of opening files on a remote server and editing them from your computer
  - press Ctrl-L to type in a network location to open







My VM is Broken!

- If your VM is misbehaving, first try a reboot of the VM and also of your machine. If that doesn't work, often it is easiest just to get a fresh VM image and start over (maybe you saved the .zip file you downloaded previously?)
- BEFORE you delete your current copy of the VM, you can save the files from your current copy of the VM using this procedure:
  - See **"My VM Seems Broken. How Do I Recover?"** here:
  - **https://https://www.cs.washington.edu/lab/software/linuxhomevm**

Basic Emacs Commands

- C- = control key M- = meta/alt key
- read a file into Emacs: C-x C-f
- save a file back to disk: C-x C-s
- exit Emacs permanently: C-x C-c
- search forward: C-s search backward: C-r
- scroll to next screen: C-v scroll to previous screen: M-v
- Undo: C-x u

entity to move over	backward	forward
character	C-b	C-f
word	M-b	M-f
line	C-p	C-n
go to line beginning/end	C-a	C-e
go to buffer beginning/end	M-<	M->

https://courses.cs.washington.edu/courses/cse391/18wi/handouts/emacs.pdf

Basic Vim Commands

- :w Write the current file
- :wq Write the current file and exit.
- :q! Quit without writing
- To change into insert mode: i or a
  - Use escape to exit
- search forward /, repeat the search backwards: N
- Basic movement:
  - h l k j character left, right; line up, down (also arrow keys)
  - b w word/token left, right
  - ge e end of word/token left, right
  - 0 $ jump to first/last character on the line
- x delete
- u undo

https://wiki.gentoo.org/wiki/Vim/Guide and http://tnerual.eriogerg.free.fr/vimqrc.p