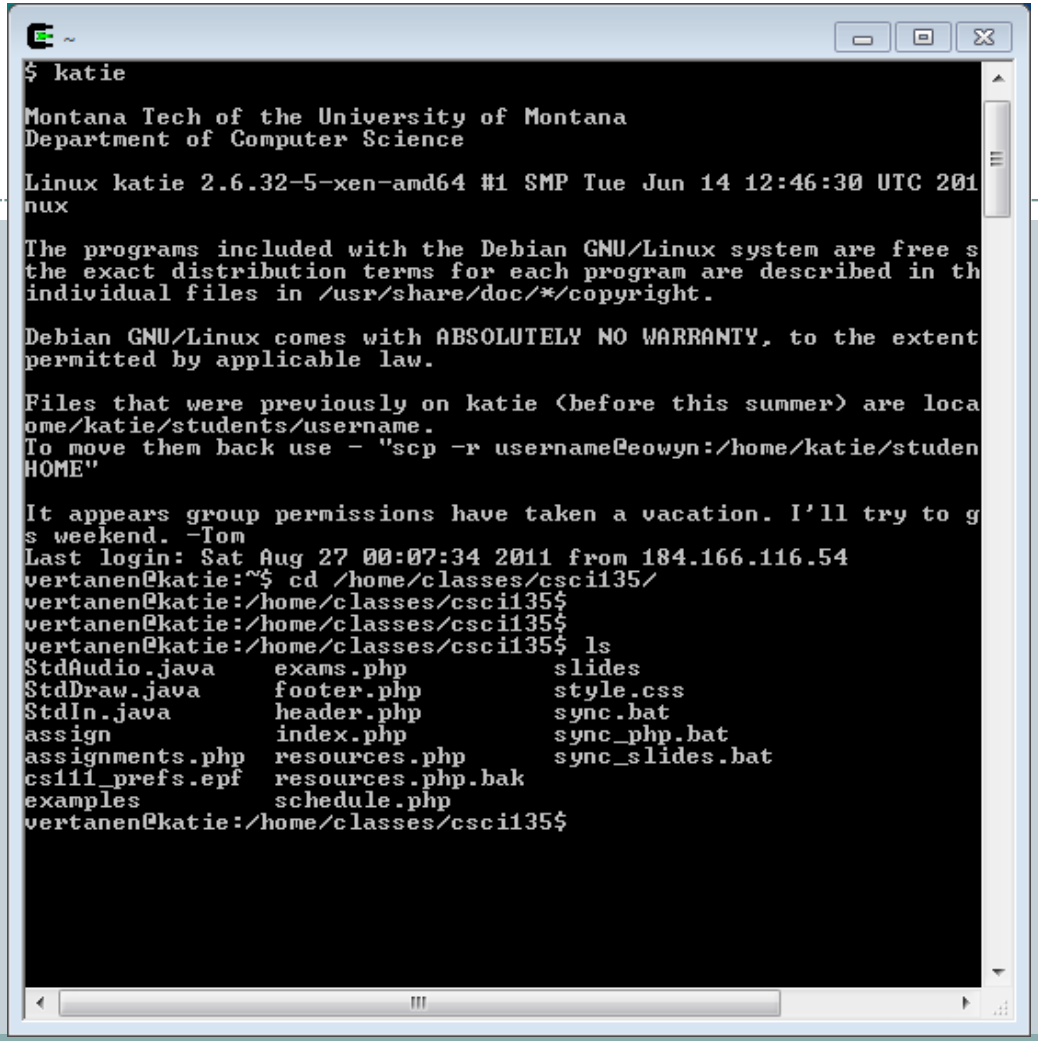
More Linux – Piping and Redirection

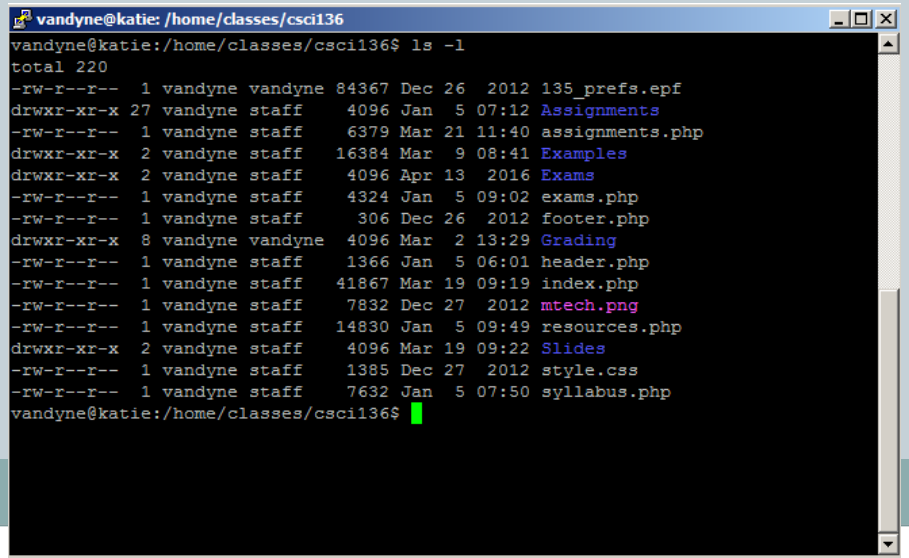


Outline

- File and Directory Permissions
- File Content
- Finding Files
- Sorting Files
- File Compression
- Processes
- Pipes
- Input/Output Redirection
- Controlling Processes

File and Directory Permissions

Permission	File	Directory
read	User can look at the contents of the file	User can list the files in the directory
write	User can modify the contents of the file	User can create new files and remove existing files in the directory
execute	User can use the filename as a Linux command	User can change into the directory, but cannot list the files unless they have read permission. User can read files if they have read permission on them.



Changing File Permissions

- `chmod options files`
- Two forms:
  - *options* as a sequence of three octal digits
    - first digit is for owner permissions
    - second for group permissions
    - third is for everyone else

```
drwxr-xr-x
-rw-r--r--
-rw-r--r--
-rw-r--r--
-rw-r--r--
drwxr-xr-x
```

    - `chmod 600 private.txt`

      -rw-------

Permission	Octal	Binary
---	0	000
--x	1	001
-w-	2	010
-wx	3	011
r--	4	100
r-x	5	101
rw-	6	110
rwx	7	111

Changing File Permissions

- `chmod options files`
- Second form:
  - *options* as a sequence of symbols
  - u – user, g – group, o, other, a – all, r – read, w – write, x – execute
  - "+" – add permission, "-" delete permission
    - `chmod ug=rw,o-rw,a-x private.txt`

      -rw-rw----

File Contents

- `file` *`filename(s)`*
  - Analyzes a files contents

```
$ file myprog.c letter.txt webpage.html
myprog.c:       C program text
letter.txt:     English text
webpage.html:   HTML document text
```

- `head, tail` *`filename`*
  - Displays the first or last few lines in a file
  - You can specify number of lines

```
$ tail -20 messages.txt ↵
$ head -5 messages.txt ↵
```

File Contents

- od *options filename*
  - Displays binary file contents in different formats

```
$ cat hello.txt↵
hello world
$ od -c hello.txt↵
0000000  h  e  l  l  o     w  o  r  l  d \n
0000014
$ od -x hello.txt↵
0000000 6865 6c6c 6f20 776f 726c 640a
0000014
```

Finding Files

- `find` *`directory`* `-name` *`targetfile`* `-print`

```
$ find /home -name "*.txt" -print 2>/dev/null↵
```

- `which` *`command`*

```
$ which ls↵
/bin/ls
```

- `locate` *`string`*

```
$ locate ".txt"↵
```

Finding Text in Files

- `grep options patterns files`
- Stands for General Regular Expression Print

The caret `^' and the dollar sign `$' are special characters that match the beginning and end of a line respectively. The dot '.' matches any character. So

```
$ grep ^..[l-z]$ hello.txt ↵
```

matches any line in `hello.txt` that contains a three character sequence that ends with a lowercase letter from l to z.

- `egrep options patterns files`
- Stands for Extended grep
  - Can join expressions with or '|', can use parentheses for grouping
  - Can use other regular expression operators:
    - ?, *, +, {N}, {N,}, {N,M}

Sorting File Contents

- `sort` *`filenames`*

```
$ sort input1.txt input2.txt > output.txt ↵
```

outputs the sorted concentenation of files `input1.txt` and `input2.txt` to the file `output.txt`.

- `uniq` *`filename`*
  - Removes duplicate adjacent lines in a file, handy when combined with sort:

```
$ sort input.txt | uniq > output.txt ↵
```

File Backup – tar – and Compression

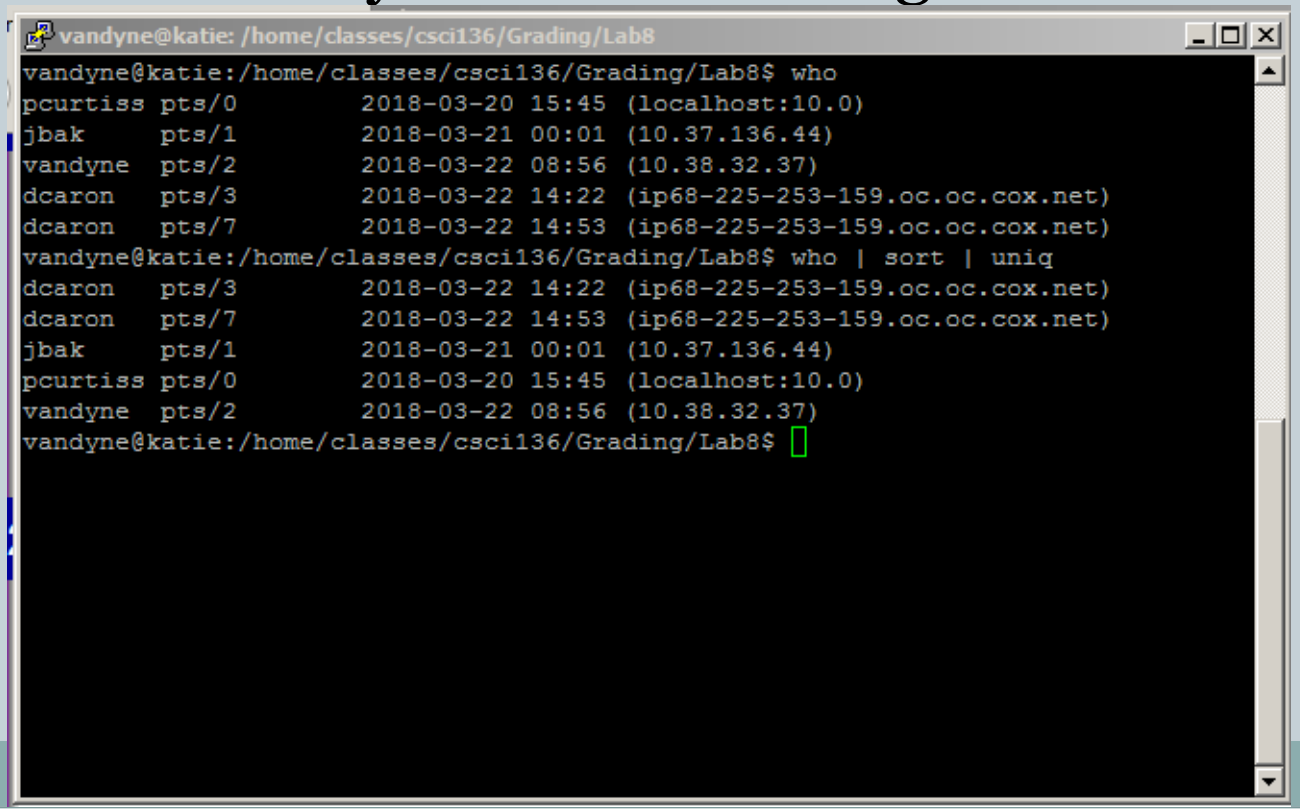
- To create a disk file `tar` archive:
  - tar -cvf *archivename filenames*
- To list the contents of an archive:
  - tar -tvf *archivename*
- To restore files from a `tar` archive:
  - tar -xvf *archivename*
- To compress files in a `tar` archive:
  - compress *filename*
- Or:
  - gzip *filename*

Processes

- A process is a program in execution
  - Each has a unique process identifier (PID)
  - The first process started when Linux boots is init
    - All processes are children of init
  - Can be any executing program:
    - Your running Java program
    - A command you are executing
    - A daemon started by the Linux kernel
    - Etc.

Pipes

- Pipe operator '|' creates concurrently executing processes which pass data directly to one another
- Used to combine system utilities together



Input/Output Redirection

- Linux treats everything as a file
  - Including standard input (keyboard), standard output (screen) and standard error (also the screen)
  - We can redirect input or output from these “files” using the redirection operators < and >
    - The “arrow” points to where the input/output goes

Redirecting Standard Output

- To redirect standard output to a file instead of a screen, use the > operator:

```
$ echo hello ↵
hello
$ echo hello > output ↵
$ cat output ↵
hello
```

- This will create a new blank file each time
  - If you want to append to a file, use >>

```
$ echo bye >> output ↵
$ cat output ↵
hello
bye
```

Redirecting Standard Error to a File

- Standard input (0), standard output (1) and standard error (2) have those numbers associated with them
- To output any error messages to a file, use 2>

```
$ cat nonexistent 2>errors↵
$ cat errors↵
cat: nonexistent: No such file or directory
$
```

- To output results to one file and errors to another:
  - find . –print 1>files 2>errors
- This is **very** handy when you are compiling a program and you get a whole list of error messages

Redirecting Standard Input

- Input will be read from a file rather than from keyboard input

```
$ cat < output↵
hello
bye
```

- Remember – the "arrow" points to where the data will go
  - In this case it will come from a file and go into the command "cat"

Controlling Processes

- You can run several processes at the same time
  - Processes can run in the foreground (the thing you currently see) or in the background (you don't see it running, but it is)
- To start a process in the background, use & at the end of the command line:

```
$ find / -print 1>output 2>errors &↵
[1] 27501
$
```

- [1] is the job number and 27501 is the process id (PID)
- Note: if your background process prints to the screen, it will show up as you're doing something else

Controlling Processes

- To put the current process in the background:
  - Type Ctrl-Z
- To bring a background process to the foreground:
  - fg %<job number>
- To see all of the processes you have running:
  - ps

```
$ ps↵
  PID TTY          TIME CMD
17717 pts/10   00:00:00 bash
27501 pts/10   00:00:01 find
27502 pts/10   00:00:00 ps
```

Controlling Processes

- What if you have a process you want to stop? (Maybe it's in an infinite loop, maybe… it's just a bad process?)
  - You can use:
    - kill %<job number> OR
    - kill <PID>
  - These are polite ways of asking the process to terminate
  - Processes are not always polite in return…
    - kill -9 <PID>
      - This will kill them on contact

Summary

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