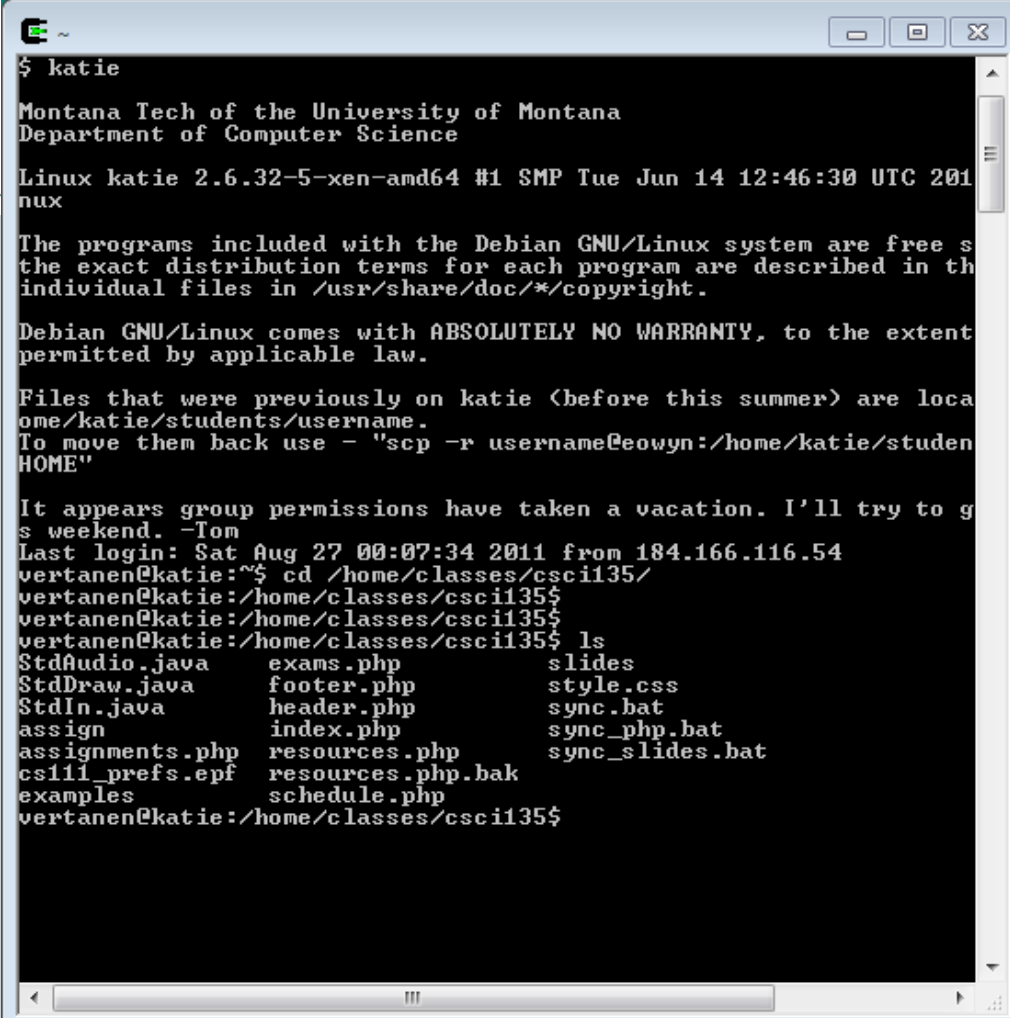


More Linux – Piping and Redirection



```
$ katie

Montana Tech of the University of Montana
Department of Computer Science

Linux katie 2.6.32-5-xen-amd64 #1 SMP Tue Jun 14 12:46:30 UTC 2011
katie

The programs included with the Debian GNU/Linux system are free software; the
exact distribution terms for each program are described in the individual files
in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent permitted
by applicable law.

Files that were previously on katie (before this summer) are located in
/home/katie/students/username.
To move them back use - "scp -r username@eowyn:/home/katie/students/username
HOME"

It appears group permissions have taken a vacation. I'll try to get it back
s weekend. -Tom
Last login: Sat Aug 27 00:07:34 2011 from 184.166.116.54
vertanen@katie:~$ cd /home/classes/csci135/
vertanen@katie:/home/classes/csci135$
vertanen@katie:/home/classes/csci135$
vertanen@katie:/home/classes/csci135$ ls
StdAudio.java      exams.php          slides
StdDraw.java       footer.php         style.css
StdIn.java         header.php         sync.bat
assign             index.php         sync_php.bat
assignments.php    resources.php     sync_slides.bat
cs111_prefs.epf   resources.php.bak
examples          schedule.php
vertanen@katie:/home/classes/csci135$
```

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.

```
vandyne@katie: /home/classes/csci136
vandyne@katie:/home/classes/csci136$ ls -l
total 220
-rw-r--r-- 1 vandyne vandyne 84367 Dec 26 2012 135_prefs.epf
drwxr-xr-x 27 vandyne staff 4096 Jan 5 07:12 Assignments
-rw-r--r-- 1 vandyne staff 6379 Mar 21 11:40 assignments.php
drwxr-xr-x 2 vandyne staff 16384 Mar 9 08:41 Examples
drwxr-xr-x 2 vandyne staff 4096 Apr 13 2016 Exams
-rw-r--r-- 1 vandyne staff 4324 Jan 5 09:02 exams.php
-rw-r--r-- 1 vandyne staff 306 Dec 26 2012 footer.php
drwxr-xr-x 8 vandyne vandyne 4096 Mar 2 13:29 Grading
-rw-r--r-- 1 vandyne staff 1366 Jan 5 06:01 header.php
-rw-r--r-- 1 vandyne staff 41867 Mar 19 09:19 index.php
-rw-r--r-- 1 vandyne staff 7832 Dec 27 2012 mtech.png
-rw-r--r-- 1 vandyne staff 14830 Jan 5 09:49 resources.php
drwxr-xr-x 2 vandyne staff 4096 Mar 19 09:22 Slides
-rw-r--r-- 1 vandyne staff 1385 Dec 27 2012 style.css
-rw-r--r-- 1 vandyne staff 7632 Jan 5 07:50 syllabus.php
vandyne@katie:/home/classes/csci136$
```

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	Binary	Octal
---	000	0
--X	001	1
-W-	010	2
-WX	011	3
r--	100	4
r-X	101	5
rW-	110	6
RWX	111	7

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/l
```

- `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 concatenation 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

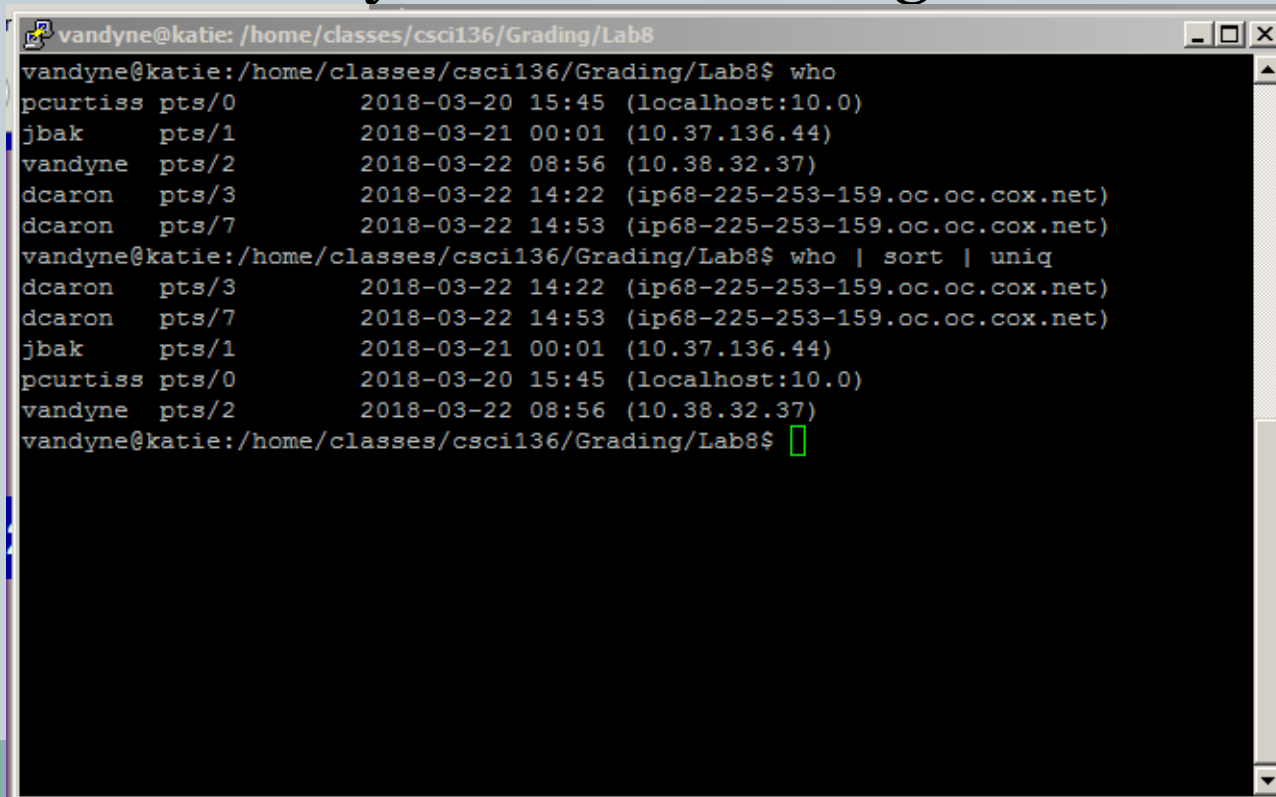
- To create a disk file tar archive:
 - `tar -cvf archivename filenames`
- To list the contents of an archive:
 - `tar -tvf archivename`
- To restore files from a tar archive:
 - `tar -xvf archivename`
- To compress files in a tar archive:
 - `compress filename`
- Or:
 - `gzip filename`

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



```
vandyne@katie: /home/classes/csci136/Grading/Lab8
vandyne@katie:/home/classes/csci136/Grading/Lab8$ who
pcurtiss pts/0      2018-03-20 15:45 (localhost:10.0)
jbak     pts/1      2018-03-21 00:01 (10.37.136.44)
vandyne  pts/2      2018-03-22 08:56 (10.38.32.37)
dcaron   pts/3      2018-03-22 14:22 (ip68-225-253-159.oc.oc.cox.net)
dcaron   pts/7      2018-03-22 14:53 (ip68-225-253-159.oc.oc.cox.net)
vandyne@katie:/home/classes/csci136/Grading/Lab8$ who | sort | uniq
dcaron   pts/3      2018-03-22 14:22 (ip68-225-253-159.oc.oc.cox.net)
dcaron   pts/7      2018-03-22 14:53 (ip68-225-253-159.oc.oc.cox.net)
jbak     pts/1      2018-03-21 00:01 (10.37.136.44)
pcurtiss pts/0      2018-03-20 15:45 (localhost:10.0)
vandyne  pts/2      2018-03-22 08:56 (10.38.32.37)
vandyne@katie:/home/classes/csci136/Grading/Lab8$
```

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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