



Lesson Module Checklist

- Slides
- WB

- Flash cards
- Page numbers
- 1st minute quiz
- Web Calendar summary
- Web book pages
- Commands

- Labx1 and Project posted

- Materials uploaded
- Backup slides, CCC info, handouts on flash drive
- Check that backup room headset is charged
- Spare 9v battery for mic

Introductions and Credits



Jim Griffin

- Created this Linux course
- Created Opus and the CIS VLab
- Jim's site: <http://cabrillo.edu/~jgriffin/>



Rich Simms

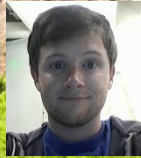
- HP Alumnus
- Started teaching this course in 2008 when Jim went on sabbatical
- Rich's site: <http://simms-teach.com>

And thanks to:

- John Govsky for many teaching best practices: e.g. the First Minute quizzes, the online forum, and the point grading system (<http://teacherjohn.com/>)



Daniel



Riley



Solomon



Instructor: **Rich Simms**
Dial-in: **888-450-4821**
Passcode: **761867**



Roger



Dillon



Pam



Aarron



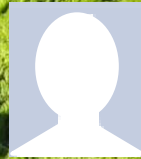
Liz



Gabe



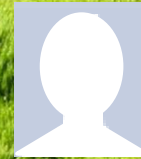
MJ



Liam



Michael L.



Ryan



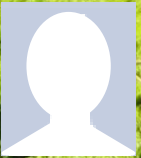
Ben L.



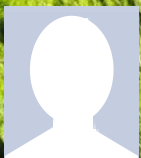
Andrew



Ariana



Ryan



Rich



Natalia



Perky



Samantha



Paul S.



Hilario



Tyrone



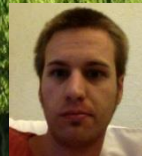
Ben C.



Justin



Jordan



Mark



Jay

First Minute Quiz

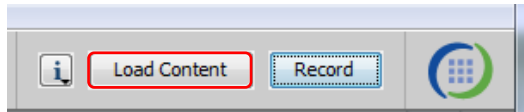
Please answer these questions **in the order** shown:

THE LAST QUIZ!

**For credit email answers to:
risimms@cabrillo.edu
within the first few minutes of class**

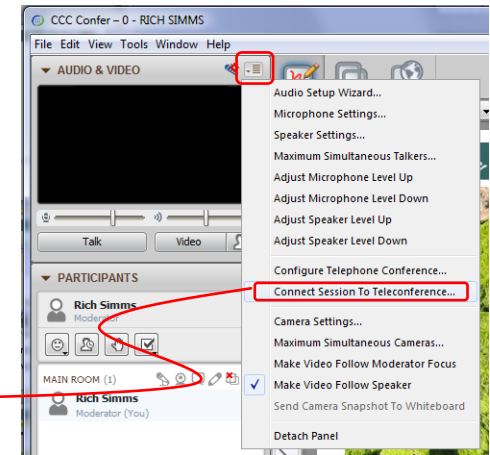
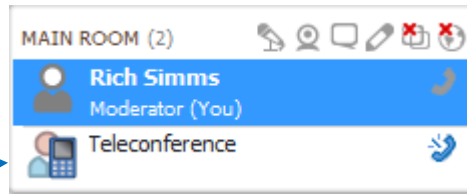


[] Preload White Board with *cis*lesson??*-WB*



[] Connect session to Teleconference

Session now connected to teleconference



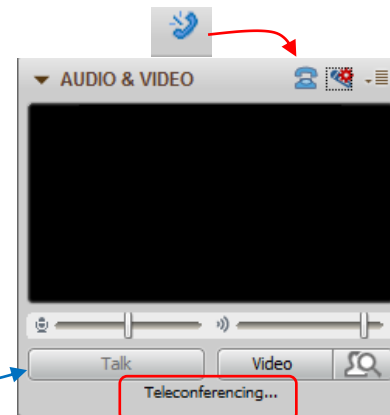
[] Is recording on?



Red dot means recording

[] Use teleconferencing, not mic

Should be greyed out





- [] Video (webcam) optional
- [] layout and share apps

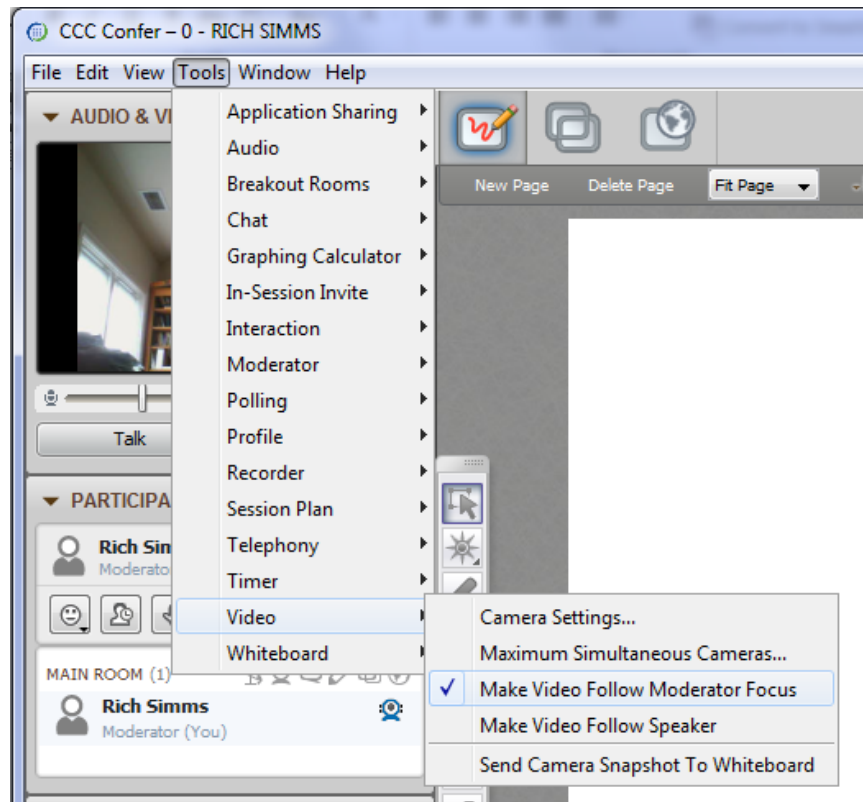
The screenshot displays a Windows desktop environment during a teleconference. On the left, the 'CCC Confer' window shows a video feed of Rich Simms and a list of participants. The main desktop area contains several open applications:

- foxit for slides:** A Foxit Reader window displaying a PDF document titled 'cis90lesson07.pdf'. A red box labeled 'foxit for slides' points to the document content.
- chrome:** A Google Chrome browser window showing a webpage from 'simms-teach.com/docs/cis90/cis-90-TEST-1-Fall-12.pdf'. A red box labeled 'chrome' points to the browser window.
- putty:** A terminal window showing a shell session for 'simben90@oslab:~'. The user has entered 'login as: simben90' and 'simben90@oslab.cabrillo.edu's password:'. The terminal output shows 'Access denied' and 'Last login: Mon Oct 8 18:58:43 2012 from d.com'. A red box labeled 'putty' points to the terminal window.
- vSphere Client:** A vCenter - vSphere Client window showing a tree view of virtual machines. A red box labeled 'vSphere Client' points to the application window.

Red lines connect the labels to their respective application windows. The desktop taskbar at the bottom shows icons for various applications, including Internet Explorer, Firefox, and Microsoft Office. The system tray in the bottom right corner shows the time as 6:52 AM on 10/10/2012.



- [] Video (webcam) optional
- [] Follow moderator
- [] Double-click on postages stamps



Universal Fix for CCC Confer:

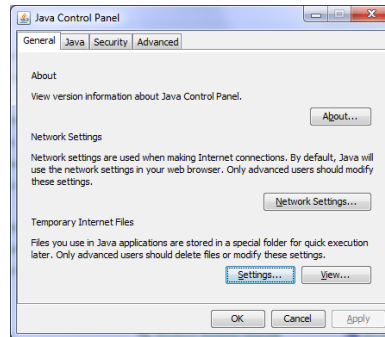
- 1) Shrink (500 MB) and delete Java cache
- 2) Uninstall and reinstall latest Java runtime



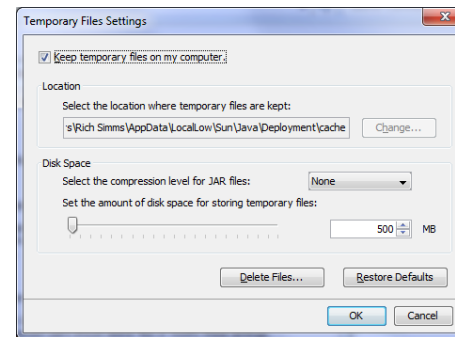
Control Panel (small icons)



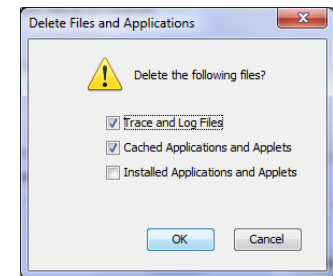
General Tab > Settings...



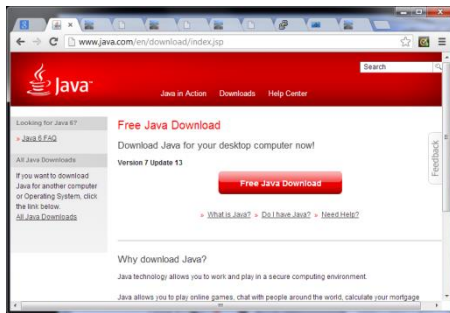
500MB cache size



Delete these



Google Java download





Shell Scripting and Printing

Objectives

- Be able to print, view the print queue and cancel print jobs

Agenda

- Quiz
- Housekeeping
- Refresh
- Shell scripting
- Printing



Questions

Questions?

Lesson material?

Labs? Tests?

How this course works?

- Graded work in home directories
- Answers in /home/cis90/answers

Who questions much, shall learn much, and retain much.

- Francis Bacon

If you don't ask, you don't get.

- Mahatma Gandhi

Chinese
Proverb

他問一個問題，五分鐘是個傻子，他不問一個問題仍然是一個傻瓜永遠。

He who asks a question is a fool for five minutes; he who does not ask a question remains a fool forever.



Breaking your path in Lab 10

The Path

- Lab 10 often results in clobbered paths and students may think all the commands have disappeared!
- The path is a list of directories each containing commands, programs and scripts.
- The path is used by the shell to locate commands to run.
- The PATH variable defines the directories (separated by ":"s) and the search order.
- If the path is not defined then each command to run must be specified using it's absolute pathname

```
/home/cis90/simben $ echo $PATH
/usr/lib/qt-
3.3/bin:/usr/local/bin:/bin:/usr/bin:/usr/local/sbin:/usr/sbin:/sbin:/
home/cis90/simben/../../bin:/home/cis90/simben/bin:
/home/cis90/simben $
```

What is the fourth directory on this path?

Can you name a command found in the fourth directory of the path?

The Path

```
/home/cis90/simben $ type tty  
tty is hashed (/usr/bin/tty)
```

The tty command is in the /usr/bin directory

```
/home/cis90/simben $ oldpath=$PATH  
/home/cis90/simben $ unset PATH
```

Backup your current path

```
/home/cis90/simben $ tty  
-bash: tty: No such file or directory
```

The tty command can no longer be run by typing just its name

```
/home/cis90/simben $ /usr/bin/tty  
/dev/pts/0
```

Instead the full absolute pathname must be used

```
/home/cis90/simben $ PATH=$oldpath  
/home/cis90/simben $ tty  
/dev/pts/0
```

Restore your path to what it was

Class Activity: Life without a path

Backup and remove your path variable:

```
/home/cis90/simben $ oldpath=$PATH
```

```
/home/cis90/simben $ unset PATH
```

```
/home/cis90/simben $ echo $PATH
```

```
/home/cis90/simben $
```

The Path

If the path is not defined then each command to run must be specified using an absolute pathname

```
/home/cis90/simben $ ls letter  
-bash: ls: No such file or directory
```



```
/home/cis90/simben $ /bin/ls letter  
letter  
/home/cis90/simben $
```


The Path

Some commands still work without a path ... why?

```
/home/cis90/simben $ echo "I want my path back"  
I want my path back
```

```
/home/cis90/simben $ type echo  
echo is a shell builtin
```

```
/home/cis90/simben $ type type  
type is a shell builtin
```

The Path

Fixing the path, one directory at a time ...

```
/home/cis90/simben $ ls letter
-bash: ls: No such file or directory
```



The **ls** command is in **/bin** so lets put that on the path



```
/home/cis90/simben $ PATH=/bin
/home/cis90/simben $ ls letter
letter
```

```
/home/cis90/simben $ stat letter
-bash: stat: command not found
```



The **stat** command is in **/usr/bin** so lets append that directory too



```
/home/cis90/simben $ PATH=$PATH:/usr/bin
/home/cis90/simben $ stat letter
  File: `letter'
  Size: 1059          Blocks: 16          IO Block: 4096
regular file
Device: fd00h/64768d  Inode: 102594       Links: 1
Access: (0644/-rw-r--r--)  Uid: ( 1000/simben90)   Gid: (
90/   cis90)
Access: 2012-04-30 15:43:28.000000000 -0700
Modify: 2012-03-20 10:31:30.000000000 -0700
Change: 2012-04-30 07:34:30.000000000 -0700
```

The Path

```
/home/cis90/simben $ allscripts  
-bash: allscripts: command not found
```



*The **allscripts** shell script is in /home/cis90/bin so lets add that directory to the path as well*



```
/home/cis90/simben $ PATH=$PATH:/home/cis90/bin  
/home/cis90/simben $ allscripts
```

```
*****  
*                               Fall 2012 CIS 90 Online Projects                               *  
*****  
1) Andrew  
2) Ben  
3) Benji  
4) Bryn  
5) Carlile  
6) Carlos  
  <snipped>  
21) Ray  
22) Rita  
23) Sean C.  
24) Sean F.  
25) Shahram  
  
99) Exit  
  
Enter Your Choice:
```

The Path

```
/home/cis90/simben $ datecal
bash: datecal: command not found
```



The **datecal** shell script is in your own bin directory so lets add that to the path as well



```
/home/cis90/simben $ PATH=$PATH:/home/cis90/simben/bin
/home/cis90/simben $ datecal
```

```
Tue May 8 14:30:59 PDT 2012
```

April 2012							May 2012							June 2012							
Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	
1	2	3	4	5	6	7			1	2	3	4	5							1	2
8	9	10	11	12	13	14	6	7	8	9	10	11	12	3	4	5	6	7	8	9	
15	16	17	18	19	20	21	13	14	15	16	17	18	19	10	11	12	13	14	15	16	
22	23	24	25	26	27	28	20	21	22	23	24	25	26	17	18	19	20	21	22	23	
29	30						27	28	29	30	31			24	25	26	27	28	29	30	

```
/home/cis90/simben $
```

The Path

```
/home/cis90/simben $ dogbone  
-bash: dogbone: command not found
```



*The **dogbone** shell script is in the current directory but not on the path*



```
/home/cis90/simben $ ./dogbone  
What is your name? Benji  
What is your favorite bone? Chicken  
Hi Benji, your favorite bone is Chicken
```

How can I run a script in the current directory without having to put a ./ in front of it?

The Path

Easy ... add "here" or "." to the path

```
/home/cis90/simben $ dogbone  
-bash: dogbone: command not found
```



```
/home/cis90/simben $ PATH=$PATH:.  
/home/cis90/simben $ dogbone  
What is your name? Benji  
What is your favorite bone? Chicken  
Hi Benji, your favorite bone is Chicken
```

The Path

Rebuilding the path by appending directories one at a time

```
/home/cis90/simben $ unset PATH
/home/cis90/simben $ echo $PATH
```

```
/home/cis90/simben $ PATH=/bin
/home/cis90/simben $ echo $PATH
/bin
```

Start with /bin which has all the essential UNIX/Linux commands

```
/home/cis90/simben $ PATH=$PATH:/usr/bin
/home/cis90/simben $ echo $PATH
/bin:/usr/bin
```

Append /usr/bin which has hundreds of additional UNIX/Linux commands

```
/home/cis90/simben $ PATH=$PATH:/home/cis90/bin
/home/cis90/simben $ echo $PATH
/bin:/usr/bin:/home/cis90/bin
```

Append the CIS 90 class bin directory

```
/home/cis90/simben $ PATH=$PATH:/home/cis90/simben/bin
/home/cis90/simben $ echo $PATH
/bin:/usr/bin:/home/cis90/bin:/home/cis90/simben/bin
```

Append your own student bin directory

```
/home/cis90/simben $ PATH=$PATH:.
/home/cis90/simben $ echo $PATH
/bin:/usr/bin:/home/cis90/bin:/home/cis90/simben/bin:.
```

Append the current directory

└──────────────────┘
└──────────────────┘
└──┘
CIS 90 class bin directory
Student bin directory
Current directory

The Path

Making the path permanent using .bash_profile

```

/home/cis90/simben $ cat .bash_profile
# .bash_profile

# Get the aliases and functions
if [ -f ~/.bashrc ]; then
    . ~/.bashrc
fi

# User specific environment and startup programs

PATH=$PATH:/home/cis90/bin:$HOME/bin:.
BASH_ENV=$HOME/.bashrc
USERNAME=""
PS1='$PWD $ '
export USERNAME BASH_ENV PATH
umask 002
set -o ignoreeof
stty susp
eval `tset -s -m vt100:vt100 -m :\?${TERM:-ansi} -r -Q `

/home/cis90/simben $

```

This customizes the normal path by appending the class bin directory, the student's bin directory and the "current" directory



Scripting Tips

echo

Silence is golden

Many UNIX commands that run successfully produce no output

```
[simben90@opus bin]$ alias details=file  
[simben90@opus bin]$ cp quiet quiet.bak  
[simben90@opus bin]$ value=002  
[simben90@opus bin]$ umask $value  
[simben90@opus bin]$ cat quiet > /dev/null  
[simben90@opus bin]$ > important_file
```

Silence is golden

Running or sourcing a script full of UNIX commands that produce no output still produces no output!

```
[simben90@opus bin]$ cat quiet
alias details=file
cp quiet quiet.bak
value=002
umask $value
cat quiet > /dev/null
> important_file
```

```
[simben90@opus bin]$ quiet
[simben90@opus bin]$
```

```
[simben90@opus bin]$ source quiet
[simben90@opus bin]$
```

Silence is golden

You can use the echo command in your scripts to provide:

- *interaction*
- *feedback*
- *tracing (for debugging)*

```
[simben90@opus bin]$ cat quiet
alias details=file
cp quiet quiet.bak
value=002
umask $value
cat quiet > /dev/null
> important_file
```

```
[simben90@opus bin]$ quiet
[simben90@opus bin]$
```

```
[simben90@opus bin]$ cat not-so-quiet
alias details=file
cp quiet quiet.bak
value=002
umask $value
echo TRACE: value=$value
cat quiet > /dev/null
echo "Quiet script successfully completed"
```

```
[simben90@opus bin]$ not-so-quiet
TRACE: value=002
Quiet script successfully completed
```




Extra Credit Special Answer

Extra Credit Special (from Lesson 12)

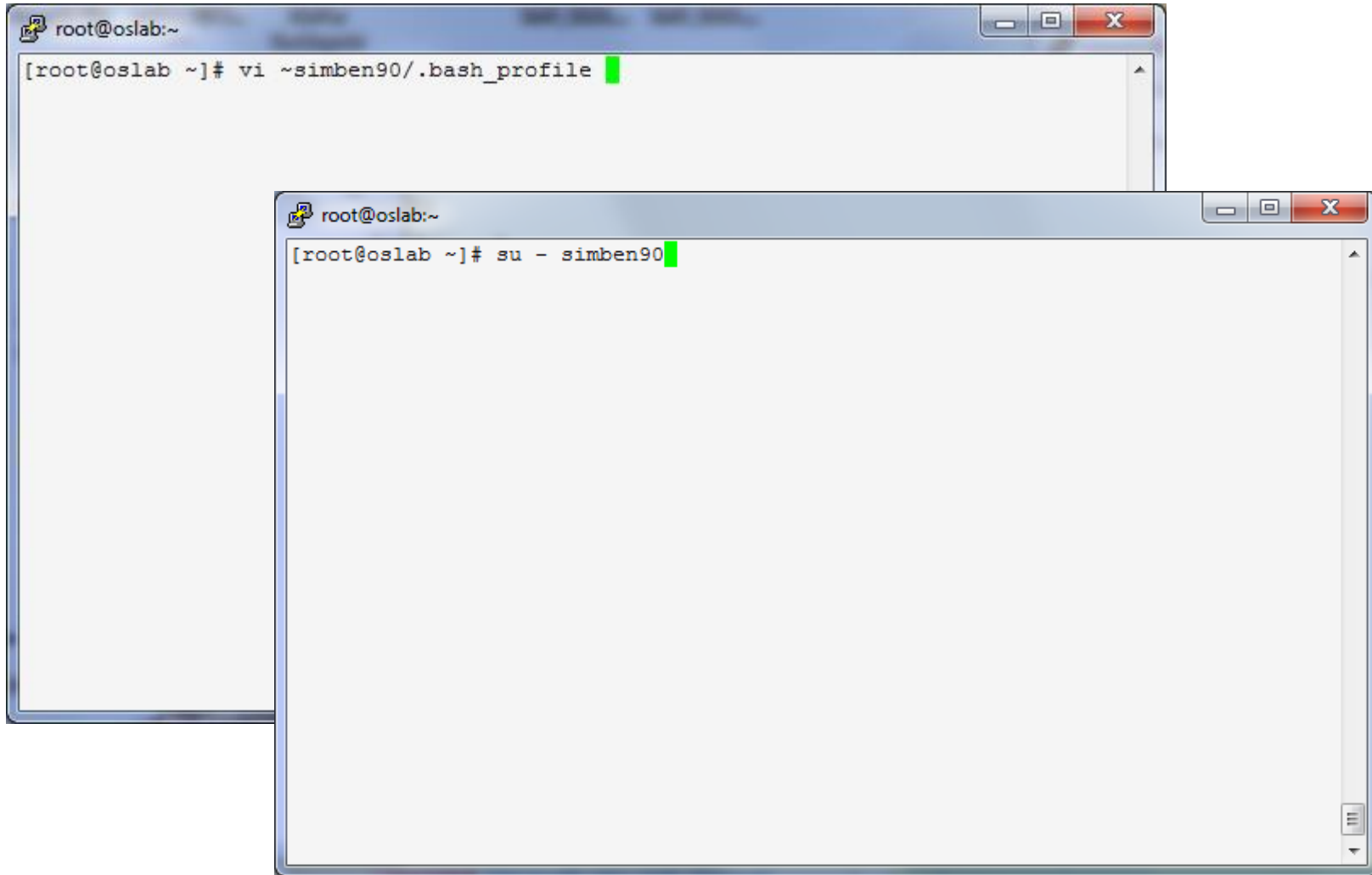
1) *Why did the prompt change?*

```
/home/cis90/simben $ bash  
[simben@opus ~]$ exit  
exit  
/home/cis90/simben $
```



2) *What command could be issued prior to the bash command above that would prevent the prompt from changing?*

For 2 points extra credit, email risimms@cabrillo.edu answers to **both** questions before the next class starts



Using echo commands to explore what is happening



Housekeeping

Previous material and assignment

1. Lab 10 due by 11:59PM tonight
2. The Extra Credit Labs X1 and X2 (30 points each) are available.
3. The Final Project is available.

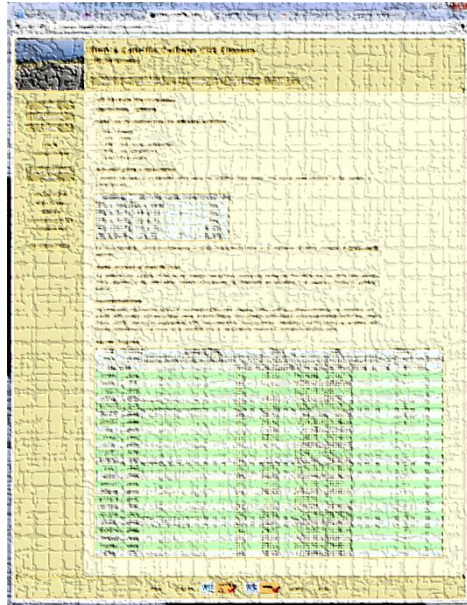
Sage advice:

Get one "practice" task script working in your project before you leave class today.

Review the final project grading rubric to see how many points you have completed so far with your practice script.

Managing your grade

Use the web page



<http://simms-teach.com/cis90grades.php>

Use Jesse's checkgrades script

```

adaldrida: 77% (322 of 417 points)
anborn: 100% (421 of 417 points)
arador: 53% (223 of 417 points)
balrog: 0% (0 of 417 points)
bilbo: 83% (349 of 417 points)
celebrian: 69% (289 of 417 points)
cirdan: 56% (234 of 417 points)
durin: 88% (369 of 417 points)
dwalin: 93% (388 of 417 points)
elrond: 103% (433 of 417 points)
eomer: 101% (425 of 417 points)
faramir: 105% (440 of 417 points)
frodo: 98% (409 of 417 points)
gimli: 67% (280 of 417 points)
goldberry: 87% (363 of 417 points)
gwaihir: 69% (291 of 417 points)
haldir: 63% (265 of 417 points)
ingold: 91% (380 of 417 points)
ioareth: 95% (399 of 417 points)
legolas: 101% (424 of 417 points)
marhari: 90% (378 of 417 points)
quickbeam: 57% (241 of 417 points)
samwise: 95% (398 of 417 points)
sauron: 92% (386 of 417 points)
shadowfax: 75% (313 of 417 points)
strider: 105% (438 of 417 points)
theoden: 91% (381 of 417 points)
treebeard: 93% (389 of 417 points)
tulkas: 94% (396 of 417 points)
    
```

AS of May 15, 2013

Managing your grade

Percentage	Total Points	Letter Grade	Pass/No Pass
90% or higher	504 or higher	A	Pass
80% to 89.9%	448 to 503	B	Pass
70% to 79.9%	392 to 447	C	Pass
60% to 69.9%	336 to 391	D	No pass
0% to 59.9%	0 to 335	F	No pass

Points gone by

- 9 quizzes - 27 points
- 2 tests - 60 points
- 3 forum periods - 60 points
- 9 labs - 270 points

417 points

Points yet to earn

- 1 quiz - 3 points
- 1 test - 30 points
- 1 forum periods - 20 points
- 1 labs - 30 points
- 1 final project - 60 points

143 points

- Plus extra credit - up to 90 points

Managing your grade Getting extra help for CIS 90

simms-teach.com/cis90grades.php

Rich's Cabrillo College CIS Classes CIS 90 Grades

Home Resources Forums **CIS Lab** CTC

Login
Flashcards
Admin

CIS 90
Previous Classes

45 days till term ends!

Cabrillo College
Web Advisor
CCC Confer
Static IPs
Quick Ref
VM Repairs
GAH!

CIS 90 (Fall 2010) Grades

[Course Home](#) [Calendar](#)

Points can be earned from the following activities:

- 5% - Quizzes
- 16% - Tests
- 14% - Help forum participation
- 54% - Lab assignments
- 11% - Final

How your grade is determined:

A student can earn up to 560 total points doing the activities listed above. The course grade is the number of points earned.

Percentage	Total Points	Letter Grade	Pass/No Pass
90% or higher	504 or higher	A	Pass
80% to 89.9%	448 to 503	B	Pass
70% to 79.9%	392 to 447	C	Pass
60% to 69.9%	336 to 391	D	No pass
0% to 59.9%	0 to 335	F	No pass

For some flexibility, personal preferences or family emergencies there is an additional 90 point **extra credit** activities.

Choice of Grade or Pass/No Pass

You indicate your grading choice on the Student Survey form passed out during the first class grading choice selection on the table below. Contact the instructor by email with any question

Come by the lab and get help from instructors and student assistants

Cabrillo Network & Systems Technology Lab

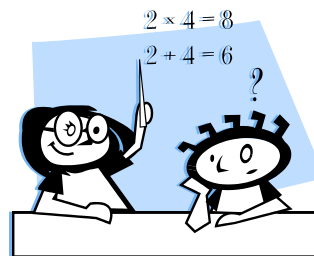
Apple Campus

Fall 2012 Instructor and Lab Assistant Hours

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
9-11							
11-12							
12-13							
13-14							
14-15							
15-16							
16-17							
17-18							
18-19							
19-20							
20-21							
21-22							
22-23							
23-24							
24-25							
25-26							
26-27							
27-28							
28-29							
29-30							
30-31							

Managing your grade Getting extra help for CIS 90

- Rich's Office Hours 4:20-5:10pm in Room 2501 (right after class) or TBA (contact me)
- Ask questions on the Forum at:
<http://opus.cabrillo.edu/forum/>



Final Exam

Can **not** be taken online using CCC Confer (must be face-to-face or proctored)

It will be held in room 2501 on Thursday, June 6th from 1:00 to 3:50PM
(hard stop, no extension time period)

If you know you can't make this date you will need to contact the instructor, in advance, to arrange an exam **EARLIER** in the week.

No makeups after the exam

Practice test will be available

	6/6	<p>Test #3 (the final exam)</p> <p>Time</p> <ul style="list-style-type: none"> • 1:00PM - 3:50PM in Room 2501 <p>Materials</p> <ul style="list-style-type: none"> • Presentation slides (download) • Test (download) 		<p>5 posts</p> <p>Lab X1</p> <p>Lab X2</p>
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Spring 2013 Linux Classes

CIS 90 Introduction to UNIX/Linux

Provides a technical overview of the UNIX/Linux operating system, including hands-on experience with commands, files, and tools. Recommended Preparation: CS 1L or CIS 172.

Transfer Credit: CSU.

Section	Days	Times	Units	Instructor	Room
80628	T	01:00PM-04:05PM	3.00	R.Simms	OL

Section 80628 is an ONLINE course. Meets weekly throughout the semester online during the scheduled times by remote technology. For details, see instructor's web page at go.cabrillo.edu/online.

CIS 191AB UNIX/Linux Installation, Configuration and Administration

Introduces skills required to administer UNIX/Linux systems. Prerequisite: CIS 90 or equivalent.

Section	Days	Times	Units	Instructor	Room
81781	TH	01:00PM-05:05PM	4.00	STAFF	OL
&	Arr.	Arr.		STAFF	OL

Section 81781 is an ONLINE course. Meets weekly throughout the semester online at the scheduled times by remote technology with an additional 4 hr 5 min online lab per week. For details, see instructor's web page at go.cabrillo.edu/online.



Final Project Grading Rubric

Grading rubric (60 points maximum)

Possible Points	Requirements
30	Implementing all five tasks (6 points each): <ul style="list-style-type: none"> Requirements for each task: <ul style="list-style-type: none"> Minimum of 10 "original" script command lines Has comments to explain what it does Has user interaction
25	You don't have to do all of these but do at least five: <ul style="list-style-type: none"> Redirecting stdin (5 points) Redirecting stdout (5 points) Redirecting stderr (5 points) Use of permissions (5 points) Use of filename expansion characters (5 points) Use of absolute path (5 points) Use of relative path (5 points) Use of a PID (5 points) Use of inodes (5 points) Use of links (5 points) Use of a GID or group (5 points) Use of a UID or user (5 points) Use of a signal (5 points) Use of piping (5 points) Use of an environment variable (5 points) Use of /bin/mail (5 points) Use of a conditional (5 points) The maximum for this section are 25 points.
5	Present your script in front of the class
Points lost	
-15	Fails to run from allscripts
-15	Other students in the class are unable to read and execute your script.
-15	Error messages are displayed when running one or more tasks
-up to 90	No credit for any task which contains unoriginal script code that: <ul style="list-style-type: none"> Doesn't give full credit to the original author Doesn't indicate where the code was obtained from Doesn't include licensing terms Violates copyright or licensing terms
Extra credit	
30	Up to three additional tasks (10 points each)



Final Project

forum

Use the forum effectively to get scripting help

Not so good ...

Preview:

Help!

My script is getting weird error

- Homer

*Not enough information has been provided
on this post for others to help*

Use the forum effectively to get scripting help

Better ... but requires viewer to log into Opus and you may have modified the script since posting

Preview:

Help!

My script is getting weird error

My script is here:

/home/cis90/milhom/bin/myscript

And this is the error:

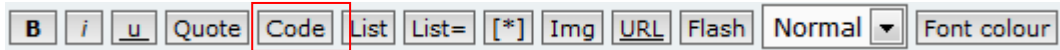
CODE: SELECT ALL

```
/home/cis90/simben/bin $ ./script99
simben90
-rwxr-x--- 1 simben90 cis90 10489 Apr 30 07:33 /home/cis90/simben/bin/myscript
./script99: line 8: unexpected EOF while looking for matching `"'
./script99: line 16: syntax error: unexpected end of file
/home/cis90/simben/bin $
```

- Homer

This post provides the location of the script and the error message which enables others to help you find and fix the problem

Use the forum effectively to get scripting help



Preview:

Help!

My script is getting weird error

This is the script:

CODE: SELECT ALL

```
#!/bin/bash
# Test script
#
echo $LOGNAME
dir=/home/cis90/simben
ls -l $dir/bin/myscript
if [ -f "$dir/bin/myscript" ]; then
    echo you have a myscript file in the bin directory
else
    echo there is no myscript file in your bin directory!
fi
exit
```

And this is the error:

CODE: SELECT ALL

```
/home/cis90/simben/bin $ ./script99
simben90
-rwxr-x--- 1 simben90 cis90 10489 Apr 30 07:33 /home/cis90/simben/bin/myscript
./script99: line 8: unexpected EOF while looking for matching `"'
./script99: line 16: syntax error: unexpected end of file
/home/cis90/simben/bin $
```

- Homer

Best ...

This post shows both the script and the error using code tags which enables others to help you find and fix the problem.

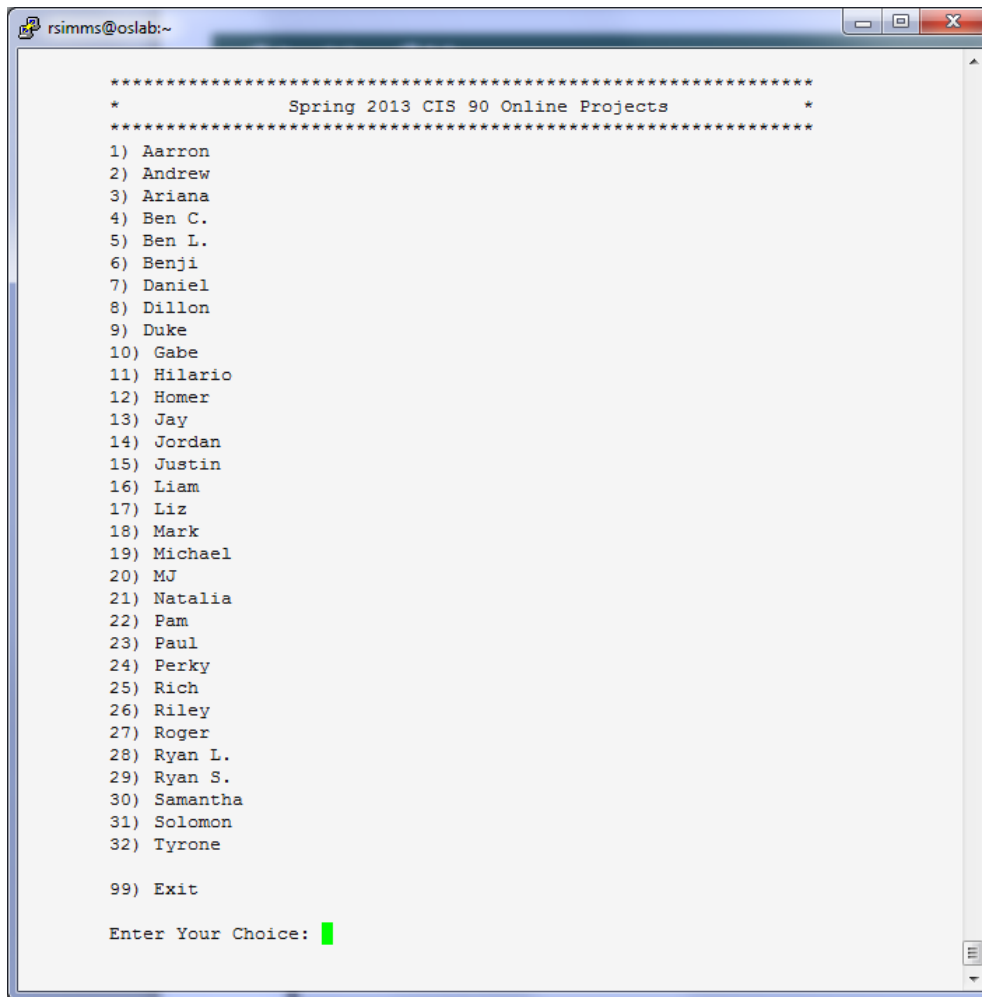
The thread will also benefit future CIS 90 students



Final Project

permissions

Final Project



```
rsimms@oslab:~  
*****  
*           Spring 2013 CIS 90 Online Projects           *  
*****  
1) Aarron  
2) Andrew  
3) Ariana  
4) Ben C.  
5) Ben L.  
6) Benji  
7) Daniel  
8) Dillon  
9) Duke  
10) Gabe  
11) Hilario  
12) Homer  
13) Jay  
14) Jordan  
15) Justin  
16) Liam  
17) Liz  
18) Mark  
19) Michael  
20) MJ  
21) Natalia  
22) Pam  
23) Paul  
24) Perky  
25) Rich  
26) Riley  
27) Roger  
28) Ryan L.  
29) Ryan S.  
30) Samantha  
31) Solomon  
32) Tyrone  
  
99) Exit  
  
Enter Your Choice: █
```


*Before leaving
class today you
want to make
sure you can run
your script from
allscripts*

Permissions

A past forum post ...

Ha Ha Class
Dby on Tue May 12, 2009 12:22 pm

I'm sure this is some kind of payback for last week "Hacking" attempt 😏



```
File Edit View Terminal Help
#!/bin/bash
# menu: A simple menu example
while true
do
clear
echo -n "
***** will fail his Final Project
1) Job 1
2) Task 2
3) Task 3
4) Task 4
5) Task 5
6) Exit
Enter Your Choice: "
read RESPONSE
case $RESPONSE in
1) # Completed Task 1
echo ***** got hacked!!!!
echo "what is your name?"
read NAME
echo "what are ur hobbies?"
"myscript" 42L, 646C
```

I will find out who did this 😏😏

~~~~~

ps. Im going to pass 😏

*Uh, oh ... someone got hacked!*



# Permissions

```
rsimms@oslab:~$ ls -l /home/cis90/*/bin/myscript
-rwxrwxr-x. 1 berric90 cis90 726 May 9 14:53 /home/cis90/berric/bin/myscript
-rwxrwxr-x. 1 cruben90 cis90 931 May 9 15:12 /home/cis90/cruben/bin/myscript
-rwxrwxr-x. 1 davmic90 cis90 552 May 9 15:53 /home/cis90/davmic/bin/myscript
-rwxrwxr-x. 1 deddil90 cis90 720 May 9 14:24 /home/cis90/deddil/bin/myscript
-rwxrwxr-x. 1 diapam90 cis90 797 May 9 14:42 /home/cis90/diapam/bin/myscript
-rwxrwxr-x. 1 dusaar90 cis90 706 May 9 14:26 /home/cis90/dusaar/bin/myscript
-rwxrwxr-x. 1 fareli90 cis90 709 May 12 18:54 /home/cis90/fareli/bin/myscript
-rwxrwxr-x. 1 gilgab90 cis90 720 May 9 14:53 /home/cis90/gilgab/bin/myscript
-rwxrwxr-x. 1 goljor90 cis90 546 May 9 14:06 /home/cis90/goljor/bin/myscript
-rwxrwxr-x. 1 joylia90 cis90 721 May 14 22:17 /home/cis90/joylia/bin/myscript
-rwxrwxr-x. 1 lejmic90 cis90 619 May 13 16:07 /home/cis90/lejmic/bin/myscript
-rwxrwxr-x. 1 lemrya90 cis90 776 May 9 14:40 /home/cis90/lemrya/bin/myscript
-rwxr-x--x. 1 marand90 cis90 561 May 14 19:54 /home/cis90/marand/bin/myscript
-rwxrwxr-x. 1 mazari90 cis90 719 May 9 14:23 /home/cis90/mazari/bin/myscript
-rwxrwxr-x. 1 mennat90 cis90 709 May 13 11:17 /home/cis90/mennat/bin/myscript
-rwxr-x---. 1 milhom90 cis90 1526 May 9 10:19 /home/cis90/milhom/bin/myscript
-rwxrwxr-x. 1 paljay90 cis90 764 May 14 23:59 /home/cis90/paljay/bin/myscript
-rwxrwxr-x. 1 perste90 cis90 651 May 9 14:49 /home/cis90/perste/bin/myscript
-rwxr-x---. 1 rodduk90 cis90 546 May 16 08:51 /home/cis90/rodduk/bin/myscript
-rwxrwxr-x. 1 rutsam90 cis90 692 May 9 14:39 /home/cis90/rutsam/bin/myscript
-rwxrwxr-x. 1 schrya90 cis90 739 May 9 14:26 /home/cis90/schrya/bin/myscript
-rwxrwxr-x. 1 shepau90 cis90 717 May 9 14:23 /home/cis90/shepau/bin/myscript
-rwxr-x---. 1 simben90 cis90 10512 May 9 10:21 /home/cis90/simben/bin/myscript
-rwxrwxr-x. 1 valjus90 cis90 546 May 9 14:34 /home/cis90/valjus/bin/myscript
-rwxrwxr-x. 1 vashil90 cis90 709 May 9 14:52 /home/cis90/vashil/bin/myscript
-rwxrwxr-x. 1 wiltyr90 cis90 702 May 9 14:51 /home/cis90/wiltyr/bin/myscript
-rwxrwxr-x. 1 wismar90 cis90 1135 May 14 23:13 /home/cis90/wismar/bin/myscript
[rsimms@oslab ~]$
```

*Which myscrip files can only be edited by their owner? Which ones could be edited by anyone in the CIS 90 class? Which ones could be edited by anyone on Opus?*

# Overall

```
rsimms@oslab:~$ /home/cis90/bin/checkmyscripts
-rwxr-x---. 1 simben90 cis90 10512 May  9 10:21 /home/cis90/simben/bin/myscript
-rwxr-x---. 1 milhom90 cis90 1526 May  9 10:19 /home/cis90/milhom/bin/myscript
-rwxr-x---. 1 rodduk90 cis90 546 May 16 08:51 /home/cis90/rodduk/bin/myscript
ls: cannot access /home/cis90/blodan/bin/myscript: No such file or directory
ls: cannot access /home/cis90/braril/bin/myscript: No such file or directory
ls: cannot access /home/cis90/bunsol/bin/myscript: No such file or directory
-rwxrwxr-x. 1 deddil90 cis90 720 May  9 14:24 /home/cis90/deddil/bin/myscript
-rwxrwxr-x. 1 diapam90 cis90 797 May  9 14:42 /home/cis90/diapam/bin/myscript
-rwxrwxr-x. 1 dusaar90 cis90 706 May  9 14:26 /home/cis90/dusaar/bin/myscript
-rwxrwxr-x. 1 fareli90 cis90 709 May 12 18:54 /home/cis90/fareli/bin/myscript
-rwxrwxr-x. 1 gilgab90 cis90 720 May  9 14:53 /home/cis90/gilgab/bin/myscript
-rwxrwxr-x. 1 joylia90 cis90 721 May 14 22:17 /home/cis90/joylia/bin/myscript
-rwxrwxr-x. 1 lejmic90 cis90 619 May 13 16:07 /home/cis90/lejmic/bin/myscript
-rwxrwxr-x. 1 lemrya90 cis90 776 May  9 14:40 /home/cis90/lemrya/bin/myscript
ls: cannot access /home/cis90/lovben/bin/myscript: No such file or directory
ls: cannot access /home/cis90/marrog/bin/myscript: No such file or directory
-rwxrwxr-x. 1 mazari90 cis90 719 May  9 14:23 /home/cis90/mazari/bin/myscript
-rwxrwxr-x. 1 mennat90 cis90 709 May 13 11:17 /home/cis90/mennat/bin/myscript
-rwxrwxr-x. 1 perste90 cis90 651 May  9 14:49 /home/cis90/perste/bin/myscript
-rwxrwxr-x. 1 rutsam90 cis90 692 May  9 14:39 /home/cis90/rutsam/bin/myscript
-rwxrwxr-x. 1 shepau90 cis90 717 May  9 14:23 /home/cis90/shepau/bin/myscript
-rwxrwxr-x. 1 vashil90 cis90 709 May  9 14:52 /home/cis90/vashil/bin/myscript
-rwxrwxr-x. 1 wilytr90 cis90 702 May  9 14:51 /home/cis90/wilytr/bin/myscript
-rwxrwxr-x. 1 cruben90 cis90 931 May  9 15:12 /home/cis90/cruben/bin/myscript
-rwxrwxr-x. 1 valjus90 cis90 546 May  9 14:34 /home/cis90/valjus/bin/myscript
-rwxr-x--x. 1 marand90 cis90 561 May 14 19:54 /home/cis90/marand/bin/myscript
-rwxrwxr-x. 1 goljor90 cis90 546 May  9 14:06 /home/cis90/goljor/bin/myscript
-rwxrwxr-x. 1 wismar90 cis90 1135 May 14 23:13 /home/cis90/wismar/bin/myscript
-rwxrwxr-x. 1 schrya90 cis90 739 May  9 14:26 /home/cis90/schrya/bin/myscript
-rwxrwxr-x. 1 davmic90 cis90 552 May  9 15:53 /home/cis90/davmic/bin/myscript
-rwxrwxr-x. 1 paljay90 cis90 764 May 14 23:59 /home/cis90/paljay/bin/myscript
-rwxrwxr-x. 1 berric90 cis90 726 May  9 14:53 /home/cis90/berric/bin/myscript
rsimms@oslab:~$
```

*Which myscript files cannot be run by the class?*

## Class Activity

Note: One of the requirements for the final project is setting permissions on your script so that all cis90 members can run it.

To meet this requirement use:

```
cd bin  
chmod 750 myscript  
ls -l myscript
```

umask

again!

# Permissions

## Why can other classmates write to my scripts?

### *Before Lab 10*

```
/home/cis90/rodduk/bin $ umask
0002
/home/cis90/rodduk/bin $ rm newscript; touch newscript
/home/cis90/rodduk/bin $ ls -l newscript
-rw-rw-r-- 1 rodduk cis90 0 Nov 23 16:17 newscript
/home/cis90/rodduk/bin $ chmod +x newscript
/home/cis90/rodduk/bin $ ls -l newscript
-rwxrwxr-x 1 rodduk cis90 0 Nov 23 16:17 newscript
```

### *After Lab 10*

```
/home/cis90ol/simmsben $ umask
0006
/home/cis90ol/simmsben $ rm newscript; touch newscript
/home/cis90ol/simmsben $ ls -l newscript
-rw-rw---- 1 simmsben cis90ol 0 May 12 08:44 newscript
/home/cis90ol/simmsben $ chmod +x newscript
/home/cis90ol/simmsben $ ls -l newscript
-rwxrwx--x 1 simmsben cis90ol 0 May 12 08:44 newscript
```

*Because your umask setting gives group members write permission on any new files you create!*

# Permissions

```
[rodduk90@opus bin]$ cat /home/cis90/rodduk/.bash_profile
```

```
# .bash_profile
```

```
# Get the aliases and functions
```

```
if [ -f ~/.bashrc ]; then
```

```
    . ~/.bashrc
```

```
fi
```

```
# User specific environment and startup programs
```

```
PATH=$PATH:$HOME/../bin:$HOME/bin:..
```

```
BASH_ENV=$HOME/.bashrc
```

```
USERNAME=""
```

```
PS1='$PWD $ '
```

```
export USERNAME BASH_ENV PATH
```

```
umask 002
```

```
set -o ignoreeof
```

```
stty susp
```

```
eval `tset -s -m vt100:vt100 -m :\?${TERM:-ansi} -r -Q `
```

*Note your umask is defined in .bash\_profile which runs every time you login. In lab 10 you change this setting to 006.*



## Class Activity

- Change your umask to 026
- Can group or other users modify your new files now?
- Try it, **touch** a new file and check the permissions with **ls -l**
- How would you make this a permanent umask setting?



# Final Project



# What takes longer?



**Writing the script?**

**Or deciding what to script?**



One way to get started ... select a random command to build a script around

### Commands

|        |         |        |       |
|--------|---------|--------|-------|
| .      | echo    | lpstat | sort  |
| at     | env     | ls     | spell |
| banner | exit    | mail   | su    |
| bash   | export  | man    | tail  |
| bc     | file    | me     | tee   |
| cal    | find    |        | touch |
| cancel | finger  | more   | type  |
| cat    | grep    | mv     | umask |
| cd     | head    | passwd | uname |
| chgrp  | history |        | unset |
| chmod  | id      |        | vi    |
| chown  | jobs    | rm     | wc    |
| clear  | kill    | rmdir  | who   |
| cp     | ln      | st     | write |
| date   | lp/lpr  | sleep  | xxd   |



*For this example we will pick the grep command*

# Research your command by reading the man page and googling examples

The image shows two overlapping windows. The background window is a terminal window titled 'rsimms@opus:~/cis90/project' displaying the man page for 'grep'. The foreground window is a web browser showing search results for 'linux grep command examples'.

**Terminal Window (man grep):**

```

GREP (1)
NAME
    grep, egrep, fgrep - print lines matching a pattern

SYNOPSIS
    grep [options] PATTERN [FILE...]
    grep [options] [-e PATTERN | -f FILE] [FILE...]

DESCRIPTION
    Grep searches the named input FILES (or standard input, if no files are
    named, or the file name - is given) for lines containing the pattern
    given PATTERN. By default, grep prints the matching lines.

    In addition, two variant programs egrep and fgrep are provided. Egrep
    is the same as grep -E. Fgrep is the same as grep -F.

OPTIONS
    -A NUM, --after-context=NUM
        Print NUM lines of trailing context after matching lines.
        Line containing -- between contiguous groups of options.

    -a, --text
        Process a binary file as if it were text; this option is
        implied for files whose name ends in .gz, .bz2, or .xz.
        --binary-files=TYPE
        If the first four characters of a file indicate that the file
        is binary, use TYPE to match or ignore it. TYPE may be 'text',
        'binary', or 'no-tell'.

    -B NUM, --before-context=NUM
        Print NUM lines of leading context before matching lines.
        Line containing -- between contiguous groups of options.

    -c, --count
        Print only the number of matching lines.

    -d DIR, --directories=DIR
        If DIR is 'only-files', only regular files are searched. If DIR
        is 'only-directories', only directories are searched. If DIR is
        'both', both files and directories are searched. The default
        behavior is to search only files.

    -E, --extended-regexp
        Interpret PATTERN as an extended regular expression.

    -f FILE, --file=FILE
        Read PATTERN from FILE.

    -G, --perl-regexp
        Interpret PATTERN as a Perl-compatible regular expression.

    -h, --no-headings
        Suppress the program name and version number.

    -I, --ignore-case
        Ignore case distinctions in PATTERN and in the input files.

    -l, --files-with-matches
        Print only the names of files that contain at least one matching
        line.

    -L, --files-without-matches
        Print only the names of files that do not contain any matching
        lines.

    -m NUM, --max-count=NUM
        Print at most NUM lines per file.

    -n, --line-number
        Print line numbers of each matching line.

    -N, --line-number=NUM
        Print line numbers starting from NUM.

    -o, --only-matching
        Print only the matching part of each line.

    -q, --quiet, --silent
        Suppress all normal output.

    -r, --recursive
        Recursively search subdirectories.

    -R, --recursive-only
        Recursively search subdirectories, but do not search files.

    -s, --suppress-leading-space
        Suppress leading spaces in matching lines.

    -t, --text
        Process a binary file as if it were text; this option is implied
        for files whose name ends in .gz, .bz2, or .xz.

    -T, --text-only
        Process a binary file as if it were text; this option is implied
        for files whose name ends in .gz, .bz2, or .xz.

    -v, --invert-match
        Invert the sense of the search; print only lines that do not
        match.

    -w, --word-regexp
        Interpret PATTERN as a word-regular expression.

    -x, --line-regexp
        Interpret PATTERN as a line-regular expression.

    -y, --perl-regexp
        Interpret PATTERN as a Perl-compatible regular expression.

    -Z, --null
        Print the null character (\0) after each line of output.
    
```

**Web Browser Window (Google Search Results):**

Search query: linux grep command examples

Results:

- [HowTo: Use grep Command In Linux / UNIX \[ Examples \]](#)  
www.cyberciti.biz/faq/howto-use-grep-command-in-linux-unix/  
Aug 2, 2007 – How do I use **grep command** in Linux and Unix like operating systems? Can you give me a simple **example of grep command**? The grep ...
- [15 Practical Grep Command Examples In Linux / UNIX](#)  
www.thegeekstuff.com/.../15-practical-unix-grep-command-example...  
Mar 26, 2009 – You should get a grip on the **Linux grep command**. This is part of the on-going 15 **Examples** series, where 15 detailed **examples** will be ...
- [Linux and UNIX grep command help and examples](#)  
www.computerhope.com/unix/ugrep.htm  
40+ items – Information about the Unix **grep command**, including syntax and ...  
A NUM, --after-context=NUM Print NUM lines of trailing context after matching ...

*Review the various options and arguments for the command*

Next, decide what you want to do with the command you selected. For this example we will:

1. Start a new task in **myscript**
2. Customize the menu for the new task
3. Start with a simple **grep** command
4. Add some simple interaction
5. Add successive grep commands that experiment with different options
6. Iterate till happy with it.

## Start hacking the menu!

*Customize the menu options for Task 1*

*After*

```
rodduk90@oslab:~/bin
#!/bin/bash
#
# menu: A simple menu template
#
while true
do
    clear
    echo -n "
        CIS 90 Final Project
    1) Task 1
    2) Task 2
    3) Task 3
    4) Task 4
    5) Task 5
    6) Exit

    Enter Your Choice: "
    read RESPONSE
    case $RESPONSE in
        1) # Commands for Task 1
            ;;
        2) # Commands for Task 2
            ;;
        *)
            ;;
    esac
done
"myscript" 37L, 546C
```

*Before*

```
rodduk90@oslab:~/bin
#!/bin/bash
#
# menu: A simple menu template
#
while true
do
    clear
    echo -n "
        CIS 90 Final Project
    1) Hacking with the grep command
    2) Task 2
    3) Task 3
    4) Task 4
    5) Task 5
    6) Exit

    Enter Your Choice: "
    read RESPONSE
    case $RESPONSE in
        1) # Commands for Task 1
            ;;
        2) # Commands for Task 2
            ;;
        *)
            ;;
    esac
done
-- INSERT --
10,5-12 Top
```

← → C [www.catb.org/jargon/html/H/hacker.html](http://www.catb.org/jargon/html/H/hacker.html) 🔍 ☆ ☰

**hacker:** n.

[originally, someone who makes furniture with an axe]

1. A person who enjoys exploring the details of programmable systems and how to stretch their capabilities, as opposed to most users, who prefer to learn only the minimum necessary. RFC1392, the *Internet Users' Glossary*, usefully amplifies this as: A person who delights in having an intimate understanding of the internal workings of a system, computers and computer networks in particular.
2. One who programs enthusiastically (even obsessively) or who enjoys programming rather than just theorizing about programming.
3. A person capable of appreciating [hack value](#).
4. A person who is good at programming quickly.
5. An expert at a particular program, or one who frequently does work using it or on it; as in 'a Unix hacker'. (Definitions 1 through 5 are correlated, and people who fit them congregate.)
6. An expert or enthusiast of any kind. One might be an astronomy hacker, for example.
7. One who enjoys the intellectual challenge of creatively overcoming or circumventing limitations.
8. [deprecated] A malicious meddler who tries to discover sensitive information by poking around. Hence password hacker, network hacker. The correct term for this sense is [cracker](#).

The term 'hacker' also tends to connote membership in the global community defined by the net (see [the network](#). For discussion of some of the basics of this culture, see the [How To Become A Hacker](#) FAQ. It also implies that the person described is seen to subscribe to some version of the hacker ethic (see [hacker ethic](#)).

It is better to be described as a hacker by others than to describe oneself that way. Hackers consider themselves something of an elite (a meritocracy based on ability), though one to which new members are gladly welcome. There is thus a certain ego satisfaction to be had in identifying yourself as a hacker (but if you claim to be one and are not, you'll quickly be labeled [bogus](#)). See also [geek](#), [wannabee](#).

This term seems to have been first adopted as a badge in the 1960s by the hacker culture surrounding TMRC and the MIT AI Lab. We have a report that it was used in a sense close to this entry's by teenage radio hams and electronics tinkerers in the mid-1950s.

*Hacking (building, exploring) is not cracking (malicious)*

# Layout your work area on the screen

```

rodduk90@oslab:~/bin
#!/bin/bash
#
# menu: A simple menu template
#
while true
do
    clear
    echo -n "
        CIS 90 Final Project
    1) Hacking with the grep command
    2) Task 2
    3) Task 3
    4) Task 4
    5) Task 5
    6) Exit

    Enter Your Choice: "
    read RESPONSE
    case $RESPONSE in
        1) # Commands for Task 1
            ;;
        2) # Commands for Task 2
            ;;
        3) # Commands for Task 3
            ;;
        4) # Commands for Task 4
            ;;
        5) # Commands for Task 5
            ;;
        6) exit 0
            ;;
        *) echo "Please enter a number between 1 and 6"
            ;;
    esac
    echo -n "Hit the Enter key to return to menu "
    read dummy
done
~
~
~
-- INSERT --
1,12 All
    
```

1st

```

rodduk90@oslab:~/bin
/home/cis90/rodduk $ cd bin
/home/cis90/rodduk/bin $ myscript
    
```

2nd

```

rodduk90@oslab:~
GREP(1)
NAME
    grep, egrep, fgrep - print lines matching a pattern

SYNOPSIS
    grep [OPTIONS] PATTERN [FILE...]
    grep [OPTIONS] [-e PATTERN | -f FILE] [FILE...]

DESCRIPTION
    grep searches the named input FILES (or standard input if no files are
    named, or if a single hyphen-minus (-) is given as file name) for lines
    containing a match to the given PATTERN. By default, grep prints the
    matching lines.

    In addition, two variant programs egrep and fgrep are available. egrep
    is the same as grep -E. fgrep is the same as grep -F. Direct
    invocation as either egrep or fgrep is deprecated, but is provided to
    allow historical applications that rely on them to run unmodified.

OPTIONS
    Generic Program Information
    --help Print a usage message briefly summarizing these command-line
    :
    
```

3rd

Utilize screen real estate with multiple windows:

- the 1<sup>st</sup> for vi,
- the 2<sup>nd</sup> for testing **myscript**,
- and a 3<sup>rd</sup> for experimenting or showing man pages

# Test your menu change

```

rodduk90@oslab:~/bin
#!/bin/bash
#
# menu: A simple menu template
#
while true
do
    clear
    echo -n "
        CIS 90 Final Project
    1) Hacking with the grep command
    2) Task 2
    3) Task 3
    4) Task 4
    5) Task 5
    6) Exit

    Enter Your Choice: "
    read RESPONSE
    case $RESPONSE in
        1) # Commands for Task 1
            ;;
        2) # Commands for Task 2
            ;;
        3) # Commands for Task 3
            ;;
        4) # Commands for Task 4
            ;;
        5) # Commands for Task 5
            ;;
        6) exit 0
            ;;
        *) echo "Please enter a number between 1 and 6"
            ;;
    esac
    echo -n "Hit the Enter key to return to menu "
    read dummy
done
~
~
~
"myscript" 37L, 569C written          1,11          All
    
```

```

rodduk90@oslab:~/bin
        CIS 90 Final Project
    1) Hacking with the grep command
    2) Task 2
    3) Task 3
    4) Task 4
    5) Task 5
    6) Exit

    Enter Your Choice: █
    
```

*Changes work!*

```

rodduk90@oslab:~
GREP(1)                                GREP(1)
NAME
    grep, egrep, fgrep - print lines matching a pattern

SYNOPSIS
    grep [OPTIONS] PATTERN [FILE...]
    grep [OPTIONS] [-e PATTERN | -f FILE] [FILE...]

DESCRIPTION
    grep searches the named input FILES (or standard input if no files are
    named, or if a single hyphen-minus (-) is given as file name) for lines
    containing a match to the given PATTERN. By default, grep prints the
    matching lines.

    In addition, two variant programs egrep and fgrep are available. egrep
    is the same as grep -E. fgrep is the same as grep -F. Direct
    invocation as either egrep or fgrep is deprecated, but is provided to
    allow historical applications that rely on them to run unmodified.

OPTIONS
    Generic Program Information
    --help Print a usage message briefly summarizing these command-line
    :
    
```

Run **myscript** in the 2<sup>nd</sup> window and verify your changes work



# Find the location to insert your new task commands

```

rodduk90@oslab:~/bin
3) Task 3
4) Task 4
5) Task 5
6) Exit

Enter Your Choice: "
read RESPONSE
case $RESPONSE in
  1)  # Commands for Task 1
      ;;
  2)  # Commands for Task 2
      ;;
  3)  # Commands for Task 3
      ;;
  4)  # Commands for Task 4
      ;;
  5)  # Commands for Task 5
      ;;
  6)  exit 0
      ;;
  *)  echo "Please enter a number between 1 and 6"
      ;;
esac
-- INSERT --
12,5-12 78%
```

*Now its time to add some commands to the task.*

*Be sure to insert commands **after** the generic comment and **before** the ;;*

# Add a simple command first and test it

```

rodduk90@oslab:~/bin
#!/bin/bash
#
# menu: A simple menu template
#
while true
do
    clear
    echo -n "
        CIS 90 Final Project
    1) Hacking with the grep command
    2) Task 2
    3) Task 3
    4) Task 4
    5) Task 5
    6) Exit

    Enter Your Choice: "
    read RESPONSE
    case $RESPONSE in
        1) # Commands for Task 1
            grep beauty poems/**
            ;;
        2) # Commands for Task 2
            ;;
        3) # Commands for Task 3
            ;;
        4) # Commands for Task 4
            ;;
        5) # Commands for Task 5
            ;;
        *) echo "Please enter a number between 1 and 6"
            ;;
    esac
    echo -n "Hit the Enter key to return to menu "
    read dummy
done
"myscript" 38L, 593C written          21,15-29    All

```


```

rodduk90@oslab:~/bin

        CIS 90 Final Project
    1) Hacking with the grep command
    2) Task 2
    3) Task 3
    4) Task 4
    5) Task 5
    6) Exit

    Enter Your Choice: 1
grep: poems/**: No such file or directory
Hit the Enter key to return to menu █

```

 *Oops, the change broke the script! Why? Because the relative path (beauty poems/\*\*) does not work from the bin directory*

```

rodduk90@oslab:~/
/home/cis90/rodduk $ grep beauty poems/**
poems/Shakespeare/sonnet1:That thereby beauty's rose might never die,
poems/Shakespeare/sonnet10:    That beauty still may live in thine or thee.
poems/Shakespeare/sonnet11:Herein lives wisdom, beauty, and increase;
poems/Shakespeare/sonnet17:If I could write the beauty of your eyes,
poems/Shakespeare/sonnet2:And dig deep trenches in thy beauty's field,
poems/Shakespeare/sonnet2:Then being ask'd, where all thy beauty lies,
poems/Shakespeare/sonnet2:How much more praise deserv'd thy beauty's use,
poems/Shakespeare/sonnet2:Proving his beauty by succession thine.
poems/Shakespeare/sonnet4:Upon thyself thy beauty's legacy?
poems/Shakespeare/sonnet4:    Thy unus'd beauty must be tomb'd with thee,
poems/Shakespeare/sonnet5:Beauty's effect with beauty were bereft,
poems/Shakespeare/sonnet7:Yet mortal looks adore his beauty still,
poems/Shakespeare/sonnet9:But beauty's waste hath in the world an end,
poems/Yeats/old:And loved your beauty with love false or true,
/home/cis90/rodduk $ █

```

Experiment with a **grep** command in 3<sup>rd</sup> window

In the 1<sup>st</sup> window add the new grep command then save with **<esc>:w** (don't quit vi)

Run **myscript** in the 2<sup>nd</sup> second window to test change.

# Fix it and test again

```

rodduk90@oslab:~/bin
#!/bin/bash
#
# menu: A simple menu template
#
while true
do
    clear
    echo -n "
        CIS 90 Final Project
    1) Hacking with the grep command
    2) Task 2
    3) Task 3
    4) Task 4
    5) Task 5
    6) Exit

    Enter Your Choice: "
    read RESPONSE
    case $RESPONSE in
        1) # Commands for Task 1
            grep beauty /home/cis90/rodduk/poems/*/*
            ;;
        2) # Commands for Task 2
            ;;
        3) # Commands for Task 3
            ;;
        4) # Commands for Task 4
            ;;
        5) # Commands for Task 5
            ;;
        *) echo "Please enter a number between 1 and 6"
            ;;
    esac
    echo -n "Hit the Enter key to return to menu "
    read dummy
done
~
~
"myscript" 38L, 612C written          21,33-47    All
    
```

```

rodduk90@oslab:~/bin
        CIS 90 Final Project
    1) Hacking with the grep command
    2) Task 2
    3) Task 3
    4) Task 4
    5) Task 5
    6) Exit

    Enter Your Choice: 1
/home/cis90/rodduk/poems/Shakespeare/sonnet1:That thereby beauty's rose might ne
ver die,
/home/cis90/rodduk/poems/Shakespeare/sonnet10: That beauty still may live in th
ine or thee.
/home/cis90/rodduk/poems/Shakespeare/sonnet11:Herein lives wisdom, beauty, and i
ncrease;
/home/cis90/rodduk/poems/Shakespeare/sonnet17:If I could write the beauty of you
r eyes,
/home/cis90/rodduk/poems/Shakespeare/sonnet2:And dig deep trenches in thy beauty
's field,
/home/cis90/rodduk/poems/Shakespeare/sonnet2:Then being ask'd, where all thy bea
uty lies,
/home/cis90/rodduk/poems/Shakespeare/sonnet2:How much more praise deserv'd thy b
eauty's use,
/home/cis90/rodduk/poems/Shakespeare/sonnet2:Proving his beauty by succession th
ine.
/home/cis90/rodduk/poems/Shakespeare/sonnet4:Upon thyself thy beauty's legacy?
/home/cis90/rodduk/poems/Shakespeare/sonnet4: Thy unus'd beauty must be tomb'd
with thee,
/home/cis90/rodduk/poems/Shakespeare/sonnet5:Beauty's effect with beauty were be
reft,
/home/cis90/rodduk/poems/Shakespeare/sonnet7:Yet mortal looks adore his beauty s
till,
/home/cis90/rodduk/poems/Shakespeare/sonnet9:But beauty's waste hath in the worl
d an end,
/home/cis90/rodduk/poems/Yeats/old:And loved your beauty with love false or true
,
Hit the Enter key to return to menu
    
```

Fix worked! 😄

Fix task in 1<sup>st</sup> window by using an absolute pathname then save with **<esc>:w**

Re-run **myscript** in the 2<sup>nd</sup> second window and test your change. To do this quickly hit **Ctrl-C** then **<up arrow>** key.

```

/home/cis90/rodduk/poems/Shakespeare/sonnet5:Beauty's effect with beauty were bereft,
/home/cis90/rodduk/poems/Shakespeare/sonnet7:Yet mortal looks adore his beauty still,
/home/cis90/rodduk/poems/Shakespeare/sonnet9:But beauty's waste hath in the world an end,
/home/cis90/rodduk/poems/Yeats/old:And loved your beauty with love false or true,
/home/cis90/rodduk $
    
```

# Add some interaction

```

rodduk90@oslab:~/bin
#!/bin/bash
#
# menu: A simple menu template
#
while true
do
    clear
    echo -n "
    CIS 90 Final Project
    1) Hacking with the grep command
    2) Task 2
    3) Task 3
    4) Task 4
    5) Task 5
    6) Exit

    Enter Your Choice:
    read RESPONSE
    case $RESPONSE in
        1) # Commands for Task 1
            echo "Are you ready to search for beauty in the poems?"
            read dummy
            grep beauty /home/cis90/rodduk/poems/*/*
            ;;
        2) # Commands for Task 2
            ;;
        3) # Commands for Task 3
            ;;
        4) # Commands for Task 4
            ;;
        5) # Commands for Task 5
            ;;
        6) exit 0
            ;;
        *) echo "Please enter a number between 1 and 6"
            ;;
    esac
    echo -n "Hit the Enter key to return to menu "
    read dummy
done
"myscript" 40L, 711C written
    
```

*Let's add some interaction*

1) # Commands for Task 1

```

echo "Are you ready to search for beauty in the poems?"
read dummy
grep beauty /home/cis90/rodduk/poems/*/*
;;
    
```

```

rodduk90@oslab:~/bin

    CIS 90 Final Project
    1) Hacking with the grep command
    2) Task 2
    3) Task 3
    4) Task 4
    5) Task 5
    6) Exit

    Enter Your Choice: 1
    Are you ready to search for beauty in the poems?

    /home/cis90/rodduk/poems/Shakespeare/sonnet1:That thereby beauty's rose might never die,
    /home/cis90/rodduk/poems/Shakespeare/sonnet10: That beauty still may live in thine or thee.
    /home/cis90/rodduk/poems/Shakespeare/sonnet11:Herein lives wisdom, beauty, and increase;
    /home/cis90/rodduk/poems/Shakespeare/sonnet17:If I could write the beauty of your eyes,
    /home/cis90/rodduk/poems/Shakespeare/sonnet2:And dig deep trenches in thy beauty's field,
    /home/cis90/rodduk/poems/Shakespeare/sonnet2:Then being ask'd, where all thy beauty lies,
    /home/cis90/rodduk/poems/Shakespeare/sonnet2:How much more praise deserv'd thy beauty's use,
    /home/cis90/rodduk/poems/Shakespeare/sonnet2:Proving his beauty by succession thine.
    /home/cis90/rodduk/poems/Shakespeare/sonnet4:Upon thyself thy beauty's legacy?
    /home/cis90/rodduk/poems/Shakespeare/sonnet4: Thy unus'd beauty must be tomb'd with thee,
    /home/cis90/rodduk/poems/Shakespeare/sonnet5:Beauty's effect with beauty were bereft,
    /home/cis90/rodduk/poems/Shakespeare/sonnet7:Yet mortal looks adore his beauty still,
    /home/cis90/rodduk/poems/Shakespeare/sonnet9:But beauty's waste hath in the world an end,
    /home/cis90/rodduk/poems/Yeats/old:And loved your beauty with love false or true,
    Hit the Enter key to return to menu
    
```

*And it works!*

# Try a new option on the command

```

rodduk90@oslab:~/bin
#!/bin/bash
#
# menu: A simple menu template
#
while true
do
    clear
    echo -n "
    CIS 90
    1) Hacking with the grep command
    2) Task 2
    3) Task 3
    4) Task 4
    5) Task 5
    6) Exit

    Enter Your Choice:
    read RESPONSE
    case $RESPONSE in
        1) # Commands for Task 1
            echo "Are you ready to search for beauty in the poems?"
            read dummy
            grep -h beauty /home/cis90/rodduk/poems/*/*
            ;;
        2) # Commands for Task 2
            ;;
        3) # Commands for Task 3
            ;;
        4) # Commands for Task 4
            ;;
        5) # Commands for Task 5
            ;;
        6) exit 0
        *) echo "Please enter a number between 1 and 6."
            ;;
    esac
    echo -n "Hit the Enter key to return to menu: "
    read dummy
done
"myscript" 40L, 714C written
    
```

*Let's try the -h option and not print the leading file names*

```

1) # Commands for Task 1
echo "Are you ready to search for beauty in the poems?"
read dummy
grep -h beauty /home/cis90/rodduk/poems/*/*
;;
    
```

```

rodduk90@oslab:~/bin
CIS 90 Final Project
1) Hacking with the grep command
2) Task 2
3) Task 3
4) Task 4
5) Task 5
6) Exit

Enter Your Choice: 1
Are you ready to search for beauty in the poems?
1
That thereby beauty's rose might never die,
    That beauty still may live in thine or thee.
Herein lives wisdom, beauty, and increase;
If I could write the beauty of your eyes,
And dig deep trenches in thy beauty's field,
Then being ask'd, where all thy beauty lies,
How much more praise deserv'd thy beauty's use,
Proving his beauty by succession thine.
Upon thyself thy beauty's legacy?
    Thy unus'd beauty must be tomb'd with thee,
Beauty's effect with beauty were bereft,
Yet mortal looks adore his beauty still,
But beauty's waste hath in the world an end,
And loved your beauty with love false or true,
Hit the Enter key to return to menu
    
```

*And it works!*

# Add a new feature

Let's add a count of the strings found now

1) # Commands for Task 1

```

echo "Are you ready to search for beauty in the poems?"
read dummy
grep -h beauty /home/cis90/rodduk/poems/*/*
echo "Ready to count them?"
read dummy
grep -h beauty /home/cis90/rodduk/poems/*/* | wc -l

```

```

#!/bin/bash
#
# menu: A s
#
while true
do
  cle
  ech
  1) # Commands for Task 1
  echo "Are you ready to search for beauty in the poems?"
  read dummy
  grep -h beauty /home/cis90/rodduk/poems/*/*
  echo "Ready to count them?"
  read dummy
  grep -h beauty /home/cis90/rodduk/poems/*/* | wc -l
  ;;
  2) # Commands for Task 2
  ;;
  3) # Commands for Task 3
  ;;
  4) # Commands for Task 4
  ;;
  5) # Commands for Task 5
  ;;
  6) exit 0
  ;;
  *) echo "Please enter a number between 1 and 6"
  ;;
esac
"myscript" 43L, 839C written
26,53-67

```

```

rodduk90@oslab:~/bin
CIS 90 Final Project
1) Hacking with the grep command
2) Task 2
3) Task 3
4) Task 4
5) Task 5
6) Exit

Enter Your Choice: 1
Are you ready to search for beauty in the poems?

That thereby beauty's rose might never die,
That beauty still may live in thine or thee.
Herein lives wisdom, beauty, and increase;
If I could write the beauty of your eyes,
And dig deep trenches in thy beauty's field,
Then being ask'd, where all thy beauty lies,
How much more praise deserv'd thy beauty's use,
Proving his beauty by succession thine.
Upon thyself thy beauty's legacy?
Thy unus'd beauty must be tomb'd with thee,
Beauty's effect with beauty were bereft,
Yet mortal looks adore his beauty still,
But beauty's waste hath in the world an end,
And loved your beauty with love false or true,
Ready to count them?

14
Hit the Enter key to return to menu

```

## How many points so far?

*Let's score our mini-script so far*

```
1) # Commands for Task 1
echo "Are you ready to search for beauty in the poems?"
read dummy
grep -h beauty /home/cis90/rodduk/poems/*/*
echo "Ready to count them?"
read dummy
grep -h beauty /home/cis90/rodduk/po
;;
```

Implementing all five tasks (6 points each):

- Requirements for each task:
- NO** -Minimum of 10 "original" script command lines
- NO** -Has one or more non-generic comments to explain what it is doing
- ✓ -Has user interaction

You don't have to do all of these but do at least five:

- Redirecting stdin (5 points)
- Redirecting stdout (5 points)
- Redirecting stderr (5 points)
- Use of permissions (5 points)
- ✓ • Use of filename expansion characters (5 points)
- ✓ • Use of absolute path (5 points)
- Use of relative path (5 points)
- Use of a PID (5 points)
- Use of inodes (5 points)
- Use of links (5 points)
- Use of scheduling (5 points)
- Use of a GID or group (5 points)
- Use of a UID or user (5 points)
- Use of a /dev/tty device (5 points)
- Use of a signal (5 points)
- ✓ • Use of piping (5 points)
- Use of an environment variable (5 points)
- Use of /bin/mail (5 points)
- Use of a conditional (5 points)

The maximum for this section is 25 points.

# Make another enhancement

*Enhance script to let user specify search string and use color*

```

1) # Commands for Task 1
echo "Are you ready to search for beauty in the poems?"
read dummy
grep -h beauty /home/cis90/rodduk/poems/*/*
echo "Ready to count them?"
read dummy
2)
3) grep -h beauty /home/cis90/rodduk/poems/*/* | wc -l
4)
5) echo "Enter a new string to search for"
6) read string
echo searching for '$string'
grep -h --color $string /home/cis90/rodduk/poems/*/*
;;

```

```

read dummy
grep -h beauty /home/cis90/rodduk/poems/*/*
echo "Ready to count them?"
read dummy
grep -h beauty /home/cis90/rodduk/poems/*/* | wc -l
echo "Enter a new string to search for"
read string
echo searching for '$string'
grep -h --color $string /home/cis90/rodduk/poems/*/*
;;

```

```

rodduk90@oslab:~/bin
5) Task 5
6) Exit

Enter Your Choice: 1
Are you ready to search for beauty in the poems?

That thereby beauty's rose might never die,
    That beauty still may live in thine or thee.
Herein lives wisdom, beauty, and increase;
If I could write the beauty of your eyes,
And dig deep trenches in thy beauty's field,
Then being ask'd, where all thy beauty lies,
How much more praise deserv'd thy beauty's use,
Proving his beauty by succession thine.
Upon thyself thy beauty's legacy?
    Thy unus'd beauty must be tomb'd with thee,
Beauty's effect with beauty were bereft,
Yet mortal looks adore his beauty still,
But beauty's waste hath in the world an end,
And loved your beauty with love false
Ready to count them?

14
Enter a new string to search for
sweet
searching for "sweet"
Thyself thy foe, to thy sweet self too cruel.
To show me worthy of thy sweet respect:
To thy sweet will making addition thus.
Thou of thyself thy sweet self dost deceive,
    Leese but their show, their substance still lives sweet.
Hit the Enter key to return to menu

```

*And it works!*



## Check the score again

### Let's re-score modified script

```
1) # Commands for Task 1
echo "Are you ready to search for beauty in the poems?"
read dummy
grep -h beauty /home/cis90/rodduk/poems/*/*
echo "Ready to count them?"
read dummy
grep -h beauty /home/cis90/rodduk/poems/*/*
echo "Enter a new string to search for:"
read string
echo searching for "'$string'"
grep -h --color $string /home/cis90/rodduk/poems/*/*
;;
```

#### Implementing all five tasks (6 points each):

- Requirements for each task:
  - ✓ -Minimum of 10 "original" script command lines
  - NO -Has one or more non-generic comments to explain what it is doing
  - ✓ -Has user interaction

#### You don't have to do all of these but do at least five:

- Redirecting stdin (5 points)
- Redirecting stdout (5 points)
- Redirecting stderr (5 points)
- Use of permissions (5 points)
- ✓ • Use of filename expansion characters (5 points)
- ✓ • Use of absolute path (5 points)
- Use of relative path (5 points)
- Use of a PID (5 points)
- Use of inodes (5 points)
- Use of links (5 points)
- Use of scheduling (5 points)
- Use of a GID or group (5 points)
- Use of a UID or user (5 points)
- Use of a /dev/tty device (5 points)
- Use of a signal (5 points)
- ✓ • Use of piping (5 points)
- Use of an environment variable (5 points)
- Use of /bin/mail (5 points)
- Use of a conditional (5 points)

The maximum for this section is 25 points.

# Bing - one task done that meets minimum requirements!

*Add some comments to help others understand what you are doing*

```
1) # Task 1 - grep command explored

# Simple grep for "beauty"
echo "Are you ready to search for beauty in the poems?"
read dummy
grep -h beauty /home/cis90/rodduk/poem

# Same as before but counts matches to
echo "Ready to count them?"
read dummy
grep -h beauty /home/cis90/rodduk/poem

# Prompt user to supply search string
echo "Enter a new string to search for"
read string
echo searching for "'$string'"
grep -h $string /home/cis90/rodduk/poem
;;
```

Implementing all five tasks (6 points each):

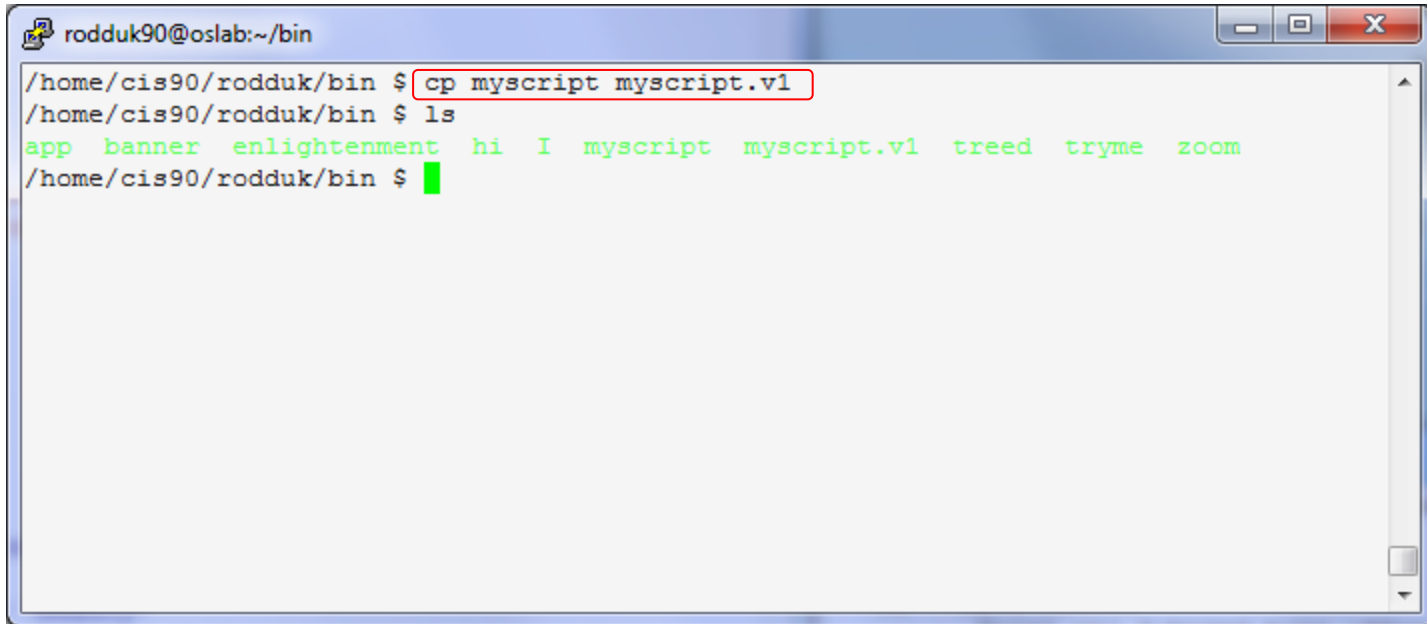
- Requirements for each task:
  - ✓ -Minimum of 10 "original" script command lines
  - ✓ -Has one or more non-generic comments to explain what it is doing
  - ✓ -Has user interaction

You don't have to do all of these but do at least five:

- Redirecting stdin (5 points)
- Redirecting stdout (5 points)
- Redirecting stderr (5 points)
- Use of permissions (5 points)
- ✓ Use of filename expansion characters (5 points)
- ✓ Use of absolute path (5 points)
- Use of relative path (5 points)
- Use of a PID (5 points)
- Use of inodes (5 points)
- Use of links (5 points)
- Use of scheduling (5 points)
- Use of a GID or group (5 points)
- Use of a UID or user (5 points)
- Use of a /dev/tty device (5 points)
- Use of a signal (5 points)
- ✓ Use of piping (5 points)
- Use of an environment variable (5 points)
- Use of /bin/mail (5 points)
- Use of a conditional (5 points)

The maximum for this section is 25 points.

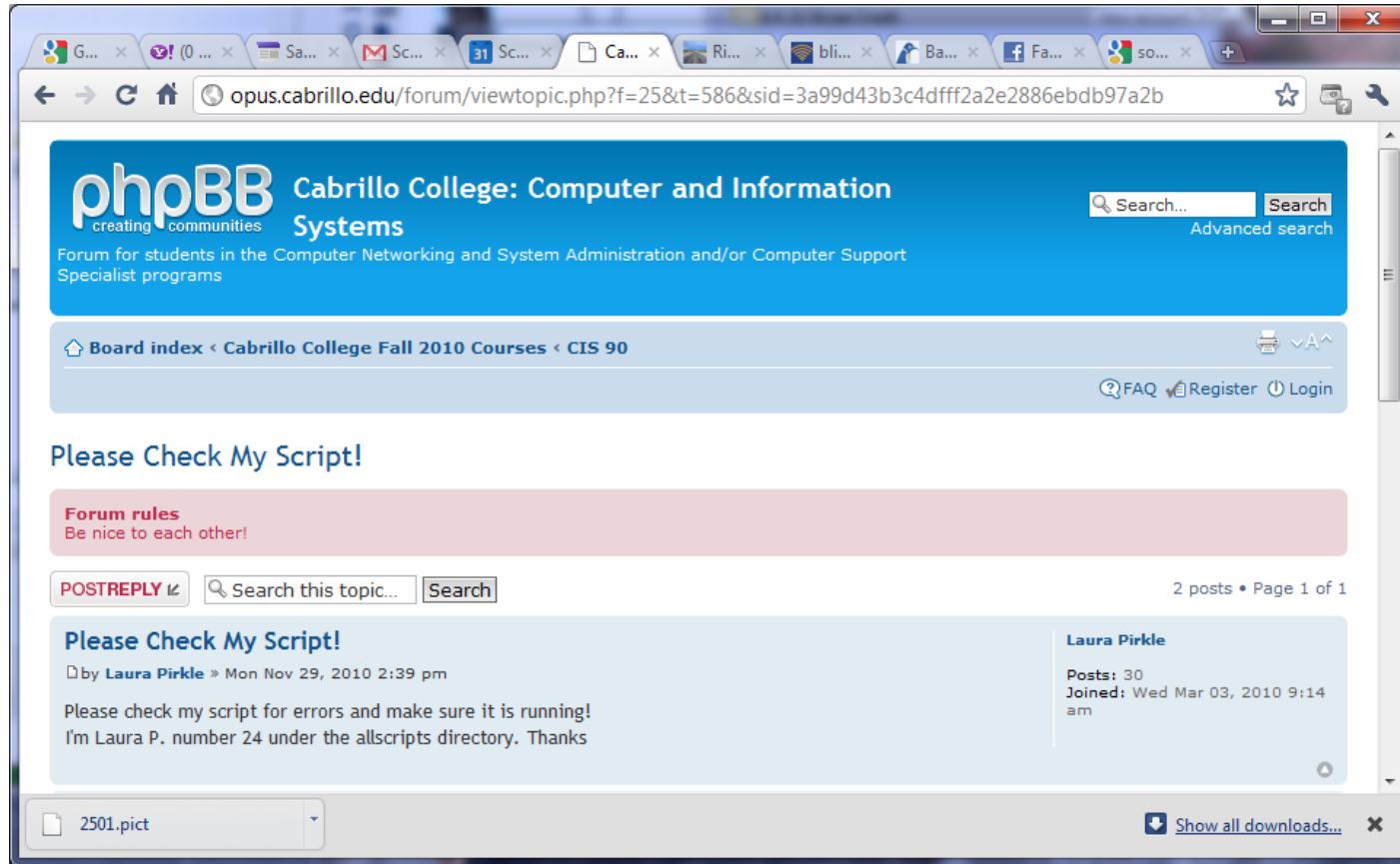
*And has fulfilled three of the five requirements for the overall project!*



```
rodduk90@oslab:~/bin
/home/cis90/rodduk/bin $ cp myscript myscript.v1
/home/cis90/rodduk/bin $ ls
app banner enlightenment hi I myscript myscript.v1 treed tryme zoom
/home/cis90/rodduk/bin $
```

*Make a backup copy of your hard work!*

# Testing your script



*The ask others on the forum to check your script and give you feedback*

## Plan extra time for:

- Figuring out how to do what you really want to do!
- Removing syntax errors
- Removing logic errors
- Posting script code on the forum and asking others to view it and suggest how to fix it
- Sleeping on it

*Don't wait till the last minute to start your project!*



# Scripting Tips

date

## Utilizing the date command

The date command prints the current date and time

```
/home/cis90/simben $ date
Tue Nov 20 15:54:13 PST 2012
```

The **\$** metacharacter provides the “value” of both variables, e.g. \$PS1 or commands, e.g. **\$(command)**:

```
/home/cis90/simben $ echo $PS1
$PWD $
```

```
/home/cis90/simben $ echo $(grep love poems/Shakespeare/* | wc -l)
11
```

```
/home/cis90/simben $ myname=$(grep $LOGNAME /etc/passwd | cut -f5 -d":")
/home/cis90/simben $ echo $myname
Benji Simms
```

# Utilizing the date command

```
/home/cis90/simben $ date  
Wed Nov 26 15:35:53 PST 2008
```

```
/home/cis90/simben $ date +%r  
04:14:26 PM
```

```
/home/cis90/simben $ time=$(date +%r)
```

```
/home/cis90/simben $ echo "At the tone the time will be $time"
```

```
At the tone the time will be 04:15:02 PM
```

```
/home/cis90/simben $ date +%A
```

```
Tuesday
```

```
/home/cis90/simben $ day=$(date +%A)
```

```
/home/cis90/simben $ echo "Today is $day"
```

```
Today is Tuesday
```

*See the man page on date for lots of other % codes*



## Class Activity

Your turn, make a script by adding the following two lines to a file named *mydate* using the vi editor:

```
echo "Hola $LOGNAME"  
echo Today is $(date +%m/%d/%Y')
```

Give the script execute permissions and run it:

```
/home/cis90/simben $ chmod +x mydate  
/home/cis90/simben $ mydate  
Hola simben90  
Today is 11/20/2012
```



# tips on script names

# Don't name your scripts "script"

```
[simben90@opus bin]$ ls -l script  
-rwxr-x--- 1 simben90 cis90 47 Nov 23 16:44 script
```

```
[simben90@opus bin]$ cat script  
echo "Hello from the script file named script"
```

*What would happen if you ran the script above?*

# Don't name your scripts "script"

```
[simben90@opus bin]$ cat script
echo "Hello from the script file named script"
```



```
[simben90@opus bin]$ script
Script started, file is typescript
```



*Why the heck  
doesn't my script  
do what it's  
supposed to do?*

```
[simben90@opus bin]$ Where is my script?
bash: Where: command not found
[simben90@opus bin]$ exit
Script done, file is typescript
[simben90@opus bin]$ cat typescript
Script started on Wed 13 May 2009 08:00:02 AM PDT
[simben90@opus bin]$ Where is my script?
bash: Where: command not found
[simben90@opus bin]$ exit
```

```
Script done on Wed 13 May 2009 08:00:47 AM PDT
[simben90@opus bin]$
```

# Don't name your scripts "script"

*Why doesn't script do what it is supposed to do? ... because script is the name of an existing UNIX command!*

```
[simben90@opus bin]$ man script
```

```
[simben90@opus bin]$
```

The screenshot shows a terminal window titled "roddyduk@opus:~/bin" with a window manager title bar. The terminal displays the output of the command "man script". The output is formatted as follows:

```
SCRIPT (1)                                BSD General Commands Manual                SCRIPT (1)
NAME
    script - make typescript of terminal session
SYNOPSIS
    script [-a] [-c COMMAND] [-f] [-q] [-t] [file]
DESCRIPTION
    Script makes a typescript of everything printed on your terminal.  It is
    useful for students who need a hardcopy record of an interactive session
    as proof of an assignment, as the typescript file can be printed out
    later with lpr(1).

    If the argument file is given, script saves all dialogue in file.  If no
    file name is given, the typescript is saved in the file typescript.

Options:

-a      Append the output to file or typescript, retaining the prior con-
        tents.

-c COMMAND
        Run the COMMAND rather than an interactive shell.  This makes it
        easy for a script to capture the output of a program that behaves
        differently when its stdout is not a tty.
```

# Don't name your scripts "script"

*There are (at least) two files named script on Opus*

```
[simben90@opus bin]$ type script
script is hashed (/usr/bin/script)
[simben90@opus bin]$ file /usr/bin/script
/usr/bin/script: ELF 32-bit LSB executable, Intel 80386, version 1
(SYSV), for GNU/Linux 2.6.9, dynamically linked (uses shared libs),
for GNU/Linux 2.6.9, stripped
```

```
[simben90@opus bin]$ type /home/cis90/simben/bin/script
/home/cis90/simben/bin/script is /home/cis90/simben/bin/script
[simben90@opus bin]$ file /home/cis90/simben/bin/script
/home/cis90/simben/bin/script: ASCII text
[simben90@opus bin]$
```

**Question:** *Why did bash run the script in /usr/bin instead of the script in /home/cis90/simben/bin?*

# Don't name your scripts "script"

**Question:** Why did bash run the script in /usr/bin instead of the script in /home/cis90/simben/bin?

The Linux **script** command is in this directory

```
[simben90@opus bin]$ echo $PATH  
/usr/kerberos/bin:/usr/local/bin:/bin:/usr/bin:/home/cis90/bin:  
/home/cis90/simben/bin:.
```

Our script, named **script**, is in this directory

**Answer:** bash searches the path in the order the directories are listed. It finds the script command in /user/bin first.

# Don't name your scripts "script"

*To override the PATH you can always specify an absolute pathname to the file you want to run:*

```
[simben90@opus bin]$ /home/cis90/simben/bin/script  
Hello from the script file named script
```

```
[simben90@opus bin]$ ./script  
Hello from the script file named script
```

*Note the shell treats the . above as "here" which in this case is /home/cis90/simben/bin*



## Try the script command

- Use the **script** command to start recording
- Type various commands of your choice
- Type **exit** or hit **Ctrl-D** to end recording
- Use **cat typescript** to see what you recorded

*This would be a good way to record a session such as working one of the lab assignments for future reference.*



# Review

```
function runningScript ()  
{
```

# The rules of the road for variables

- Rule 1: A child process can only see variables the parent has exported.
- Rule 2: A child process cannot change the parent's variables.

## Running a Script

```
/home/cis90/simben $ cat mydate  
#!/bin/bash  
echo "Hola $LOGNAME"  
date +%m/%d/%Y'  
echo $myvar1 $myvar2 $myvar3
```

*Add this line to  
the last script we  
made*

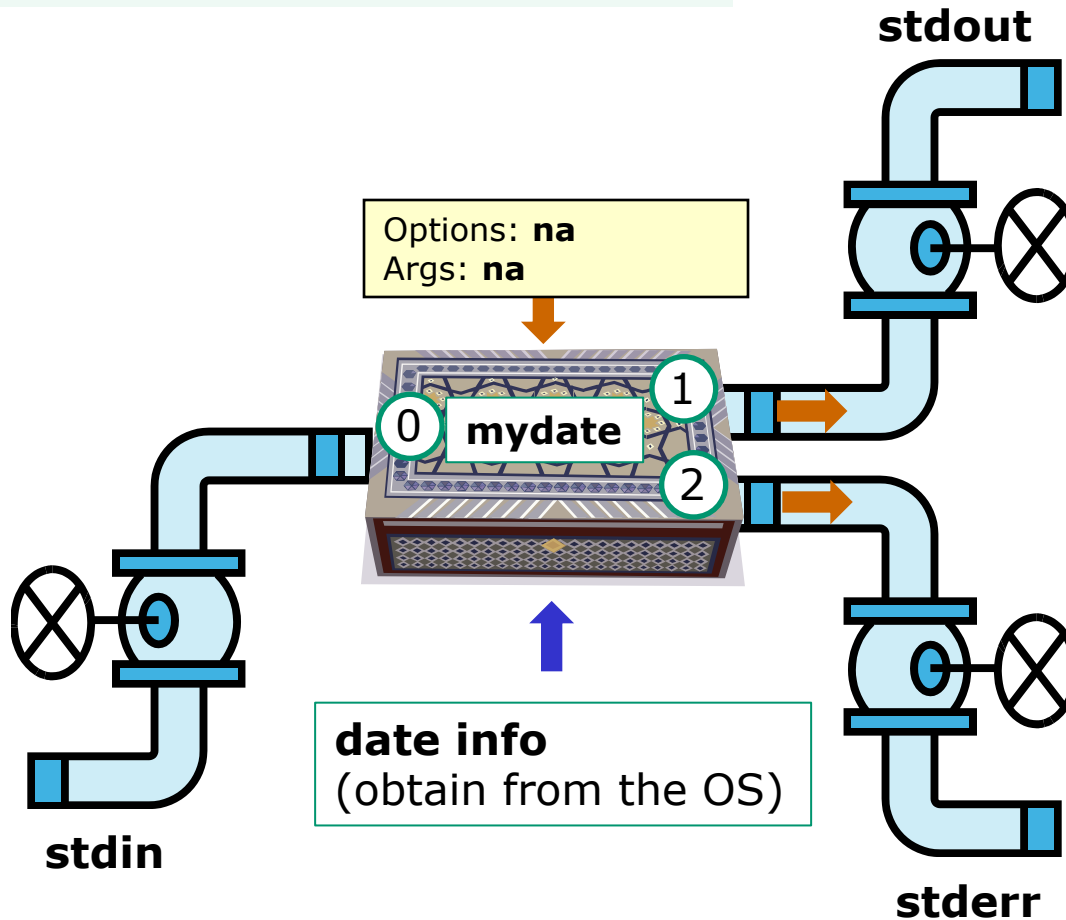
*Don't initialize  
them yet*

```
/home/cis90/simben $ mydate  
Hola simben90  
05/16/2013  
  
/home/cis90/simben $
```

*Because the variables  
don't exist yet the last  
echo statement prints a  
blank line*

# Running a Script

```
$ mydate
```



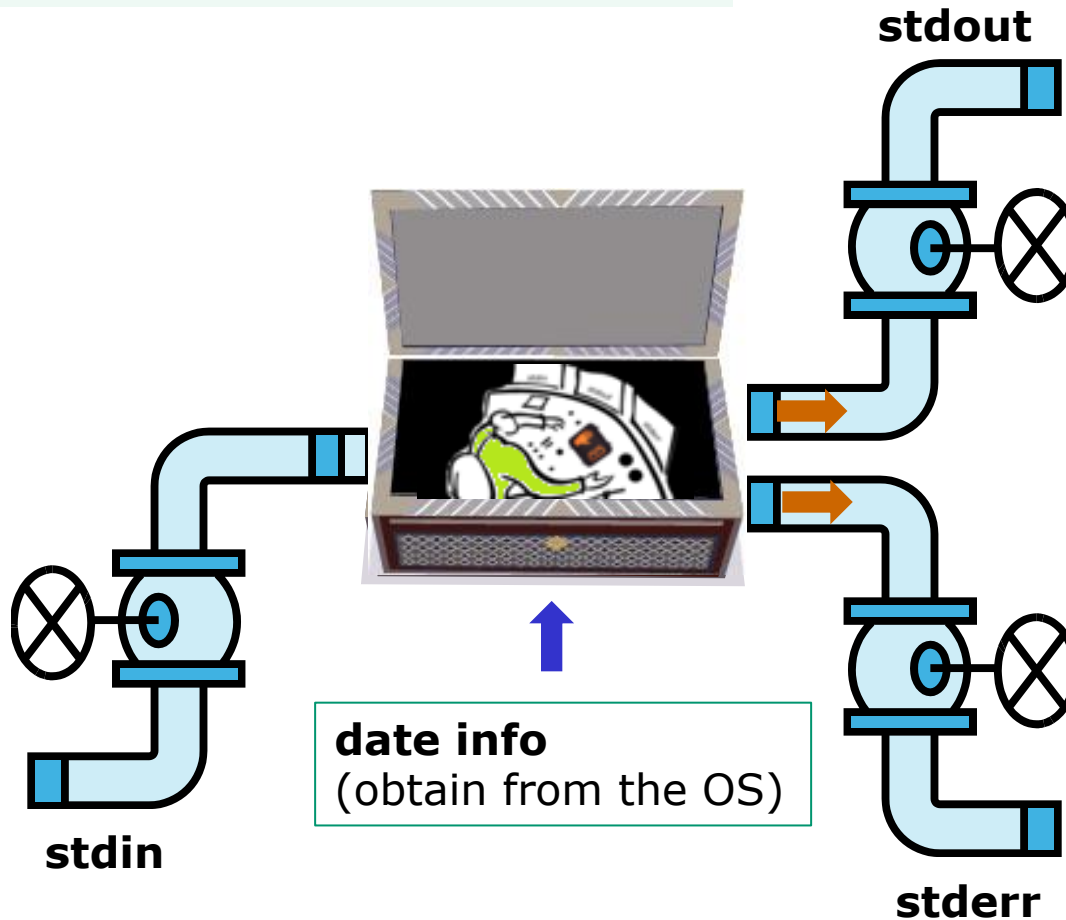
```
Hola simben90  
05/09/2013
```

*In this example, output from **myscript** goes to **stdout**.*

***stdout** has not been redirected so it goes to the default terminal device (your screen).*

# Running a Script

```
$ mydate
```

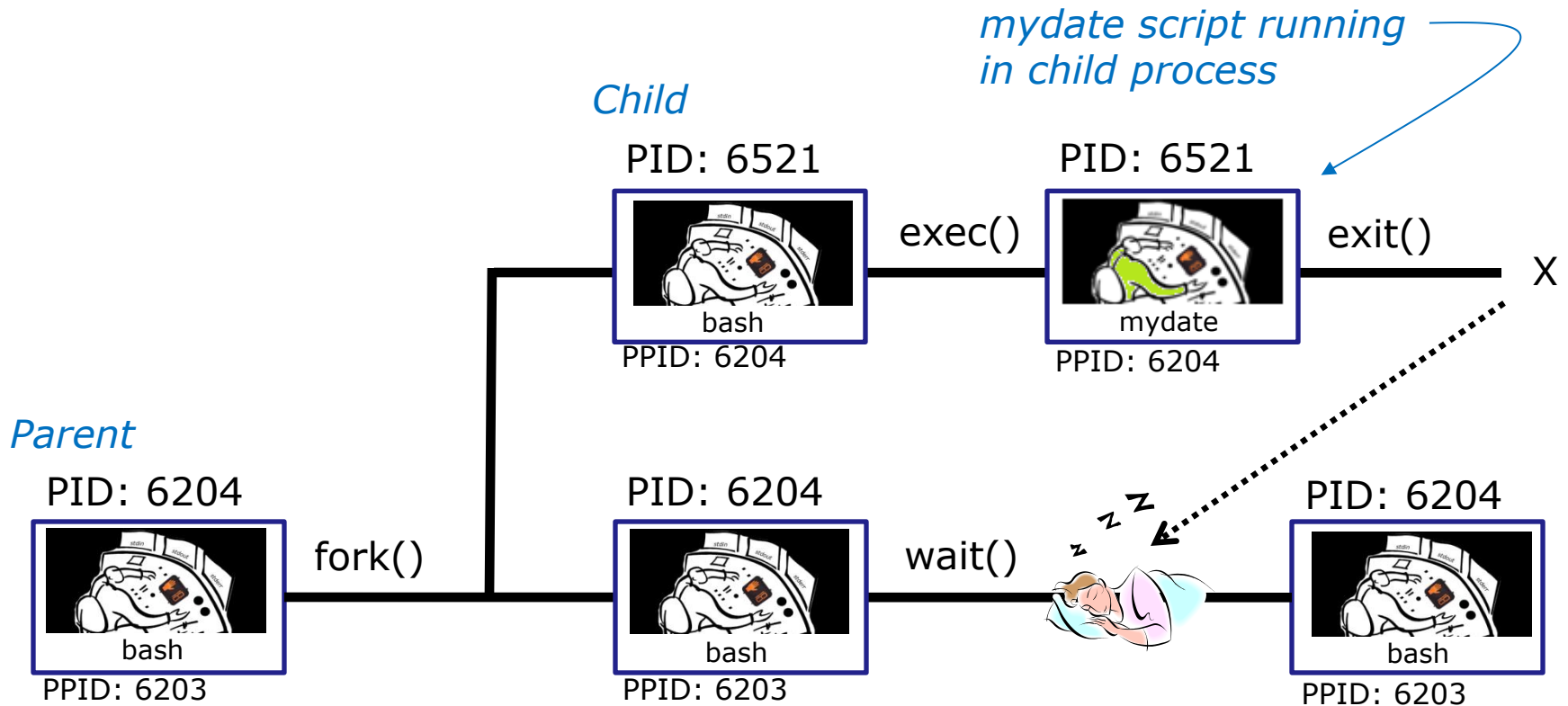


```
Hola simben90  
05/16/2012
```

*A sneak peek into memory to see what our process looks like!*



# Running a Script



Whenever you run any command, program, or script it runs as a **child process**

## Running a Script

```
/home/cis90/simben $ cat mydate
#!/bin/bash
echo "Hola $LOGNAME"
date +%m/%d/%Y'
echo $myvar1 $myvar2 $myvar3
```

*In the parent process, initialize the three variables*

```
/home/cis90/simben $ myvar1=Tic; myvar2=Tac; myvar3=Toe
/home/cis90/simben $ echo $myvar1 $myvar2 $myvar3
Tic Tac Toe
```

*What happens if we run **mydate** now?*



## Running a Script

```
/home/cis90/simben $ cat mydate  
#!/bin/bash  
echo "Hola $LOGNAME"  
date +%m/%d/%Y'  
echo $myvar1 $myvar2 $myvar3
```

```
/home/cis90/simben $ myvar1=Tic; myvar2=Tac; myvar3=Toe  
/home/cis90/simben $ echo $myvar1 $myvar2 $myvar3  
Tic Tac Toe
```

```
/home/cis90/simben $ mydate  
Hola simben90  
05/09/2012
```

*Running **mydate**  
(as a child process)*

```
/home/cis90/simben $
```

***Why no Tic Tac Toe output?***

## Running a Script

```
/home/cis90/simben $ export myvar1  
/home/cis90/simben $ mydate  
Hola simben90  
05/09/2012  
Tic
```

*Rule 1: A child process can only see variables the parent has exported*

```
/home/cis90/simben $ export myvar2  
/home/cis90/simben $ mydate  
Hola simben90  
05/09/2012  
Tic Tac
```

```
/home/cis90/simben $ export myvar3  
/home/cis90/simben $ mydate  
Hola simben90  
05/09/2012  
Tic Tac Toe
```

## Running a Script

```
/home/cis90/simben $ echo $myvar1 $myvar2 $myvar3  
Tic Tac Toe
```

```
/home/cis90/simben $ cat mydate
```

```
#!/bin/bash
```

```
echo "Hola $LOGNAME"
```

```
date +%m/%d/%Y'
```

```
echo $myvar1 $myvar2 $myvar3
```

```
myvar1=red myvar2=white myvar3=blue
```

```
echo $myvar1 $myvar2 $myvar3
```

*Add these  
new lines*

```
/home/cis90/simben $ mydate
```

```
Hola simben90
```

```
05/09/2012
```

```
Tic Tac Toe
```

```
red white blue
```

*Rule 2: A child process  
cannot change the  
parent's variables.*

```
/home/cis90/simben $ echo $myvar1 $myvar2 $myvar3
```

```
Tic Tac Toe
```

## Running a Script

*Unless we want them to*

```
/home/cis90/simben $ echo $myvar1 $myvar2 $myvar3  
Tic Tac Toe
```

```
/home/cis90/simben $ source mydate  
Hola simben90  
05/09/2012  
Tic Tac Toe  
red white blue
```

*Sourcing a script causes the instructions to be run in the parent process. A child process is not created*

```
/home/cis90/simben $ echo $myvar1 $myvar2 $myvar3  
red white blue
```



```
}  
while no-comprende  
do  
  runningScript  
done
```



# Printers

Sneak Peak for CIS 90 Students





Two predominate types of printers

- Thermal inkjet technology
- Laser, drum, toner technology





So many ways to hook them up ...

Now:

- Network
- USB
- Wireless (Bluetooth, IR)



Back then:

- Serial cable
- Parallel printer cable



# Printer Configuration

# CUPS

Example printer configuration



Printer: HP LaserJet 1320n  
Connection: LAN

# CUPS



*The LaserJets have a web-based management utility*

The screenshot shows a web browser window displaying the HP LaserJet 1320 series management utility. The browser address bar shows the IP address 172.30.1.14. The page has a blue header with the HP logo and the text "hp LaserJet 1320 series". Below the header, there are tabs for "Information", "Settings", and "Networking". The "Information" tab is selected, showing a "Device Status" section with a "Status: Ready" indicator and buttons for "Refresh Status", "Enter", and "Cancel Job". A "Supplies" section shows "Toner: (% Remaining)" with a progress bar for the "Black Cartridge" at 97%. A "Product Information" section lists details such as Product Name, Formatter Number, Product Serial Number, Service ID, Firmware Datecode, and Total Memory.

| Product Information    |                         |
|------------------------|-------------------------|
| Product Name:          | hp LaserJet 1320 series |
| Formatter Number:      | JH03T2Z                 |
| Product Serial Number: | CNHC6360LV              |
| Service ID:            | 16101                   |
| Firmware Datecode:     | 20041024                |
| Total Memory:          | 16 MBytes               |

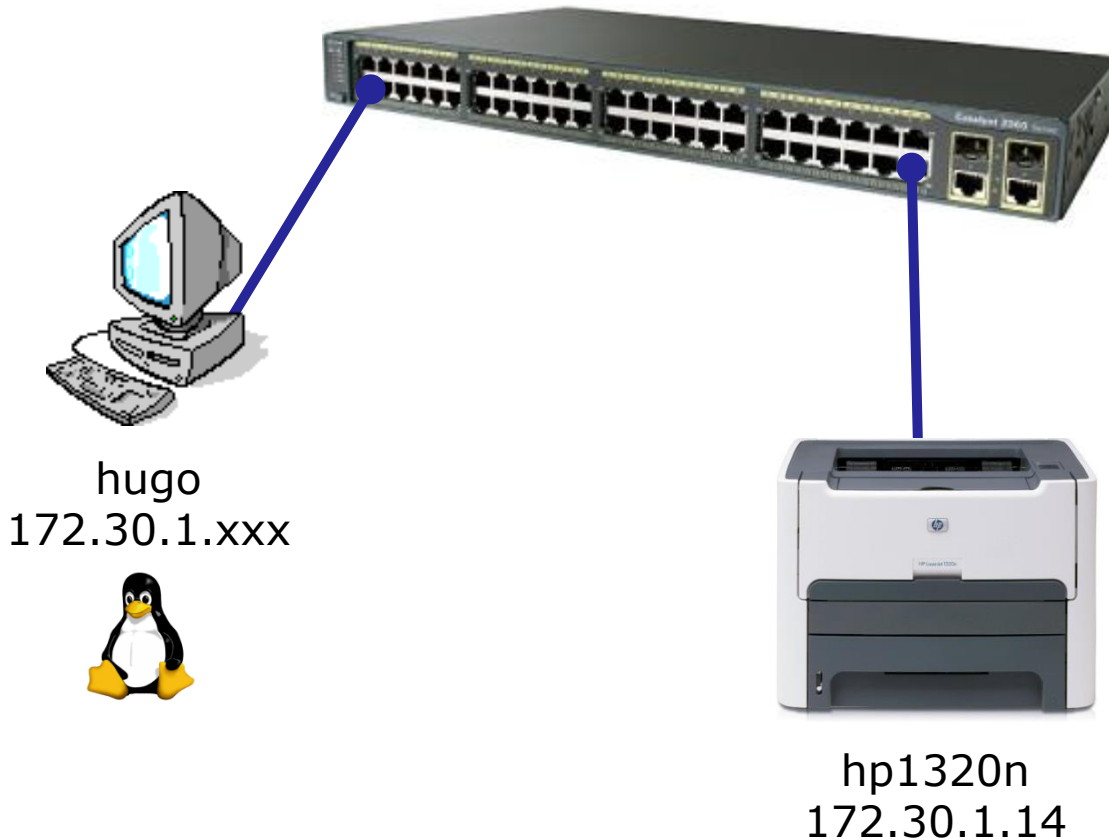
*IP Address for this 1320n  
is 172.30.1.14*



# CUPS

# CUPS

*This example will show how to add the HP 1320n as a networked printer.*



# CUPS



The image shows a terminal window titled "Hugo [Running] - Oracle VM VirtualBox". The terminal output shows the following commands and results:

```
rsimms@hugo:~$ ps -l
F S  UID  PID  PPID  C  PRI  NI ADDR  SZ  WCHAN  TTY          TIME CMD
0 S  1000  1797  1787  2  80   0  -  1777 wait   pts/0    00:00:00 bash
0 R  1000  1856  1797  0  80   0  -  1172 -      pts/0    00:00:00 ps
rsimms@hugo:~$ ps -ef | grep cups
root      674    1  0  20:24 ?        00:00:00 /usr/sbin/cupsd -F
rsimms   1878  1797  0  20:26 pts/0    00:00:00 grep --color=auto cups
rsimms@hugo:~$ firefox localhost:631 &
```

A white box with a black border is overlaid on the terminal, containing the following text:

*Access the CUPS service using a web browser with*

```
rsimms@hugo:~$ firefox localhost:631 &
```

Hugo [Running] - Oracle VM VirtualBox

Machine View Devices Help

File Edit View History Bookmarks Tools Help

6:23 PM Rich Simms

Home - CUPS 1.5.2


localhost:631

Google

Home Administration Classes Online Help Jobs Printers Search Help

## CUPS 1.5.2

CUPS is the standards-based, open source printing system developed by [Apple Inc.](#) for Mac OS® X and other UNIX®-like operating systems.



### CUPS for Users

- [Overview of CUPS](#)
- [Command-Line Printing and Options](#)
- [What's New in CUPS 1.5](#)
- [User Forum](#)

### CUPS for Administrators

- [Adding Printers and Classes](#)
- [Managing Operation Policies](#)
- [Printer Accounting Basics](#)
- [Server Security](#)
- [Using Kerberos Authentication](#)
- [Using Network Printers](#)
- [cupsd.conf Reference](#)
- [Find Printer Drivers](#)

### CUPS for Developers

- [Introduction to CUPS Programming](#)
- [CUPS API](#)
- [Filter and Backend Programming](#)
- [HTTP and IPP APIs](#)
- [PPD API](#)
- [Raster API](#)
- [PPD Compiler Driver Information File Reference](#)
- [Developer Forum](#)

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**CUPS 1.5.2**

CUPS is the standards-based, open source printing system developed by [Apple Inc.](#) for Mac OS® X and other UNIX®-like operating systems.

**CUPS for Users**

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- [User Forum](#)

**CUPS for Administrators**

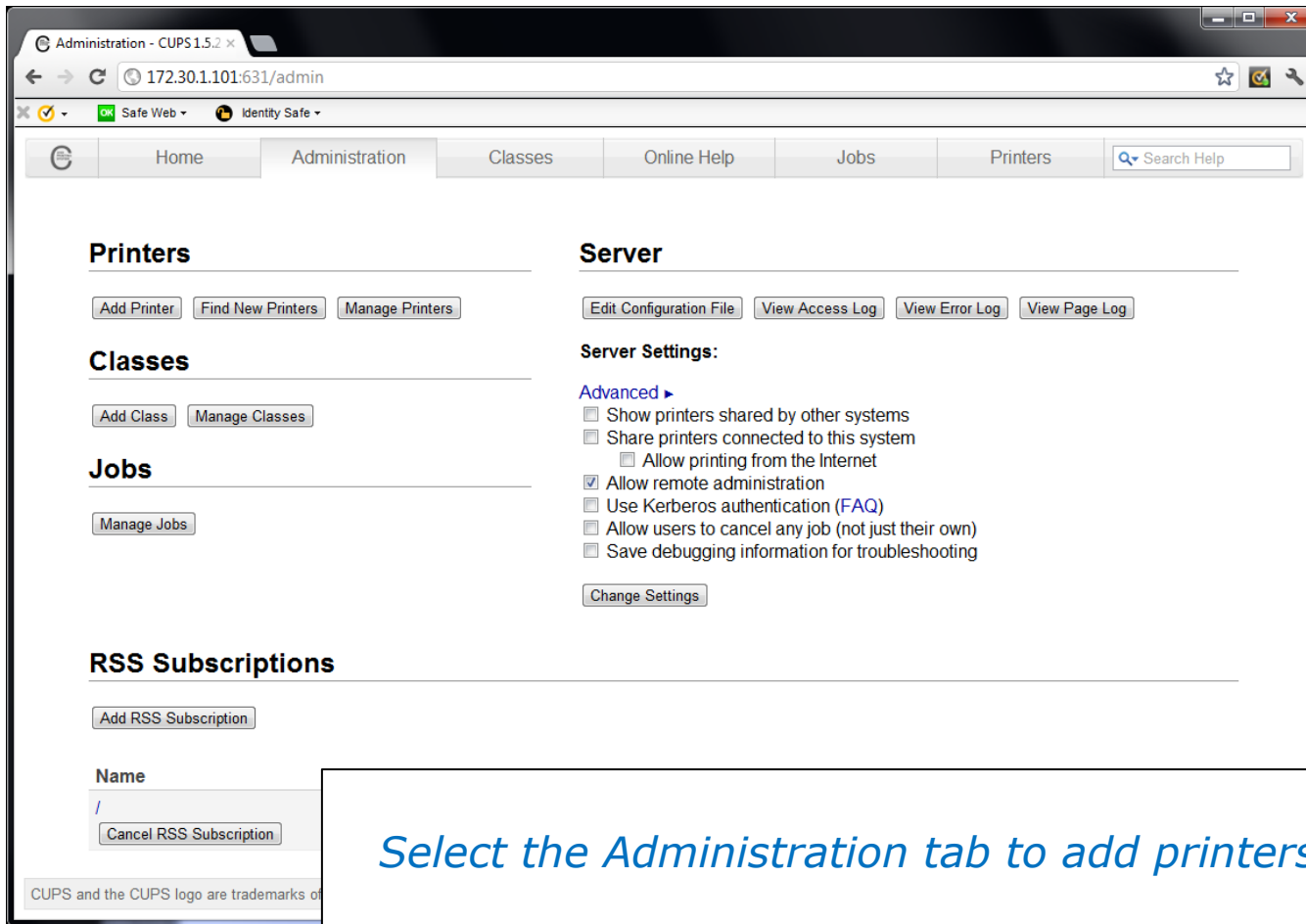
- [Adding Printers and Classes](#)
- [Managing Operation Policies](#)
- [Printer Accounting Basics](#)
- [Server Security](#)
- [Using Kerberos Authentication](#)
- [Using Network Printers](#)
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- [Raster API](#)
- [PPD Compiler Driver Information File Reference](#)
- [Developer Forum](#)

UNIX PRINTING SYSTEM

*Access the CUPS service remotely using a web browser on a different system*



The screenshot shows a web browser window titled "Administration - CUPS 1.5.2" with the URL "172.30.1.101:631/admin". The browser's address bar shows "172.30.1.101:631/admin" and the page has a "Safe Web" and "Identity Safe" indicator. The navigation menu includes "Home", "Administration", "Classes", "Online Help", "Jobs", and "Printers", along with a "Search Help" field. The "Administration" tab is selected. The main content area is divided into several sections: "Printers" with buttons for "Add Printer", "Find New Printers", and "Manage Printers"; "Classes" with "Add Class" and "Manage Classes"; "Jobs" with "Manage Jobs"; "Server" with "Edit Configuration File", "View Access Log", "View Error Log", and "View Page Log"; "Server Settings:" with an "Advanced" section containing checkboxes for "Show printers shared by other systems", "Share printers connected to this system" (with a sub-option "Allow printing from the Internet"), "Allow remote administration" (checked), "Use Kerberos authentication (FAQ)", "Allow users to cancel any job (not just their own)", and "Save debugging information for troubleshooting"; and "RSS Subscriptions" with an "Add RSS Subscription" button. A "Name" field with a slash "/" and a "Cancel RSS Subscription" button are also visible. A white box with a black border is overlaid on the bottom right of the screenshot, containing the text "Select the Administration tab to add printers".

Select the Administration tab to add printers



The screenshot shows the CUPS 1.5.2 administration web interface. The browser address bar shows <https://172.30.1.101:631/admin/>. The interface has a navigation menu with "Home", "Administration", "Classes", "Online Help", "Jobs", and "Printers". The main content area is divided into sections: "Printers" (with buttons for "Add Printer", "Find New Printers", "Manage Printers"), "Classes" (with "Add Class" and "Manage Classes"), "Jobs" (with "Manage Jobs"), and "RSS Subscriptions" (with "Add RSS Subscription" and "Cancel RSS Subscription"). A "Server Settings" section is partially visible. An "Authentication Required" dialog box is overlaid on the interface, containing the message: "The server 172.30.1.101:631 requires a username and password. The server says: CUPS." Below the message are input fields for "User Name" (containing "rsimms") and "Password" (containing "\*\*\*\*\*"). At the bottom of the dialog are "Log In" and "Cancel" buttons.

*Must authenticate to add new printer*



The screenshot shows a web browser window titled "Add Printer - CUPS 1.5.2" with the URL "https://172.30.1.101:631/admin/". The browser's address bar shows "https://172.30.1.101:631/admin/". The page has a navigation menu with "Home", "Administration", "Classes", "Online Help", "Jobs", and "Printers". A search box labeled "Search Help" is also present. The main content area is titled "Add Printer" and lists three categories of printers:

- Local Printers:**
  - HP Printer (HPLIP)
  - HP Fax (HPLIP)
- Discovered Network Printers:**
  - hp LaserJet 1320 series (9C595F) (hp hp LaserJet 1320 series)
  - hp LaserJet 1320 series (9C595F) (hp hp LaserJet 1320 series)
- Other Network Printers:**
  - Backend Error Handler
  - LPD/LPR Host or Printer
  - Internet Printing Protocol (https)
  - Internet Printing Protocol (ipp)
  - Internet Printing Protocol (ipp)
  - AppSocket/HP JetDirect
  - Internet Printing Protocol (http)
  - Windows Printer via SAMBA

A "Continue" button is located at the bottom of the list.

*Nice! CUPS service already discovered a printer on the network*



The screenshot shows a web browser window titled "Add Printer - CUPS 1.5.2" with the address bar displaying "https://172.30.1.101:631/admin". The browser interface includes a navigation menu with "Home", "Administration", "Classes", "Online Help", "Jobs", and "Printers", along with a "Search Help" field. The main content area is titled "Add Printer" and contains the following fields:

- Name:** HP\_LaserJet\_1320\_series (Note: May contain any printable characters except "/", "#", and space)
- Description:** HP LaserJet 1320 series (Note: Human-readable description such as "HP LaserJet with Duplexer")
- Location:** Family room (Note: Human-readable location such as "Lab 1")
- Connection:** socket://172.30.1.14
- Sharing:**  Share This Printer

A "Continue" button is located below the sharing options.

*Customize printer description*



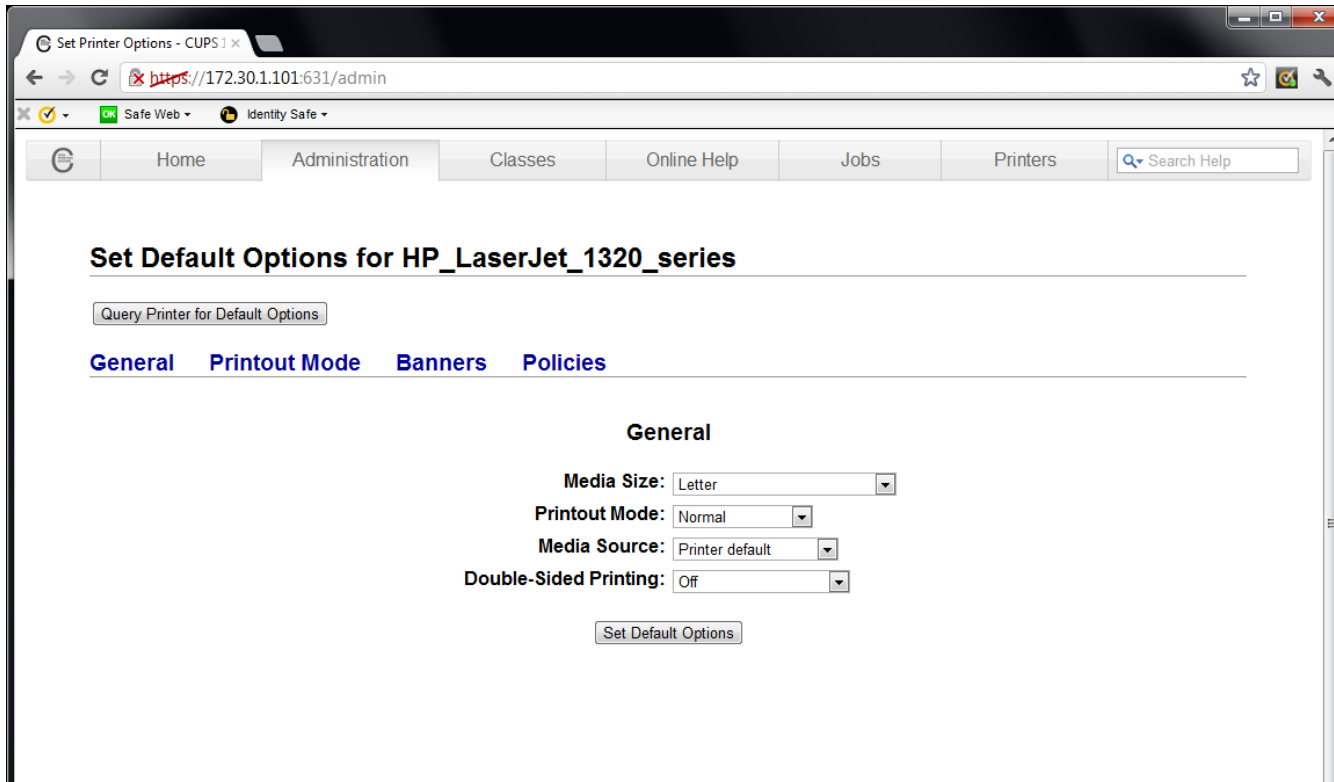
The screenshot shows a web browser window titled "Add Printer - CUPS1.5.2" with the URL <https://172.30.1.101:631/admin>. The browser's address bar shows "https://172.30.1.101:631/admin" and the page content includes a navigation menu with "Home", "Administration", "Classes", "Online Help", "Jobs", and "Printers".

### Add Printer

**Name:** HP\_LaserJet\_1320\_series  
**Description:** HP LaserJet 1320 series  
**Location:** Family room  
**Connection:** socket://172.30.1.14  
**Sharing:** Do Not Share This Printer  
**Make:** HP   
**Model:**   
HP LaserJet 1320 Series pcl3, hpcups 3.12.2 (en)  
HP 910 hpjps, 3.12.2 (en)  
HP 910, hpcups 3.12.2 (en)  
HP 915 hpjps, 3.12.2 (en)  
HP 915, hpcups 3.12.2 (en)  
HP 2000C Foomatic/pcl3 (en)  
HP 2000c hpjps, 3.12.2 (en)  
HP 2000c, hpcups 3.12.2 (en)  
HP 2500C Foomatic/pcl3 (en)

**Or Provide a PPD File:**  No file chosen

*Select the printer driver*



The screenshot shows a web browser window titled "Set Printer Options - CUPS". The address bar shows "https://172.30.1.101:631/admin". The browser has tabs for "Safe Web" and "Identity Safe". The navigation menu includes "Home", "Administration", "Classes", "Online Help", "Jobs", and "Printers", along with a "Search Help" field. The main content area is titled "Set Default Options for HP\_LaserJet\_1320\_series" and contains a "Query Printer for Default Options" button. Below this are tabs for "General", "Printout Mode", "Banners", and "Policies". The "General" tab is active, showing settings for "Media Size" (Letter), "Printout Mode" (Normal), "Media Source" (Printer default), and "Double-Sided Printing" (Off). A "Set Default Options" button is located at the bottom of the settings area.

*Set default printing options for new printer*



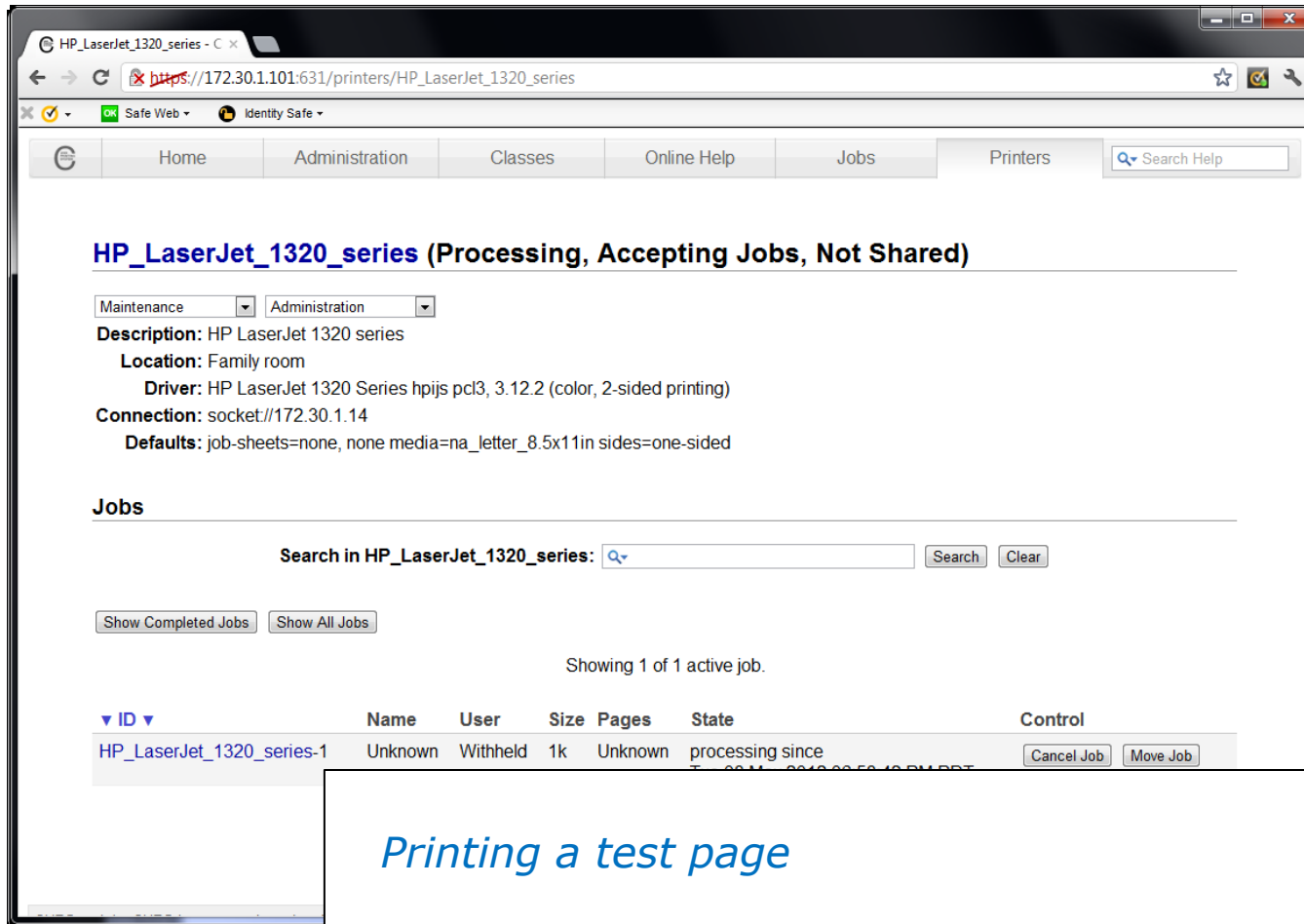
The screenshot shows a web browser window with the URL `https://172.30.1.101:631/printers/HP_LaserJet_1320_series`. The page has a navigation bar with tabs for Home, Administration, Classes, Online Help, Jobs, and Printers. The main content area is titled "HP\_LaserJet\_1320\_series (Idle, Accepting Jobs, Not Shared)". It includes dropdown menus for Maintenance and Administration, and the following details:

- Description:** HP LaserJet 1320 series
- Location:** Family room
- Driver:** HP LaserJet 1320 Series hpijs pcl3, 3.12.2 (color, 2-sided printing)
- Connection:** socket://172.30.1.14
- Defaults:** job-sheets=none, none media=na\_letter\_8.5x11in sides=one-sided

Below the details is a "Jobs" section with a search bar labeled "Search in HP\_LaserJet\_1320\_series:" and buttons for "Search" and "Clear". At the bottom of the jobs section are buttons for "Show Completed Jobs" and "Show All Jobs". The text "No jobs." is displayed in the center of the jobs section.

*Ready to roll!*





The screenshot shows a web browser window with the URL `https://172.30.1.101:631/printers/HP_LaserJet_1320_series`. The page title is "HP\_LaserJet\_1320\_series (Processing, Accepting Jobs, Not Shared)".

Navigation tabs include: Home, Administration, Classes, Online Help, Jobs, Printers. A search bar is present.

Dropdown menus for "Maintenance" and "Administration" are visible.

**Description:** HP LaserJet 1320 series  
**Location:** Family room  
**Driver:** HP LaserJet 1320 Series hpijs pcl3, 3.12.2 (color, 2-sided printing)  
**Connection:** socket://172.30.1.14  
**Defaults:** job-sheets=none, none media=na\_letter\_8.5x11in sides=one-sided

**Jobs**

Search in HP\_LaserJet\_1320\_series:

Showing 1 of 1 active job.

| ID                        | Name    | User     | Size | Pages   | State            | Control                                                                           |
|---------------------------|---------|----------|------|---------|------------------|-----------------------------------------------------------------------------------|
| HP_LaserJet_1320_series-1 | Unknown | Withheld | 1k   | Unknown | processing since | <input type="button" value="Cancel Job"/> <input type="button" value="Move Job"/> |

*Printing a test page*



The screenshot shows a web browser window with the address bar displaying `https://172.30.1.101:631/printers/HP_LaserJet_1320_series`. The browser's address bar also shows "Safe Web" and "Identity Safe" indicators. The page has a navigation menu with tabs for Home, Administration, Classes, Online Help, Jobs, and Printers. A search box labeled "Search Help" is located to the right of the Printers tab. The main content area features the heading "HP\_LaserJet\_1320\_series (Idle, Accepting Jobs, Not Shared)". Below this heading are two dropdown menus for "Maintenance" and "Administration". The page lists the following details: "Description: HP LaserJet 1320 series", "Location: Family room", "Driver: HP LaserJet 1320 Series hpijs pcl3, 3.12.2 (color, 2-sided printing)", "Connection: socket://172.30.1.14", and "Defaults: job-sheets=none, none media=na\_letter\_8.5x11in sides=one-sided". A "Jobs" section is present with a search box labeled "Search in HP\_LaserJet\_1320\_series:" and "Search" and "Clear" buttons. Below the search box are two buttons: "Show Completed Jobs" and "Show All Jobs". The text "No jobs." is displayed in the center of the jobs section.

*Printed ... this printer is ready to go!*



# Printing in Linux

# Printing Commands

## **ATT System V based print subsystem**

- lp (to print)
- lpstat (queue management)
- cancel (to remove jobs)

## **BSD (Berkeley Software Distribution) based print subsystem**

- lpr (to print)
- lpq (queue management)
- lprm (to remove jobs)

## **CUPS**

- Provides both System V and Berkeley based command-line interfaces
- Supports new Internet Printing Protocol
- Works with Samba

*BSD is a branch of UNIX developed at the University of California, Berkeley*

# CUPS

## lpstat command

*Use **lpstat** to show spooled print jobs,  
available and default printers*

```
rsimms@hugo:~$ lpstat
```

```
rsimms@hugo:~$ lpstat -p
```

```
printer HP_LaserJet_1320_series is idle.  enabled since Tue 08 May  
2012 08:46:45 PM PDT
```

```
rsimms@hugo:~$ lpstat -p -d
```

```
printer HP_LaserJet_1320_series is idle.  enabled since Tue 08 May  
2012 08:46:45 PM PDT  
system default destination: HP_LaserJet_1320_series
```

*The **-p** option will show the available printers*

*The **-d** option will identify the default printer*

# CUPS

## lpstat command

### *On Opus*

```
/home/cis90/simben $ lpstat -p -d  
printer charlie disabled since Tue 26 Jan 2010 05:03:19 PM PST -  
    I don't really exist  
printer hplaser disabled since Tue 26 Jan 2010 04:58:14 PM PST -  
    Out of paper  
system default destination: charlie
```

*There are two "pretend" printers named charlie and hplaser on Opus*

# CUPS

## lpstat command

*On Opus*

```
lpstat -p
```

```
lpstat -p -d
```

# CUPS

## lp and lpr commands

*Use **lp** (or **lpr**) to print files*

```
/home/cis90/simben $ lp lab10  
request id is hplaser-5 (1 file(s))
```

```
/home/cis90/simben $ lp -d hplaser lab10  
request id is hplaser-6 (1 file(s))
```

*With **lp**, use the **-d** option to manually select a printer*

```
/home/cis90/simben $ lpr lab10
```

```
/home/cis90/simben $ lpr -P hplaser lab10
```

*With **lpr**, use the **-P** option to manually select a printer*



# CUPS

## lp and lpr commands

```
/home/cis90/simben $ echo "Print Me Quietly" | lpr -P hplaser  
/home/cis90/simben $
```

*Note that both lp and lpr will read from stdin.*

*This allows output from another command to be piped in*

# CUPS

## Practice Printing

### *On Opus*

```
lp lab10  
lpstat
```

```
lpr letter  
lpstat
```

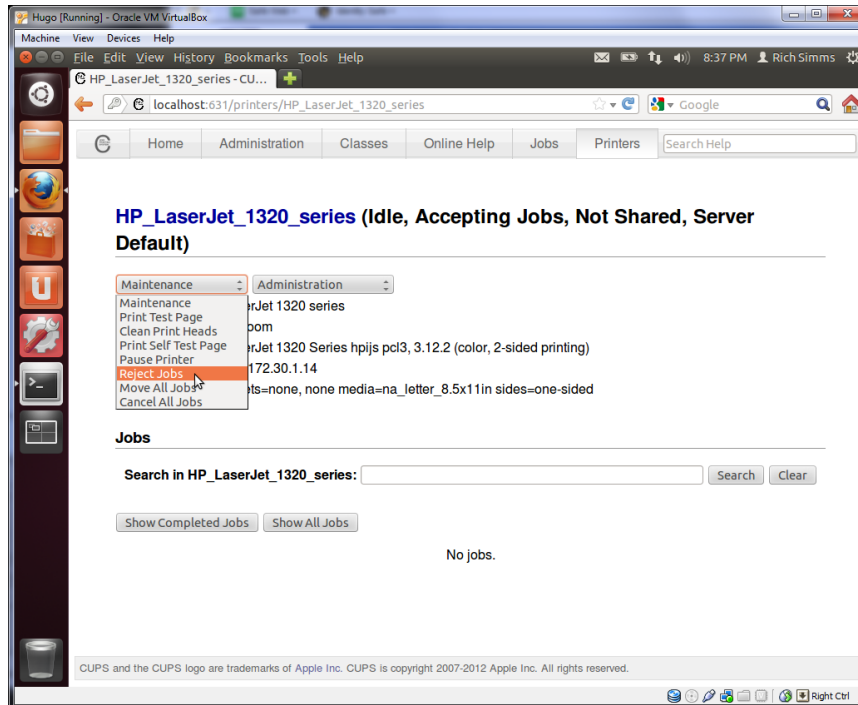
```
echo "Print Me Quietly" | lpr -P hplaser  
lpstat
```



# Managing Print Jobs

# CUPS

## Rejecting Jobs



*Clicking the **Reject Jobs** selection on the web based utility will reject further jobs*

```
[root@benji ~]# lp myfile
lp: Destination "hp7550" is not accepting jobs.
[root@benji ~]#
```

```
[root@benji ~]# lpr myfile
lpr: Destination "hp7550" is not accepting jobs.
[root@benji ~]#
```

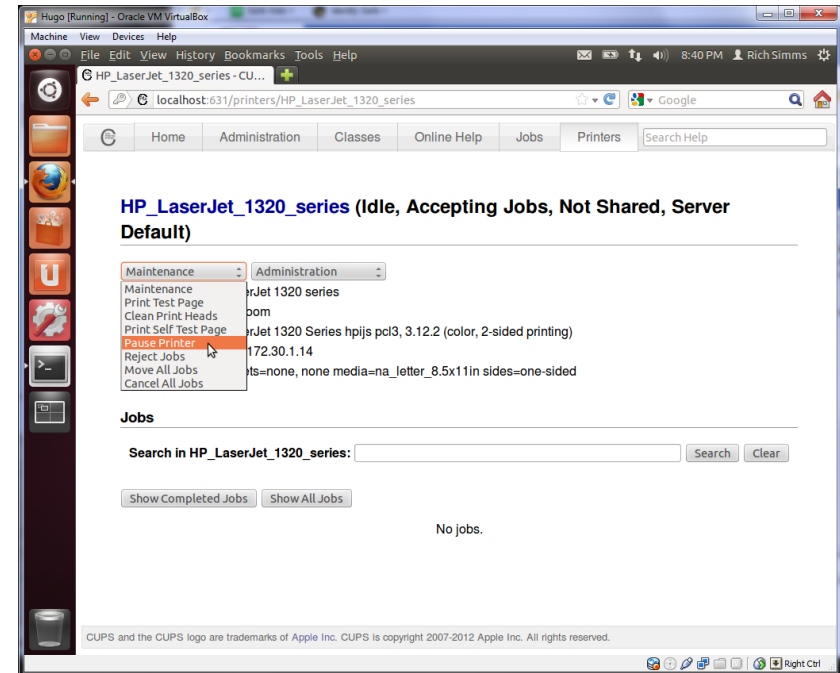
# CUPS

## Pausing the Printer

```
[root@benji ~]# lp myfile
request id is hp7550-22 (1 file(s))
```

```
[root@benji ~]# lpq
hp7550 is not ready
Rank      Owner    Job      File(s)
Total Size
1st       root    22      myfile
1024 bytes
```

```
[root@benji ~]# lpstat
hp7550-22          root
1024      Sat 15 Nov 2008 12:20:23 PM
PST
```



*Clicking the **Pause Printer** selection on the web based utility will still allow jobs to be spooled*



# CUPS

## Showing jobs waiting to print

```
[root@benji ~]# lpq
hp7550 is not ready
Rank   Owner   Job      File(s)
Total Size
1st    root    22      myfile
1024 bytes
2nd    root    23      myfile
1024 bytes
3rd    root    24      myfile
1024 bytes
4th    root    25      myfile
1024 bytes
```

*Use **lpq** or **lpstat** to show spooled print jobs*

```
[root@benji ~]# lpstat
hp7550-22          root          1024    Sat 15
Nov 2008 12:20:23 PM PST
hp7550-23          root          1024    Sat 15
Nov 2008 12:20:28 PM PST
hp7550-24          root          1024    Sat 15
Nov 2008 12:20:31 PM PST
hp7550-25          root          1024    Sat 15
Nov 2008 12:20:34 PM PST
```

# CUPS

## Removing/canceling pending print jobs

```
[root@benji ~]# lpq
hp7550 is not ready
Rank   Owner   Job    File(s)
Total Size
1st    root    22     myfile
1024 bytes
2nd    root    23     myfile
1024 bytes
3rd    root    24     myfile
1024 bytes
4th    root    25     myfile
1024 bytes
```

```
[root@benji ~]# cancel 22
[root@benji ~]# cancel 23
[root@benji ~]# lprm 24
[root@benji ~]# lprm 25
```

*Use **cancel** or **lprm**  
to remove print jobs*

```
[root@benji ~]# lpq
hp7550 is not ready
no entries
```

```
[root@benji ~]# lpstat
[root@benji ~]#
```

# CUPS

## Practice Printing

### *On Opus*

```
lpq  
lpstat
```

```
cancel <print job number>  
lpq
```

```
lprm <print job number>  
lpq
```





# Wrap up

Commands:

|              |                       |
|--------------|-----------------------|
| lp, lpr      | - Linux print command |
| cancel, lprm | - cancel print job    |
| lpq, lpstat  | - Show print queue    |

Web:

|                                                         |                                     |
|---------------------------------------------------------|-------------------------------------|
| <a href="http://hostname:631">http://hostname:631</a>   | - CUPS web based management utility |
| <a href="http://hostname:9100">http://hostname:9100</a> | - HP JetDirect printer              |



## Next Class

Assignment: Check Calendar Page on web site to see what is due next week.

No Quiz

No Lab due

Work on final projects

Optional extra credit labs

## Final Project Workshop

- See if you can get one “starter” task scripted and working before leaving class today.
- Grade your starter script using the Final Project rubric

Implementing all five tasks (6 points each):

- Requirements for each task:
  - Minimum of 10 “original” script command lines
  - Has one or more non-generic comments to explain what it is doing
  - Has user interaction

You don't have to do all of these but do at least five:

- Redirecting stdin (5 points)
- Redirecting stdout (5 points)
- Redirecting stderr (5 points)
- Use of permissions (5 points)
- Use of filename expansion characters (5 points)
- Use of absolute path (5 points)
- Use of relative path (5 points)
- Use of a PID (5 points)
- Use of inodes (5 points)
- Use of links (5 points)
- Use of scheduling (5 points)
- Use of a GID or group (5 points)
- Use of a UID or user (5 points)
- Use of a /dev/tty device (5 points)
- Use of a signal (5 points)
- Use of piping (5 points)
- Use of an environment variable (5 points)
- Use of /bin/mail (5 points)
- Use of a conditional (5 points)

The maximum for this section is 25 points.



# Backup