Lesson Module Checklist

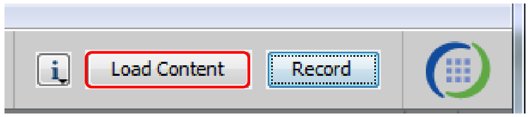
- Slides
- Flash cards
- First minute quiz
- Web calendar summary
- Web book pages
- Commands
- Howtos

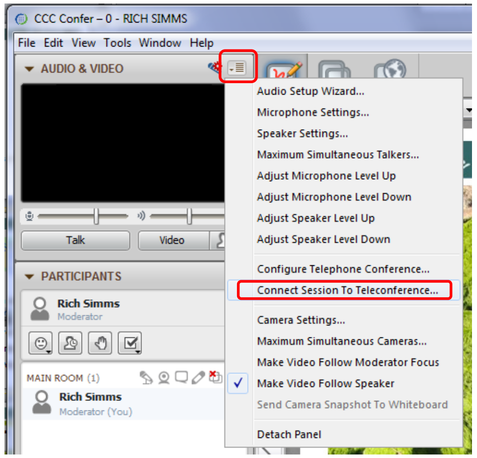
- Lab tested

- Bring class roster
- Backup slides, Confer links, handouts on flash drive

CIS 90 - Lesson 2

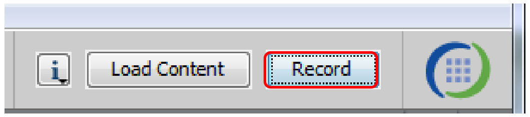
[ ] Load White Board with faces & quiz



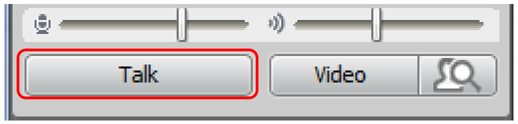

CCC Confer – 0 - RICH SIMMS
File Edit View Tools Window Help
AUDIO & VIDEO
Audio Setup Wizard...
Microphone Settings...
Speaker Settings...
Maximum Simultaneous Talkers...
Adjust Microphone Level Up
Adjust Microphone Level Down
Adjust Speaker Level Up
Adjust Speaker Level Down
Configure Telephone Conference...
Connect Session To Teleconference...
Camera Settings...
Maximum Simultaneous Cameras...
Make Video Follow Moderator Focus
Make Video Follow Speaker
Send Camera Snapshot To Whiteboard
Detach Panel
Talk
Video
PARTICIPANTS
Rich Simms
Moderator
MAIN ROOM (1)
Rich Simms
Moderator (You)

[ ] Has the phone bridge been added?

[ ] Is recording on?



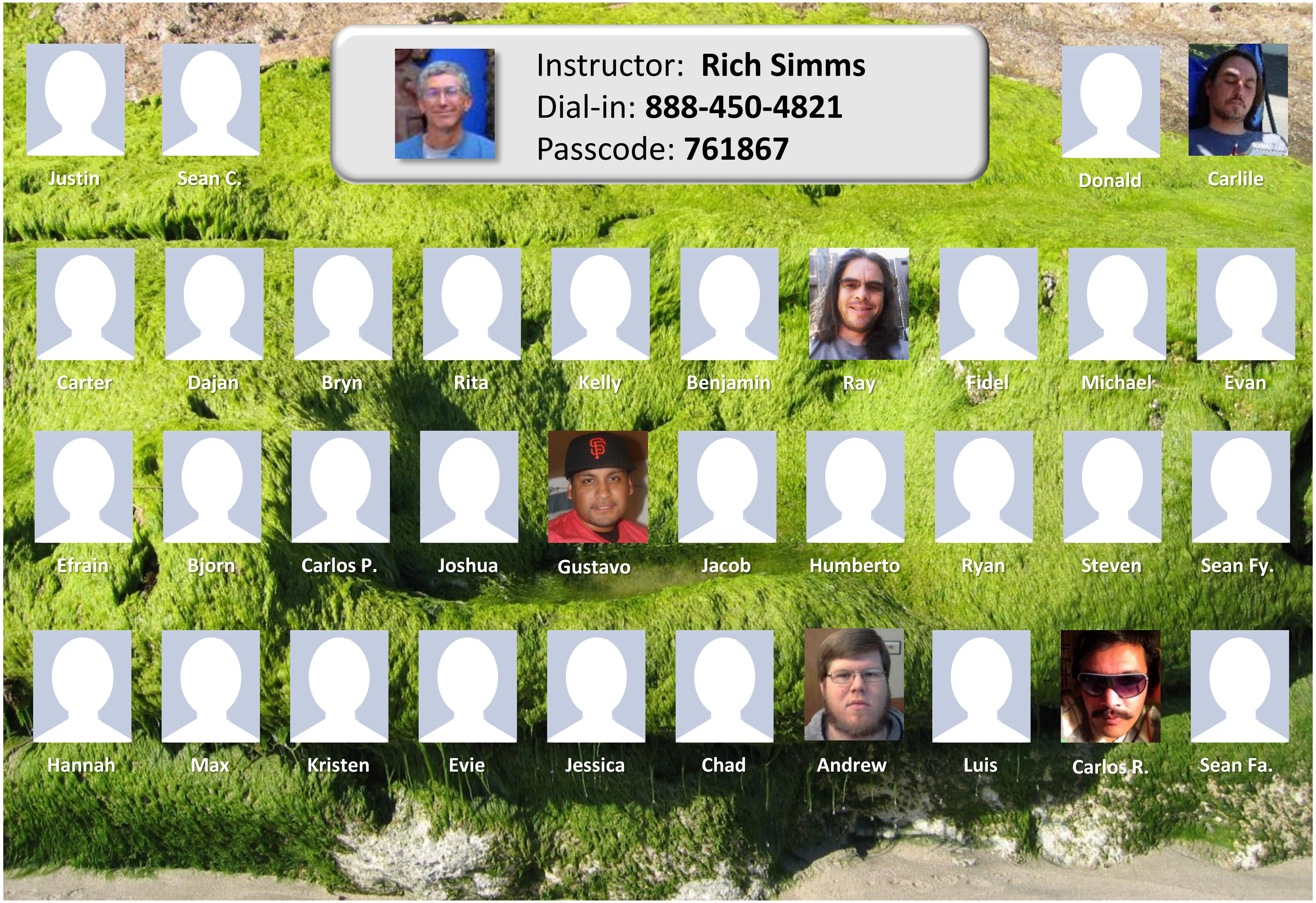
[ ] Toggle Talk button to not use Mic



[ ] Disable spelling on PowerPoint

[ ] Share slides, putties, Chrome and VLab

CIS 90 - Lesson 2



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

Email me (risimms@cabrillo.edu) a relatively current photo of your face for 3 points extra credit

First Minute Quiz

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

See CCC Confer White Board

email answers to: `risimms@cabrillo.edu`

`(answers must be emailed within the first few minutes of class for credit)`

First Minute Quiz

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

1. What is the lowest level, inner-most component of a UNIX/Linux Operating System called?

2. What part of UNIX/Linux is both a user interface and a programming language?

3. What command shows the other users logged in to the computer?

email answers to: `risimms@cabrillo.edu`

`(answers must be emailed within the first few minutes of class for credit)`

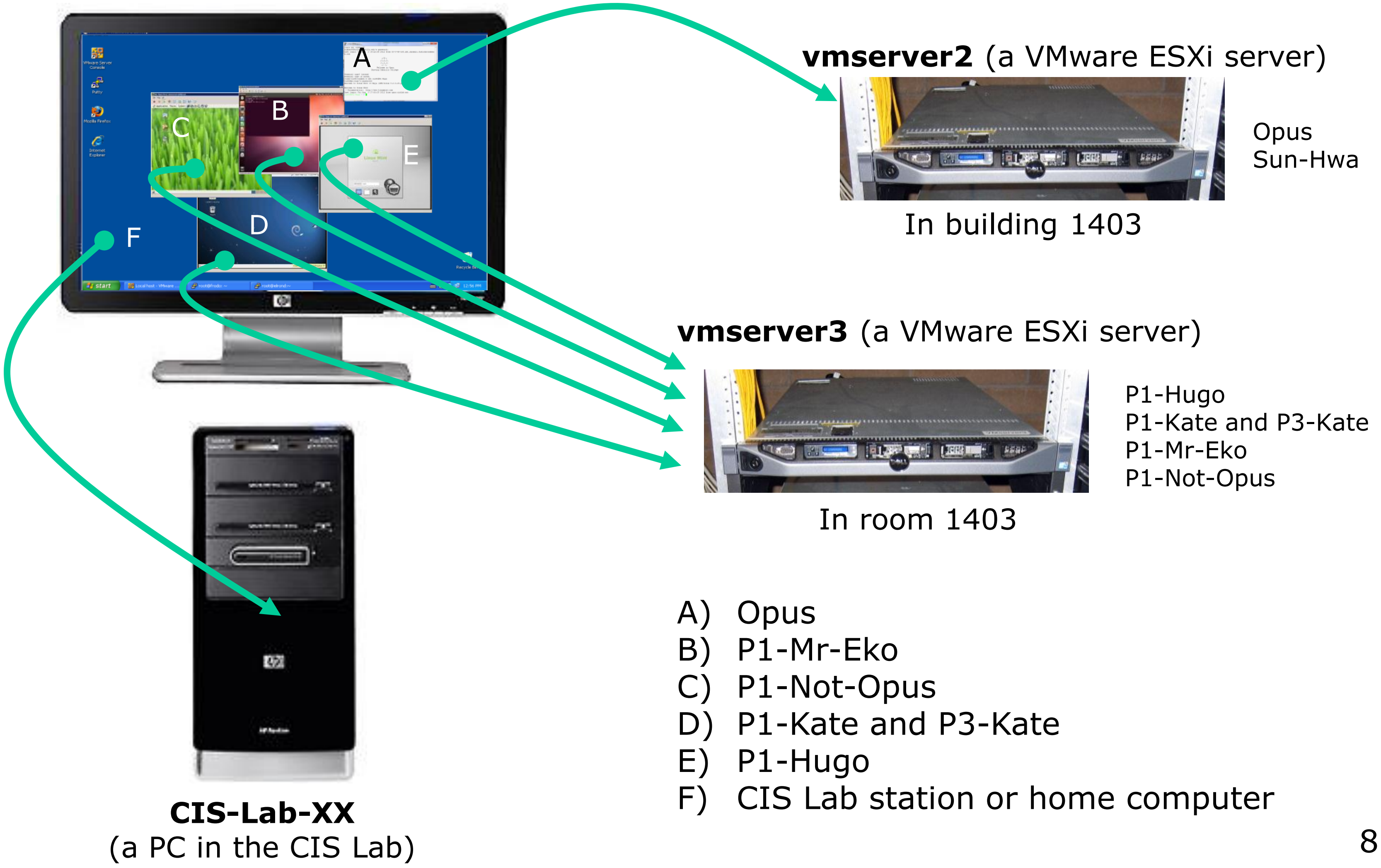
Commands

Objectives	Agenda
• Understand how the UNIX login operation works. • Meet John the Ripper and learn how vulnerable a poor password is. • Understand basic command syntax and operation. • Understand program files and what happens when they are run. • Understand how the shell works and environment variables. • Understand how to get documentation when online.	• Quiz • Questions and Review • Putty tips • Deep dive on logging in • Passwords • Housekeeping • New commands • Programs/processes • Command line syntax • Environment variables • Metacharacters • Life of the shell • Docs • Wrap up

Questions?

Lab assignment?
Previous Material?

We used (at least) three physical and six virtual computers for Lab 1 !!

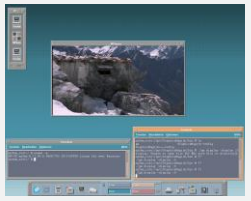


A) Opus
B) P1-Mr-Eko
C) P1-Not-Opus
D) P1-Kate and P3-Kate
E) P1-Hugo
F) CIS Lab station or home computer

Review and clarifications

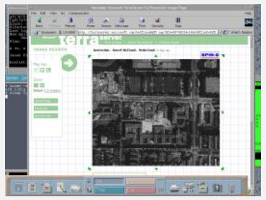
UNIX and Unix-like Operating Systems

AT&T UNIX
(1969)


HP-UX

Sun Solaris

SCO


IBM AIX

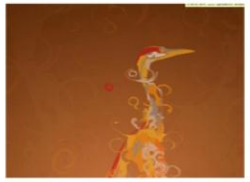
BSD UNIX

Mac OS X and iOS

Apple operating systems use the Mach Kernel

All Linux distributions use the Linux Kernel

Various GNU/Linux Distributions


Ubuntu

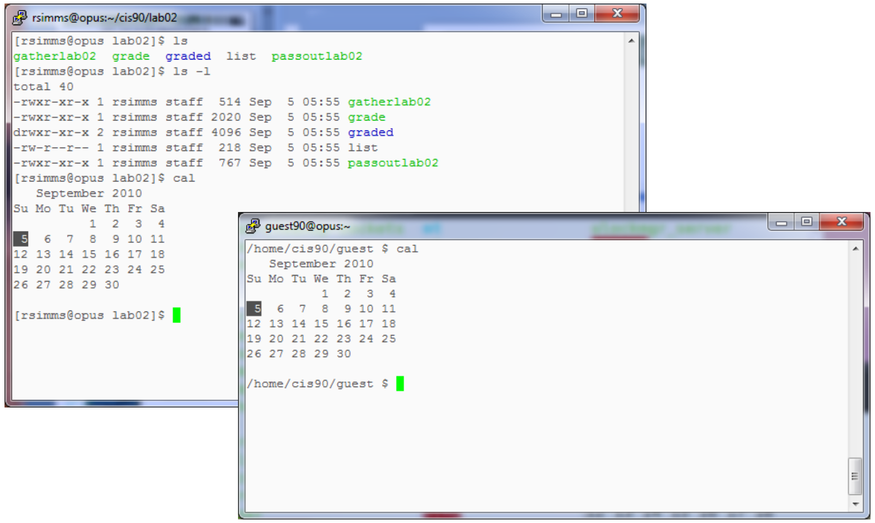
Red Hat

SUSE

Debian

Embedded Linux

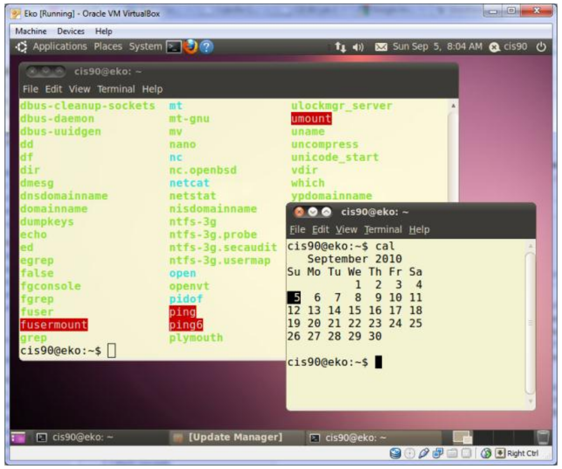
Terminals



```
[rsimms@opus lab02]$ ls
gatherlab02  grade  graded  list  passoutlab02
[rsimms@opus lab02]$ ls -l
total 40
-rwxr-xr-x 1 rsimms staff  514 Sep  5 05:55 gatherlab02
-rwxr-xr-x 1 rsimms staff 2020 Sep  5 05:55 grade
drwxr-xr-x 2 rsimms staff 4096 Sep  5 05:55 graded
-rw-r--r-- 1 rsimms staff  218 Sep  5 05:55 list
-rwxr-xr-x 1 rsimms staff  767 Sep  5 05:55 passoutlab02
[rsimms@opus lab02]$ cal
   September 2010
Su Mo Tu We Th Fr Sa
          1  2  3  4
 5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30

[rsimms@opus lab02]$
```

```
/home/cis90/guest $ cal
   September 2010
Su Mo Tu We Th Fr Sa
          1  2  3  4
 5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30

/home/cis90/guest $
```

Terminal emulators like PuTTY (with scroll bars, colors, customizable backgrounds, fonts and sizes) and runs on another computer



```
dbus-cleanup-sockets  mt                  ulockmgr_server
dbus-daemon           mt-gnu              umount
dbus-uuidgen          mv                  uname
dd                    nano                uncompress
df                    nc                  unicode_start
dir                   nc.openbsd          vdir
dmesg                 netcat              which
dnsdomainname         netstat             ypdomainname
domainname            nisdomainname
dumpkeys              ntfs-3g
echo                  ntfs-3g.probe
ed                    ntfs-3g.secaudit
egrep                 ntfs-3g.usermap
false                 open
fgconsole             openvt
fgrep                 pidof
fuser                 ping
fusermount            ping6
grep                  plymouth
cis90@eko:~$
```

```
cis90@eko:~$ cal
   September 2010
Su Mo Tu We Th Fr Sa
          1  2  3  4
 5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30

cis90@eko:~$
```

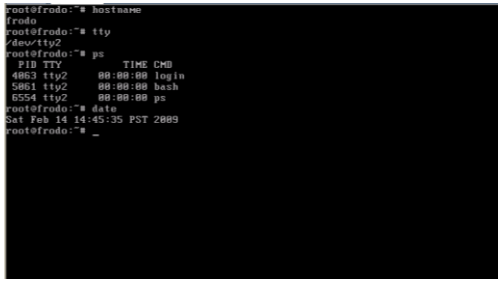
Eko [Running] - Oracle VM VirtualBox
Machine Devices Help
Applications Places System
Sun Sep 5, 8:04 AM
cis90
cis90@eko: ~
File Edit View Terminal Help
[Update Manager]
Right Ctrl

Graphical terminals (with scroll bars, colors, customizable backgrounds, fonts and sizes) available on the graphical desktop

tty = teletype

Terminals were used in the old days to interact with computers.

Today we use **terminal emulators** that are software programs.

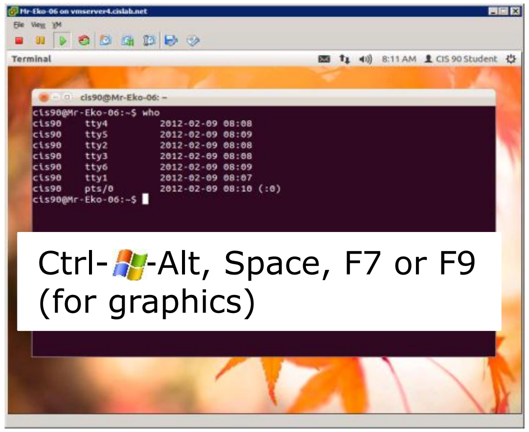


```
root@frodo:~# hostname
frodo
root@frodo:~# tty
/dev/tty2
root@frodo:~# ps
  PID TTY          TIME CMD
 4063 tty2     00:00:00 login
 5061 tty2     00:00:00 bash
 6554 tty2     00:00:00 ps
root@frodo:~# date
Sat Feb 14 14:45:35 PST 2009
root@frodo:~# _
```

Virtual terminals (use ctrl-alt-fn)
(no scroll bars, also called a console)

Changing Virtual Terminals using VMware vSphere

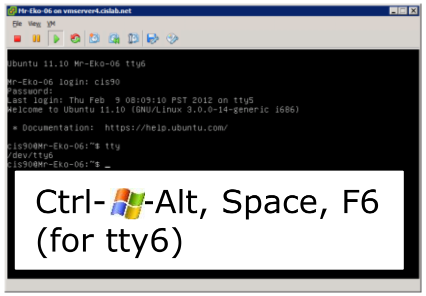
Windows PC Keyboard



```
cis90@Mr-Eko-06:~$ who
cis90    tty4         2012-02-09 08:08
cis90    tty5         2012-02-09 08:09
cis90    tty2         2012-02-09 08:08
cis90    tty3         2012-02-09 08:08
cis90    tty6         2012-02-09 08:09
cis90    tty1         2012-02-09 08:07
cis90    pts/0        2012-02-09 08:10 (:0)
cis90@Mr-Eko-06:~$ 
```

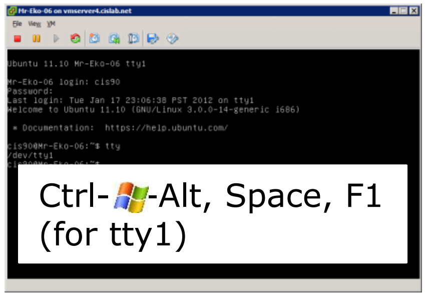
Ctrl-🪟-Alt, Space, F7 or F9 (for graphics)

While holding down Crtl-🪟-Alt keys, tap Space, then tap Fn key*



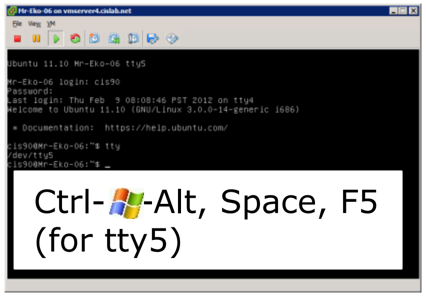
```
Ubuntu 11.10 Mr-Eko-06 tty6

Mr-Eko-06 login: cis90
Password:
Last login: Thu Feb  9 08:09:10 PST 2012 on tty5
Welcome to Ubuntu 11.10 (GNU/Linux 3.0.0-14-generic i686)

 * Documentation:  https://help.ubuntu.com/

cis90@Mr-Eko-06:~$ tty
/dev/tty6
cis90@Mr-Eko-06:~$ _
```

Ctrl-🪟-Alt, Space, F6 (for tty6)



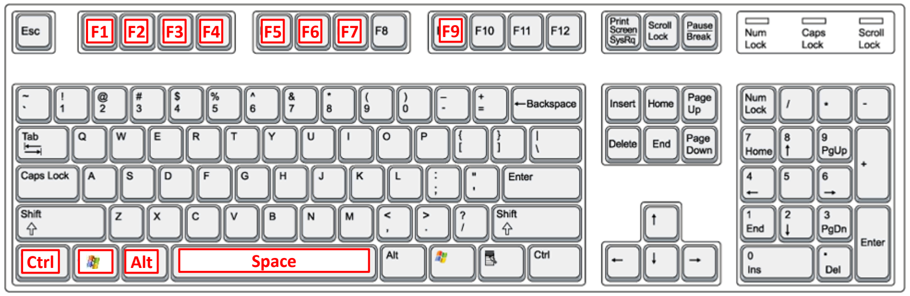
```
Ubuntu 11.10 Mr-Eko-06 tty1

Mr-Eko-06 login: cis90
Password:
Last login: Tue Jan 17 23:06:38 PST 2012 on tty1
Welcome to Ubuntu 11.10 (GNU/Linux 3.0.0-14-generic i686)

 * Documentation:  https://help.ubuntu.com/

cis90@Mr-Eko-06:~$ tty
/dev/tty1
```

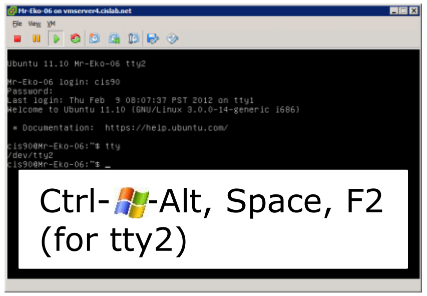
Ctrl-🪟-Alt, Space, F1 (for tty1)



```
Ubuntu 11.10 Mr-Eko-06 tty5

Mr-Eko-06 login: cis90
Password:
Last login: Thu Feb  9 08:08:46 PST 2012 on tty4
Welcome to Ubuntu 11.10 (GNU/Linux 3.0.0-14-generic i686)

 * Documentation:  https://help.ubuntu.com/

cis90@Mr-Eko-06:~$ tty
/dev/tty5
cis90@Mr-Eko-06:~$ _
```

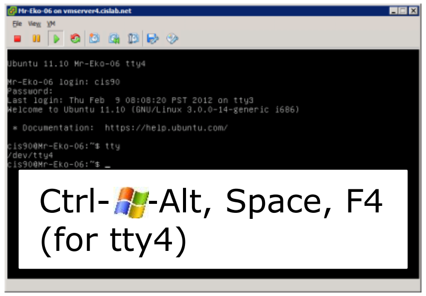
Ctrl-🪟-Alt, Space, F5 (for tty5)





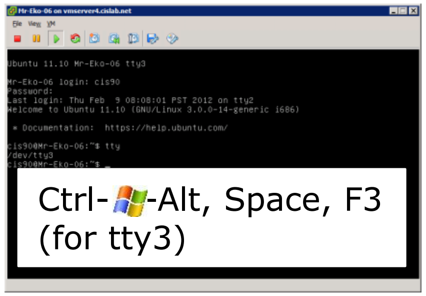
```
Ubuntu 11.10 Mr-Eko-06 tty2

Mr-Eko-06 login: cis90
Password:
Last login: Thu Feb  9 08:07:37 PST 2012 on tty1
Welcome to Ubuntu 11.10 (GNU/Linux 3.0.0-14-generic i686)

 * Documentation:  https://help.ubuntu.com/

cis90@Mr-Eko-06:~$ tty
/dev/tty2
cis90@Mr-Eko-06:~$ _
```

Ctrl-🪟-Alt, Space, F2 (for tty2)



```
Ubuntu 11.10 Mr-Eko-06 tty4

Mr-Eko-06 login: cis90
Password:
Last login: Thu Feb  9 08:08:20 PST 2012 on tty3
Welcome to Ubuntu 11.10 (GNU/Linux 3.0.0-14-generic i686)

 * Documentation:  https://help.ubuntu.com/

cis90@Mr-Eko-06:~$ tty
/dev/tty4
cis90@Mr-Eko-06:~$ _
```

Ctrl-🪟-Alt, Space, F4 (for tty4)



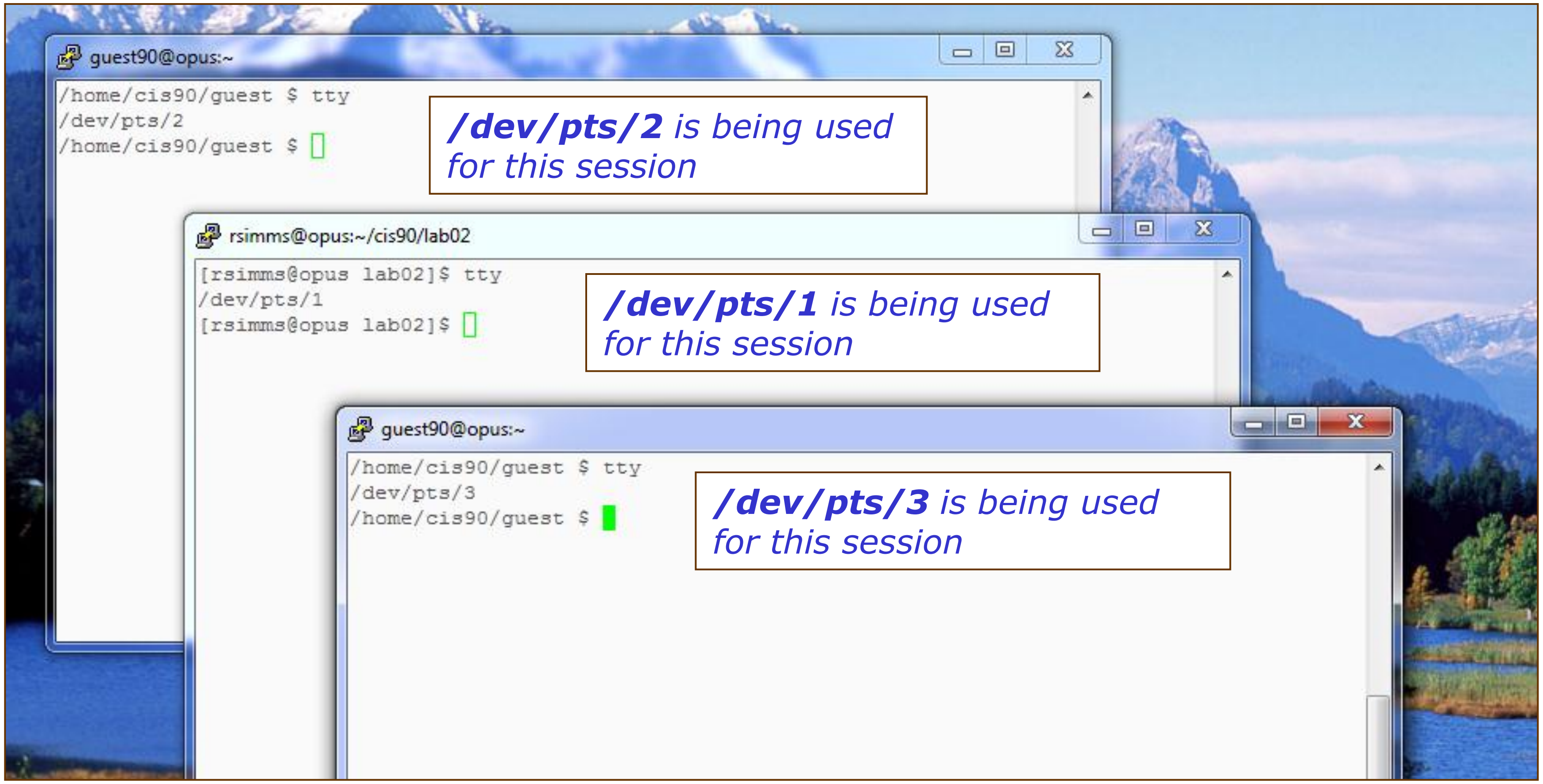
```
Ubuntu 11.10 Mr-Eko-06 tty3

Mr-Eko-06 login: cis90
Password:
Last login: Thu Feb  9 08:08:01 PST 2012 on tty2
Welcome to Ubuntu 11.10 (GNU/Linux 3.0.0-14-generic i686)

 * Documentation:  https://help.ubuntu.com/

cis90@Mr-Eko-06:~$ tty
/dev/tty3
cis90@Mr-Eko-06:~$
```

Ctrl-🪟-Alt, Space, F3 (for tty3)

*On some PC keyboards it is not necessary to use the 🪟 key

Shell tty command

Running three Putty sessions at the same time to Opus. Note that every session is assigned a different terminal device.



```
/home/cis90/guest $ tty
/dev/pts/2
/home/cis90/guest $
```

***/dev/pts/2** is being used for this session*

```
[rsimms@opus lab02]$ tty
/dev/pts/1
[rsimms@opus lab02]$
```

***/dev/pts/1** is being used for this session*

```
/home/cis90/guest $ tty
/dev/pts/3
/home/cis90/guest $
```

***/dev/pts/3** is being used for this session*

*Use the **tty** command to identify the **terminal device** being used for a session*

Commands from last week's lesson and lab

cal	*Prints calendars*
clear	*Clears the screen*
date	*Shows the time and date*
exit	*Exits login session*
history	*Shows previous commands*
hostname	*Shows name of computer being interacted with*
id	*Shows UID's, GID's and SELinux information*
ps	*Shows process information*
ssh	*Initiates connection and login to remote computer*
uname	*Shows name of operating system kernel*
tty	*Shows name of terminal device*
who	*Shows all users who are logged in*
who am i	*Like **who**, but only shows your login session*

Note, each of these commands is actually a program residing in the /bin or /usr/bin directories.

Class Activity
Command Review

Login to Opus if you haven’t already

Now follow along as we review the commands learned last week and new commands for this week

Subtle Distinctions

```
login as: simben90
simben90@oslab.cabrillo.edu's password:
Last login: Sat Sep  1 09:26:51 2012 from 50-0-68-
235.dsl.dynamic.fusionbroadband.com

                                  _
                                ('v')
                               //-=-\\
                               (\_=_/)
                                ^^ ^^
                           Welcome to Opus
                      Serving Cabrillo College

Terminal type? [xterm]
Terminal type is xterm.
/home/cis90/simben $ tty
/dev/pts/3
```

*The terminal type is **xterm***

*The terminal device used for this session is **/dev/pts/3***

Learning the lingo – terminal "types" are different than terminal "devices." More on terminal types later …

cal command

```
/home/cis90/simben $ cal
   September 2012
Su Mo Tu We Th Fr Sa
                   1
 2  3  4  5  6  7  8
 9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30
```

*The **cal** command outputs a calendar*

```
/home/cis90/simben $ cal 9 2001
   September 2001
Su Mo Tu We Th Fr Sa
                   1
 2  3  4  5  6  7  8
 9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30
/home/cis90/simben $
```

*Month and year **arguments** can be specified on the command line to print a specific month*

Learning the lingo – the "command line" can often include "arguments" in addition to the "command." The arguments get passed to the command to process when it executes.

date command

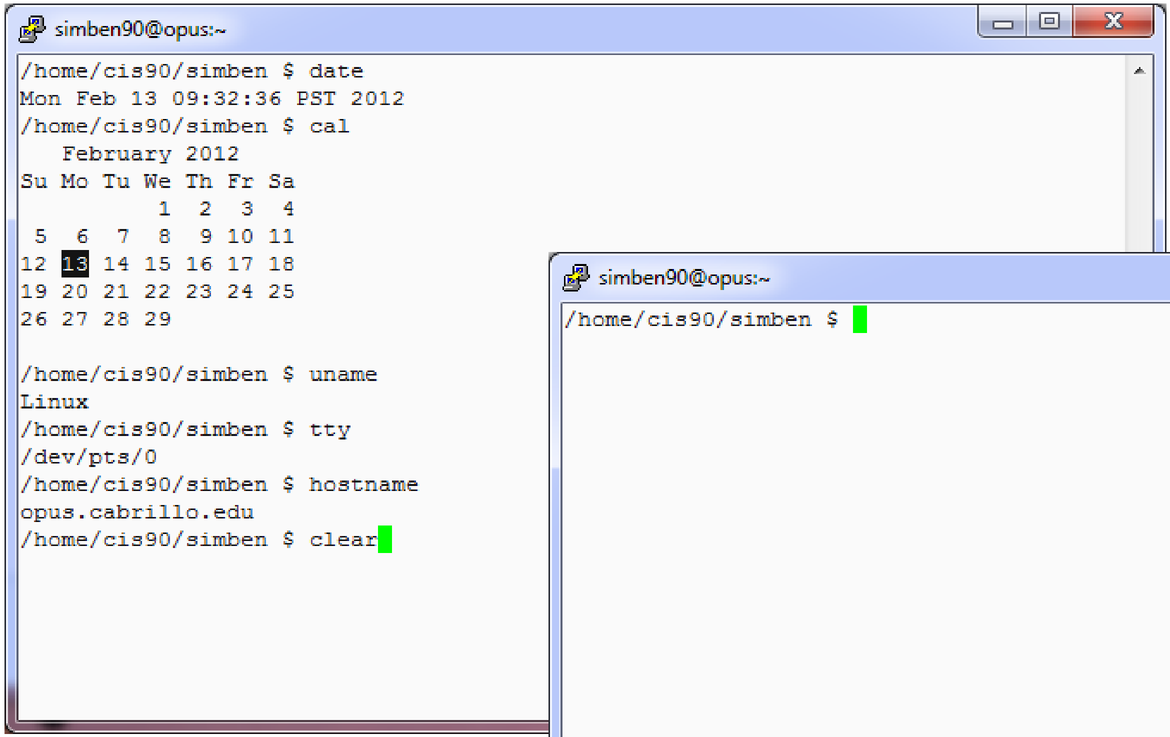
Remember, this is the "prompt"

and this is the "command"

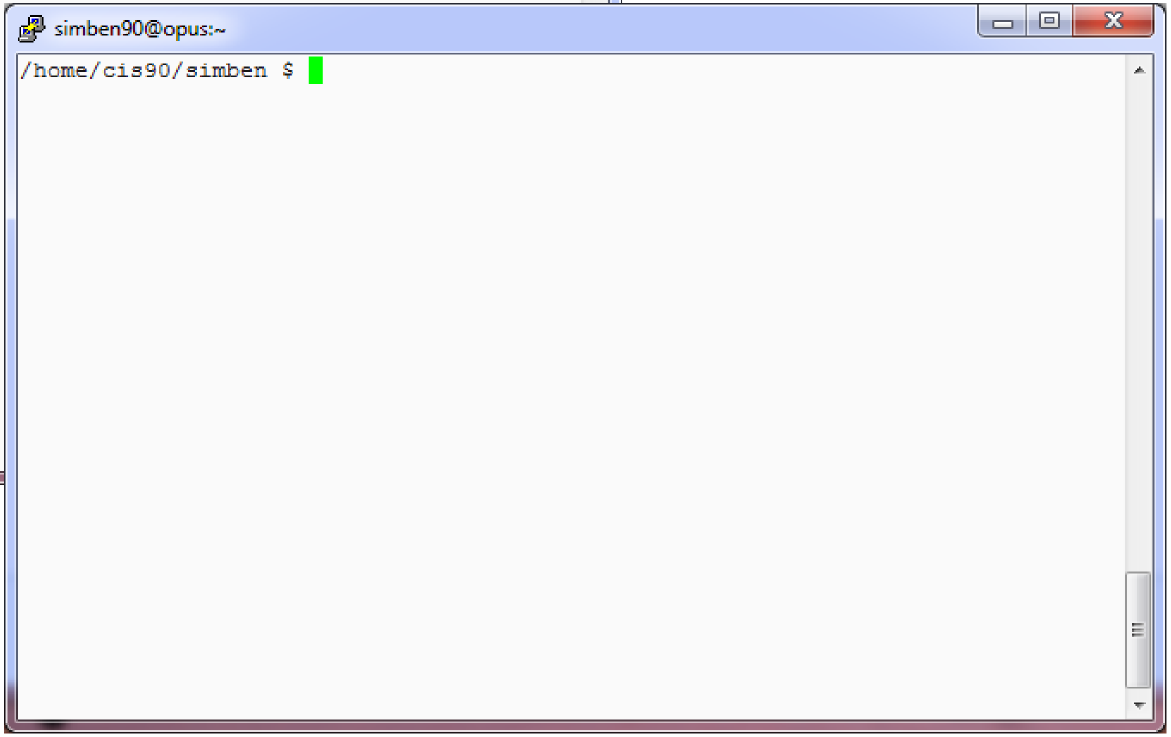
```
/home/cis90/simben $ date
Sat Sep  1 14:03:33 PDT 2012
/home/cis90/simben $
```

*The **date** command outputs the current date and time*

clear command



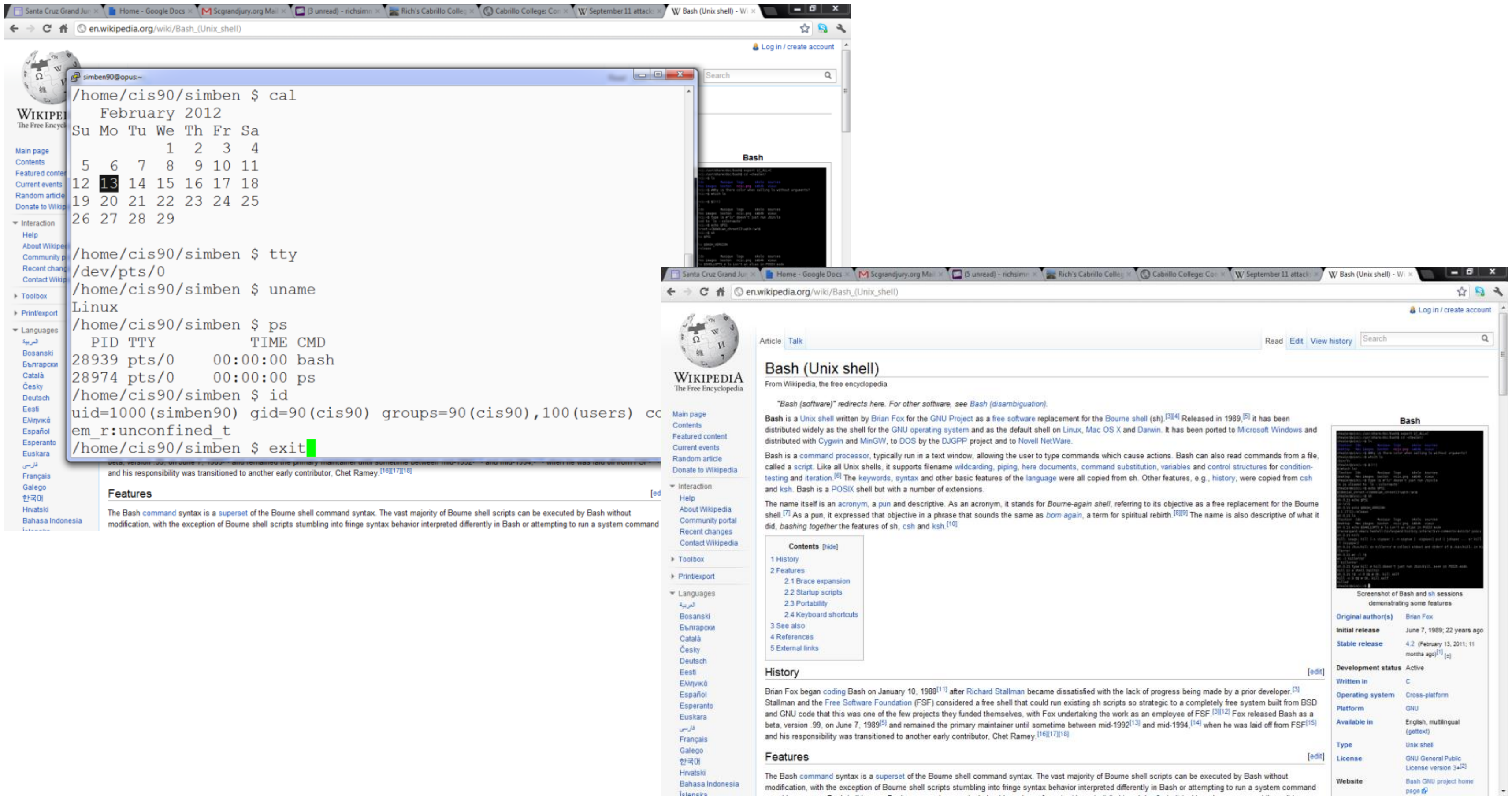
```
/home/cis90/simben $ date
Mon Feb 13 09:32:36 PST 2012
/home/cis90/simben $ cal
   February 2012
Su Mo Tu We Th Fr Sa
          1  2  3  4
 5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29

/home/cis90/simben $ uname
Linux
/home/cis90/simben $ tty
/dev/pts/0
/home/cis90/simben $ hostname
opus.cabrillo.edu
/home/cis90/simben $ clear
```



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

*The **clear** command scrolls previous commands out of sight*

exit command



```
/home/cis90/simben $ cal
   February 2012
Su Mo Tu We Th Fr Sa
          1  2  3  4
 5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29

/home/cis90/simben $ tty
/dev/pts/0
/home/cis90/simben $ uname
Linux
/home/cis90/simben $ ps
  PID TTY          TIME CMD
28939 pts/0    00:00:00 bash
28974 pts/0    00:00:00 ps
/home/cis90/simben $ id
uid=1000(simben90) gid=90(cis90) groups=90(cis90),100(users) co
em_r:unconfined_t
/home/cis90/simben $ exit
```

en.wikipedia.org/wiki/Bash_(Unix_shell)

Bash (Unix shell)

From Wikipedia, the free encyclopedia

"Bash (software)" redirects here. For other software, see Bash (disambiguation).

Bash is a Unix shell written by Brian Fox for the GNU Project as a free software replacement for the Bourne shell (sh).[3][4] Released in 1989,[5] it has been distributed widely as the shell for the GNU operating system and as the default shell on Linux, Mac OS X and Darwin. It has been ported to Microsoft Windows and distributed with Cygwin and MinGW, to DOS by the DJGPP project and to Novell NetWare.

Bash is a command processor, typically run in a text window, allowing the user to type commands which cause actions. Bash can also read commands from a file, called a script. Like all Unix shells, it supports filename wildcarding, piping, here documents, command substitution, variables and control structures for condition-testing and iteration.[6] The keywords, syntax and other basic features of the language were all copied from sh. Other features, e.g., history, were copied from csh and ksh. Bash is a POSIX shell but with a number of extensions.

The name itself is an acronym, a pun and descriptive. As an acronym, it stands for *Bourne-again shell*, referring to its objective as a free replacement for the Bourne shell.[7] As a pun, it expressed that objective in a phrase that sounds the same as *born again*, a term for spiritual rebirth.[8][9] The name is also descriptive of what it did, *bashing together* the features of sh, csh and ksh.[10]

Contents [hide]
1 History
2 Features
2.1 Brace expansion
2.2 Startup scripts
2.3 Portability
2.4 Keyboard shortcuts
3 See also
4 References
5 External links

History [edit]

Brian Fox began coding Bash on January 10, 1988[11] after Richard Stallman became dissatisfied with the lack of progress being made by a prior developer.[3] Stallman and the Free Software Foundation (FSF) considered a free shell that could run existing sh scripts so strategic to a completely free system built from BSD and GNU code that this was one of the few projects they funded themselves, with Fox undertaking the work as an employee of FSF.[3][12] Fox released Bash as a beta, version .99, on June 7, 1989[5] and remained the primary maintainer until sometime between mid-1992[13] and mid-1994,[14] when he was laid off from FSF[15] and his responsibility was transitioned to another early contributor, Chet Ramey.[16][17][18]

Features [edit]

The Bash command syntax is a superset of the Bourne shell command syntax. The vast majority of Bourne shell scripts can be executed by Bash without modification, with the exception of Bourne shell scripts stumbling into fringe syntax behavior interpreted differently in Bash or attempting to run a system command

Bash	
Original author(s)	Brian Fox
Initial release	June 7, 1989; 22 years ago
Stable release	4.2 (February 13, 2011; 11 months ago)[1] [±]
Development status	Active
Written in	C
Operating system	Cross-platform
Platform	GNU
Available in	English, multilingual (gettext)
Type	Unix shell
License	GNU General Public License version 3+[2]
Website	Bash GNU project home page

*The **exit** command ends the session and the terminal window disappears … POOF!*

history command

```
/home/cis90/simben $ history
    1  hostname
    2  exit
    3  who
    4  who -q
    5  ps -e
< snipped >
  177  cal 9 2001
  178  exit
  179  who
  180  cal
  181  tty
  182  uname
  183  ps
  184  id
  185  exit
  186  history
/home/cis90/simben $
```

*The **history** command outputs commands previously used*

Tip: Use the "Up Arrow" key to use a previous command again!

hostname command

```
/home/cis90/simben $ hostname
oslab.cabrillo.edu
/home/cis90/simben $
```

*The **hostname** command outputs the name of the computer*

id command

```
/home/cis90/simben $ id
uid=1001(simben90) gid=190(cis90) groups=190(cis90),100(users)
context=unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023
```

*The **id** command outputs your specific uid (user ID number), username, group membership, and SELinux context.*

ps command

```
/home/cis90/simben $ ps
  PID TTY          TIME CMD
28994 pts/0    00:00:00 bash
29093 pts/0    00:00:00 ps
```

Process ID numbers

*the shell is sleeping and waiting for **ps** command to finish*

***ps** command is running as it outputs this*

Terminal device being used

*The **ps** command outputs the current processes you own*

ssh command

*The **ssh** command is used to log into another computer*

username on remote computer

hostname of remote computer

Notice how the prompt changes on the remote computer

```
/home/cis90/simben $ ssh cis90@p01-hugo
cis90@p01-hugo's password:
Welcome to Linux Mint 13 Maya (GNU/Linux 3.2.0-23-generic x86_64)

Welcome to Linux Mint
 * Documentation:  http://www.linuxmint.com
Last login: Sat Sep  1 12:09:07 2012 from opus.cislab.net
cis90@P01-Hugo ~ $ hostname
P01-Hugo
cis90@P01-Hugo ~ $
```

*Note: You can also **ssh** into the same computer you are using already for an additional session.*

uname command

```
/home/cis90/simben $ uname
Linux
```

*The **uname** command outputs the name of the operating system kernel*

tty command

```
/home/cis90/simben $ tty
/dev/pts/5
/home/cis90/simben $
```

*The **tty** command outputs the name of the terminal device being used*

who command

```
/home/cis90/simben $ who
marray90 pts/0        2012-09-01 13:54 (adsl-67-53-34-201.dsl.net)
rsimms   pts/1        2012-09-01 13:45 (45-10-78-22.dsl.com)
dinchr98 pts/2        2012-09-01 12:53 (c-45-76-204-113.cable.net)
simben90 pts/3        2012-09-01 13:46 (45-10-78-22.dsl.com)
jimg     pts/4        2012-09-01 14:03 (73.31.20.103)
kenrit90 pts/5        2012-09-01 14:30 (c-45-76-89-14.cable.net)
```

username

terminal device
(pts/5 = /dev/pts/5)

*The **who** command outputs the other user sessions currently logged into the system*

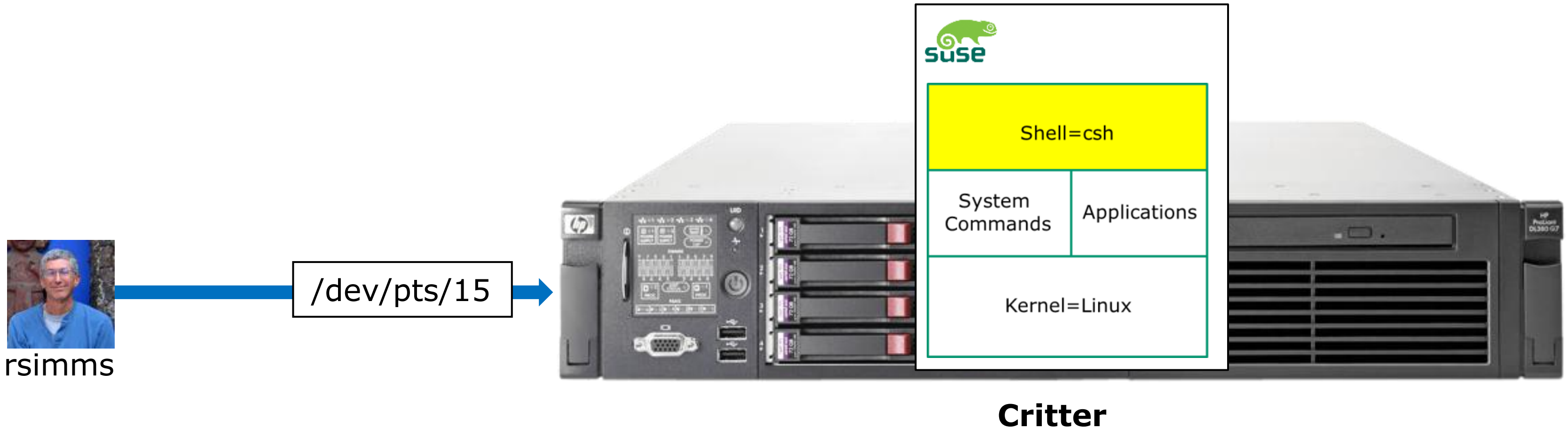
who am i command

```
/home/cis90/simben $ who
marray90 pts/0        2012-09-01 13:54 (adsl-67-53-34-201.dsl.net)
rsimms   pts/1        2012-09-01 13:45 (45-10-78-22.dsl.com)
dinchr98 pts/2        2012-09-01 12:53 (c-45-76-204-113.cable.net)
simben90 pts/3        2012-09-01 13:46 (45-10-78-22.dsl.com)
jimg     pts/4        2012-09-01 14:03 (73.31.20.103)
kenrit90 pts/5        2012-09-01 14:30 (c-45-76-89-14.cable.net)

/home/cis90/simben $ who am i
simben90 pts/3        2012-09-01 13:46 (45-10-78-22.dsl.com)
```

*The **who am i** shows which of the user sessions is your session*

Name Lingo

Example Linux System



user**name** = rsimms

name of terminal device used by rsimms = /dev/pts/15

(terminal type = ansi)

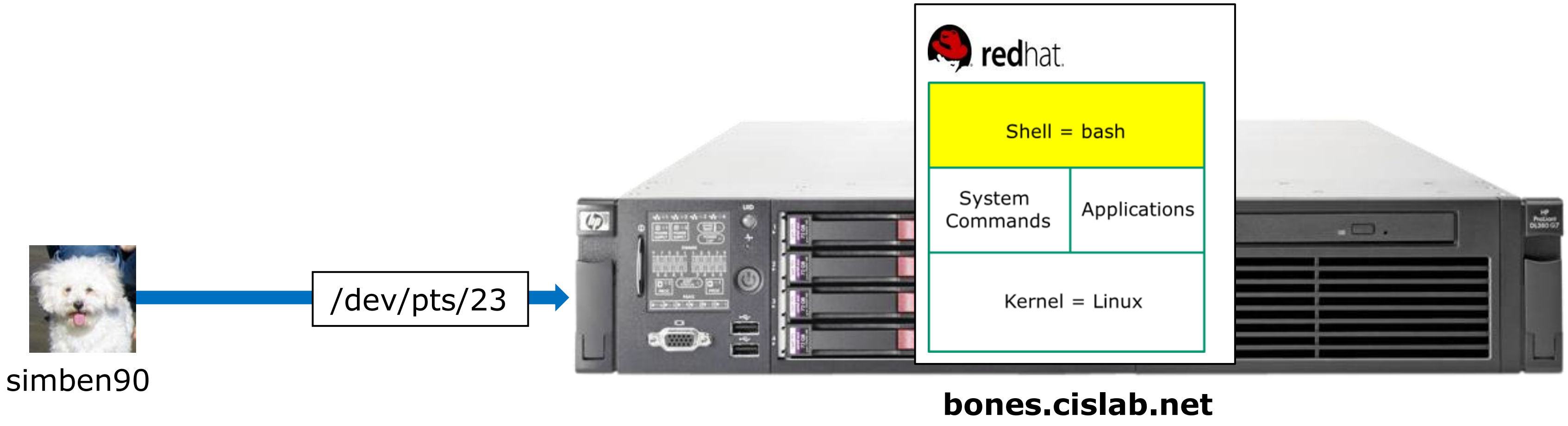
host**name** = Critter

Name of distro = SUSE Linux Enterprise

Name of shell = sh

Name of kernel = Linux

Another Example Linux System



user**name** = simben90

name of terminal device used by simben90 = /dev/pts/23

(terminal type = xterm)

host**name** = bones.cislab.net

Name of distro = Red Hat Enterprise Linux

Name of shell = bash

Name of kernel = Linux

Test your knowledge

What’s in a name?

What’s the name of the terminal device I’m using right now?

```
login as: simben90
simben90@oslab.cabrillo.edu's password:
Last login: Sat Sep  1 09:26:51 2012 from 172.30.90.83

                               _
                             ('v')
                            //-=-\\
                            (\_=_/)
                             ~~ ~~
                          Welcome to Opus
                      Serving Cabrillo College

Terminal type? [xterm]
Terminal type is xterm.
/home/cis90/simben $
/home/cis90/simben $ tty
/dev/pts/0
/home/cis90/simben $
```

*Use the **tty** command to find out*

Answer: /dev/pts/0

What’s in a name?

What type of terminal am I using right now?

```
login as: simben90
simben90@oslab.cabrillo.edu's password:
Last login: Sat Sep  1 09:26:51 2012 from 172.30.90.83

                                  _
                                ('v')
                               //-=-\\
                               (\_=_/)
                                ^^ ^^
                         Welcome to Opus
                      Serving Cabrillo College

Terminal type? [xterm]
Terminal type is xterm.
/home/cis90/simben $
```

We have the answer already!

Answer: xterm

What's in a name?

What is the hostname of the computer I'm using?

```
/home/cis90/simben $
/home/cis90/simben $ hostname
oslab.cabrillo.edu
/home/cis90/simben $
```

*Use the **hostname** command to find out*

Answer: oslab.cabrillo.edu

What's in a name?

What is the name of the OS (operating System) kernel?

```
/home/cis90/simben $
/home/cis90/simben $ uname
Linux
/home/cis90/simben $
```

*Use the **uname** command to find out*

Answer: Linux

What's in a name?

What is the name of the Linux Distribution being run?

```
/home/cis90/simben $
/home/cis90/simben $ cat /etc/*-release
CentOS release 6.2 (Final)
CentOS release 6.2 (Final)
CentOS release 6.2 (Final)
/home/cis90/simben $
```

Answer: CentOS

Use the ***cat /etc/*-release***

Or ***cat /etc/issue*** *command to find out*

What's in a name?

What is my username and uid (user ID number)?

```
/home/cis90/simben $
/home/cis90/simben $ id
uid=1001(simben90) gid=190(cis90)
groups=190(cis90),100(users)
context=unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023
/home/cis90/simben $
```

Answer: username=simben90 and the uid=1001

*Use the **id** command to find out*

What's in a name?

What is the name of the shell I'm using?

```
/home/cis90/simben $
/home/cis90/simben $ ps
  PID TTY          TIME CMD
28237 pts/0    00:00:00 bash
28752 pts/0    00:00:00 ps
/home/cis90/simben $
```

*Use the **ps** command to find out.*

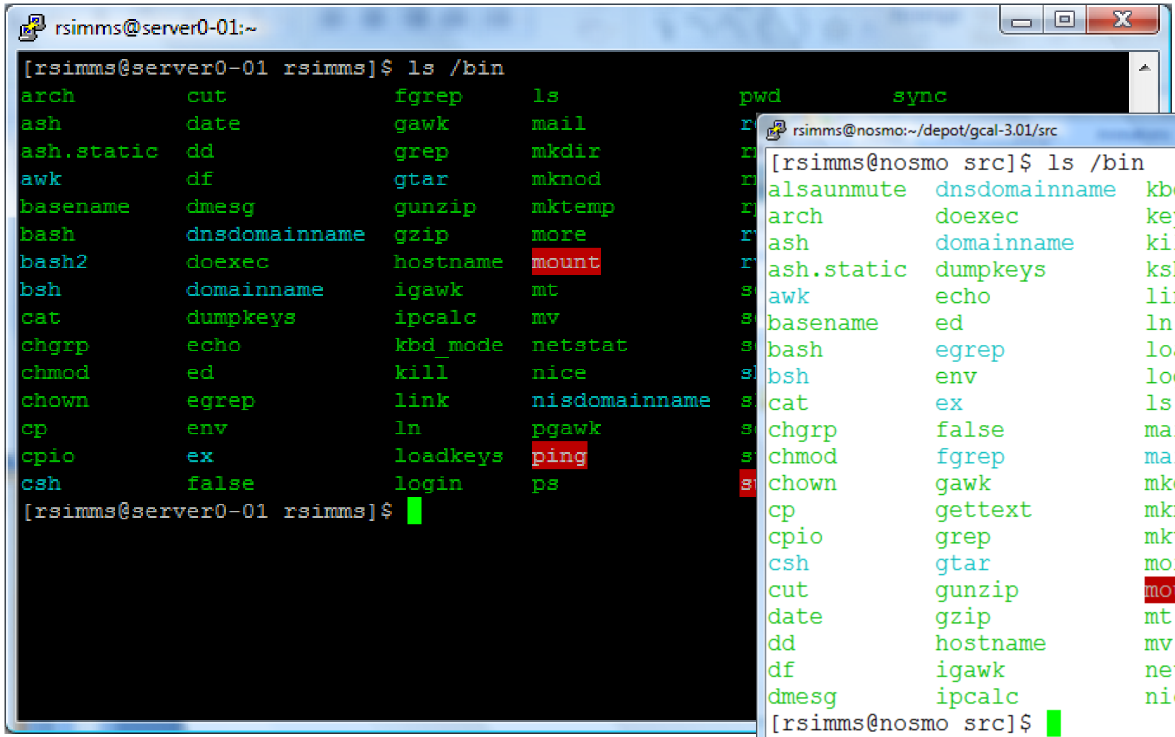
We will soon learn another command for doing this.

Answer: bash

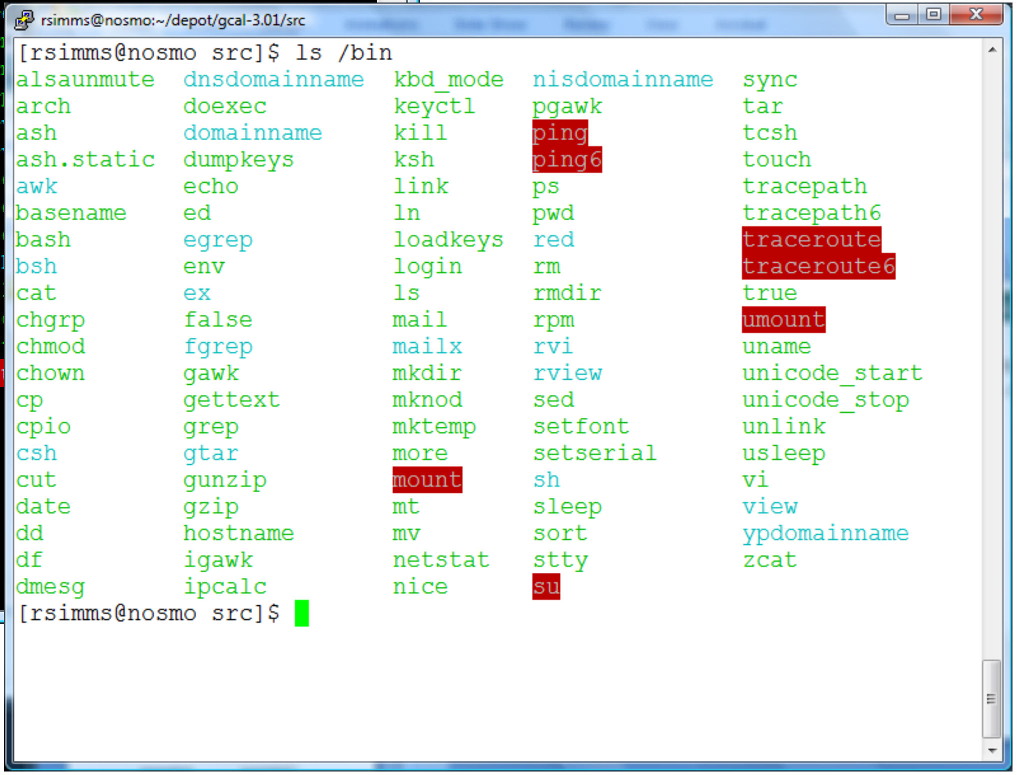
Putty Tips

(Note: tty = teletype)

The Putty program



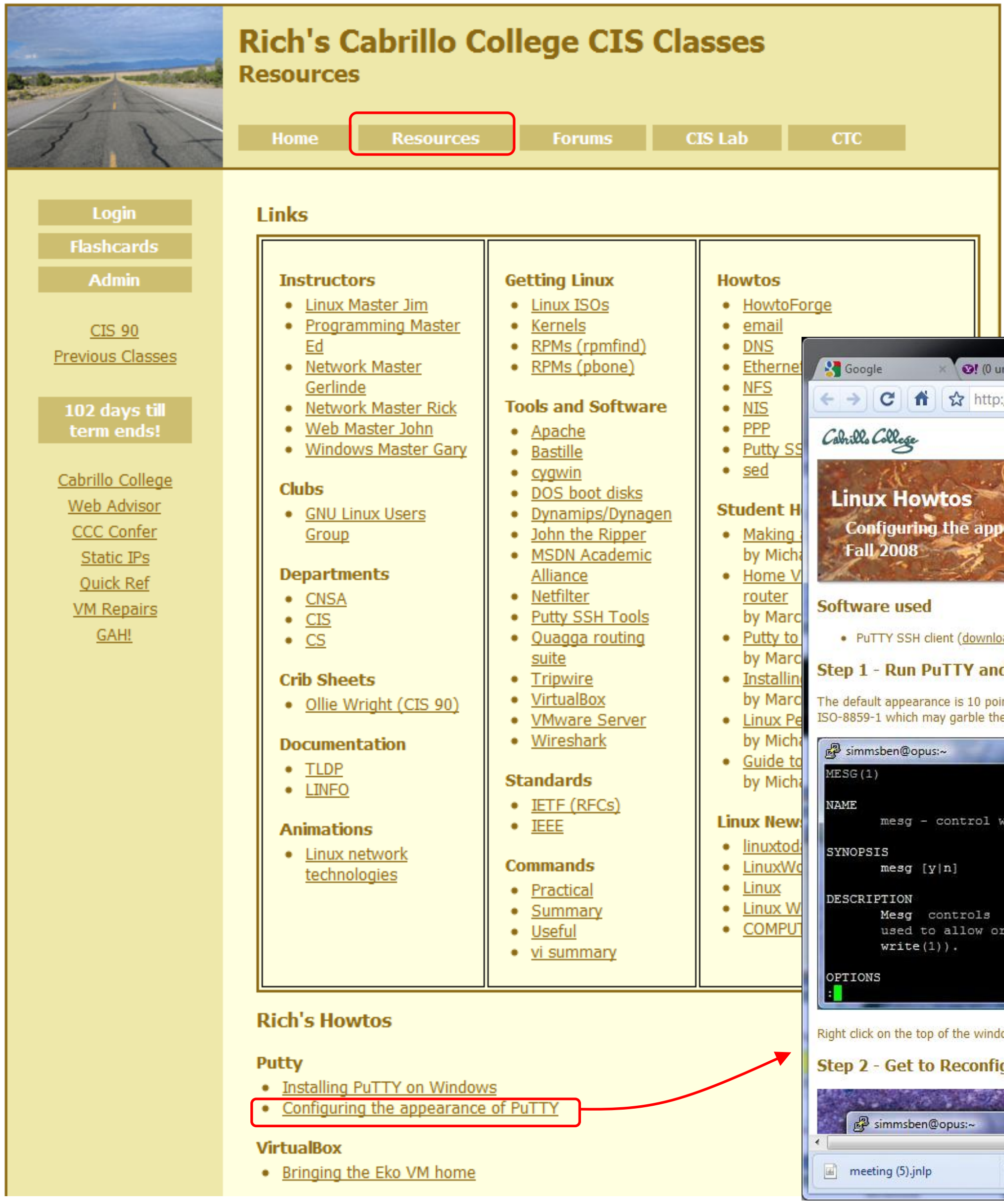
```
rsimms@server0-01:~
[rsimms@server0-01 rsimms]$ ls /bin
arch         cut            fgrep      ls              pwd       sync
ash          date           gawk       mail            r
ash.static   dd             grep       mkdir           r
awk          df             gtar       mknod           r
basename     dmesg          gunzip     mktemp          r
bash         dnsdomainname  gzip       more            r
bash2        doexec         hostname   mount           r
bsh          domainname     igawk      mt              s
cat          dumpkeys       ipcalc     mv              s
chgrp        echo           kbd_mode   netstat         s
chmod        ed             kill       nice            s
chown        egrep          link       nisdomainname   s
cp           env            ln         pgawk           s
cpio         ex             loadkeys   ping            s
csh          false          login      ps              s
[rsimms@server0-01 rsimms]$
```



```
rsimms@nosmo:~/depot/gcal-3.01/src
[rsimms@nosmo src]$ ls /bin
alsaunmute   dnsdomainname  kbd_mode  nisdomainname  sync
arch         doexec         keyctl    pgawk          tar
ash          domainname     kill      ping           tcsh
ash.static   dumpkeys       ksh       ping6          touch
awk          echo           link      ps             tracepath
basename     ed             ln        pwd            tracepath6
bash         egrep          loadkeys  red            traceroute
bsh          env            login     rm             traceroute6
cat          ex             ls        rmdir          true
chgrp        false          mail      rpm            umount
chmod        fgrep          mailx     rvi            uname
chown        gawk           mkdir     rview          unicode_start
cp           gettext        mknod     sed            unicode_stop
cpio         grep           mktemp    setfont        unlink
csh          gtar           more      setserial      usleep
cut          gunzip         mount     sh             vi
date         gzip           mt        sleep          view
dd           hostname       mv        sort           ypdomainname
df           igawk          netstat   stty           zcat
dmesg        ipcalc         nice      su
[rsimms@nosmo src]$
```

*Why does Putty sometimes have a **black background** and sometimes a **white background**?*

CIS 90 - Lesson 2



Rich's Cabrillo College CIS Classes
Resources

CIS 90
Previous Classes

102 days till term ends!

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

Links

Instructors
- Linux Master Jim
- Programming Master Ed
- Network Master Gerlinde
- Network Master Rick
- Web Master John
- Windows Master Gary

Clubs
- GNU Linux Users Group

Departments
- CNSA
- CIS
- CS

Crib Sheets
- Ollie Wright (CIS 90)

Documentation
- TLDP
- LINFO

Animations
- Linux network technologies

Getting Linux
- Linux ISOs
- Kernels
- RPMs (rpmfind)
- RPMs (pbone)

Tools and Software
- Apache
- Bastille
- cygwin
- DOS boot disks
- Dynamips/Dynagen
- John the Ripper
- MSDN Academic Alliance
- Netfilter
- Putty SSH Tools
- Quagga routing suite
- Tripwire
- VirtualBox
- VMware Server
- Wireshark

Standards
- IETF (RFCs)
- IEEE

Commands
- Practical
- Summary
- Useful
- vi summary

Howtos
- HowtoForge
- email
- DNS
- Etherne
- NFS
- NIS
- PPP
- Putty SS
- sed

Student H
- Making by Micha
- Home V router by Marc
- Putty to by Marc
- Installin by Marc
- Linux Pe by Micha
- Guide to by Micha

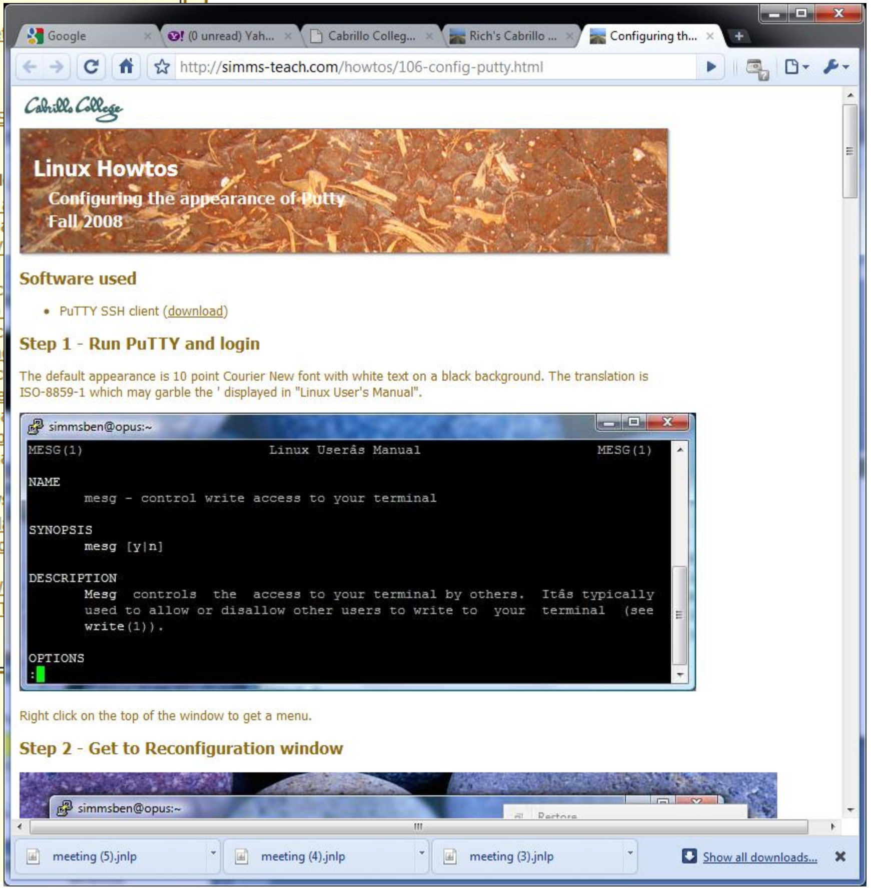
Linux News
- linuxtod
- LinuxWo
- Linux
- Linux W
- COMPUT

Rich's Howtos

Putty
- Installing PuTTY on Windows
- Configuring the appearance of PuTTY

VirtualBox
- Bringing the Eko VM home

There is a Howto on the Resource page to walk you through customizing Putty



Linux Howtos
Configuring the appearance of Putty
Fall 2008

Software used

- PuTTY SSH client (download)

Step 1 - Run PuTTY and login

The default appearance is 10 point Courier New font with white text on a black background. The translation is ISO-8859-1 which may garble the ' displayed in "Linux User's Manual".

simmsben@opus:~

```
MESG(1)                    Linux Userâs Manual                    MESG(1)

NAME
       mesg - control write access to your terminal

SYNOPSIS
       mesg [y|n]

DESCRIPTION
       Mesg  controls  the  access to your terminal by others.  Itâs typically
       used to allow or disallow other users to write to  your  terminal  (see
       write(1)).

OPTIONS
:
```

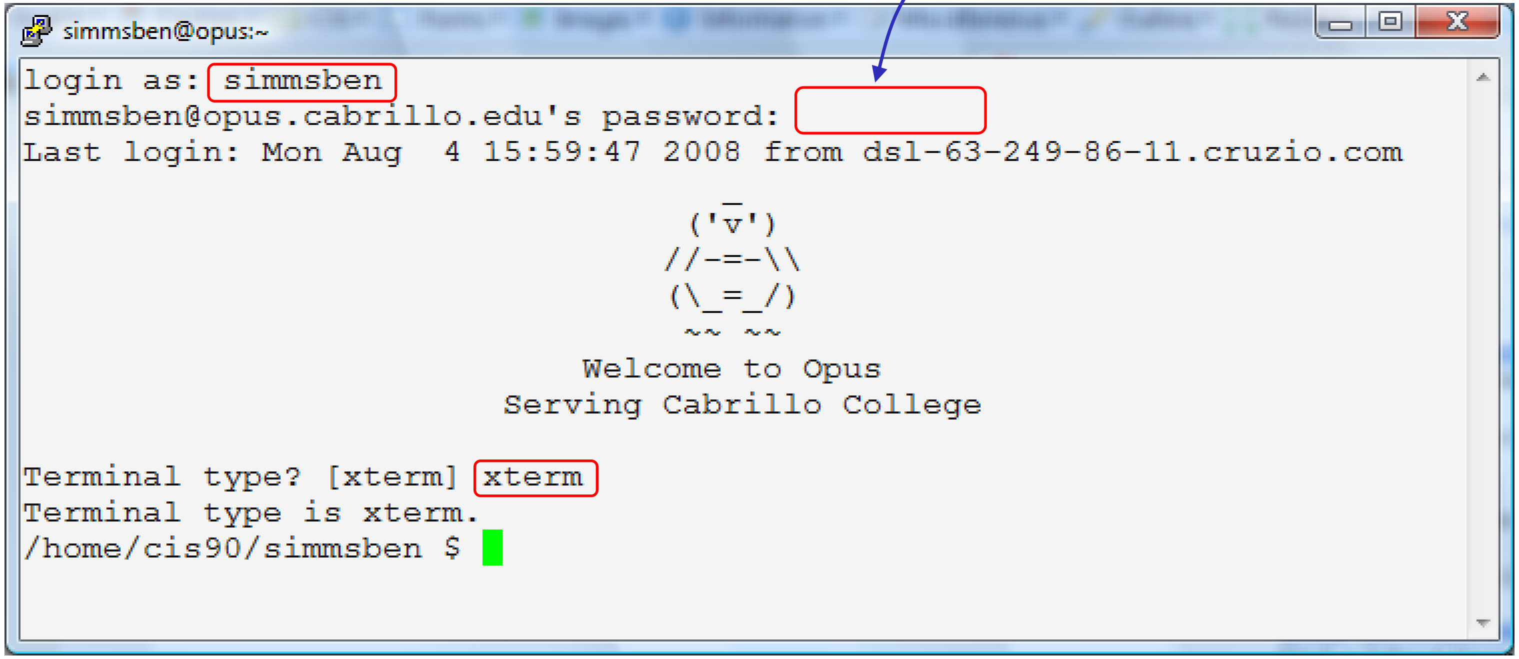
Right click on the top of the window to get a menu.

Step 2 - Get to Reconfiguration window

Logging In (A deep dive)

Logging in

Note: the password is never echoed for security reasons



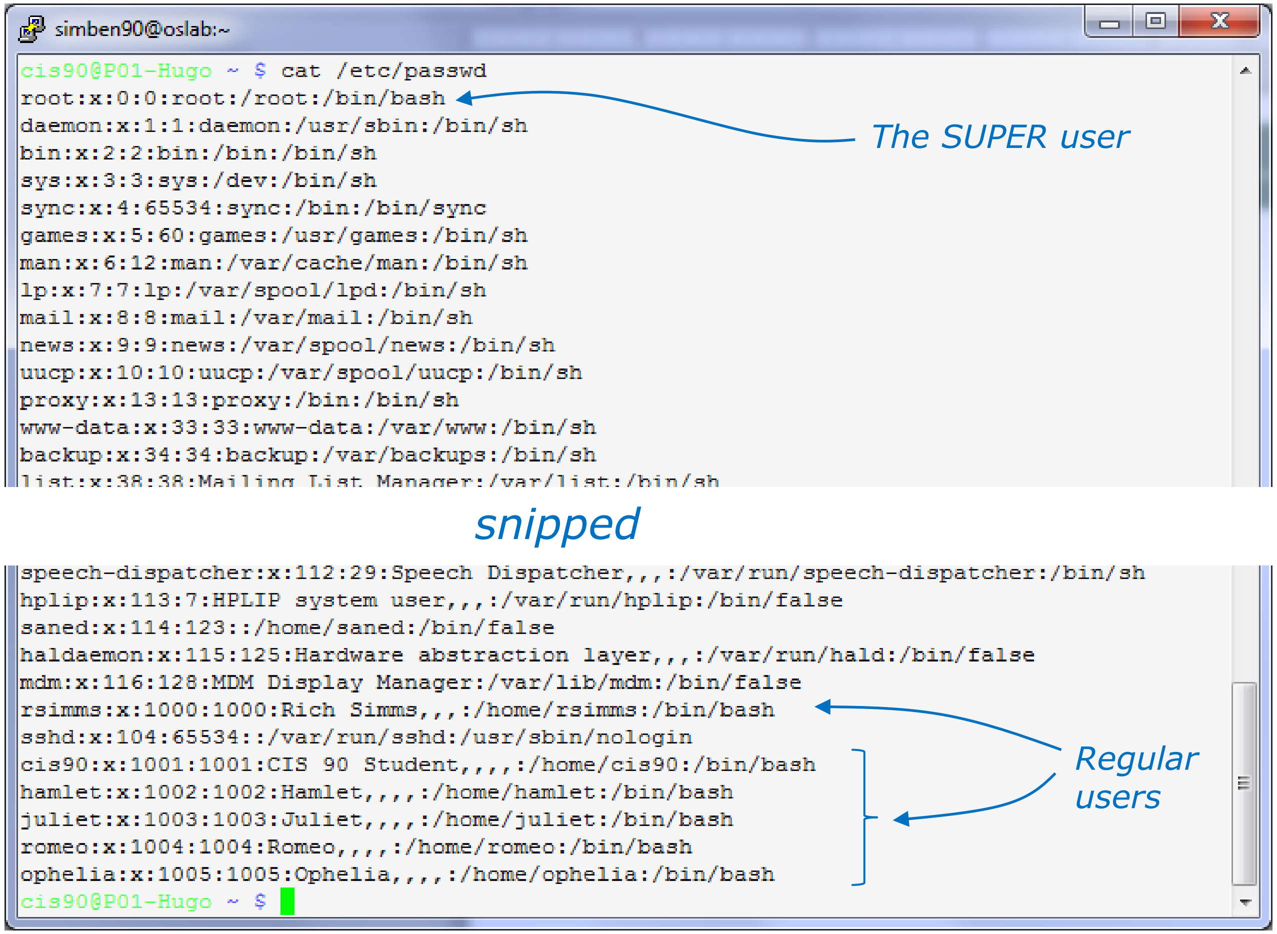
```
login as: simmsben
simmsben@opus.cabrillo.edu's password:
Last login: Mon Aug  4 15:59:47 2008 from dsl-63-249-86-11.cruzio.com

                              _
                            ('v')
                           //-=-\\
                           (\_=_/)
                            ^^ ^^
                        Welcome to Opus
                    Serving Cabrillo College

Terminal type? [xterm] xterm
Terminal type is xterm.
/home/cis90/simmsben $ 
```

always requires:

username + password + terminal type

Note: Terminal Type ≠ Terminal Device

/etc/passwd



```
cis90@P01-Hugo ~ $ cat /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/bin/sh
bin:x:2:2:bin:/bin:/bin/sh
sys:x:3:3:sys:/dev:/bin/sh
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/bin/sh
man:x:6:12:man:/var/cache/man:/bin/sh
lp:x:7:7:lp:/var/spool/lpd:/bin/sh
mail:x:8:8:mail:/var/mail:/bin/sh
news:x:9:9:news:/var/spool/news:/bin/sh
uucp:x:10:10:uucp:/var/spool/uucp:/bin/sh
proxy:x:13:13:proxy:/bin:/bin/sh
www-data:x:33:33:www-data:/var/www:/bin/sh
backup:x:34:34:backup:/var/backups:/bin/sh
list:x:38:38:Mailing List Manager:/var/list:/bin/sh
```

```
speech-dispatcher:x:112:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/sh
hplip:x:113:7:HPLIP system user,,,:/var/run/hplip:/bin/false
saned:x:114:123::/home/saned:/bin/false
haldaemon:x:115:125:Hardware abstraction layer,,,:/var/run/hald:/bin/false
mdm:x:116:128:MDM Display Manager:/var/lib/mdm:/bin/false
rsimms:x:1000:1000:Rich Simms,,,:/home/rsimms:/bin/bash
sshd:x:104:65534::/var/run/sshd:/usr/sbin/nologin
cis90:x:1001:1001:CIS 90 Student,,,,:/home/cis90:/bin/bash
hamlet:x:1002:1002:Hamlet,,,,:/home/hamlet:/bin/bash
juliet:x:1003:1003:Juliet,,,,:/home/juliet:/bin/bash
romeo:x:1004:1004:Romeo,,,,:/home/romeo:/bin/bash
ophelia:x:1005:1005:Ophelia,,,,:/home/ophelia:/bin/bash
cis90@P01-Hugo ~ $
```

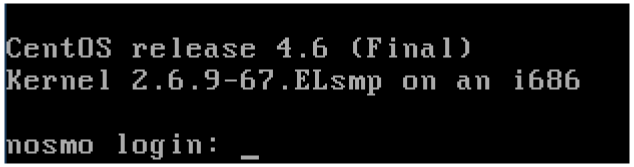
All user accounts are kept in the /etc/passwd file

Passwords are no longer kept here though!

Passwords are now kept (encrypted) in the /etc/shadow file

Login and Passwords

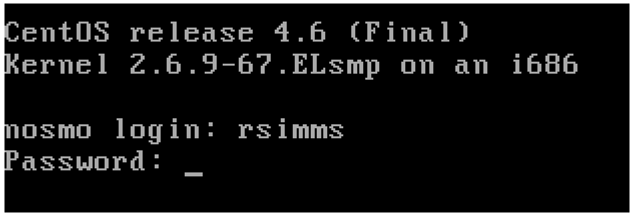
1) ***init*** *starts up the* ***mingetty*** *program for each terminal which then prompts for login username, gets it, then starts login.*



```
CentOS release 4.6 (Final)
Kernel 2.6.9-67.ELsmp on an i686

nosmo login: _
```

```
[root@nosmo ~]# ps t tty1
  PID TTY      STAT   TIME COMMAND
 3545 tty1     Ss+    0:00 /sbin/mingetty tty1
```

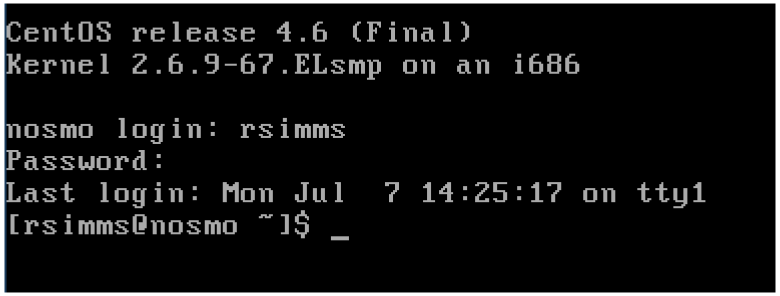
2) ***login*** *collects the password and checks it with /etc/passwd and /etc/shadow*



```
CentOS release 4.6 (Final)
Kernel 2.6.9-67.ELsmp on an i686

nosmo login: rsimms
Password: _
```

```
[root@nosmo ~]# ps t tty1
  PID TTY      STAT   TIME COMMAND
 3545 tty1     Ss+    0:00 /bin/login -
```

3) If a match then the shell specified in the /etc/passwd file is started



```
CentOS release 4.6 (Final)
Kernel 2.6.9-67.ELsmp on an i686

nosmo login: rsimms
Password:
Last login: Mon Jul  7 14:25:17 on tty1
[rsimms@nosmo ~]$ _
```

```
[root@nosmo ~]# ps t tty1
  PID TTY      STAT   TIME COMMAND
 4917 tty1     Ss+    0:00 -bash
```

/etc/passwd

*This command, which we will learn how to do later, outputs **just one line** of the /etc/passwd file on Opus*

```
/home/cis90/simben $ cat /etc/passwd | grep simben
simben90:x:1001:190:Benji Simms:/home/cis90/simben:/bin/bash
```

username

password (just a placeholder now)

User ID (UID)

Group ID (gid)

Comment

Home directory

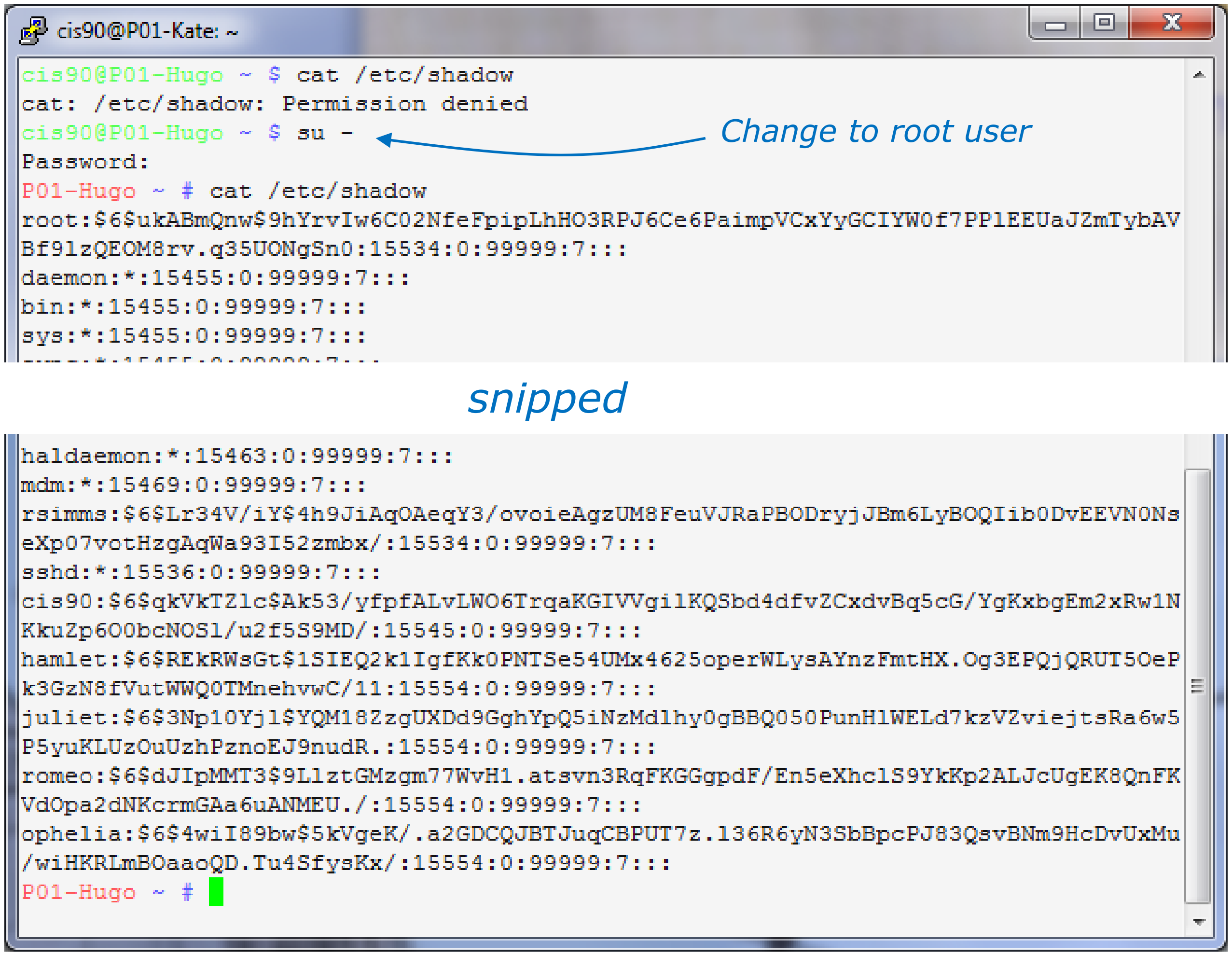
Shell

Note the field separator used in /etc/passwd is a ":"

```
/home/cis90/simben $ id
uid=1001(simben90) gid=190(cis90) groups=190(cis90),100(users)
context=unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023
```

Can you tell where the id command gets (some of) the data that it displays?

/etc/shadow


cis90@P01-Kate: ~

```
cis90@P01-Hugo ~ $ cat /etc/shadow
cat: /etc/shadow: Permission denied
cis90@P01-Hugo ~ $ su -
Password:
P01-Hugo ~ # cat /etc/shadow
root:$6$ukABmQnw$9hYrvIw6C02NfeFpipLhHO3RPJ6Ce6PaimpVCxYyGCIYW0f7PPlEEUaJZmTybAV
Bf9lzQEOM8rv.q35UONgSn0:15534:0:99999:7:::
daemon:*:15455:0:99999:7:::
bin:*:15455:0:99999:7:::
sys:*:15455:0:99999:7:::
```

Change to root user

snipped

```
haldaemon:*:15463:0:99999:7:::
mdm:*:15469:0:99999:7:::
rsimms:$6$Lr34V/iY$4h9JiAqOAeqY3/ovoieAgzUM8FeuVJRaPBODryjJBm6LyBOQIib0DvEEVNONs
eXp07votHzgAqWa93I52zmbx/:15534:0:99999:7:::
sshd:*:15536:0:99999:7:::
cis90:$6$qkVkTZlc$Ak53/yfpfALvLWO6TrqaKGIVVgilKQSbd4dfvZCxdvBq5cG/YgKxbgEm2xRw1N
KkuZp6O0bcNOSl/u2f5S9MD/:15545:0:99999:7:::
hamlet:$6$REkRWsGt$1SIEQ2k1IgfKk0PNTSe54UMx4625operWLysAYnzFmtHX.Og3EPQjQRUT5OeP
k3GzN8fVutWWQ0TMnehvwC/11:15554:0:99999:7:::
juliet:$6$3Np10Yjl$YQM18ZzgUXDd9GghYpQ5iNzMdlhy0gBBQ050PunHlWELd7kzVZviejtsRa6w5
P5yuKLUzOuUzhPznoEJ9nudR.:15554:0:99999:7:::
romeo:$6$dJIpMMT3$9LlztGMzgm77WvH1.atsvn3RqFKGGgpdF/En5eXhclS9YkKp2ALJcUgEK8QnFK
VdOpa2dNKcrmGAa6uANMEU./:15554:0:99999:7:::
ophelia:$6$4wiI89bw$5kVgeK/.a2GDCQJBTJuqCBPUT7z.136R6yN3SbBpcPJ83QsvBNm9HcDvUxMu
/wiHKRLmBOaaoQD.Tu4SfysKx/:15554:0:99999:7:::
P01-Hugo ~ #
```

All passwords are encrypted and kept in the /etc/shadow file now.

Only the root user can view this file!

Class Activity - /etc/passwd and /etc/shadow files

```
/home/cis90/simben $ cat /etc/passwd | grep simben
simben90:x:1001:190:Benji Simms:/home/cis90/simben:/bin/bash
```

username

Comment

Home directory

Shell

Group ID (gid)

User ID (UID)

password (just a placeholder now)

Note the field separator used in /etc/passwd is a ":"

1. **cat /etc/passwd**
   - Find your own username
   - Compare your /etc/passwd home directory with your prompt
   - Compare your /etc/passwd shell with output from the ps command
   - Compare your /etc/passwd uid and gid with output from the **id** command
2. **cat /etc/shadow**

What happens when you try to look at /etc/shadow?

Your Opus Password

Your Opus password

- Strong passwords are critical!

- **Botnets** and **ne-er-do-wells** are constantly attempting to break into computers attached to the Internet!
  (Even my little Frodo VM at home)

They never stop trying

The ne'er-do-wells trying to break in …
this is why you need strong passwords

```
 --------------------- SSHD Begin ------------------------

SSHD Killed: 1 Time(s)

SSHD Started: 1 Time(s)

Disconnecting after too many authentication failures for user:
   guest90 : 1 Time(s)


 Failed logins from:
    76.254.22.196 (adsl-76-254-22-196.dsl.pltn13.sbcglobal.net): 2 times
    201.7.115.194 (201-7-115-194.spopa302.ipd.brasiltelecom.net.br): 2135 times
    210.240.12.14: 20 times

 Illegal users from:
    201.7.115.194 (201-7-115-194.spopa302.ipd.brasiltelecom.net.br): 564 times
    210.240.12.14: 42 times


Users logging in through sshd:
   guest:
      76.254.22.196 (adsl-76-254-22-196.dsl.pltn13.sbcglobal.net): 2 times
   jimg:
      70.132.20.25 (adsl-70-132-20-25.dsl.snfc21.sbcglobal.net): 7 times
   ordazedw:
      76.254.22.196 (adsl-76-254-22-196.dsl.pltn13.sbcglobal.net): 1 time
   root:
      63.249.86.11 (dsl-63-249-86-11.cruzio.com): 3 times
      70.132.20.25 (adsl-70-132-20-25.dsl.snfc21.sbcglobal.net): 1 time
   rsimms:
      63.249.86.11 (dsl-63-249-86-11.cruzio.com): 2 times
```

From a logwatch report showing malicious attempts to break into Opus

They never stop trying

The firewall on Opus slows down but does not end the attacks

```
Failed logins from:
    122.249.183.95 (x183095.ppp.asahi-net.or.jp): 3 times
    218.64.5.131 (131.5.64.218.broad.nc.jx.dynamic.163data.com.cn): 3
times

 Illegal users from:
    78.46.83.76 (static.76.83.46.78.clients.your-server.de): 3 times
    218.4.157.178: 3 times

 pam_succeed_if(sshd:auth): error retrieving information about user
teamspeak : 1 time(s)
 reverse mapping checking getaddrinfo for
131.5.64.218.broad.nc.jx.dynamic.163data.com.cn failed - POSSIBLE
BREAK-IN ATTEMPT! : 3 time(s)
 pam_succeed_if(sshd:auth): error retrieving information about user ts
: 2 time(s)
 pam_succeed_if(sshd:auth): error retrieving information about user
plcmspip : 2 time(s)
 pam_succeed_if(sshd:auth): error retrieving information about user
PlcmSpIp : 1 time(s)
```

We used to get up thousands of attempts every day until we made some changes to the firewall on Opus. Attacks always would come from different computers around the world.

/var/log/wtmp and var/log/btmp

```
[root@opus log]# lastb | sort | cut -f1 -d' ' | grep -v ^$ | uniq -c > bad
[root@opus log]# sort -g bad > bad.sort
[root@opus log]# cat  bad.sort | tail -50
    471 ftp
    472 public
    490 test
    490 tomcat
    498 user
    506 service
    508 mike
    508 username
    524 cyrus
    530 pgsql
    532 test1
    544 master
    554 linux
    554 toor
    576 paul
    584 support
    590 testuser
    604 irc
    610 test
    656 noc
    686 www
    690 postfix
    723 john
    734 testing
    738 adam
    746 alex
    754 info
    798 tester
    832 library
    935 guest
    990 admin
   1002 office
   1022 temp
   1070 ftpuser
   1138 webadmin
   1298 nagios
   1332 web
   1374 a
   1384 student
   1416 postgres
   1690 user
   1858 oracle
   1944 mysql
   2086 webmaste
   5324 test
  10803 root
  10824 admin
  18679 root
  24064 root
[root@opus log]#
```

Top 50 usernames used by the ne'er-do-wells

How to make a strong password

- The longer the better (8 or more characters)
- Not in any dictionary
- Use upper case, lowercase, punctuation, digits
- Something you can remember
- Keep it secret
- Change when compromised

`Wh0le#!!`	(Whole sh'bang)
`KuKu4(co)2`	(Cuckoo for Cocoa Puffs)
`#0p&s@ve`	(shop and save)
`Idl02$da`	(I do laundry on Tuesday)

passwd command

change password

*Use the **passwd** command to change your password*

```
/home/cis90/simmsben $ passwd
Changing password for user simben90.
Changing password for simben90
(current) UNIX password:
New UNIX password:
Retype new UNIX password:
passwd: all authentication tokens updated successfully.
/home/cis90/simmsben $
```

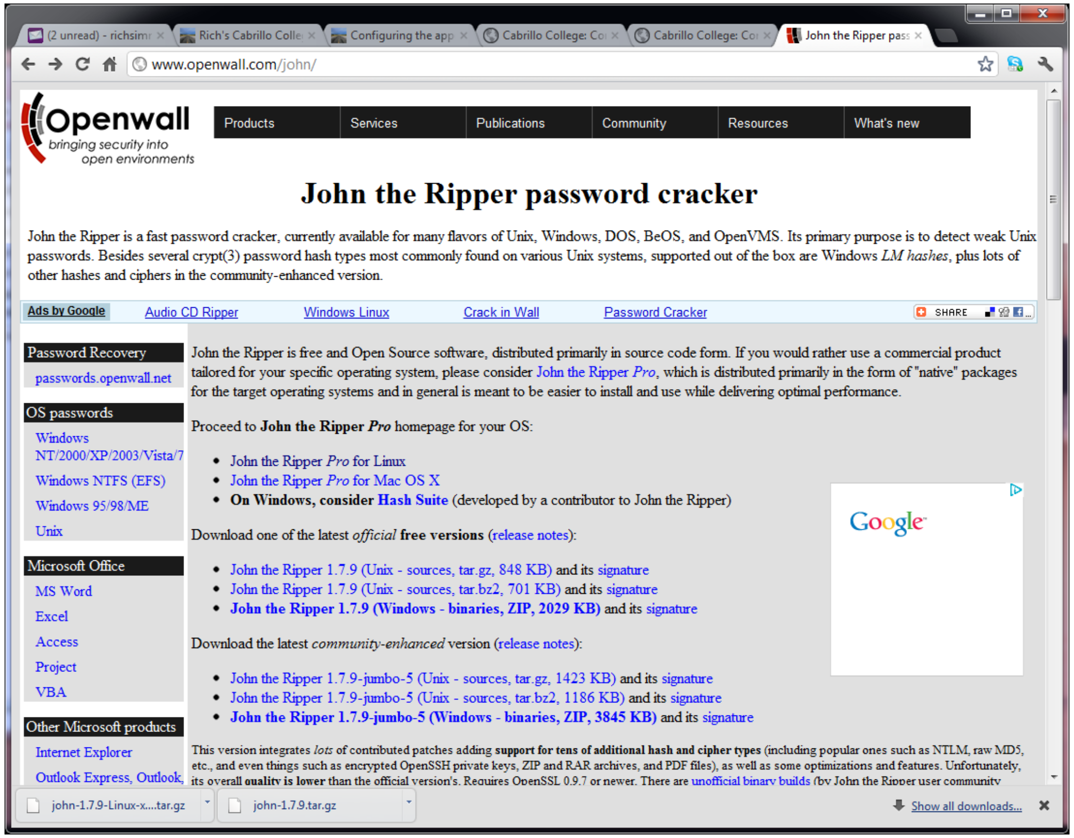
Note, the passwords are not echoed as you type them.

This will change you password on Opus only (not on Vlab or the forum)

Note, the password command reads its input from the keyboard

John the Ripper

An open source cracker that tries common passwords first followed by a brute force dictionary attack



(2 unread) - richsimr | Rich's Cabrillo Colle | Configuring the app | Cabrillo College: Co | Cabrillo College: Co | John the Ripper pass

www.openwall.com/john/

Openwall bringing security into open environments

Products | Services | Publications | Community | Resources | What's new

John the Ripper password cracker

John the Ripper is a fast password cracker, currently available for many flavors of Unix, Windows, DOS, BeOS, and OpenVMS. Its primary purpose is to detect weak Unix passwords. Besides several crypt(3) password hash types most commonly found on various Unix systems, supported out of the box are Windows *LM hashes*, plus lots of other hashes and ciphers in the community-enhanced version.

Ads by Google | Audio CD Ripper | Windows Linux | Crack in Wall | Password Cracker | SHARE

Password Recovery
- passwords.openwall.net

OS passwords
- Windows NT/2000/XP/2003/Vista/7
- Windows NTFS (EFS)
- Windows 95/98/ME
- Unix

Microsoft Office
- MS Word
- Excel
- Access
- Project
- VBA

Other Microsoft products
- Internet Explorer
- Outlook Express, Outlook,

John the Ripper is free and Open Source software, distributed primarily in source code form. If you would rather use a commercial product tailored for your specific operating system, please consider John the Ripper *Pro*, which is distributed primarily in the form of "native" packages for the target operating systems and in general is meant to be easier to install and use while delivering optimal performance.

Proceed to **John the Ripper *Pro*** homepage for your OS:

- John the Ripper *Pro* for Linux
- John the Ripper *Pro* for Mac OS X
- **On Windows, consider Hash Suite** (developed by a contributor to John the Ripper)

Download one of the latest *official* **free versions** (release notes):

- John the Ripper 1.7.9 (Unix - sources, tar.gz, 848 KB) and its signature
- John the Ripper 1.7.9 (Unix - sources, tar.bz2, 701 KB) and its signature
- **John the Ripper 1.7.9 (Windows - binaries, ZIP, 2029 KB)** and its signature

Download the latest *community-enhanced* version (release notes):

- John the Ripper 1.7.9-jumbo-5 (Unix - sources, tar.gz, 1423 KB) and its signature
- John the Ripper 1.7.9-jumbo-5 (Unix - sources, tar.bz2, 1186 KB) and its signature
- **John the Ripper 1.7.9-jumbo-5 (Windows - binaries, ZIP, 3845 KB)** and its signature

Google

This version integrates *lots* of contributed patches adding **support for tens of additional hash and cipher types** (including popular ones such as NTLM, raw MD5, etc., and even things such as encrypted OpenSSH private keys, ZIP and RAR archives, and PDF files), as well as some optimizations and features. Unfortunately, its overall **quality is lower** than the official version's. Requires OpenSSL 0.9.7 or newer. There are unofficial binary builds (by John the Ripper user community

john-1.7.9-Linux-x....tar.gz | john-1.7.9.tar.gz | Show all downloads...

john-1.7.9/run/password.lst has most popular passwords to try first

Housekeeping

Housekeeping

1. Student surveys due today
2. Lab 1 submittal due by 11:59PM tonight
3. Last day to add is Saturday 9/8

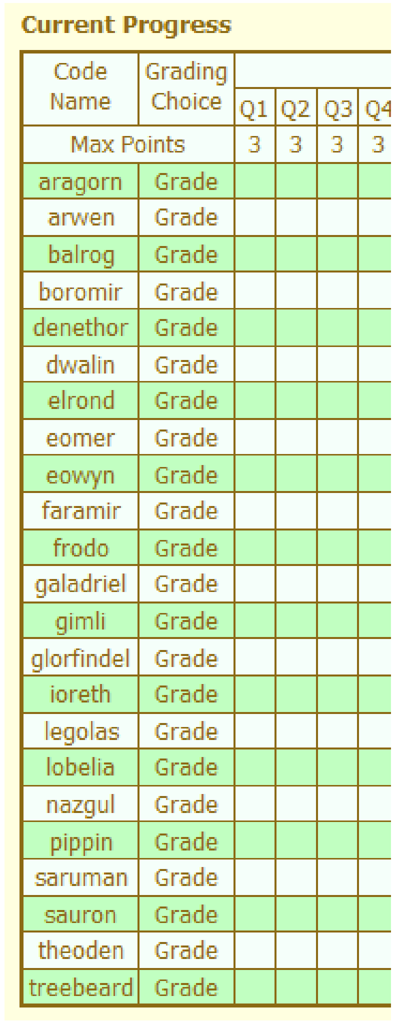
Turn OFF the recording

Roll Call

Turn recording back ON

CIS 90 – Code Names

Lord of the Rings Characters



Current Progress

Code Name	Grading Choice	Q1	Q2	Q3	Q4
Max Points		3	3	3	3
aragorn	Grade				
arwen	Grade				
balrog	Grade				
boromir	Grade				
denethor	Grade				
dwalin	Grade				
elrond	Grade				
eomer	Grade				
eowyn	Grade				
faramir	Grade				
frodo	Grade				
galadriel	Grade				
gimli	Grade				
glorfindel	Grade				
ioreth	Grade				
legolas	Grade				
lobelia	Grade				
nazgul	Grade				
pippin	Grade				
saruman	Grade				
sauron	Grade				
theoden	Grade				
treebeard	Grade				

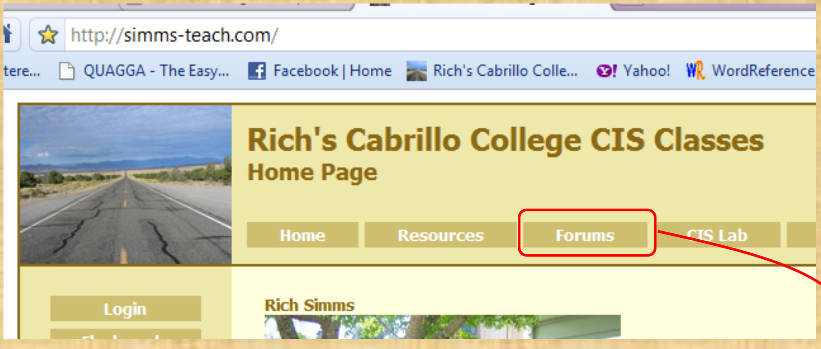
Everyone who is enrolled for this course will be assigned a code name.

I will use your grading choice on the survey you send me (you can change your mind later)

I'll start sending out code names tomorrow for ***everyone who sends or has sent me their survey****.*

Class Activity
Forum Registration

*There is a Forums link on **simms-teach.com***



http://simms-teach.com/

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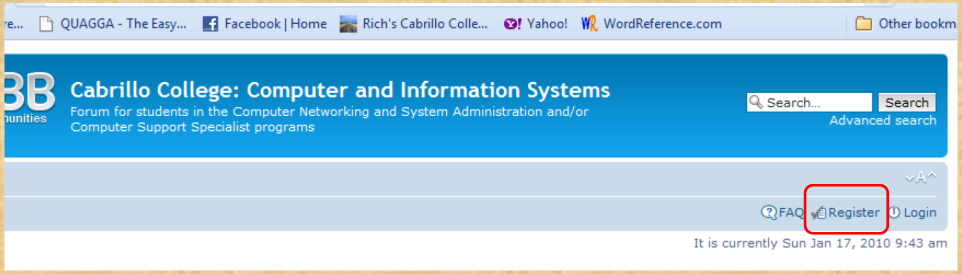
Rich's Cabrillo College CIS Classes
Home Page

Home Resources Forums CIS Lab

Login

Rich Simms

*Or browse to **oslab.cabrillo.edu/forum***



re... QUAGGA - The Easy... Facebook | Home Rich's Cabrillo Colle... Yahoo! WordReference.com Other bookm

Cabrillo College: Computer and Information Systems
Forum for students in the Computer Networking and System Administration and/or Computer Support Specialist programs

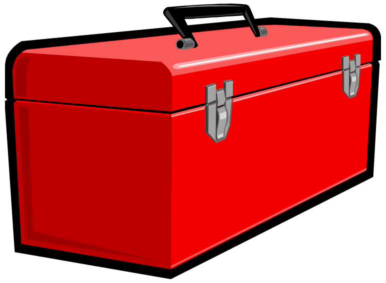
Search... Search
Advanced search

FAQ Register Login

It is currently Sun Jan 17, 2010 9:43 am

To Register:

1. Browse to the forum
2. Click on Register
3. Review and agree to terms
4. Your **Username** must:
   - Be your **first and last name separated by a space**
   - e.g. Rich Simms
     Not rsimms71 or richsimms



More commands for your toolbox

Introducing some new commands for this lesson

cat *filename*	*print a file (from concatenate)*
cd *path*	*Change to a new directory*
ls *path*	*List files in a directory*
echo *string*	*Print string (on screen)*
file *filename*	*Show additional file information*
type *command*	*Shows where command resides on the path*
man *command*	*Show manual page for a command*
bc	*Binary calculator*
banner *text*	*Make a banner*
passwd	*Change password*
apropos *command*	*Looks up references in the whatis database*

cat command

Concatenate files and print on the standard output

```
/home/cis90/simben $ cat letter
Hello Mother!  Hello Father!

Here I am at Camp Granada.  Things are very entertaining,
and they say we'll have some fun when it stops raining.

< snipped >

Wait a minute!  It's stopped hailing!  Guys are swimming!
Guys are sailing!  Playing baseball, gee that's better!
Mother, Father, kindly disregard this letter.

                                                Alan Sherman
/home/cis90/simben $
```

cd and ls commands

Change directory and list directory contents

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

*Using **cd** by itself with no argument will return you to your home directory*

```
/home/cis90/simben $ ls
bigfile  lab01-submitted      letter         Poems      small_town  timecal
bin      lab01-submitted.bak  log            proposal1  spellk      what_am_i
empty    Lab2.0               Miscellaneous  proposal2  text.err
Hidden   Lab2.1               mission        proposal3  text.fxd
```

List files in current directory

```
/home/cis90/simben $ cd Poems/
/home/cis90/simben/Poems $ ls
ant  Blake  nursery  Shakespeare  twister  Yeats
/home/cis90/simben/Poems $
```

Change to the Poems directory

Notice how your prompt changes when changing into the Poems directory

ls command

List directory contents

```
/home/cis90/simben $ ls
bigfile  Lab2.0         mission    proposal3  text.fxd
bin      Lab2.1         Poems      small_town timecal
empty    letter         proposal1  spellk     what_am_i
Hidden   Miscellaneous  proposal2  text.err
```

If no argument is specified, the current directory is listed

```
/home/cis90/simben $ ls Poems/
ant  Blake  nursery  Shakespeare  twister  Yeats
```

If one or more directories are specified as arguments then they will be listed

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

If one or more filenames are specified as arguments then those filenames will be listed

Regular files show as black, directories show as blue and executable programs/scripts show as green

echo command

Echo (output) the arguments on the command line

```
/home/cis90/simben $ echo hello rich
hello rich

/home/cis90/simben $ echo 123
123

/home/cis90/simben $ echo 1 2 3
1 2 3
```

file command

Show extended file information

```
/home/cis90/simben $ file letter
letter: ASCII English text

/home/cis90/simben $ file Miscellaneous/
Miscellaneous/: directory

/home/cis90/simben $ file timecal
timecal: shell archive or script for antique kernel text
```

type command

Locate where a command resides on your path

```
[rsimms@opus run]$ type cal
cal is /usr/bin/cal
```

*The **cal** command is on the user's path and is located in the /usr/bin directory*

```
/home/cis90/simben $ type bogus
-bash: type: bogus: not found
```

*The **bogus** command is not on the user's path*

```
[rsimms@opus run]$ type uname cal
uname is /bin/uname
cal is /usr/bin/cal
```

*Both **uname** and **cal** commands are on the user's path. **uname** is in the /bin directory and **cal** is in the /usr/bin directory*

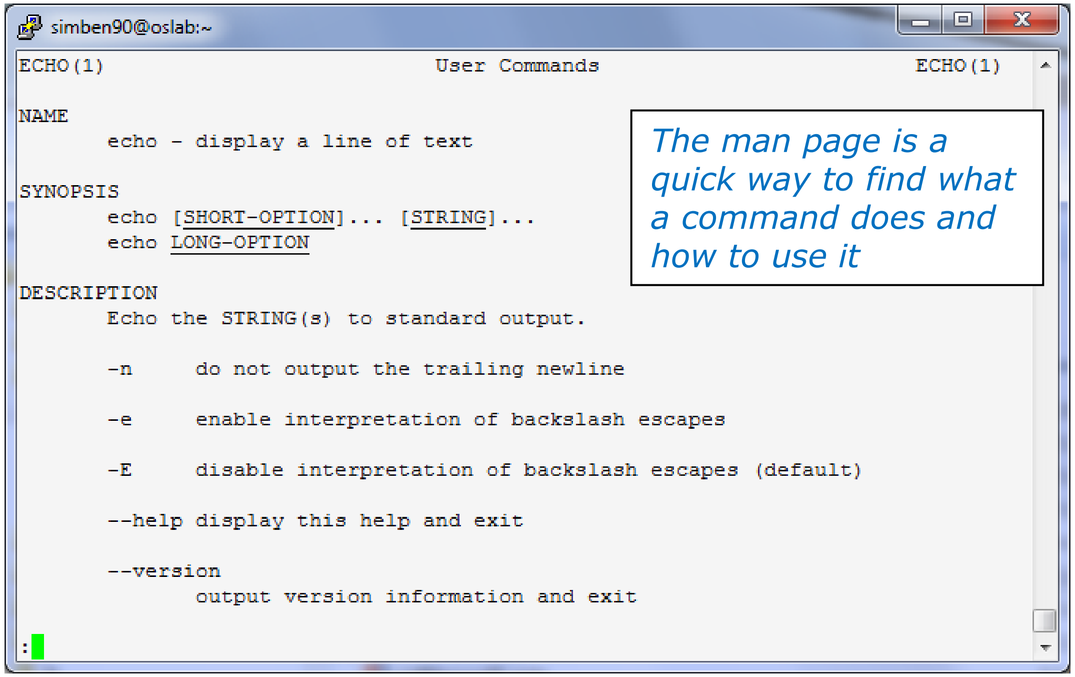
name of the file (command/program)

name of the directory where file is found

man command

Show the manual page (documentation) for a command

```
/home/cis90/simben $ man echo
```



```
ECHO(1)                         User Commands                        ECHO(1)

NAME
       echo - display a line of text

SYNOPSIS
       echo [SHORT-OPTION]... [STRING]...
       echo LONG-OPTION

DESCRIPTION
       Echo the STRING(s) to standard output.

       -n     do not output the trailing newline

       -e     enable interpretation of backslash escapes

       -E     disable interpretation of backslash escapes (default)

       --help display this help and exit

       --version
              output version information and exit

:
```

The man page is a quick way to find what a command does and how to use it

Use these keys to scroll

Use q key to quit

bc command

A binary calculator

```
/home/cis90/simben $ bc
bc 1.06.95
Copyright 1991-1994, 1997, 1998, 2000, 2004, 2006
Free Software Foundation, Inc.
This is free software with ABSOLUTELY NO WARRANTY.
For details type `warranty'.
2+2
4
3*30
90
(3*31)+251*1.5
469.5
quit
/home/cis90/simben $
```

Enter mathematical equations for bc to solve

Use quit to end program

banner command

Make a banner

```
/home/cis90/simben $ banner I Love Linux
 #####
   #
   #
   #
   #
   #
 #####

#       ####### #     # #######
#       #     # #     # #
#       #     # #     # #
#       #     # #     # #####
#       #     #  #   #  #
#       #     #   # #   #
####### #######    #    #######

#        #####  #     # #     # #     #
#          #    ##    # #     #  #   #
#          #    # #   # #     #   # #
#          #    #  #  # #     #    #
#          #    #   # # #     #   # #
#          #    #    ## #     #  #   #
#######  #####  #     #  #####  #     #
```

Similar to echo command but outputs banner sized letters instead

apropos command

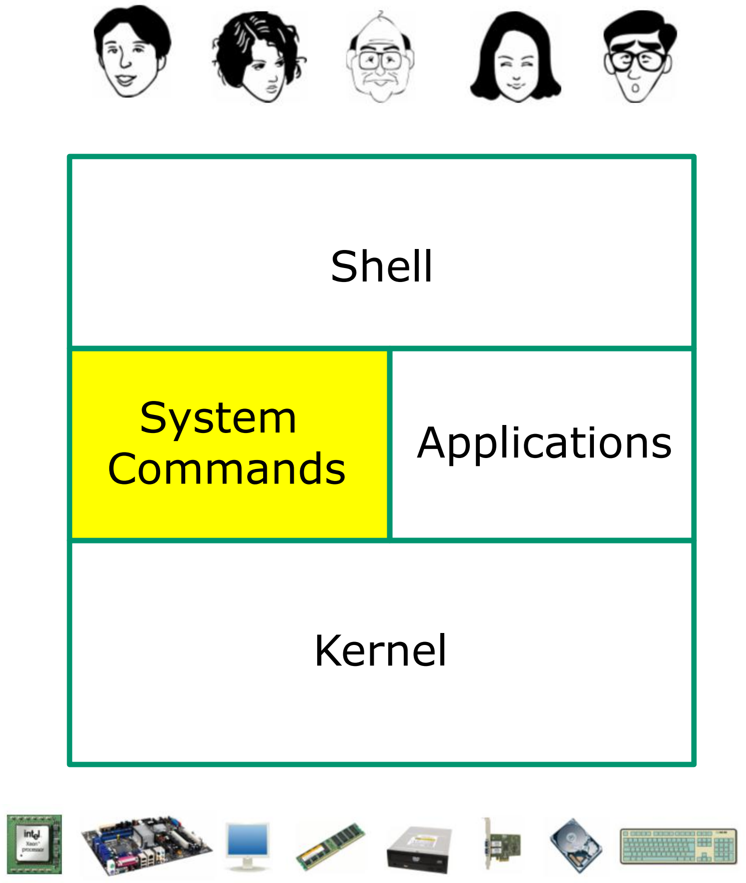
apropos - search the whatis database for strings

```
/home/cis90/simben $ apropos echo
echo                     (1)   - display a line of text
echo                     (1p)   - write arguments to standard output
echo [builtins]          (1)   - bash built-in commands, see bash(1)
lessecho                 (1)   - expand metacharacters
pam_echo                 (8)   - PAM module for printing text messages
ping                     (8)   - send ICMP ECHO_REQUEST to network hosts
ping6 [ping]             (8)   - send ICMP ECHO_REQUEST to network hosts
/home/cis90/simben $
```

Where are the UNIX commands & utilities

UNIX/Linux Architecture

System Commands

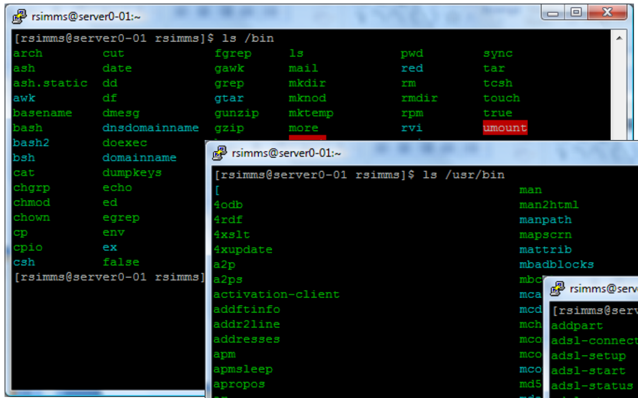


- 100's of system commands and utilities .
- Commands like **ls** (list directories), **cat** (print a file), **rm** (remove a file), … etc.
- Utilities like **vi** (text editor), **sort** (sorts file contents), **find** (searches), … etc.
- Larger utilities like **sendmail** (email), **tar** (backup), **tcpdump** (sniffer), … etc.
- Administrative utilities like **useradd**, **groupadd**, **passwd** (change password), … etc.

Commands and Utilities

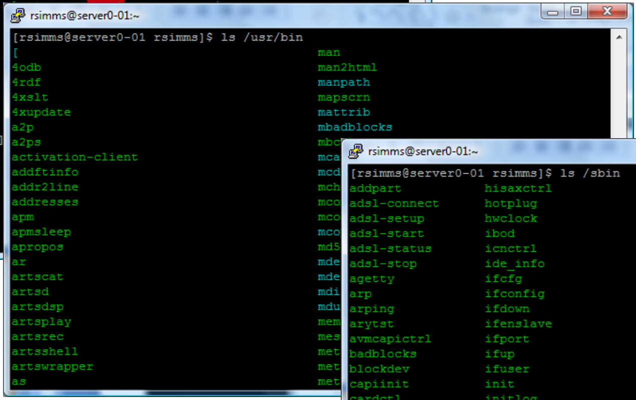
Executable binary code (programs) or scripts

There are lots and LOTS of commands & utilities in the four "bin" (binary) directories



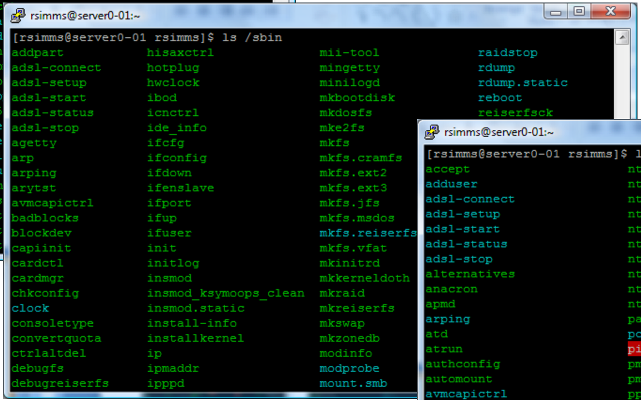
```
[rsimms@server0-01 rsimms]$ ls /bin
arch        cut            fgrep    ls          pwd     sync
ash         date           gawk     mail        red     tar
ash.static  dd             grep     mkdir       rm      tcsh
awk         df             gtar     mknod       rmdir   touch
basename    dmesg          gunzip   mktemp      rpm     true
bash        dnsdomainname  gzip     more        rvi     umount
bash2       doexec
bsh         domainname
cat         dumpkeys
chgrp       echo
chmod       ed
chown       egrep
cp          env
cpio        ex
csh         false
[rsimms@server0-01 rsimms]
```

/bin



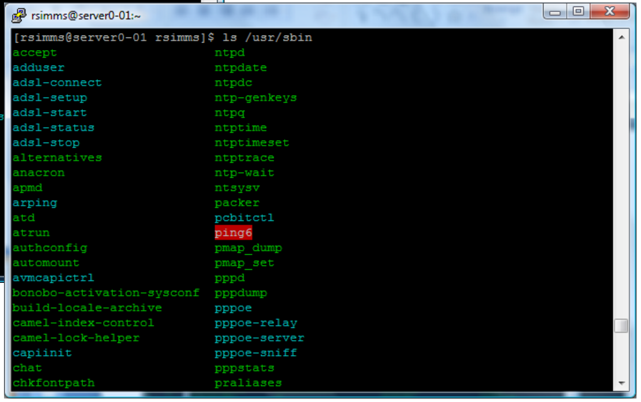
```
[rsimms@server0-01 rsimms]$ ls /usr/bin
[                                            man
4odb                                         man2html
4rdf                                         manpath
4xslt                                        mapscrn
4xupdate                                     mattrib
a2p                                          mbadblocks
a2ps                                         mbc
activation-client                            mca
addftinfo                                    mcd
addr2line                                    mch
addresses                                    mco
apm                                          mco
apmsleep                                     mco
apropos                                      md5
ar                                           mde
artscat                                      mde
artsd                                        mdi
artsdsp                                      mdu
artsplay                                     mem
artsrec                                      mes
artsshell                                    met
artswrapper                                  met
as                                           met
```

/usr/bin



```
[rsimms@server0-01 rsimms]$ ls /sbin
addpart          hisaxctrl              mii-tool         raidstop
adsl-connect     hotplug                mingetty         rdump
adsl-setup       hwclock                minilogd         rdump.static
adsl-start       ibod                   mkbootdisk       reboot
adsl-status      icnctrl                mkdosfs          reiserfsck
adsl-stop        ide_info               mke2fs
agetty           ifcfg                  mkfs
arp              ifconfig               mkfs.cramfs
arping           ifdown                 mkfs.ext2
arytst           ifenslave              mkfs.ext3
avmcapictrl      ifport                 mkfs.jfs
badblocks        ifup                   mkfs.msdos
blockdev         ifuser                 mkfs.reiserfs
capiinit         init                   mkfs.vfat
cardctl          initlog                mkinitrd
cardmgr          insmod                 mkkerneldoth
chkconfig        insmod_ksymoops_clean  mkraid
clock            insmod.static          mkreiserfs
consoletype      install-info           mkswap
convertquota     installkernel          mkzonedb
ctrlaltdel       ip                     modinfo
debugfs          ipmaddr                modprobe
debugreiserfs    ipppd                  mount.smb
```

/sbin

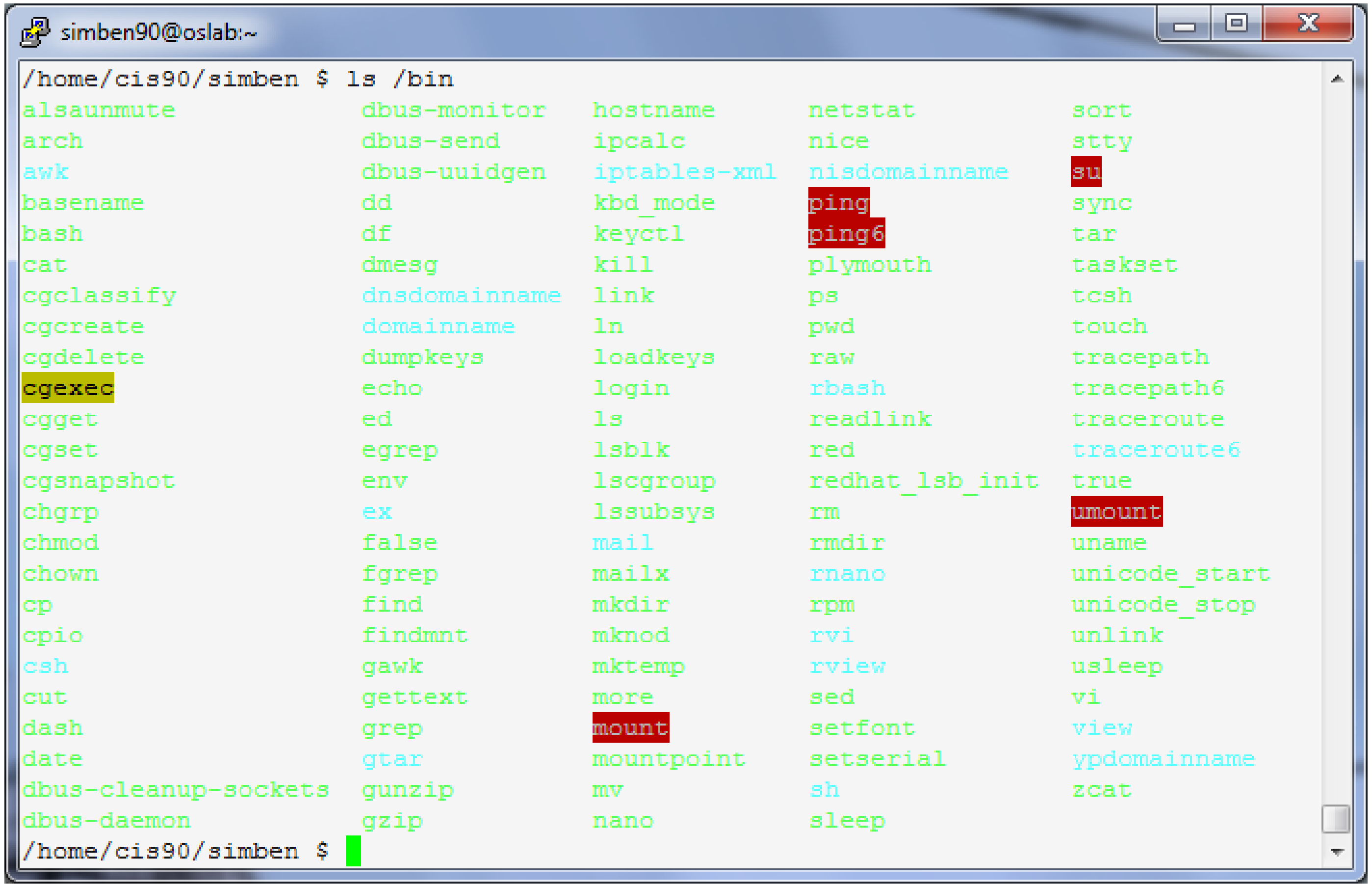


```
[rsimms@server0-01 rsimms]$ ls /usr/sbin
accept                      ntpd
adduser                     ntpdate
adsl-connect                ntpdc
adsl-setup                  ntp-genkeys
adsl-start                  ntpq
adsl-status                 ntptime
adsl-stop                   ntptimeset
alternatives                ntptrace
anacron                     ntp-wait
apmd                        ntsysv
arping                      packer
atd                         pcbitctl
atrun                       ping6
authconfig                  pmap_dump
automount                   pmap_set
avmcapictrl                 pppd
bonobo-activation-sysconf   pppdump
build-locale-archive        pppoe
camel-index-control         pppoe-relay
camel-lock-helper           pppoe-server
capiinit                    pppoe-sniff
chat                        pppstats
chkfontpath                 praliases
```

/usr/sbin

The /bin directory

Use **ls /bin** to view



```
/home/cis90/simben $ ls /bin
alsaunmute              dbus-monitor   hostname       netstat           sort
arch                    dbus-send      ipcalc         nice              stty
awk                     dbus-uuidgen   iptables-xml   nisdomainname     su
basename                dd             kbd_mode       ping              sync
bash                    df             keyctl         ping6             tar
cat                     dmesg          kill           plymouth          taskset
cgclassify              dnsdomainname  link           ps                tcsh
cgcreate                domainname     ln             pwd               touch
cgdelete                dumpkeys       loadkeys       raw               tracepath
cgexec                  echo           login          rbash             tracepath6
cgget                   ed             ls             readlink          traceroute
cgset                   egrep          lsblk          red               traceroute6
cgsnapshot              env            lscgroup       redhat_lsb_init   true
chgrp                   ex             lssubsys       rm                umount
chmod                   false          mail           rmdir             uname
chown                   fgrep          mailx          rnano             unicode_start
cp                      find           mkdir          rpm               unicode_stop
cpio                    findmnt        mknod          rvi               unlink
csh                     gawk           mktemp         rview             usleep
cut                     gettext        more           sed               vi
dash                    grep           mount          setfont           view
date                    gtar           mountpoint     setserial         ypdomainname
dbus-cleanup-sockets    gunzip         mv             sh                zcat
dbus-daemon             gzip           nano           sleep
/home/cis90/simben $
```

/bin has essential commands used by everyone.

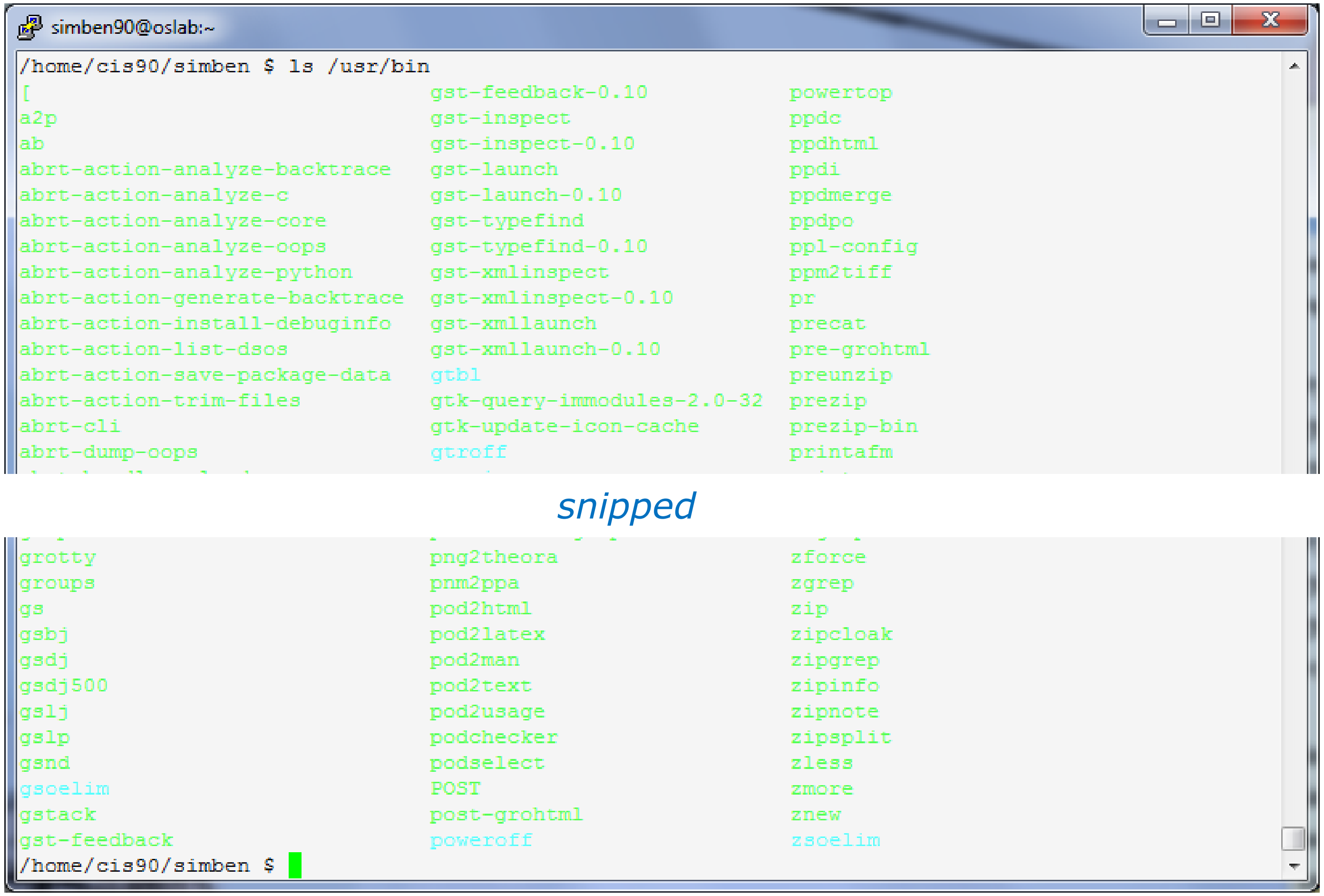
*Can you find the Lesson 1 **date**, **hostname**, **ps** and **uname** commands?*

*Can you find the **bash** shell?*

Commands are either program or script files that can be executed

The /usr/bin directory

Use **ls /usr/bin** to view


simben90@oslab:~

```
/home/cis90/simben $ ls /usr/bin
[                                  gst-feedback-0.10           powertop
a2p                                gst-inspect                 ppdc
ab                                 gst-inspect-0.10            ppdhtml
abrt-action-analyze-backtrace      gst-launch                  ppdi
abrt-action-analyze-c              gst-launch-0.10             ppdmerge
abrt-action-analyze-core           gst-typefind                ppdpo
abrt-action-analyze-oops           gst-typefind-0.10           ppl-config
abrt-action-analyze-python         gst-xmlinspect              ppm2tiff
abrt-action-generate-backtrace     gst-xmlinspect-0.10         pr
abrt-action-install-debuginfo      gst-xmllaunch               precat
abrt-action-list-dsos              gst-xmllaunch-0.10          pre-grohtml
abrt-action-save-package-data      gtbl                        preunzip
abrt-action-trim-files             gtk-query-immodules-2.0-32  prezip
abrt-cli                           gtk-update-icon-cache       prezip-bin
abrt-dump-oops                     gtroff                      printafm
```

snipped

```
grotty                             png2theora                  zforce
groups                             pnm2ppa                     zgrep
gs                                 pod2html                    zip
gsbj                               pod2latex                   zipcloak
gsdj                               pod2man                     zipgrep
gsdj500                            pod2text                    zipinfo
gslj                               pod2usage                   zipnote
gslp                               podchecker                  zipsplit
gsnd                               podselect                   zless
gsoelim                            POST                        zmore
gstack                             post-grohtml                znew
gst-feedback                       poweroff                    zsoelim
/home/cis90/simben $
```

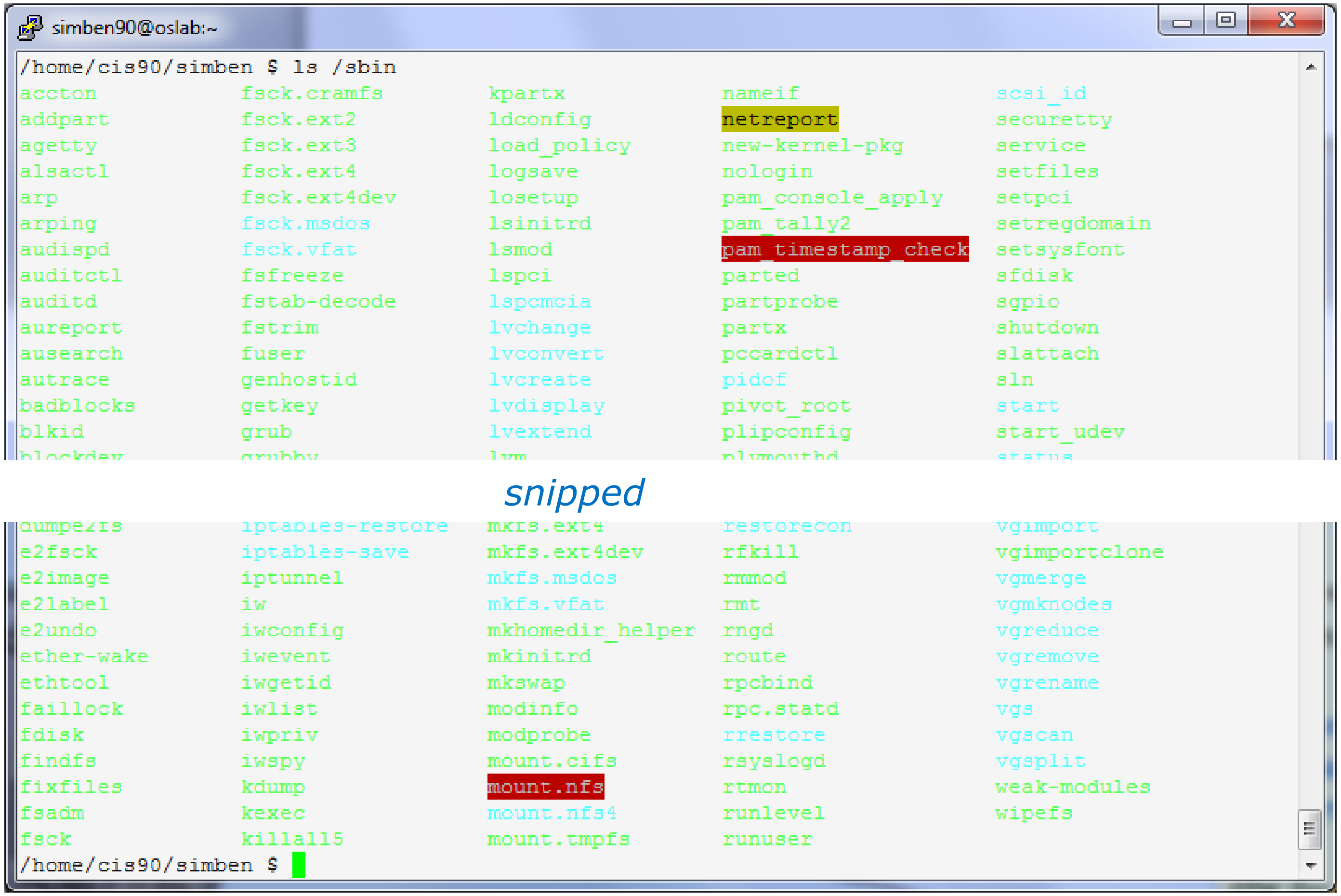
There are a "ton" of additional commands (programs) in this directory.

You will need to scroll through a lot of pages to see them all!

Can you find the Lesson 1 ***cal, clear****,* ***id, ssh, tty, and who*** *commands we used in Lab 1?*

The /sbin directory

Use **ls /sbin** to view this directory



simben90@oslab:~

```
/home/cis90/simben $ ls /sbin
accton           fsck.cramfs        kpartx              nameif                scsi_id
addpart          fsck.ext2          ldconfig            netreport             securetty
agetty           fsck.ext3          load_policy         new-kernel-pkg        service
alsactl          fsck.ext4          logsave             nologin               setfiles
arp              fsck.ext4dev       losetup             pam_console_apply     setpci
arping           fsck.msdos         lsinitrd            pam_tally2            setregdomain
audispd          fsck.vfat          lsmod               pam_timestamp_check   setsysfont
auditctl         fsfreeze           lspci               parted                sfdisk
auditd           fstab-decode       lspcmcia            partprobe             sgpio
aureport         fstrim             lvchange            partx                 shutdown
ausearch         fuser              lvconvert           pccardctl             slattach
autrace          genhostid          lvcreate            pidof                 sln
badblocks        getkey             lvdisplay           pivot_root            start
blkid            grub               lvextend            plipconfig            start_udev
blockdev         grubby             lvm                 plymouthd             status
```

snipped

```
dumpe2fs         iptables-restore   mkfs.ext4           restorecon            vgimport
e2fsck           iptables-save      mkfs.ext4dev        rfkill                vgimportclone
e2image          iptunnel           mkfs.msdos          rmmod                 vgmerge
e2label          iw                 mkfs.vfat           rmt                   vgmknodes
e2undo           iwconfig           mkhomedir_helper    rngd                  vgreduce
ether-wake       iwevent            mkinitrd            route                 vgremove
ethtool          iwgetid            mkswap              rpcbind               vgrename
faillock         iwlist             modinfo             rpc.statd             vgs
fdisk            iwpriv             modprobe            rrestore              vgscan
findfs           iwspy              mount.cifs          rsyslogd              vgsplit
fixfiles         kdump              mount.nfs           rtmon                 weak-modules
fsadm            kexec              mount.nfs4          runlevel              wipefs
fsck             killall5           mount.tmpfs         runuser
/home/cis90/simben $
```

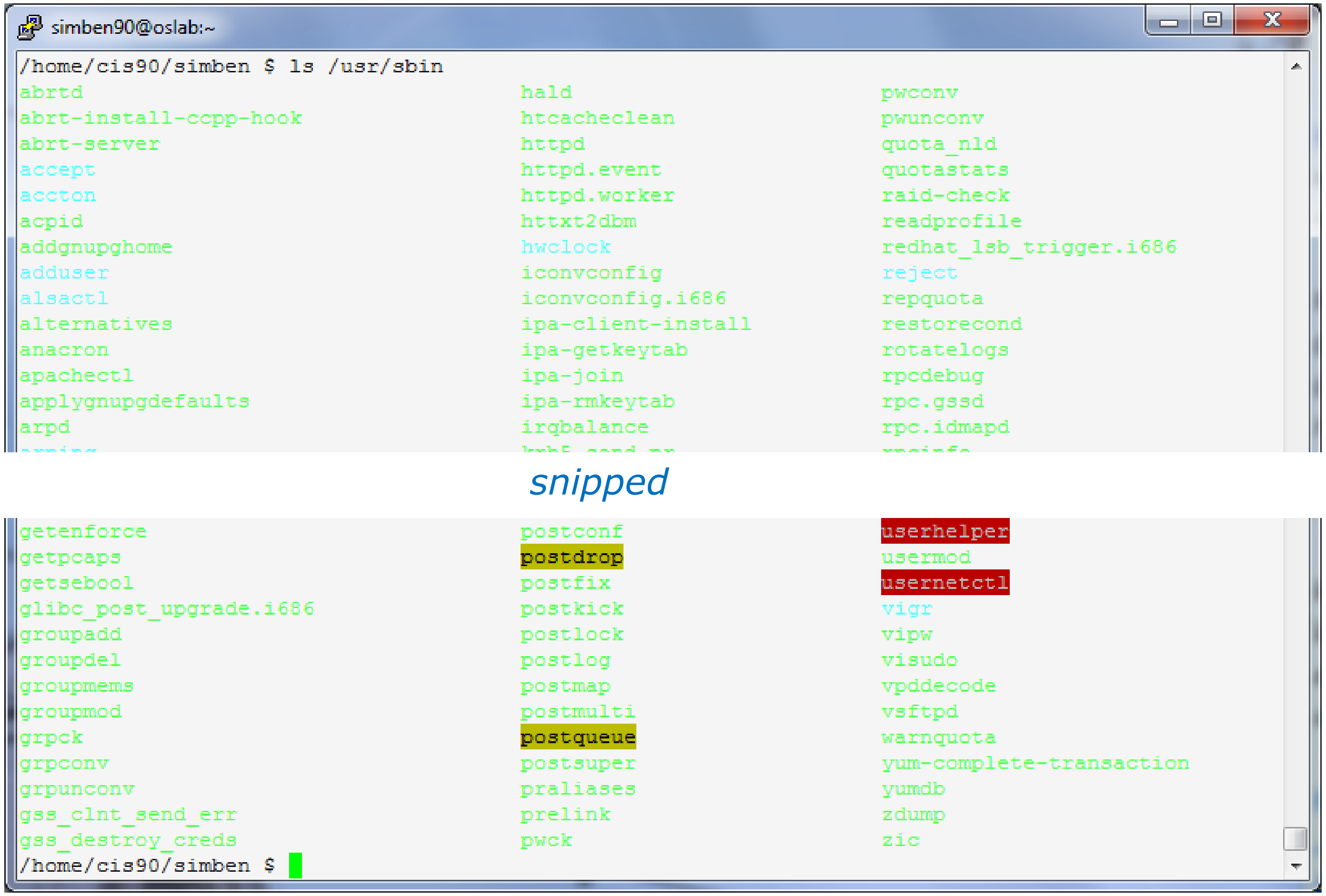
These are essential commands and utilities used by system administrators.

This is where the ***chkconfig***, ***ifconfig*** *and* ***iptables*** *commands are found.*

You will learn how to use these commands in CIS 191 and CIS 192.

The /usr/sbin directory

Use **ls /usr/sbin** to view this directory



simben90@oslab:~

```
/home/cis90/simben $ ls /usr/sbin
abrtd                                  hald                        pwconv
abrt-install-ccpp-hook                 htcacheclean                pwunconv
abrt-server                            httpd                       quota_nld
accept                                 httpd.event                 quotastats
accton                                 httpd.worker                raid-check
acpid                                  httxt2dbm                   readprofile
addgnupghome                           hwclock                     redhat_lsb_trigger.i686
adduser                                iconvconfig                 reject
alsactl                                iconvconfig.i686            repquota
alternatives                           ipa-client-install          restorecond
anacron                                ipa-getkeytab               rotatelogs
apachectl                              ipa-join                    rpcdebug
applygnupgdefaults                     ipa-rmkeytab                rpc.gssd
arpd                                   irqbalance                  rpc.idmapd
```

snipped

```
getenforce                             postconf                    userhelper
getpcaps                               postdrop                    usermod
getsebool                              postfix                     usernetctl
glibc_post_upgrade.i686                postkick                    vigr
groupadd                               postlock                    vipw
groupdel                               postlog                     visudo
groupmems                              postmap                     vpddecode
groupmod                               postmulti                   vsftpd
grpck                                  postqueue                   warnquota
grpconv                                postsuper                   yum-complete-transaction
grpunconv                              praliases                   yumdb
gss_clnt_send_err                      prelink                     zdump
gss_destroy_creds                      pwck                        zic
/home/cis90/simben $
```

These are additional commands and utilities are typically used by system administrators.

*This is where commands like **useradd, userdel, tcpdump** are located.*

You will learn how to use these commands in CIS 191 and CIS 192.

Programs

Binary code vs text scripts

All UNIX commands & utilities are executable programs.

A program can be either binary code or text-based scripts:

- Binary machine code is unprintable. A programmer must use hex dumps to examine binary code.
- Binary machine code executes very quickly and is targeted for a specific CPU instruction set.
- The binaries are produced by compiling source code written in a higher level language such as C, or C++.
- A script can be directly viewed and printed.
- A script does not need to be compiled. It is interpreted on the fly and because of that doesn't run as fast as binary code.
- Common scripting languages include bash, perl and python.

programs must have the X (execute) permission bit set to run

Programs
Executable binary code or scripts

Lets take a deep dive on two random commands:

apropos - searches the whatis database for a string of text

cal - prints a calendar

I'll be using this graphic to indicate a program that has been loaded into memory to be executed

apropos

Programs

Executable binary code or scripts

cal

*Use **apropos** to look up a reference in the whatis database.*

```
/home/cis90/simben $ apropos uname
oldolduname [obsolete] (2)   - obsolete system calls
olduname [obsolete]  (2)   - obsolete system calls
uname                (1)   - print system information
uname                (1p)   - return system name
uname                (2)   - get name and information about current kernel
uname                (3p)   - get the name of the current system
```

*Use **cal** to print a calendar*

```
/home/cis90/simben $ cal
   February 2012
Su Mo Tu We Th Fr Sa
          1  2  3  4
 5  6  7  8  9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29
```

Programs
Executable binary code or scripts

apropos

cal

Use the type command to find if cal and apropos are on the path and what directories they are in

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

They are both in the /usr/bin directory. Hashed means the command has been run previously and its location on the path has been temporarily "remembered" to speed up subsequent path searches for the same command.

Programs

Executable binary code or scripts

apropos

cal

Change into the /usr/bin directory and list both files

```
/home/cis90/simben $ cd /usr/bin
/usr/bin $ ls apropos cal
apropos  cal
```

*Using the **-l** option on the **ls** command prints a "long listing" that shows additional information. The x's indicate the execute permission bits are set.*

```
/usr/bin $ ls -l apropos cal
-rwxr-xr-x 1 root root  1786 Jul 12  2006 apropos
-rwxr-xr-x 1 root root 18764 Jul  3  2009 cal
```

execute permissions set

Programs

Executable binary code or scripts

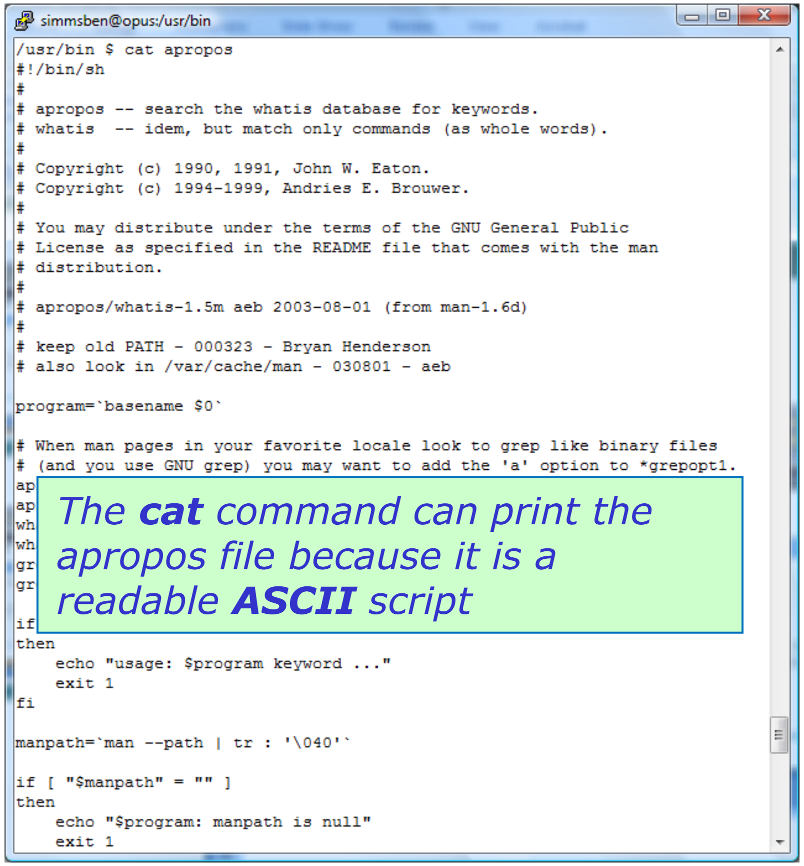
apropos

cal

*The **file** command shows that **apropos** is a shell script and **cal** is binary code (has been compiled from higher level source code)*

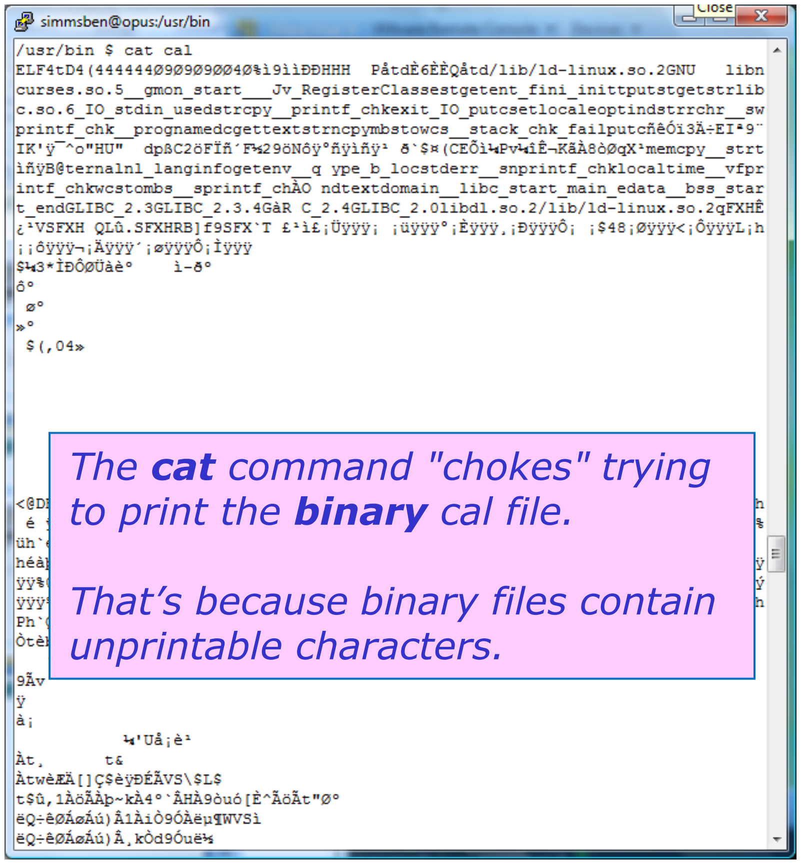
```
/usr/bin $ file apropos
apropos: Bourne shell script text executable
/usr/bin $

/usr/bin $ file cal
cal: 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
/usr/bin $
```

Programs
Executable binary code or scripts



```
/usr/bin $ cat apropos
#!/bin/sh
#
# apropos -- search the whatis database for keywords.
# whatis  -- idem, but match only commands (as whole words).
#
# Copyright (c) 1990, 1991, John W. Eaton.
# Copyright (c) 1994-1999, Andries E. Brouwer.
#
# You may distribute under the terms of the GNU General Public
# License as specified in the README file that comes with the man
# distribution.
#
# apropos/whatis-1.5m aeb 2003-08-01 (from man-1.6d)
#
# keep old PATH - 000323 - Bryan Henderson
# also look in /var/cache/man - 030801 - aeb

program=`basename $0`

# When man pages in your favorite locale look to grep like binary files
# (and you use GNU grep) you may want to add the 'a' option to *grepopt1.
ap
ap
wh
wh
gr
gr

if
then
    echo "usage: $program keyword ..."
    exit 1
fi

manpath=`man --path | tr : '\040'`

if [ "$manpath" = "" ]
then
    echo "$program: manpath is null"
    exit 1
```

*The **cat** command can print the apropos file because it is a readable **ASCII** script*



```
/usr/bin $ cat cal
ELF4tD4(44444Ø9Ø9Ø9ØØ4Ø%i9ìiÐÐHHH  PåtdÈ6ÈÈQåtd/lib/ld-linux.so.2GNU   libn
curses.so.5__gmon_start___Jv_RegisterClassestgetent_fini_inittputstgetstrlib
c.so.6_IO_stdin_usedstrcpy__printf_chkexit_IO_putcsetlocaleoptindstrrchr__sw
printf_chk__prognamedcgettextstrncpymbstowcs__stack_chk_failputcñêÓï3Ä÷EIª9¨
IK'ÿ¯^o"HU"  dpßC2öFÏñ´F¼29öNôÿ°ñÿìñÿ¹ ð`$¤(CEÕì¼Pv¼îÊ¬KãÀ8òØqX¹memcpy__strt
iñÿB@ternalnl_langinfogetenv__q ype_b_locstderr__snprintf_chklocaltime__vfpr
intf_chkwcstombs__sprintf_chÀO ndtextdomain__libc_start_main_edata__bss_star
t_endGLIBC_2.3GLIBC_2.3.4GàR C_2.4GLIBC_2.0libdl.so.2/lib/ld-linux.so.2qFXHÊ
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ëQ÷êØÁøÁú)Â,kÒd9Óuë¾
```
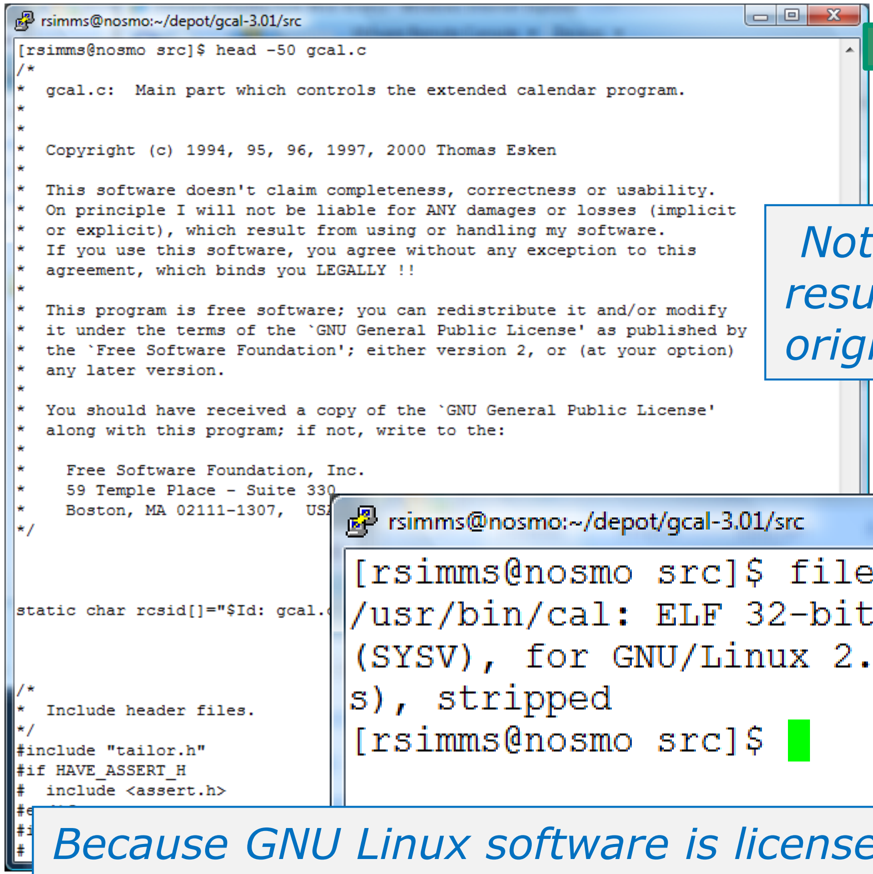

*The **cat** command "chokes" trying to print the **binary** cal file.*

That's because binary files contain unprintable characters.

Programs
Executable binary code or scripts

From: gcal-3.01.tar.gz

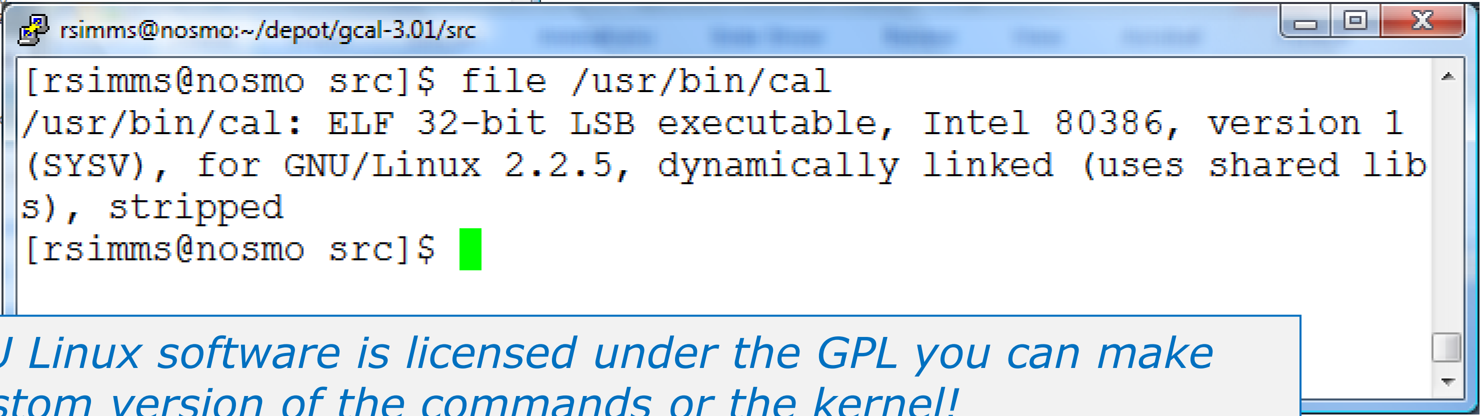


rsimms@nosmo:~/depot/gcal-3.01/src

```
[rsimms@nosmo src]$ head -50 gcal.c
/*
*  gcal.c:  Main part which controls the extended calendar program.
*
*
*  Copyright (c) 1994, 95, 96, 1997, 2000 Thomas Esken
*
*  This software doesn't claim completeness, correctness or usability.
*  On principle I will not be liable for ANY damages or losses (implicit
*  or explicit), which result from using or handling my software.
*  If you use this software, you agree without any exception to this
*  agreement, which binds you LEGALLY !!
*
*  This program is free software; you can redistribute it and/or modify
*  it under the terms of the `GNU General Public License' as published by
*  the `Free Software Foundation'; either version 2, or (at your option)
*  any later version.
*
*  You should have received a copy of the `GNU General Public License'
*  along with this program; if not, write to the:
*
*    Free Software Foundation, Inc.
*    59 Temple Place - Suite 330
*    Boston, MA 02111-1307,  USA
*/



static char rcsid[]="$Id: gcal.c



/*
*  Include header files.
*/
#include "tailor.h"
#if HAVE_ASSERT_H
#  include <assert.h>
#e
#i
#
```

cal

*Note: The **cal** binary code resulted from compiling the original gcal.c source code.*



rsimms@nosmo:~/depot/gcal-3.01/src

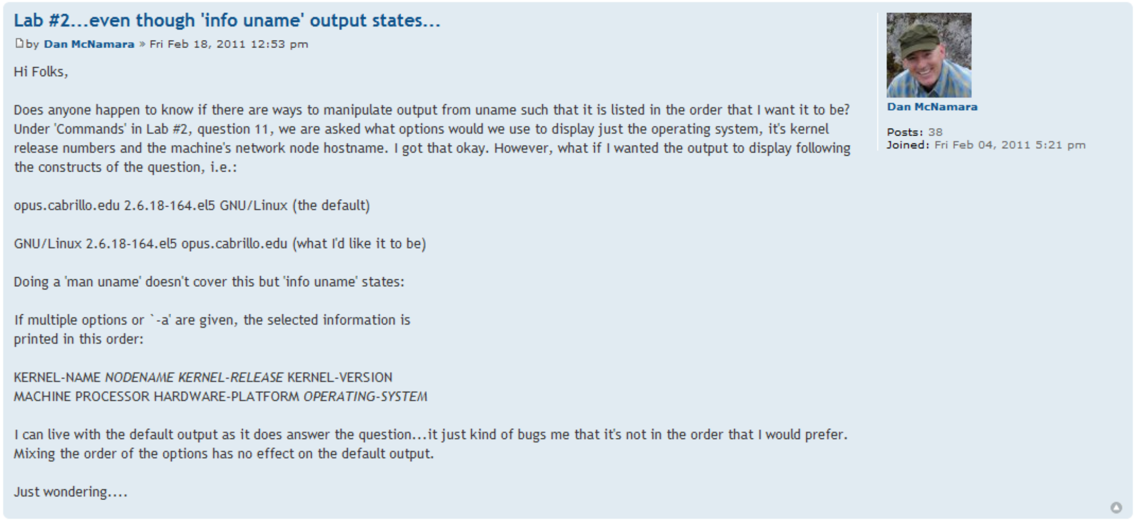
```
[rsimms@nosmo src]$ file /usr/bin/cal
/usr/bin/cal: ELF 32-bit LSB executable, Intel 80386, version 1
(SYSV), for GNU/Linux 2.2.5, dynamically linked (uses shared lib
s), stripped
[rsimms@nosmo src]$
```

Because GNU Linux software is licensed under the GPL you can make your own custom version of the commands or the kernel!

FYI

See this forum post from a previous class for an example of obtaining the source code for a Linux command and modifying it:

http://oslab.cabrillo.edu/forum/viewtopic.php?f=31&t=683&p=2774



Lab #2...even though 'info uname' output states...

by **Dan McNamara** » Fri Feb 18, 2011 12:53 pm

Hi Folks,

Does anyone happen to know if there are ways to manipulate output from uname such that it is listed in the order that I want it to be? Under 'Commands' in Lab #2, question 11, we are asked what options would we use to display just the operating system, it's kernel release numbers and the machine's network node hostname. I got that okay. However, what if I wanted the output to display following the constructs of the question, i.e.:

opus.cabrillo.edu 2.6.18-164.el5 GNU/Linux (the default)

GNU/Linux 2.6.18-164.el5 opus.cabrillo.edu (what I'd like it to be)

Doing a 'man uname' doesn't cover this but 'info uname' states:

If multiple options or `-a' are given, the selected information is
printed in this order:

KERNEL-NAME *NODENAME KERNEL-RELEASE* KERNEL-VERSION
MACHINE PROCESSOR HARDWARE-PLATFORM *OPERATING-SYSTEM*

I can live with the default output as it does answer the question...it just kind of bugs me that it's not in the order that I would prefer. Mixing the order of the options has no effect on the default output.

Just wondering....

Dan McNamara

Posts: 38
Joined: Fri Feb 04, 2011 5:21 pm

It all started when Dan wanted to change the way ***uname*** *ordered its output!*

Inputs to programs

(commands and scripts)

You will get these questions when you submit Lab 2

Name a UNIX command that gets its input only from the command line?

Name an interactive command that reads its input from the keyboard?

Name a UNIX command that gets its input from the Operating System?

Name a UNIX command that gets its input only from the command line?

```
/home/cis90/simmen $ echo hello world
hello world
```

```
/home/cis90/simben $ banner hello world
#     # ####### #       #       #######
#     # #       #       #       #     #
#     # #       #       #       #     #
####### #####   #       #       #     #
#     # #       #       #       #     #
#     # #       #       #       #     #
#     # ####### ####### ####### #######

#     # ####### ######  #       ######
#  #  # #     # #     # #       #     #
#  #  # #     # #     # #       #     #
#  #  # #     # ######  #       #     #
#  #  # #     # #   #   #       #     #
#  #  # #     # #    #  #       #     #
 ## ##  ####### #     # ####### ######
```

*The **echo** and **banner** commands are examples of commands that get their input from the command line*

Name an interactive command that reads its input from the keyboard?

```
/home/cis90/simmsben $ bc
bc 1.06
Copyright 1991-1994, 1997, 1998, 2000 Free
Software Foundation, Inc.
This is free software with ABSOLUTELY NO
WARRANTY.
For details type `warranty'.
2+2
4
500-200+3
303
sqrt(64)
8
quit
```

```
/home/cis90/simmsben $ passwd
Changing password for user simmsben.
Changing password for simmsben
(current) UNIX password:
New UNIX password:
BAD PASSWORD: is too similar to the old
one
New UNIX password:
Retype new UNIX password:
passwd: all authentication tokens updated
successfully.
```

*The **bc** (binary calculator) and **passwd** commands are examples of interactive commands that read their input from the keyboard*

Name a UNIX command that gets its input from the Operating System?

```
/home/cis90/simmen $ who
dycktim  pts/1        2010-09-07 17:07 (nosmo-nat.cabrillo.edu)
root     :0           2009-12-18 17:30
velasoli pts/2        2010-09-07 17:08 (adsl-35-201-114-102.dsl.net)
guest90  pts/3        2010-09-07 16:56 (nosmo-nat.cabrillo.edu)
rsimms   pts/4        2010-09-07 15:54 (dsl-45-78-13-81.dhcp.com)
guest90  pts/5        2010-09-07 16:59 (nosmo-nat.cabrillo.edu)
watsohar pts/6        2010-09-07 17:03 (nosmo-nat.cabrillo.edu)
swansgre pts/7        2010-09-07 17:10 (nosmo-nat.cabrillo.edu)
guest90  pts/8        2010-09-07 17:10 (nosmo-nat.cabrillo.edu)
abbenste pts/9        2010-09-07 17:11 (nosmo-nat.cabrillo.edu)
```

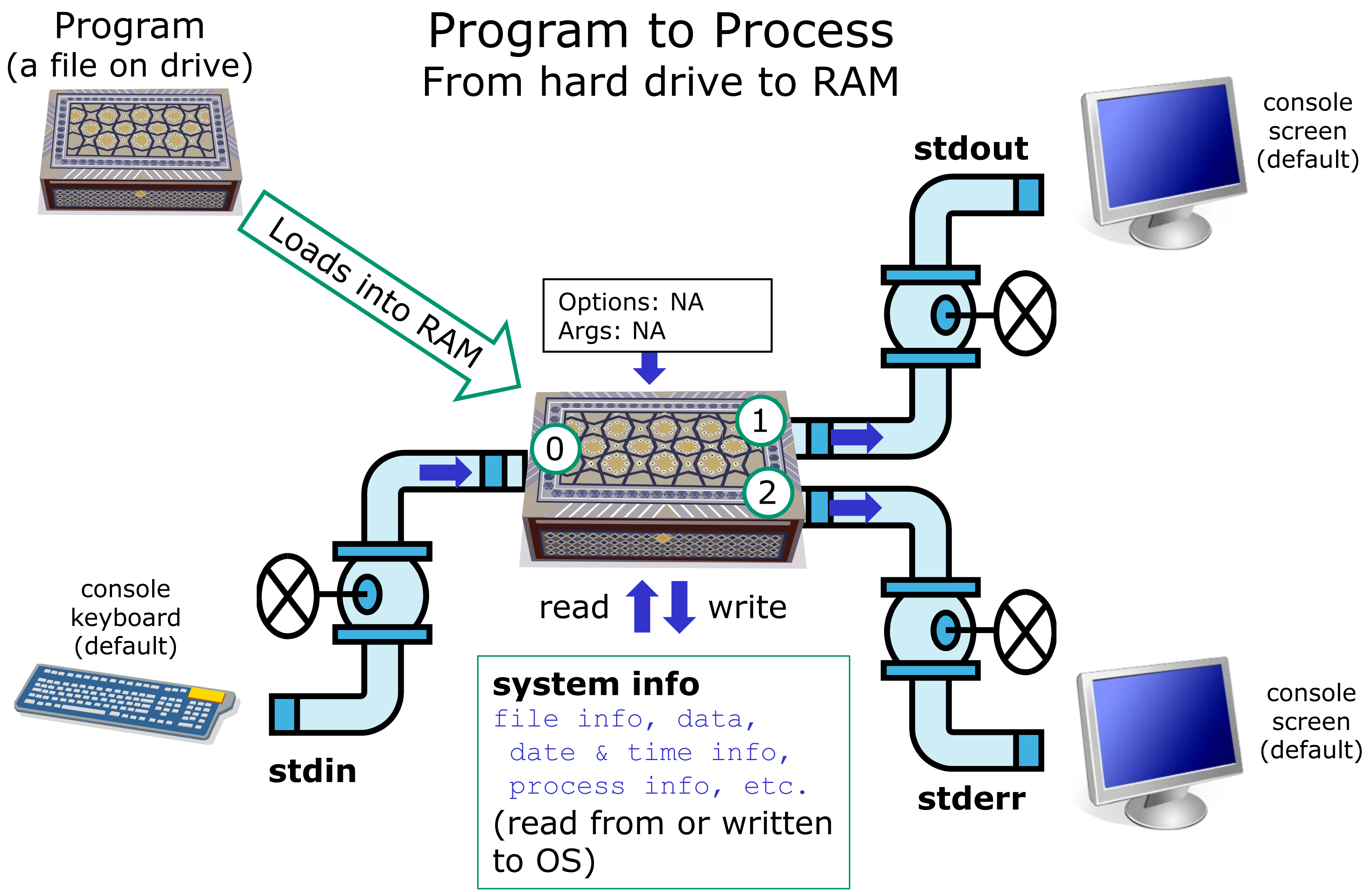
```
/home/cis90/simben $ uname
Linux
```

*The **who** and **uname** commands are examples of commands that get their input from the Operating System*

Program to Process

The next slides are a preview of future lessons on processes … for now just you don't need to understand all the ins and outs of how this works.

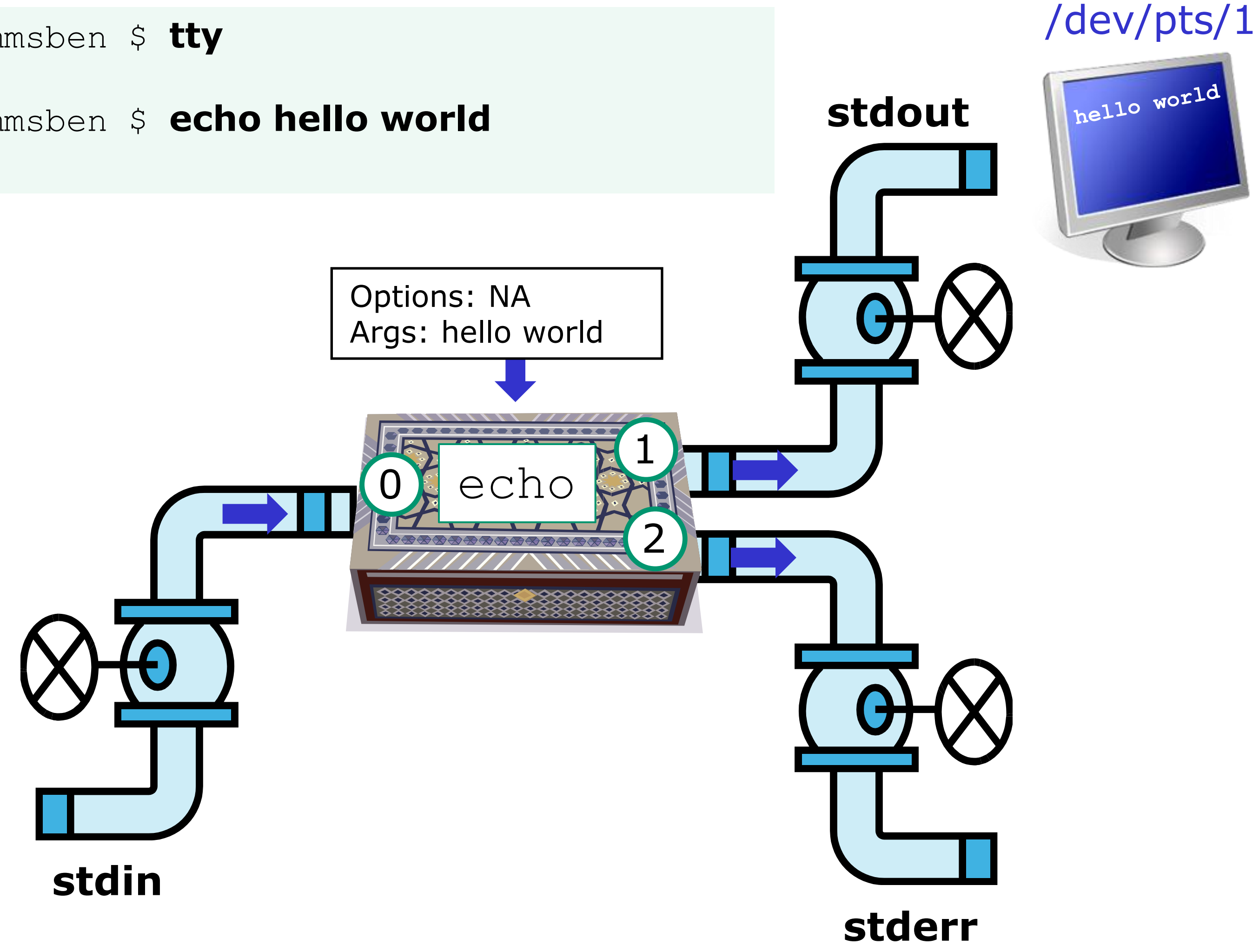
Program to Process
From hard drive to RAM



system info
`file info, data,`
`date & time info,`
`process info, etc.`
(read from or written to OS)

echo command

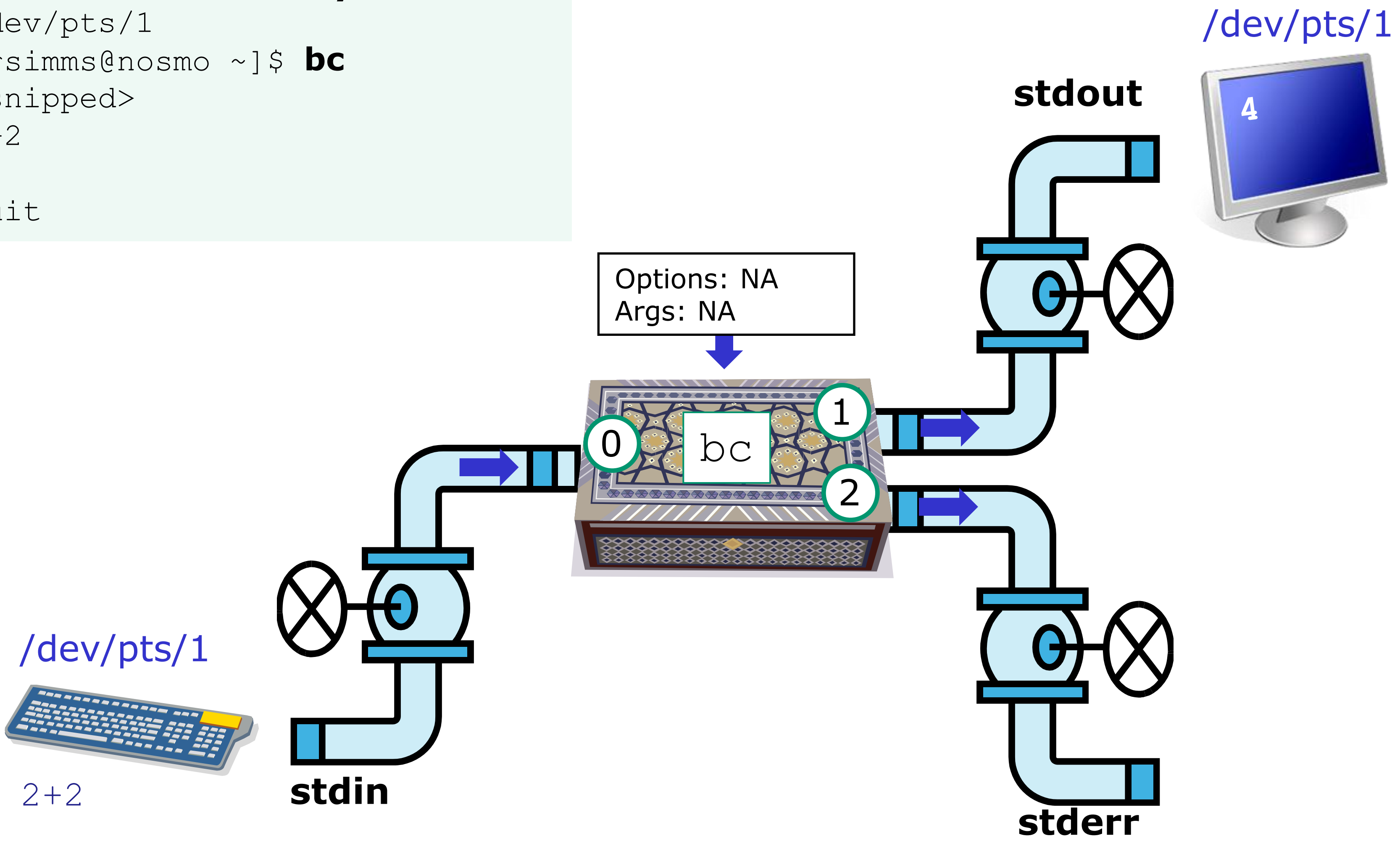
```
/home/cis90/simmsben $ tty
/dev/pts/1
/home/cis90/simmsben $ echo hello world
hello world
```



*The **echo** command is an example of a command that gets its input from the command line*

bc command

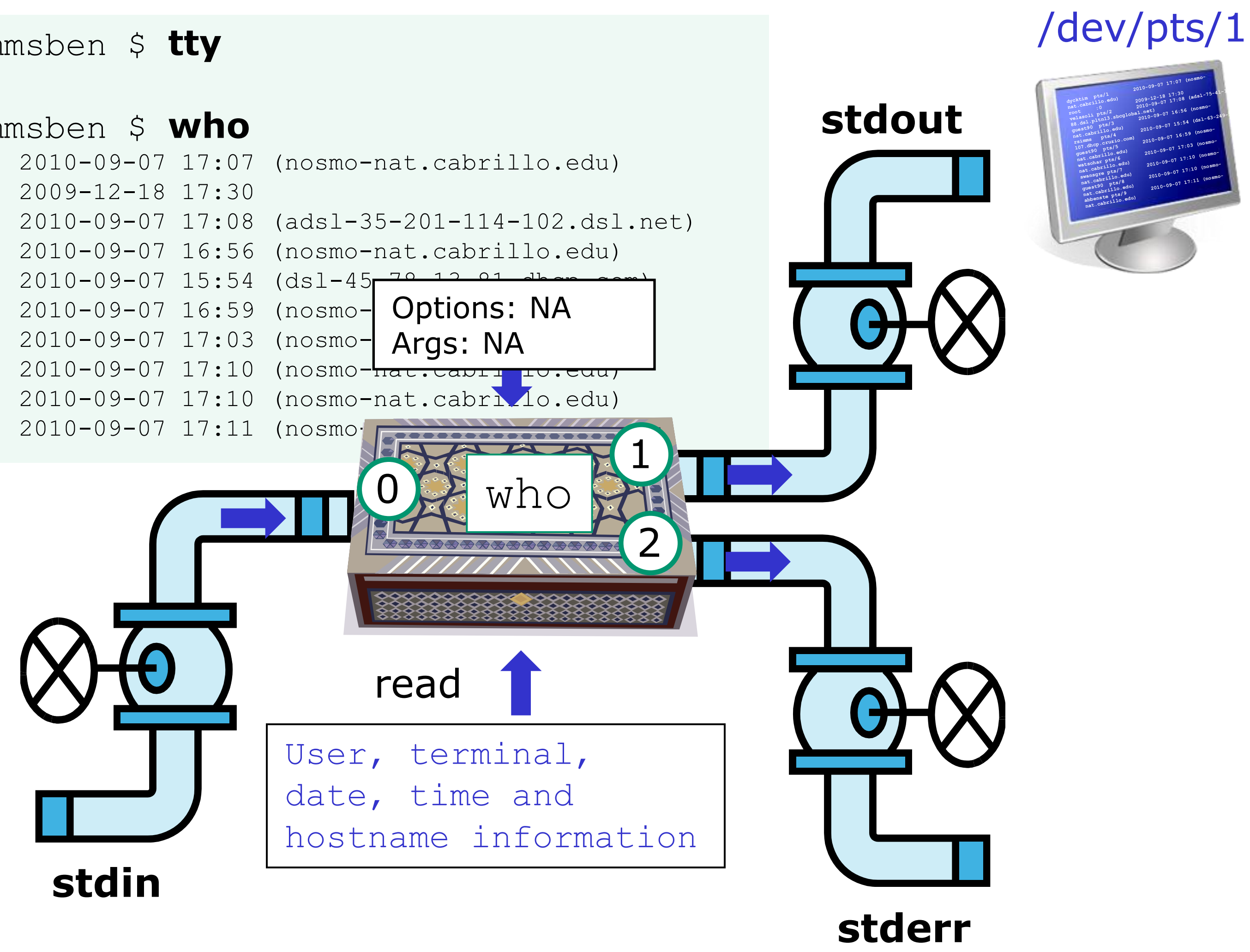
```
[rsimms@nosmo ~]$ tty
/dev/pts/1
[rsimms@nosmo ~]$ bc
<snipped>
2+2
4
quit
```



*The **bc** (binary calculator) command is an example of an interactive command that reads its input from the keyboard*

who command

```
/home/cis90/simmsben $ tty
/dev/pts/1
/home/cis90/simmsben $ who
dycktim  pts/1        2010-09-07 17:07 (nosmo-nat.cabrillo.edu)
root     :0           2009-12-18 17:30
velasoli pts/2        2010-09-07 17:08 (adsl-35-201-114-102.dsl.net)
guest90  pts/3        2010-09-07 16:56 (nosmo-nat.cabrillo.edu)
rsimms   pts/4        2010-09-07 15:54 (dsl-45-78-13-81.dhcp.com)
guest90  pts/5        2010-09-07 16:59 (nosmo-
watsohar pts/6        2010-09-07 17:03 (nosmo-
swansgre pts/7        2010-09-07 17:10 (nosmo-nat.cabrillo.edu)
guest90  pts/8        2010-09-07 17:10 (nosmo-nat.cabrillo.edu)
abbenste pts/9        2010-09-07 17:11 (nosmo-
```



*The **who** command is an example of a command that gets its input from the Operating System*

Class Exercise
Running Programs

1. Use **echo Hello World** and **banner Hello World** commands
   (these commands get their input from the command line)

2. Use **bc** to add 2+2, use quit to end
   (this command reads its input from the keyboard)

3. Run the **who, tty, and uname** commands
   (these commands get their input from the operating system)

Command Syntax

(grammar lesson)

Command Syntax

Command	Options	Arguments	Redirection

Command – is the name of an executable program file.

Options – various options which control how the program will operate.

Arguments – the objects the command is directed to work upon. Multiple arguments are separated by spaces.

Redirection – The default input stream (stdin) is from the console keyboard, the default output (stdout) and error (stderr) streams go to the console screen. Redirection can modify these streams to other files or devices.

Command Syntax

Command	Options	Arguments	Redirection

Command – usually at the beginning of the line

Options – follow the command, usually starts with a dash, may be combined after a single "-" or separated by spaces (`-iad = -i -a -d`)

Arguments – follow the options. Multiple arguments must be separated by spaces.

Redirection – Will be a <, >, >>, 2> or | followed by where the redirection is going or coming from.

Spaces are required between commands, options, arguments and any redirection

Multiple spaces are treated as a single space (unless inside quotes)

One of the things the shell does is to parse commands issued by the user

from Dictionary.com

parse [pahrs, pahrz] ***verb, parsed, pars·ing***.
verb (used with object)

1. to analyze (a sentence) in terms of grammatical constituents, identifying the parts of speech, syntactic relations, etc.

2. to describe (a word in a sentence) grammatically, identifying the part of speech, inflectional form, syntactic function, etc.

3. Computers . to analyze (a string of characters) in order to associate groups of characters with the syntactic units of the underlying grammar.

Command Syntax

Command | Options | Arguments | Redirection

The command syntax is the underlying grammar used to parse the command line

```
/home/cis90/simben $ hostname
opus.cabrillo.edu

/home/cis90/simben $ uname -o
GNU/Linux

/home/cis90/simben $ ls -ld Poems/
drwxr-xr-x 5 simben90 cis90 4096 Jan 18  2004 Poems/

/home/cis90/simben $ ls -li letter > /dev/null
```

More on redirection in later lessons

Command Syntax

Command	Options	Arguments	Redirection
clear			
who			
who	-Hu		
is			
id		root	
ls			
ls	-l		
ls	-l -i	Poems/	
ls	-li	letter log	
ls	-ld	Miscellaneous	> myfile
echo		red blue	
echo		"red blue"	
echo		Hello	>> myfile

More on redirection in later lessons

Parsing Practice

Command Syntax

Command	Options	Arguments	Redirection

```
/home/cis90/simben $ echo I love Linux
I love Linux
```

Please parse the command line above

Command: echo

Options:
- How many: NA
- What are they: NA

Arguments:
- How many: 3
- What are they: I, Love, Linux

Redirection:
- How many: NA
- What is redirected: NA

Command Syntax

Command	Options	Arguments	Redirection

```
/home/cis90/simben $ ls -ld /bin /usr/bin
drwxr-xr-x 2 root root  4096 Nov 23 13:49 /bin
drwxr-xr-x 2 root root 61440 Nov 23 13:49 /usr/bin
```

Please parse the command line above

Command: ls

Options:

How many:	2
What are they:	l, d

Arguments:

How many:	2
What are they:	/bin, /usr/bin

Redirection:

How many:	NA
What is redirected:	NA

Command Syntax

Command	Options	Arguments	Redirection

```
/home/cis90/simben $ ls-ld/bin/usr/bin
-bash: ls-ld/bin/usr/bin: No such file or directory
```

Please parse the command line above

Command: ls-ld/bin/usr/bin

Options:
How many: NA
What are they: NA

Arguments:
How many: NA
What are they: NA

Redirection:
How many: NA
What is redirected: NA

Spaces are required between commands, options, arguments and any redirection

Command Syntax

Command	Options	Arguments	Redirection

```
/home/cis90/simben $ file proposal1 timecal
proposal1: ASCII English text
timecal:   shell archive or script for antique kernel text
```

Please parse the command line above

Command: file

Options:

How many:	NA
What are they:	NA

Arguments:

How many:	2
What are they:	proposal1, timecal

Redirection:

How many:	NA
What is redirected:	NA

Command Syntax

Command	Options	Arguments	Redirection

```
/home/cis90/simben $ ls -l -i -a /bin Poems/ letter small_town > /dev/null
/home/cis90/simben $
```

Please parse the command line above

Command: ls

Options:

How many:	3
What are they:	l, i, a

Arguments:

How many:	4
What are they:	/bin, Poems/, letter, small_town

Redirection:

How many:	1
What is redirected:	stdout redirected to /dev/null

Command Syntax

Command	Options	Arguments	Redirection

```
/home/cis90/simben $ echo "1   2   3   4   5"
1   2   3   4   5
```

Please parse the command line above

Command: echo

Options:

How many:	NA
What are they:	NA

Arguments:

How many:	1
What are they:	"1 2 3 4 5"

Redirection:

How many:	NA
What is redirected:	NA

Variables

Variables

Just like any programming language, the shell has variables:

- A shell variable gives a name to a location in memory where data can be kept during the session.
- Shell variables are lost when a session ends.
- The shell variables used to customize the users environment are called *Environment* variables.
- To look at the value of a variable use the **echo** command and precede the variable name with a $

  echo $PS1 *shows the current value of the PS1 variable*

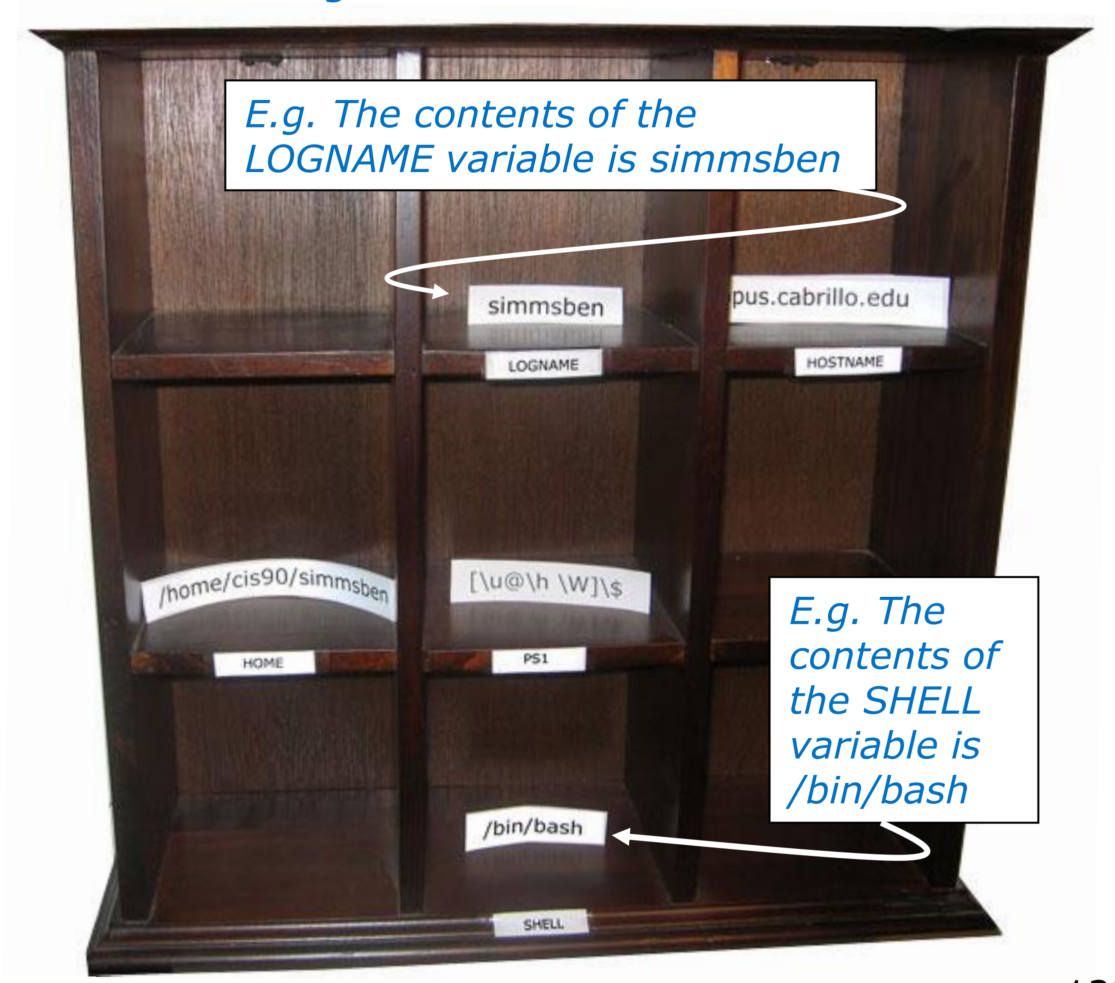
- To change the value of a variable, use an = sign with no surrounding blanks and no $

  PS1="Enter next command: " *sets the PS1 prompt variable*

Variables

Think of variables as named boxes containing data

```
$ echo $LOGNAME
simmsben

$ echo $HOSTNAME
opus.cabrillo.edu

$ echo $HOME
/home/cis90/simmsben

$ echo $SHELL
/bin/bash
```



E.g. The contents of the LOGNAME variable is simmsben

E.g. The contents of the SHELL variable is /bin/bash

Showing Variable Values

To look at the value of a variable use the echo command and precede the variable name with a $

```
/home/cis90/simben $ echo $SHELL
/bin/bash
```

Shows the name of your shell

```
/home/cis90/simben $ echo $LOGNAME
simben90
```

Shows your username

```
/home/cis90/simben $ echo I am $LOGNAME and I use the $SHELL shell
I am simben90 and I use the /bin/bash shell
```

If the $ is not used, echo prints the name of the variable instead

```
/home/cis90/simben $ echo PS1
PS1
/home/cis90/simben $ echo LOGNAME
LOGNAME
/home/cis90/simben $ echo I am LOGNAME and I use the SHELL shell
I am LOGNAME and I use the SHELL shell
```

Showing Variable Values

To look at the value of a variable use the echo command and precede the variable name with a $

```
/home/cis90/simben $ echo $TERM      Shows your terminal type
xterm

/home/cis90/simben $ echo $PWD       Shows your current working directory
/home/cis90/simben

/home/cis90/simben $ echo $PS1       Shows your level 1 prompt string
$PWD $

/home/cis90/simben $ echo $HOME      Shows your home directory
/home/cis90/simben

/home/cis90/simben $ echo $PATH      Shows the directories making up your path
/usr/lib/qt-
3.3/bin:/usr/local/bin:/bin:/usr/bin:/usr/local/sbin:/usr/sbin:/s
bin:/home/cis90/simben/../bin:/home/cis90/simben/bin:.
```

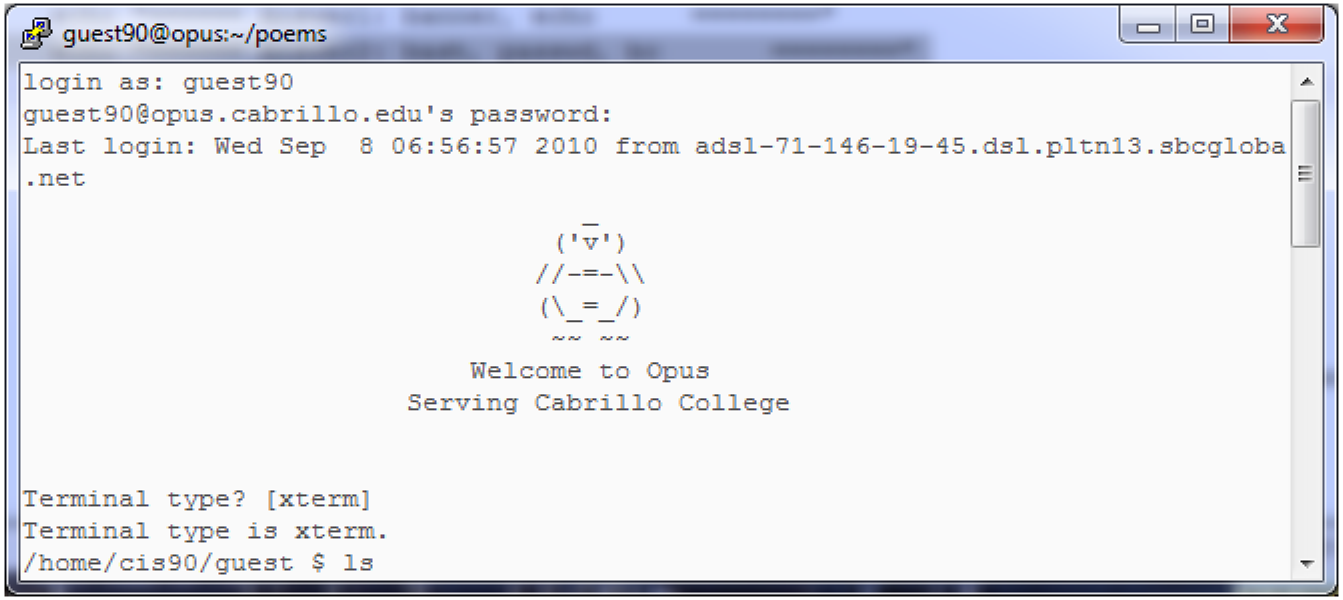
Shell (Environment) Variables

common environment variables

Shell Variable	Description
HOME	Users home directory (starts here after logging in and returns with a cd command (with no arguments)
LOGNAME	User's username for logging in with.
PATH	List of directories, separated by :'s, for the Shell to search for commands (which are program files) .
PS1	The prompt string.
PWD	Current working directory
SHELL	Name of the Shell program being used.
TERM	Type of terminal device , e.g. dumb, vt100, xterm, ansi, linux, etc.

Shell (Environment) Variables
common environment variables

Shell Variable	Description
TERM	Type of terminal device , e.g. dumb, vt100, xterm, ansi, linux, etc.



```
login as: guest90
guest90@opus.cabrillo.edu's password:
Last login: Wed Sep  8 06:56:57 2010 from adsl-71-146-19-45.dsl.pltn13.sbcgloba
.net

                                     _
                                   ('v')
                                  //-=-\\
                                  (\_=_/)
                                   ~~ ~~
                            Welcome to Opus
                        Serving Cabrillo College


Terminal type? [xterm]
Terminal type is xterm.
/home/cis90/guest $ ls
```

Note the TERM variable gets set every time we log into Opus

Setting Variable Values

To change the value of a variable, use an = sign with no surrounding blanks and no $

```
/home/cis90/simben $ echo $TERM
xterm
```

Show the current terminal type

```
/home/cis90/simben $ TERM=dumb
/home/cis90/simben $ echo $TERM
dumb
```

Change the terminal type and display the new value

```
/home/cis90/simben $ TERM=xterm
/home/cis90/simben $ echo $TERM
xterm
```

Change the terminal type back to the original value

In Lab 2 you will see what happens when the terminal type is changed

Changing the prompt (PS1 variable)

Changing the prompt

```
/home/cis90/simben $ echo $PS1
$PWD $
/home/cis90/simben $ cd Poems/
/home/cis90/simben/Poems $ cd /bin
/bin $ cd
/home/cis90/simben $
```

View the current prompt variable which contains another variable $PWD followed by a $.

The PWD variable always contains the name of the current directory. Notice how the prompt changes when you change directories.

```
/home/cis90/simben $ PS1="By your command > "
By your command > date
Mon Sep  3 17:25:32 PDT 2012
By your command >
```

Set the prompt to a new value

```
By your command > PS1='What can I do for you $LOGNAME? '
What can I do for you simben90? date
Mon Sep  3 17:26:10 PDT 2012
What can I do for you simben90?
```

Set the prompt to a new value

```
What can I do for you simben90? PS1='$PWD $ '
/home/cis90/simben $
/home/cis90/simben $
```

Restore the original CIS 90 prompt. This prompt is automatically set every time you login

Changing the prompt

Special Codes	Meaning
\!	history command number
\#	session command number
\d	date
\h	hostname
\n	new line
\s	shell name
\t	time
\u	user name
\w	entire path of working directory
\W	only working directory
\$	$ or # (for root user)

The PS1 variable (defines the prompt) can be set to any combination of text, variables and these special codes.

Changing the prompt

There are some special \codes you can use when setting the prompt

\h gets replaced by the hostname

\W gets replaced by the base working directory

\u gets replaced by the username

```
/home/cis90/simben $ PS1="[\u@\h \W]\$ "
[simben90@oslab ~]$ date
Mon Sep  3 17:38:54 PDT 2012
[simben90@oslab ~]$
```

\$ gets replaced by a $ for regular users or # if the root user

user name

hostname

indicates regular user

working directory (~ is shorthand for the home directory)

Environment variables
Changing the shell prompt

Prompt string	Result
`PS1='$PWD $ '`	`/home/cis90/simmsben/Poems $`
`PS1="\w $ "`	`~/Poems $`
`PS1="\W $ "`	`Poems $`
`PS1="\u@\h $ "`	`simmsben@opus $`
`PS1='\u@\h $PWD $ '`	`simmsben@opus /home/cis90/simmsben/Poems $`
`PS1='\u@\$HOSTNAME $PWD $ '`	`simmsben@opus.cabrillo.edu /home/cis90/simmsben/Poems $`
`PS1='\u \! $PWD $ '`	`simmsben 825 /home/cis90/simmsben/Poems $`
`PS1="[\u@\h \W] $ "`	`[simmsben@opus Poems] $`

Important: Use single quotes around variables that change. For example if you use $PWD with double quotes, the prompt will not changes as you change directories! More on this later …

Need a fresh start -- just log out and back in again and your prompt will be back to normal!

Listing all the variables

Shell Variables

set command

```
/home/cis90/simben $ set
BASH=/bin/bash
BASHOPTS=checkwinsize:cmdhist:expand_aliases:extquote:force_fignore:hostco
mplete:interactive_comments:login_shell:progcomp:promptvars:sourcepath
BASH_ALIASES=()
BASH_ARGC=()
BASH_ARGV=()
BASH_CMDS=()
BASH_ENV=/home/cis90/simben/.bashrc
BASH_LINENO=()
BASH_SOURCE=()
BASH_VERSINFO=([0]="4" [1]="1" [2]="2" [3]="1" [4]="release" [5]="i386-
redhat-linux-gnu")
BASH_VERSION='4.1.2(1)-release'
COLORS=/etc/DIR_COLORS
COLUMNS=123
CVS_RSH=ssh
DIRSTACK=()
EUID=1001
GROUPS=()
G_BROKEN_FILENAMES=1
HISTCONTROL=ignoredups
HISTFILE=/home/cis90/simben/.bash_history
HISTFILESIZE=1000
HISTSIZE=1000
HOME=/home/cis90/simben
HOSTNAME=oslab.cabrillo.edu
HOSTTYPE=i386
ID=1001
IFS=$' \t\n'
IGNOREEOF=10
LANG=en_US.UTF-8
LESSOPEN='|/usr/bin/lesspipe.sh %s'
LINES=38
LOGNAME=simben90
LS_COLORS='rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;3
3;01:cd=40;33;01:or=40;31;01:mi=01;05;37;41:su=37;41:sg=30;43:ca=30;41:tw=
30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;31:*.arj=01;31:*.taz
=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31:*.zip=01;31:*.z=01
;31:*.Z=01;31:*.dz=01;31:*.gz=01;31:*.lz=01;31:*.xz=01;31:*.bz2=01;31:*.tb
z=01;31:*.tbz2=01;31:*.bz=01;31:*.tz=01;31:*.deb=01;31:*.rpm=01;31:*.jar=0
1;31:*.rar=01;31:*.ace=01;31:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;3
1:*.jpg=01;35:*.jpeg=01;35:*.gif=01;35:*.bmp=01;35:*.pbm=01;35:*.pgm=01;35
:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff=01;35:
*.png=01;35:*.svg=01;35:*.svgz=01;35:*.mng=01;35:*.pcx=01;35:*.mov=01;35:*
.mpg=01;35:*.mpeg=01;35:*.m2v=01;35:*.mkv=01;35:*.ogm=01;35:*.mp4=01;35:*.
m4v=01;35:*.mp4v=01;35:*.vob=01;35:*.qt=01;35:*.nuv=01;35:*.wmv=01;35:*.as
f=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi=01;35:*.fli=01;35:*.flv=
01;35:*.gl=01;35:*.dl=01;35:*.xcf=01;35:*.xwd=01;35:*.yuv=01;35:*.cgm=01;3
5:*.emf=01;35:*.axv=01;35:*.anx=01;35:*.ogv=01;35:*.ogx=01;35:*.aac=01;36:
*.au=01;36:*.flac=01;36:*.mid=01;36:*.midi=01;36:*.mka=01;36:*.mp3=01;36:*
.mpc=01;36:*.ogg=01;36:*.ra=01;36:*.wav=01;36:*.axa=01;36:*.oga=01;36:*.sp
x=01;36:*.xspf=01;36:'
MACHTYPE=i386-redhat-linux-gnu
MAIL=/var/spool/mail/simben90
MAILCHECK=60
OLDPWD=/bin
OPTERR=1
OPTIND=1
OSTYPE=linux-gnu
PATH=/usr/lib/qt-
3.3/bin:/usr/local/bin:/bin:/usr/bin:/usr/local/sbin:/usr/sbin:/sbin:/home
/cis90/simben/../bin:/home/cis90/simben/bin:.
PIPESTATUS=([0]="127")
PPID=17309
PROMPT_COMMAND='printf "\033]0;%s@%s:%s\007" "${USER}" "${HOSTNAME%%.*}"
"${PWD/#$HOME/~}"'
PS1='$PWD $ '
PS2='> '
PS4='+ '
PWD=/home/cis90/simben
QTDIR=/usr/lib/qt-3.3
QTINC=/usr/lib/qt-3.3/include
QTLIB=/usr/lib/qt-3.3/lib
SELINUX_LEVEL_REQUESTED=
SELINUX_ROLE_REQUESTED=
SELINUX_USE_CURRENT_RANGE=
SHELL=/bin/bash
SHELLOPTS=braceexpand:emacs:hashall:histexpand:history:ignoreeof:interacti
ve-comments:monitor
SHLVL=1
SSH_CLIENT='50.0.68.235 51849 2220'
SSH_CONNECTION='50.0.68.235 51849 172.30.5.20 2220'
SSH_TTY=/dev/pts/2
TERM=xterm
UID=1001
USER=simben90
USERNAME=
_=ser
colors=/etc/DIR_COLORS
/home/cis90/simben $
```

*The **set** command shows all shell variables including the special environment variables.*

Shell (Environment) Variables

env command

*The **env** command shows just the environment variables*

```
/home/cis90/simben $ env
HOSTNAME=oslab.cabrillo.edu
SELINUX_ROLE_REQUESTED=
TERM=xterm
SHELL=/bin/bash
HISTSIZE=1000
SSH_CLIENT=50.0.68.235 51849 2220
SELINUX_USE_CURRENT_RANGE=
QTDIR=/usr/lib/qt-3.3
QTINC=/usr/lib/qt-3.3/include
SSH_TTY=/dev/pts/2
USER=simben90
LS_COLORS=rs=0:di=01;34:ln=01;36:mh=00:pi=40;33:so=01;35:do=01;35:bd=40;33;01:cd=40;33;01:or=40;31;01:mi=01;05;37;41:su=37;41:sg=30;43:ca=
30;41:tw=30;42:ow=34;42:st=37;44:ex=01;32:*.tar=01;31:*.tgz=01;31:*.arj=01;31:*.taz=01;31:*.lzh=01;31:*.lzma=01;31:*.tlz=01;31:*.txz=01;31
:*.zip=01;31:*.z=01;31:*.Z=01;31:*.dz=01;31:*.gz=01;31:*.lz=01;31:*.xz=01;31:*.bz2=01;31:*.tbz=01;31:*.tbz2=01;31:*.bz=01;31:*.tz=01;31:*.
deb=01;31:*.rpm=01;31:*.jar=01;31:*.rar=01;31:*.ace=01;31:*.zoo=01;31:*.cpio=01;31:*.7z=01;31:*.rz=01;31:*.jpg=01;35:*.jpeg=01;35:*.gif=01
;35:*.bmp=01;35:*.pbm=01;35:*.pgm=01;35:*.ppm=01;35:*.tga=01;35:*.xbm=01;35:*.xpm=01;35:*.tif=01;35:*.tiff=01;35:*.png=01;35:*.svg=01;35:*
.svgz=01;35:*.mng=01;35:*.pcx=01;35:*.mov=01;35:*.mpg=01;35:*.mpeg=01;35:*.m2v=01;35:*.mkv=01;35:*.ogm=01;35:*.mp4=01;35:*.m4v=01;35:*.mp4
v=01;35:*.vob=01;35:*.qt=01;35:*.nuv=01;35:*.wmv=01;35:*.asf=01;35:*.rm=01;35:*.rmvb=01;35:*.flc=01;35:*.avi=01;35:*.fli=01;35:*.flv=01;35
:*.gl=01;35:*.dl=01;35:*.xcf=01;35:*.xwd=01;35:*.yuv=01;35:*.cgm=01;35:*.emf=01;35:*.axv=01;35:*.anx=01;35:*.ogv=01;35:*.ogx=01;35:*.aac=0
1;36:*.au=01;36:*.flac=01;36:*.mid=01;36:*.midi=01;36:*.mka=01;36:*.mp3=01;36:*.mpc=01;36:*.ogg=01;36:*.ra=01;36:*.wav=01;36:*.axa=01;36:*
.oga=01;36:*.spx=01;36:*.xspf=01;36:
USERNAME=
MAIL=/var/spool/mail/simben90
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:.
PWD=/home/cis90/simben
LANG=en_US.UTF-8
SELINUX_LEVEL_REQUESTED=
HISTCONTROL=ignoredups
SHLVL=1
HOME=/home/cis90/simben
BASH_ENV=/home/cis90/simben/.bashrc
LOGNAME=simben90
QTLIB=/usr/lib/qt-3.3/lib
CVS_RSH=ssh
SSH_CONNECTION=50.0.68.235 51849 172.30.5.20 2220
LESSOPEN=|/usr/bin/lesspipe.sh %s
G_BROKEN_FILENAMES=1
_=/bin/env
OLDPWD=/bin
/home/cis90/simben $
```

Class Exercise
Environment Variables

1. Change your prompt to "What is your command master? "
2. Use **echo** to show your logname ($LOGNAME)

Meta-characters

Metacharacters

The shell gives special meaning to metacharacters

" - use double quotes to preserve blanks and allow variable expansion

' - use single quotes to preserve blanks and block variable expansion

$ - use to show the value rather than the name of a variable

; - allows multiple commands on one line

<enter key> - The invisible newline control character marking the end of a command

= - use to set variables to new values

\ - removes (escapes) the special powers of a metacharacter

Other metacharacters we will learn about later include:
*?, *, <, >, >>, !, |, [], {}, &, && and ||*

Metacharacters - quotes

" - use double quotes preserve blanks and allows variable expansion
' - use single quotes preserve blanks and block variable expansion

```
/home/cis90/simben $ echo I am               $LOGNAME   (3 arguments)
I am simben90  Extra blanks ignored, variable expanded
```

```
/home/cis90/simben $ echo "I am               $LOGNAME"   (1 argument)
I am               simben90  Extra blanks preserved, variable expanded to show value
```

```
/home/cis90/simben $ echo 'I am               $LOGNAME'   (1 argument)
I am               $LOGNAME  Extra blanks preserved, variable expansion blocked
```

Sometimes you will hear single quotes called strong quotes as they block variable expansion. Likewise you may hear double quotes called weak quotes because they allow variable expansion.

Metacharacters - quotes

" - use double quotes preserve blanks and allows variable expansion
' - use single quotes preserve blanks and block variable expansion

```
/home/cis90/simben $ echo '"double quotes"'
"double quotes"
```

```
/home/cis90/simben $ echo "'single quotes'"
'single quotes'
```

Tip: single quotes can be used to output double quotes and vice-versa

Metacharacters
<enter key> newline control character

<enter key> - The invisible *newline* control character marking the end of a command

```
[rsimms@opus ~]$ ps
  PID TTY          TIME CMD
19015 pts/0    00:00:00 bash
19378 pts/0    00:00:00 ps

[rsimms@opus ~]$ hostname
opus.cabrillo.edu

[rsimms@opus ~]$ echo "Use <enter key> to end the command"
Use <enter key> to end the command
```

Pressing the Enter key here generates an invisible `<newline>` *character*

Metacharacters - \ (backslash)

\ - removes (escapes) the special powers of a metacharacter

```
[rsimms@oslab ~]$ echo a b c d e f
a b c d e f

[rsimms@opus ~]$ echo a b c \
> d e f
a b c d e f
```

Escape the invisible newline <enter key> which marks the end of a command

```
[rsimms@opus ~]$ echo $PS1
[\u@\h \W]\$

[rsimms@opus ~]$ echo \$PS1
$PS1
```

Escape the $ (which shows the value of the variable)

```
[rsimms@opus ~]$ echo "Hello World"
Hello World

[rsimms@opus ~]$ echo \"Hello World\"
"Hello World”
```

Escape the double quote marks

Metacharacters - ; (command separator)

; - allows multiple commands on one line

```
[simmsben@opus Poems]$ hostname; uname; echo $LOGNAME; ls
opus.cabrillo.edu
Linux
simmsben
ant   Blake   nursery   Shakespeare   twister   Yeats
```

Four commands on one line

Shortcuts

More on the Command Line

Handy Shortcuts

- Use up and down arrows to “retype” previous commands
- Left and right arrow for editing current command
- Use <tab> to complete filenames automatically

```
[simmsben@opus Poems]$ hostname; name; echo $LOGNAME; ls Blake/
opus.cabrillo.edu
bash: name: command not found
simmsben
jerusalem  tiger

[simmsben@opus Poems]$ hostname; uname; echo $LOGNAME; ls Blake/
opus.cabrillo.edu
Linux
simmsben
jerusalem  tiger
```

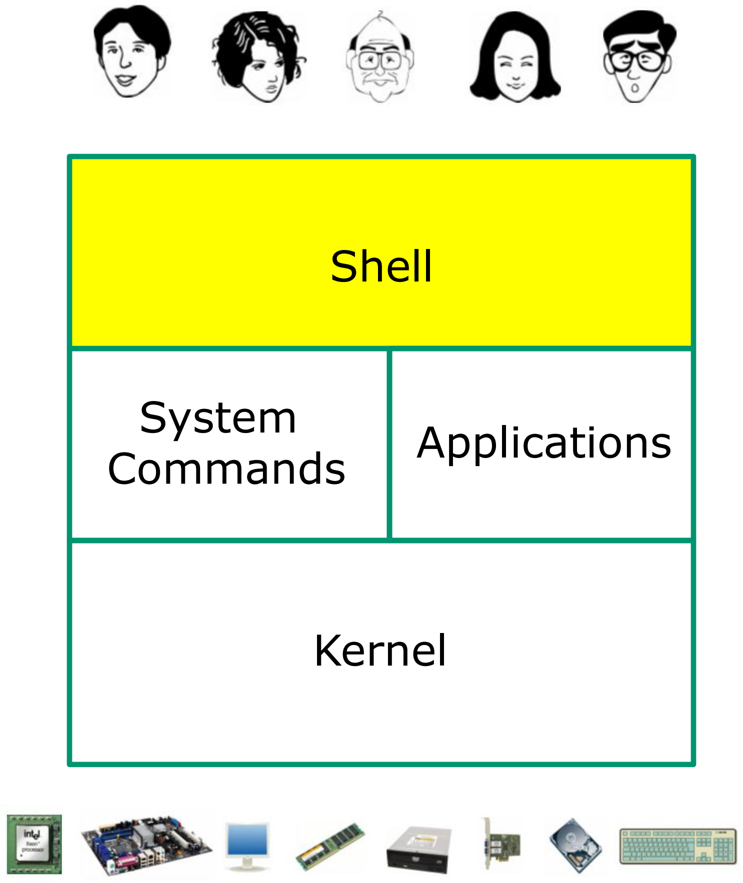
Press <tab> after the B and the shell fills in the remaining “lake/”

Press up arrow and the shell retypes the previous command

Use the left arrow to backup and fix the typo (uname instead of name)

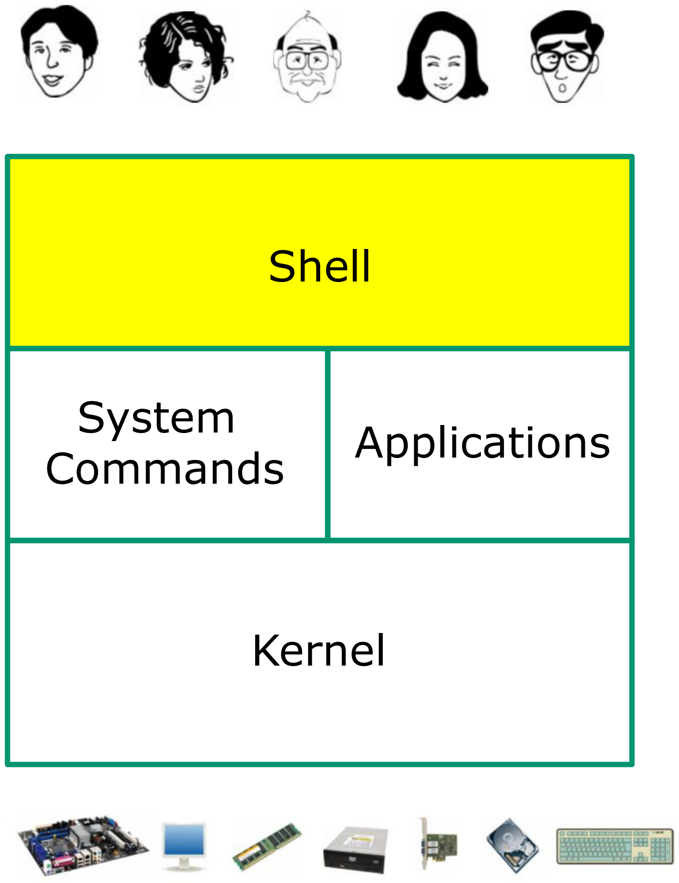
Shell

The Shell



- Allows users to interact with the computer via a "**command line**".
- **Prompts** for a command, parses the command, finds the right program and gets that program executed.
- Is called a "**shell**" because it hides the underlying operating system.
- Multiple shell programs are available: **sh** (Bourne shell), **bash** (born again shell), **csh** (C shell), **ksh** (Korn shell).
- The shell is a **user interface** and a **programming language** (scripts).
- GNOME and KDE desktops could be called **graphical shells**

Life of the Shell



1) Prompt
2) Parse
3) Search
4) Execute
5) Nap
6) Repeat

Life of the Shell

Example:

```
/home/cis90/simben $ ls -lt proposal1 proposal2
-rw-r--r--. 1 simben90 cis90 1074 Aug 26  2003 proposal1
-rw-r--r--. 1 simben90 cis90 2175 Jul 20  2001 proposal2
/home/cis90/simben $
```

Shell Steps
1) Prompt
2) Parse
3) Search
4) Execute
5) Nap
6) Repeat

Lets take a deep dive into how a command gets executed.

Note it is always a team effort by both the shell and the command.

Life of the Shell

Shell Steps
1) Prompt
2) Parse
3) Search
4) Execute
5) Nap
6) Repeat

1) Prompt user for a command

Example:

The shell begins by outputting the prompt (which is based on the PS1 variable)

```
/home/cis90/simben $ ls -lt proposal1 proposal2
```

Then you type the command

FYI, you can mimic outputting the prompt yourself with these commands:

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

to show value of PS1 variable

echo the output of the previous command

was output by the echo command above

was output by the shell (the same output)

Life of the Shell

Shell Steps
1) Prompt
2) Parse
3) Search
4) Execute
5) Nap
6) Repeat

2) Parse command user typed

Example:

```
ls -lt proposal1 proposal2
```

- Command = ls
- 2 Options = l, t
- 2 Arguments = proposal1, proposal2
- 1 Redirection = NA

During the parse step the shell identifies all options & arguments, handles any metacharacters and redirection

Life of the Shell

Shell Steps
1) Prompt
2) Parse
3) Search
4) Execute
5) Nap
6) Repeat

3) Search path for the program to run

```
ls -lt proposal1 proposal2
```

Use this command to see the path directories (separated by :'s) on your path

```
/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:.
```

*The shell will search each directory in order for an **ls** command*

```
/usr/lib/qt-3.3/bin  no
/usr/local/bin       no
/bin                 YES! – it was found in the /bin directory
/usr/bin
/usr/local/sbin
/usr/sbin
/sbin
/home/cis90/simben/../bin
/home/cis90/simben/bin
      .
```

Try mimicking what the shell does to search for ls:

```
/home/cis90/simben $ ls /usr/lib/qt-3.3/bin/ls
ls: cannot access /usr/lib/qt-3.3/bin/ls: No
such file or directory

/home/cis90/simben $ ls /usr/local/bin/ls
ls: cannot access /usr/local/bin/ls: No such
file or directory

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

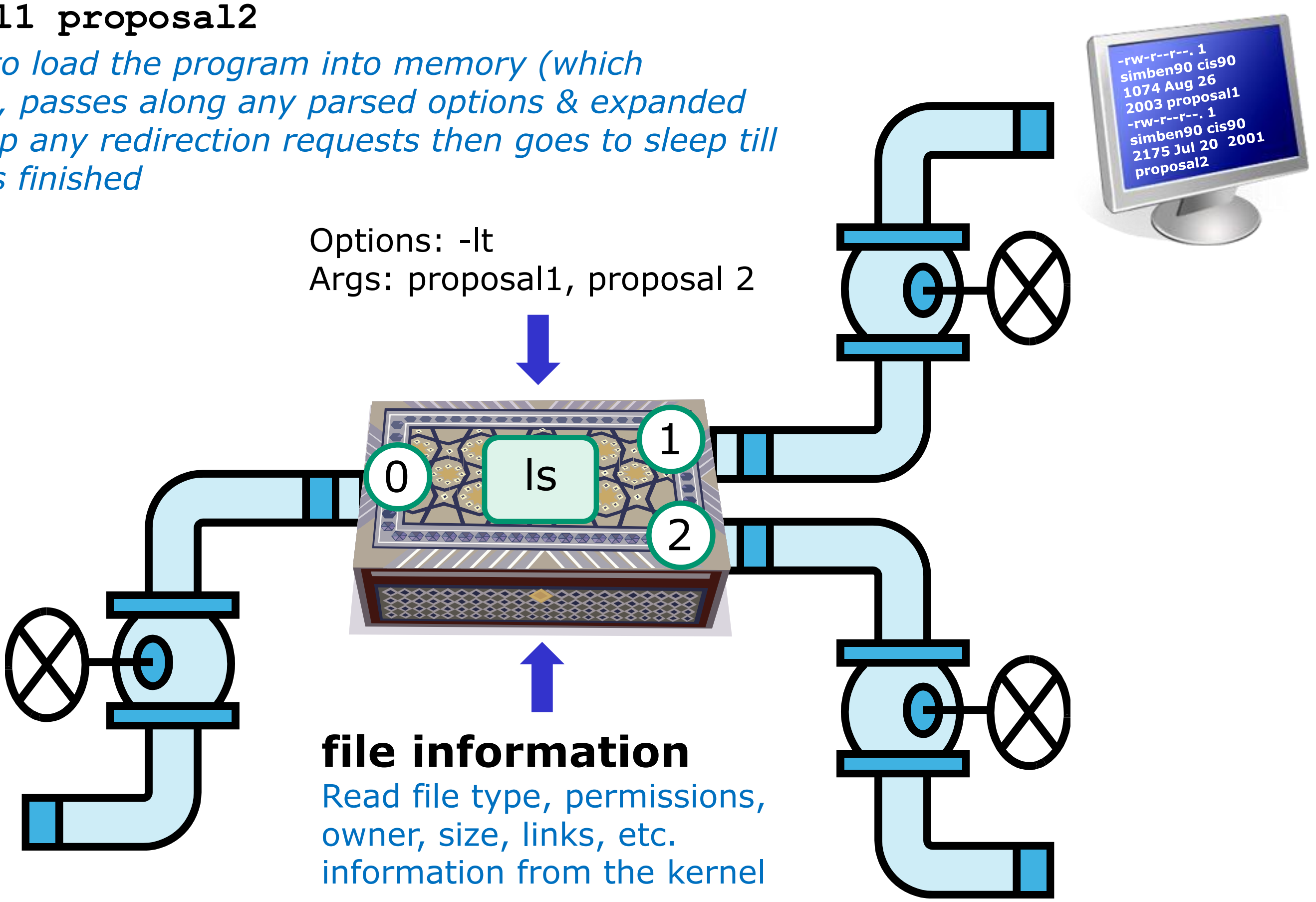
Life of the Shell

Shell Steps
1) Prompt
2) Parse
3) Search
4) Execute
5) Nap
6) Repeat

4) Execute the command

`ls -lt proposal1 proposal2`

Invokes the kernel to load the program into memory (which becomes a process), passes along any parsed options & expanded arguments, hooks up any redirection requests then goes to sleep till the new process has finished



```
-rw-r--r--. 1 simben90 cis90 1074 Aug 26 2003 proposal1
-rw-r--r--. 1 simben90 cis90 2175 Jul 20 2001 proposal2
```

file information
Read file type, permissions, owner, size, links, etc. information from the kernel

Life of the Shell

Shell Steps
1) Prompt
2) Parse
3) Search
4) Execute
5) Nap
6) Repeat

5) Nap while the command (process) runs to completion

(The shell, itself a loaded process, goes into the sleep state and waits till the command process is finished)

```
/home/cis90/simben $ ls -lt proposal1 proposal2
-rw-r--r--. 1 simben90 cis90 1074 Aug 26  2003 proposal1
-rw-r--r--. 1 simben90 cis90 2175 Jul 20  2001 proposal2
```

Life of the Shell

6) And do it all over again
… go to step 1

Shell Steps
1) Prompt
2) Parse
3) Search
4) Execute
5) Nap
6) Repeat

Life of the Shell

A
```
/home/cis90/simben $ Ls -lt proposal1 proposal2
-bash: Ls: command not found
```
What's wrong?
Who output the error?

B
```
/home/cis90/simben $ ls -lt proposal1 proposal5
ls: cannot access proposal5: No such file or directory
-rw-r--r--. 1 simben90 cis90 1074 Aug 26  2003 proposal1
```
What's wrong?
Who output the error?

C
```
/home/cis90/simben $ ls -lw proposal1 proposal2
ls: invalid line width: proposal1
```
What's wrong?
Who output the error?

D
```
/home/cis90/simben $ ls -lt proposal1proposal2
ls: cannot access proposal1proposal2: No such file or directory
```
What's wrong?
Who output the error?

E
```
/home/cis90/simben $ ls-lt proposal1 proposal2
-bash: ls-lt: command not found
```
What's wrong?
Who output the error?

Life without a path

-bash: *xxxx*: command not found

Don't get mad, just fix your path!

The Path

The shell uses your path to locate commands to execute

- A path is a ordered set of directories along which the shell will search to locate commands to execute
- The path is defined by the PATH variable
- Show your path with **echo $PATH**
- If you specify a command *xxxx* that the shell cannot find on the path it will print the following error message:

  -bash: *xxxx*: command not found

- To run a command that is not on your path the complete absolute pathname must be specified. e.g. /usr/bin/uname

The Path

Use this command to see the directories (separated by :'s) on your path

```
/home/cis90/simben $ echo $PATH
/usr/lib/qt-
3.3/bin:/usr/local/bin:/bin:/usr/bin:/usr/local/sbin:/usr/sbin:/sbin:/home/c
is90/simben/../bin:/home/cis90/simben/bin:.
```

The shell will search for the ls command along the path in this order:

```
/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
.
```

yes, . is a directory too and it is whatever directory you have currently changed into

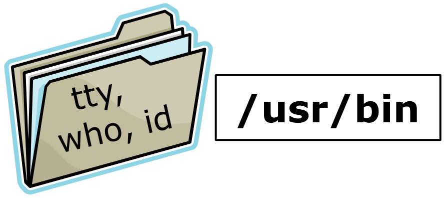
Experiment – Breaking the Path

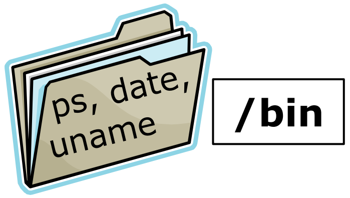
*The **echo** command is built into bash*

```
/home/cis90/simben $ type echo ps tty
echo is a shell builtin
ps is /bin/ps
tty is /usr/bin/tty
```

*the **ps**command is in the /bin directory*

*The **tty** command is in the /usr/bin directory*





Experiment – Breaking the Path

Default path

```
/home/cis90/simben $ echo I love Linux
I love Linux
/home/cis90/simben $ date
Mon Sep  3 15:17:52 PDT 2012
/home/cis90/simben $ tty
/dev/pts/2
/home/cis90/simben $
```

TROUBLE!

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

/home/cis90/simben $
```

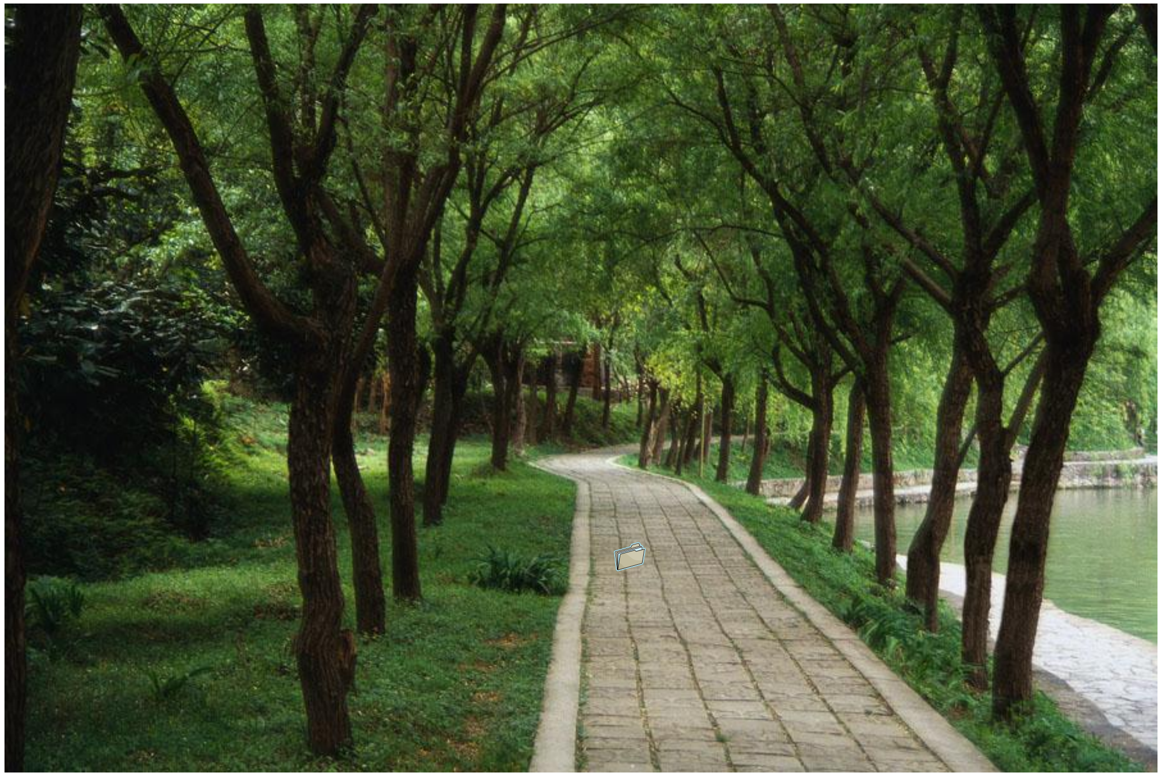
Break the path by setting it to null

No path

```
/home/cis90/simben $ echo I love Linux
I love Linux
/home/cis90/simben $ date
-bash: date: No such file or directory
/home/cis90/simben $ tty
-bash: tty: No such file or directory
```

*Only **echo** works because it is built into the shell!*

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

/home/cis90/simben $
```



There is nothing on the path!

Experiment – Restoring the Path

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

/home/cis90/simben $ echo I love Linux
I love Linux
/home/cis90/simben $ date
Mon Sep  3 15:24:19 PDT 2012
/home/cis90/simben $ tty
-bash: tty: No such file or directory
```

Add the /bin directory to the path

***echo** works because it is built into the shell*

***date** works because it resides in the /bin directory which is now on the path*

***tty** does not work because it is in the /usr/bin directory which is not on the path*

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

Experiment – Restoring the Path

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

/home/cis90/simben $ echo I love Linux
I love Linux
/home/cis90/simben $ date
Mon Sep  3 15:24:19 PDT 2012
/home/cis90/simben $ tty
/dev/pts/2
```

Append the /usr/bin directory to the path

All three commands work because /bin and /usr/bin are on the path.

The shell will only run commands found in the directories that make up the path

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

tty,
who, id
/usr/bin
ps, date,
uname
/bin

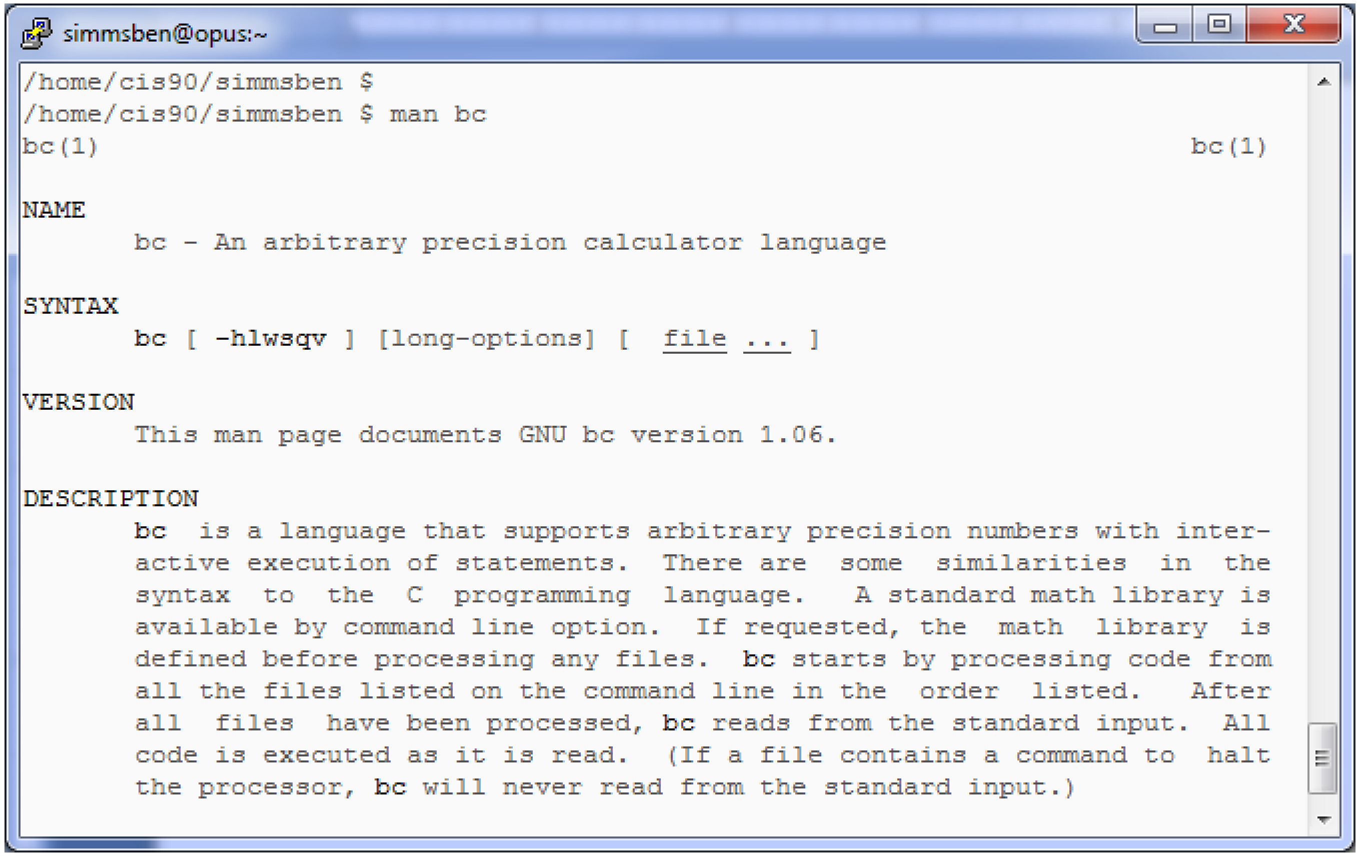
Need a fresh start -- just log out and back in again and your path will be back to normal!

Docs

Using man (manual) pages

*Type the **man** command followed by the name of the command you want documentation on.*

Example: **man bc**



```
/home/cis90/simmsben $
/home/cis90/simmsben $ man bc
bc(1)                                                                  bc(1)

NAME
       bc - An arbitrary precision calculator language

SYNTAX
       bc [ -hlwsqv ] [long-options] [  file ... ]

VERSION
       This man page documents GNU bc version 1.06.

DESCRIPTION
       bc  is a language that supports arbitrary precision numbers with inter-
       active execution of statements.  There are  some  similarities  in  the
       syntax  to  the  C  programming  language.   A standard math library is
       available by command line option.  If requested, the  math  library  is
       defined before processing any files.  bc starts by processing code from
       all the files listed on the command line in the  order  listed.   After
       all  files  have been processed, bc reads from the standard input.  All
       code is executed as it is read.  (If a file contains a command to  halt
       the processor, bc will never read from the standard input.)
```

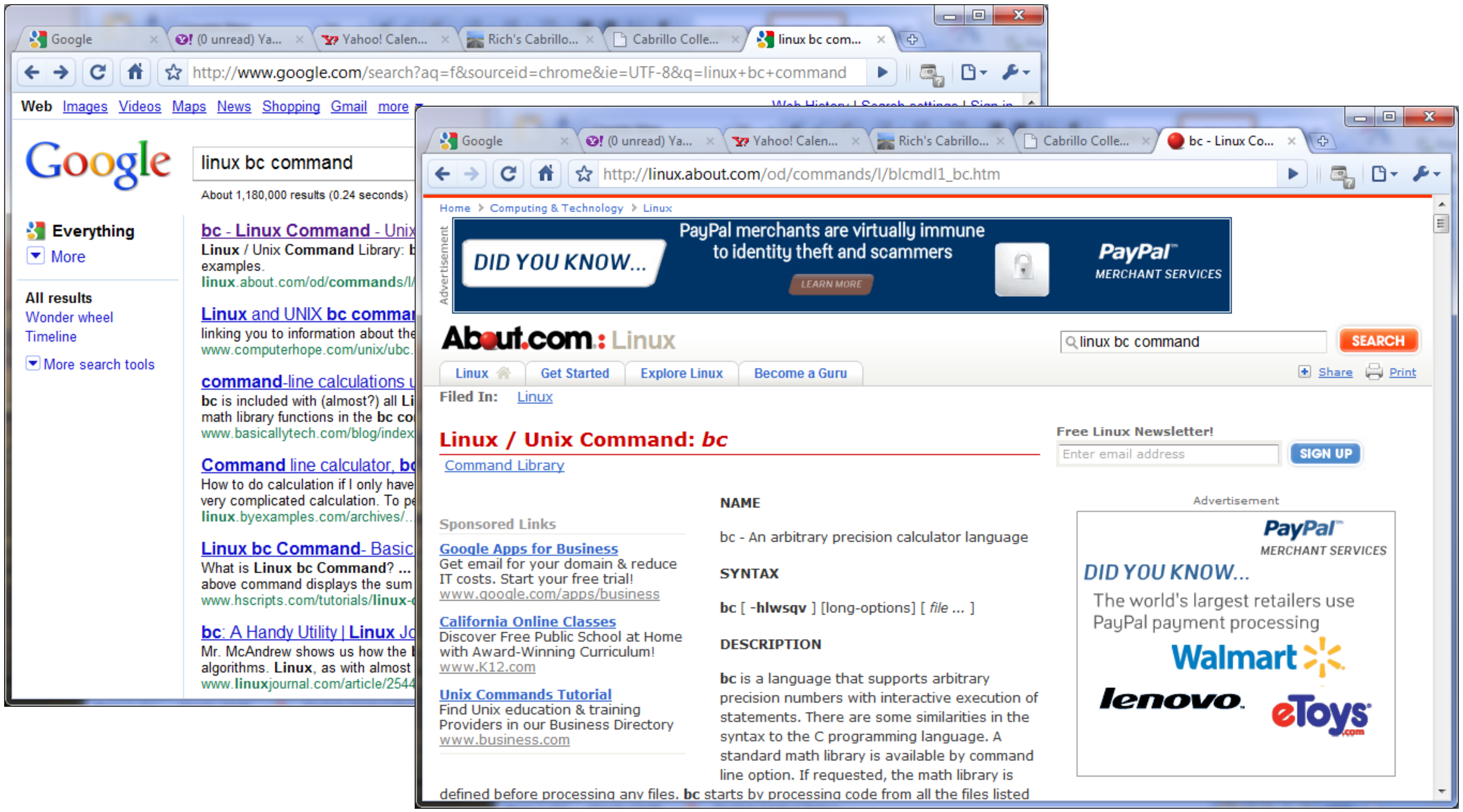
Use these keys to scroll

Use q key to quit

Using Google

Do a Google search on "linux xxx command" where xxx is the command you want documentation for.

Example: google linux bc command



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linux bc command

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More search tools

bc - Linux Command - Unix
Linux / Unix Command Library: b
examples.
linux.about.com/od/commands/l/

Linux and UNIX bc comma
linking you to information about the
www.computerhope.com/unix/ubc.

command-line calculations u
bc is included with (almost?) all Li
math library functions in the bc co
www.basicallytech.com/blog/index

Command line calculator, bc
How to do calculation if I only have
very complicated calculation. To pe
linux.byexamples.com/archives/...

Linux bc Command- Basic
What is Linux bc Command? ...
above command displays the sum
www.hscripts.com/tutorials/linux-c

bc: A Handy Utility | Linux Jo
Mr. McAndrew shows us how the b
algorithms. Linux, as with almost
www.linuxjournal.com/article/2544

Google | (0 unread) Ya... | Yahoo! Calen... | Rich's Cabrillo... | Cabrillo Colle... | bc - Linux Co...

http://linux.about.com/od/commands/l/blcmdl1_bc.htm

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Command Library

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NAME

bc - An arbitrary precision calculator language

SYNTAX

bc [**-hlwsqv**] [long-options] [*file* ...]

DESCRIPTION

bc is a language that supports arbitrary precision numbers with interactive execution of statements. There are some similarities in the syntax to the C programming language. A standard math library is available by command line option. If requested, the math library is defined before processing any files. **bc** starts by processing code from all the files listed

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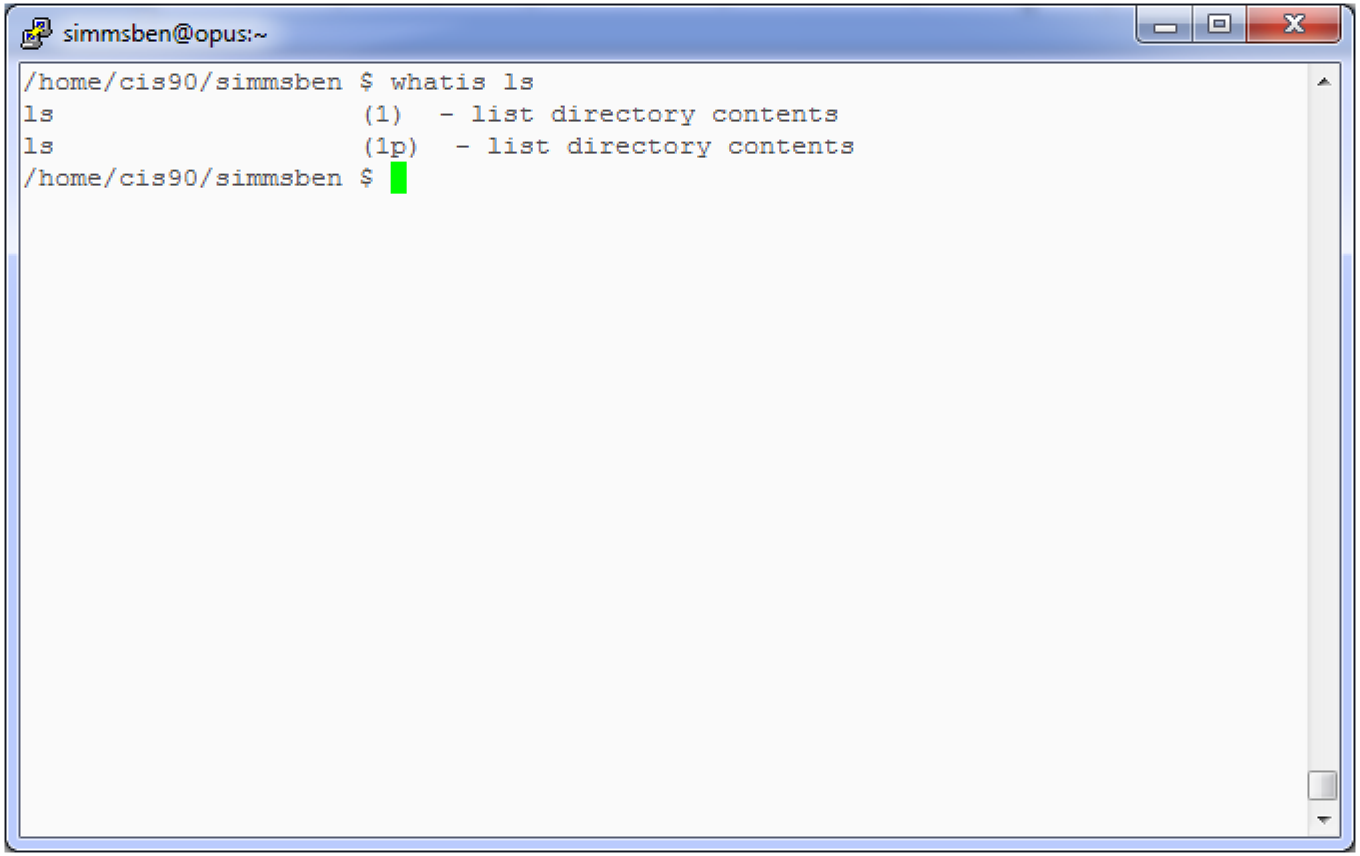
Other Documentation

- **whatis** *command* *same as the **man –f** command*
- **apropos** *command* *same as the **man –k** command*
- **info** *command*

Documentation examples

Example: **whatis ls**



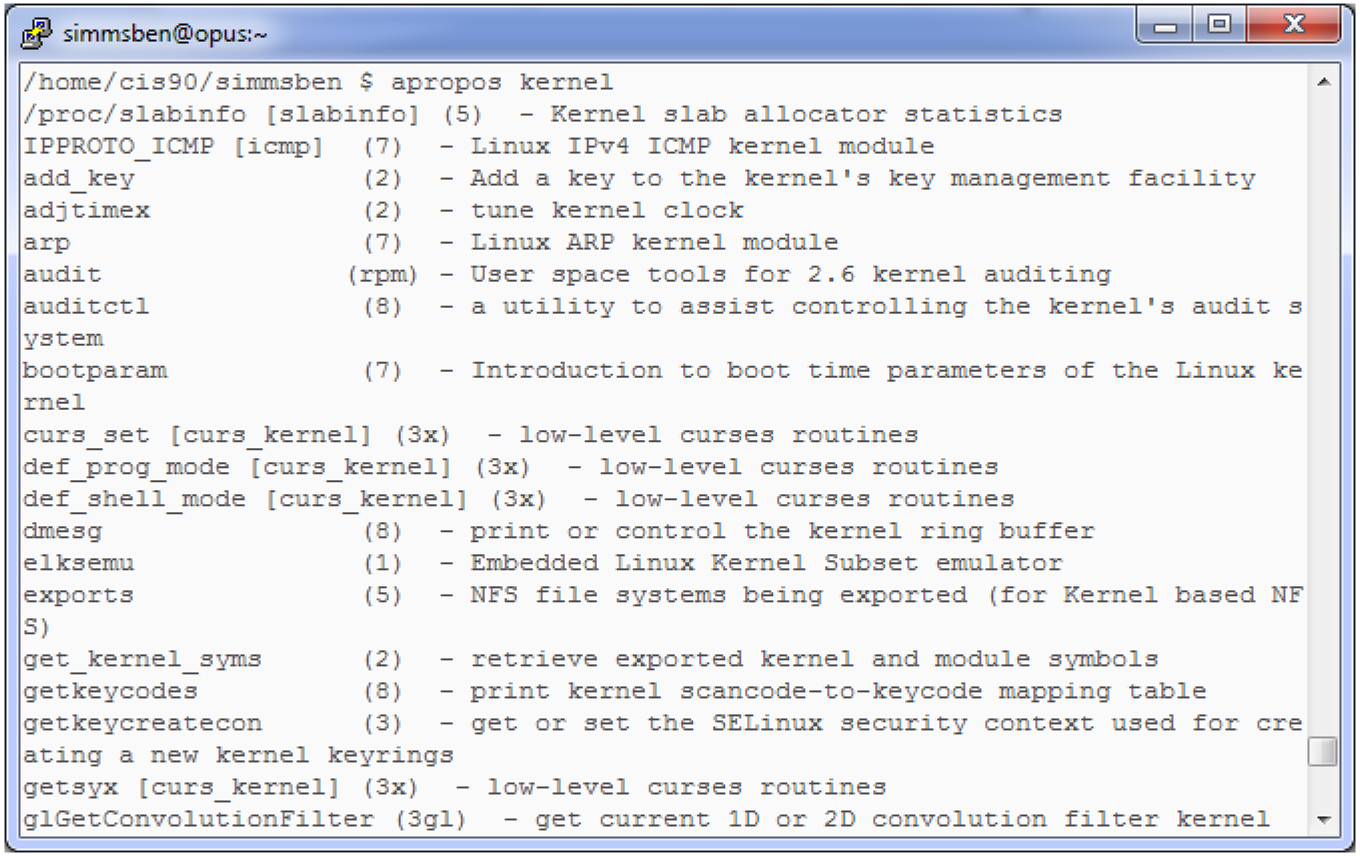
simmsben@opus:~

```
/home/cis90/simmsben $ whatis ls
ls                   (1)  - list directory contents
ls                   (1p)  - list directory contents
/home/cis90/simmsben $ 
```

whatis *searches the whatis database for a complete word. Same as the* ***man -f*** *command .*

Documentation examples

Example: **apropos kernel**



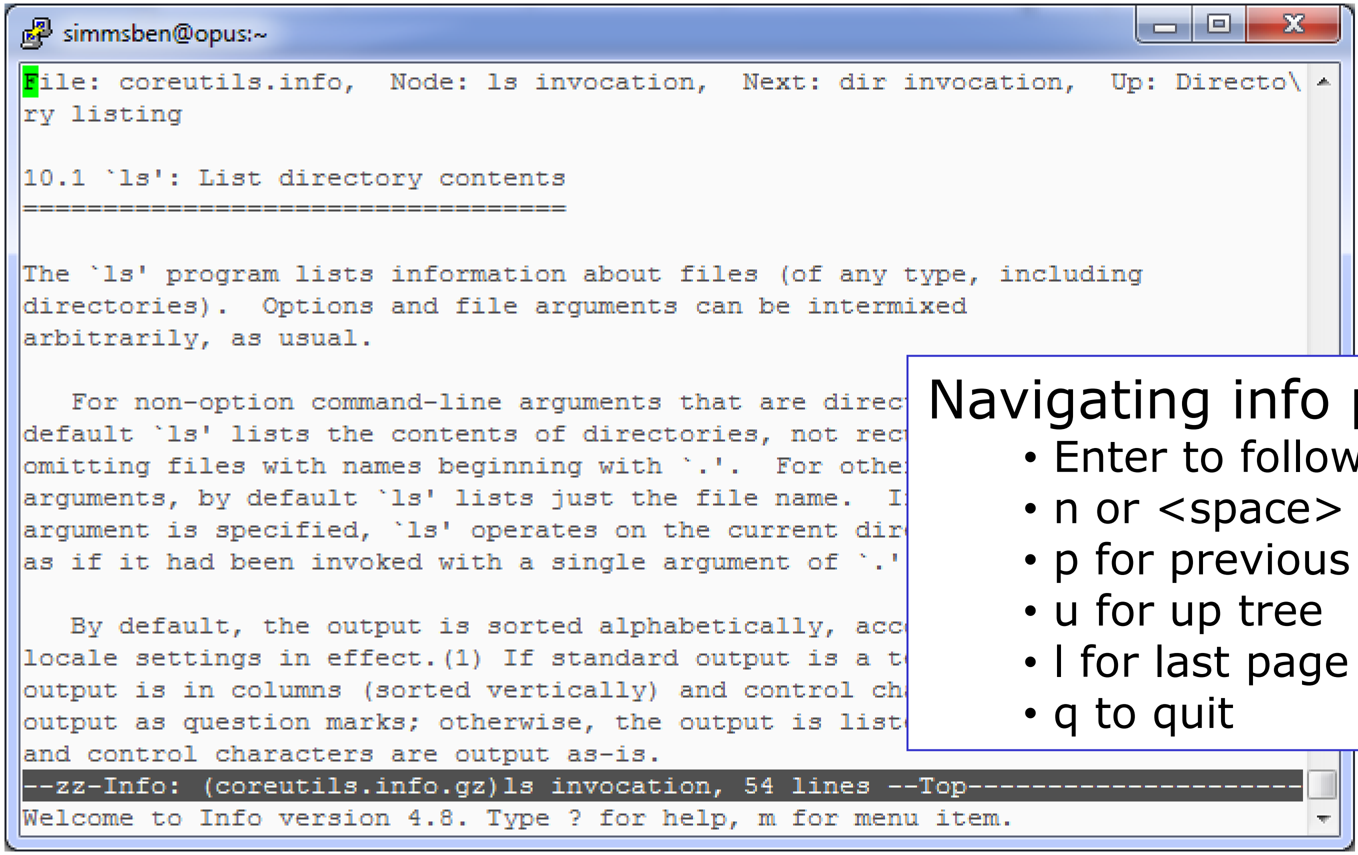
simmsben@opus:~

```
/home/cis90/simmsben $ apropos kernel
/proc/slabinfo [slabinfo] (5)  - Kernel slab allocator statistics
IPPROTO_ICMP [icmp]  (7)  - Linux IPv4 ICMP kernel module
add_key              (2)  - Add a key to the kernel's key management facility
adjtimex             (2)  - tune kernel clock
arp                  (7)  - Linux ARP kernel module
audit              (rpm)  - User space tools for 2.6 kernel auditing
auditctl             (8)  - a utility to assist controlling the kernel's audit s
ystem
bootparam            (7)  - Introduction to boot time parameters of the Linux ke
rnel
curs_set [curs_kernel] (3x)  - low-level curses routines
def_prog_mode [curs_kernel] (3x)  - low-level curses routines
def_shell_mode [curs_kernel] (3x)  - low-level curses routines
dmesg                (8)  - print or control the kernel ring buffer
elksemu              (1)  - Embedded Linux Kernel Subset emulator
exports              (5)  - NFS file systems being exported (for Kernel based NF
S)
get_kernel_syms      (2)  - retrieve exported kernel and module symbols
getkeycodes          (8)  - print kernel scancode-to-keycode mapping table
getkeycreatecon      (3)  - get or set the SELinux security context used for cre
ating a new kernel keyrings
getsyx [curs_kernel] (3x)  - low-level curses routines
glGetConvolutionFilter (3gl)  - get current 1D or 2D convolution filter kernel
```

***apropos** searches the whatis database for a string of text. Same as the **man -k** command .*

Documentation examples

Example: **info ls**



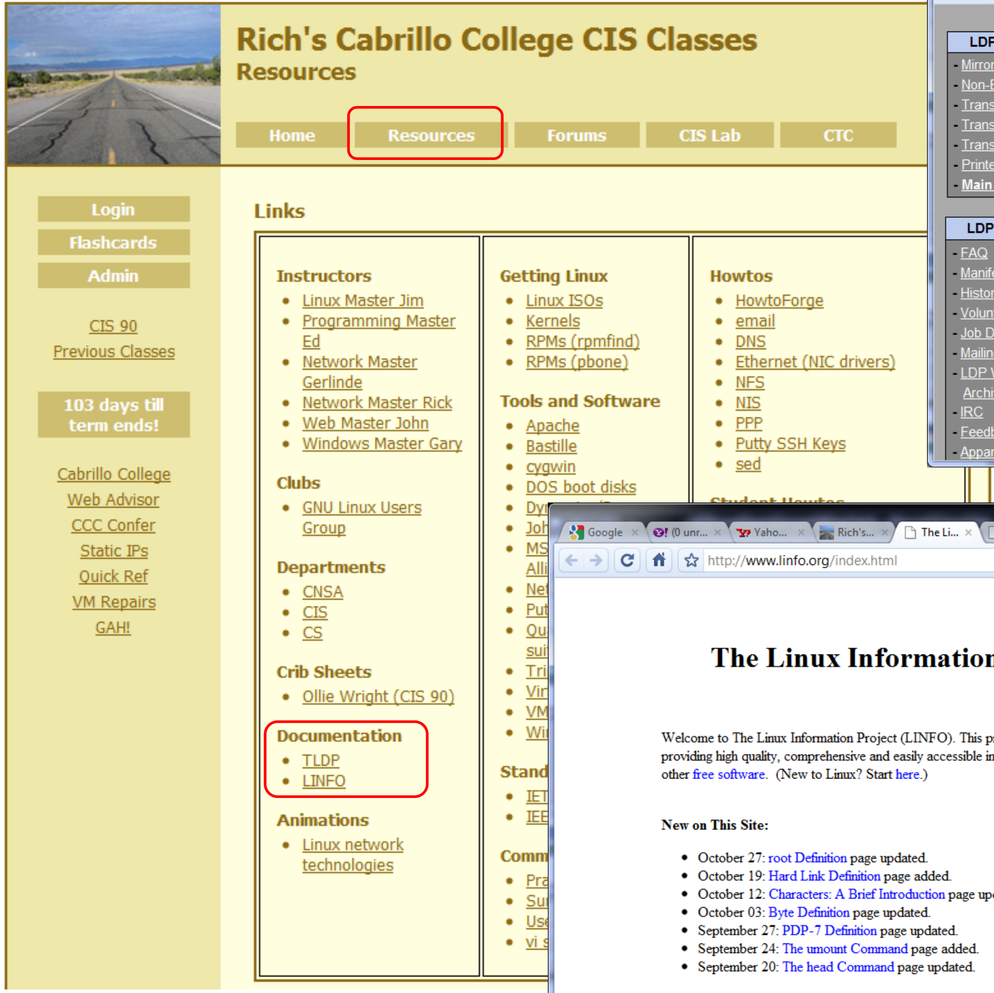
```
File: coreutils.info,  Node: ls invocation,  Next: dir invocation,  Up: Directo\
ry listing

10.1 `ls': List directory contents
==================================

The `ls' program lists information about files (of any type, including
directories).  Options and file arguments can be intermixed
arbitrarily, as usual.

   For non-option command-line arguments that are direc
default `ls' lists the contents of directories, not rec
omitting files with names beginning with `.'.  For othe
arguments, by default `ls' lists just the file name.  I
argument is specified, `ls' operates on the current dir
as if it had been invoked with a single argument of `.'

   By default, the output is sorted alphabetically, acc
locale settings in effect.(1) If standard output is a t
output is in columns (sorted vertically) and control ch
output as question marks; otherwise, the output is list
and control characters are output as-is.
--zz-Info: (coreutils.info.gz)ls invocation, 54 lines --Top---------------------
Welcome to Info version 4.8. Type ? for help, m for menu item.
```

Navigating info pages:

- Enter to follow links (*'s)
- n or <space> for next page
- p for previous page
- u for up tree
- l for last page
- q to quit

Documentation

Two of my favorite documentation links



Rich's Cabrillo College CIS Classes
Resources

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CIS 90
Previous Classes

103 days till term ends!

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Web Advisor
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Static IPs
Quick Ref
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GAH!

Links

Instructors
- Linux Master Jim
- Programming Master Ed
- Network Master Gerlinde
- Network Master Rick
- Web Master John
- Windows Master Gary

Clubs
- GNU Linux Users Group

Departments
- CNSA
- CIS
- CS

Crib Sheets
- Ollie Wright (CIS 90)

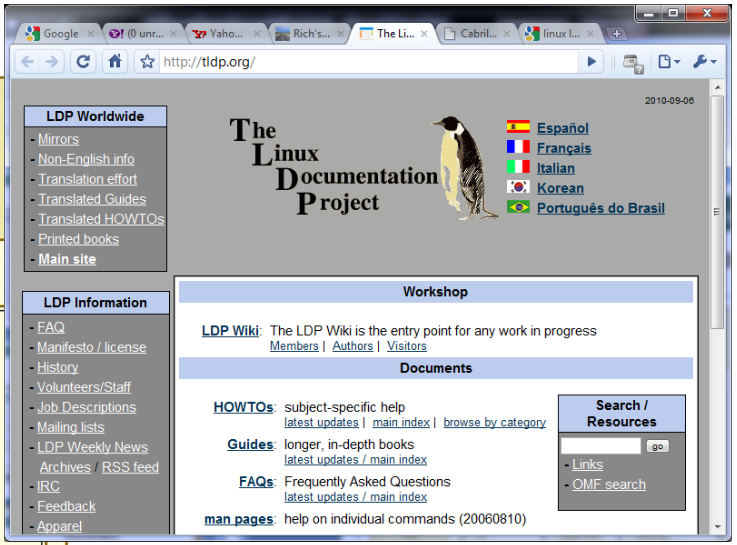
Documentation
- TLDP
- LINFO

Animations
- Linux network technologies

Getting Linux
- Linux ISOs
- Kernels
- RPMs (rpmfind)
- RPMs (pbone)

Tools and Software
- Apache
- Bastille
- cygwin
- DOS boot disks

Howtos
- HowtoForge
- email
- DNS
- Ethernet (NIC drivers)
- NFS
- NIS
- PPP
- Putty SSH Keys
- sed



http://tldp.org/

2010-09-06

The Linux Documentation Project

LDP Worldwide
- Mirrors
- Non-English info
- Translation effort
- Translated Guides
- Translated HOWTOs
- Printed books
- Main site

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- FAQ
- Manifesto / license
- History
- Volunteers/Staff
- Job Descriptions
- Mailing lists
- LDP Weekly News
- Archives / RSS feed
- IRC
- Feedback
- Apparel

Workshop

LDP Wiki: The LDP Wiki is the entry point for any work in progress
Members | Authors | Visitors

Documents

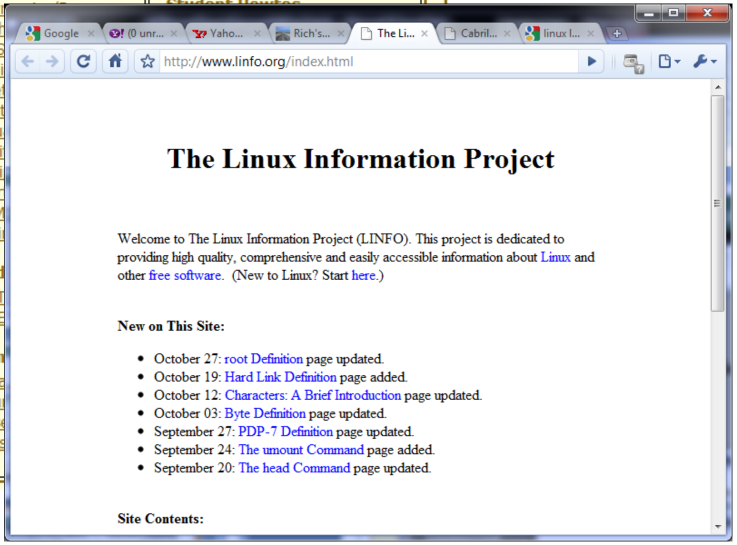
HOWTOs: subject-specific help
latest updates | main index | browse by category

Guides: longer, in-depth books
latest updates / main index

FAQs: Frequently Asked Questions
latest updates / main index

man pages: help on individual commands (20060810)

Search / Resources
- Links
- OMF search



http://www.linfo.org/index.html

The Linux Information Project

Welcome to The Linux Information Project (LINFO). This project is dedicated to providing high quality, comprehensive and easily accessible information about Linux and other free software. (New to Linux? Start here.)

New on This Site:

- October 27: root Definition page updated.
- October 19: Hard Link Definition page added.
- October 12: Characters: A Brief Introduction page updated.
- October 03: Byte Definition page updated.
- September 27: PDP-7 Definition page updated.
- September 24: The umount Command page added.
- September 20: The head Command page updated.

Site Contents:

The Linux Documentation and Information Projects

Class Exercise
Documentation

Use the man command on itself:
- **man man**

Research the **ls** command using:
- The **whatis** command
- The **man** command
- The **info** command
- Google

Wrap up

New commands:

apropos	- search for string in whatis database
bc	- binary calculator
cat	- print file(s)
cd	- change directory
echo	- print text
env	- show shell environment variables
info	- online documentation with hot links
file	- show file information
ls	- show directory contents
passwd	- change password
set	- show (or set) shell variables
type	- show command location in path
man	- manual page for a command
whatis	- command summary

New Files and Directories:

/etc/passwd	- user accounts
/etc/shadow	- encrypted passwords
/bin	- directory of commands
/sbin	- directory of superuser commands
/usr/bin	- directory of commands, tools and utilities
/usr/sbin	- directory of superuser commands, tools and utilities

Next Class

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

Lab #2

Quiz questions for next class:

- Name four directories where one can find commands?
- How do you show your path?
- What is the command to print the manual page for a command?

Backup