



Hunan University of Arts and Science

Networking Theory & Applications

CIS 291

2018 – 2019

UNIX/Linux Operating System



UNIX

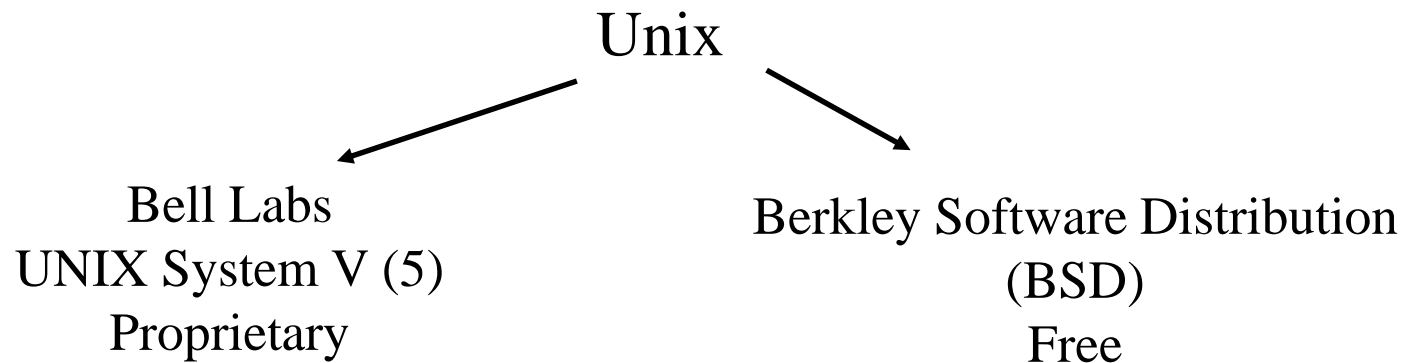
- UNIX is a computer operating system originally developed in 1969 by a group of AT&T employees at Bell Labs
- Computing Service, the name of an earlier operating system project in which AT&T
- In constant development since its creation
- Intimately related to the C programming language
- There are different types of Unix (sharing some characteristics), the most popular are:
 - ✓ Sun/Solaris
 - ✓ Gnu/Linux
 - ✓ MacOS X

Why UNIX ?

- The most popular operating systems: Windows - from Microsoft. cheap and “billions served”.
- UNIX was developed long before Windows, about 36 years ago at AT&T Bell Labs in the US.
- UNIX systems also have a graphical user interface (GUI) similar to Microsoft Windows
- UNIX is required for operations which aren't covered by a graphical program, or for when there is no windows interface available

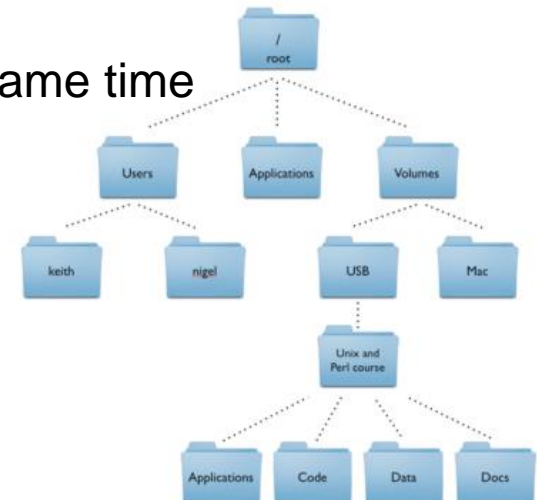
Development of Unix OS

Students at University of California (in Berkley) further developed the UNIX operating system and introduced the BSD version of Unix



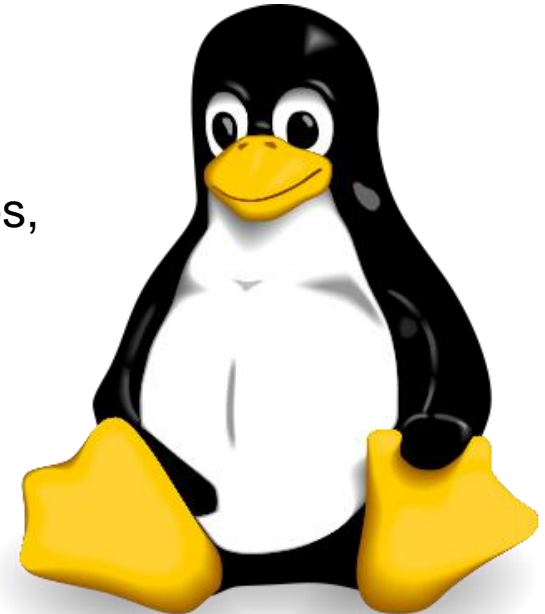
UNIX Philosophy

- Portable
 - ✓ Same code should work the same in different platforms
- Multi-tasking
 - ✓ Different processes can run simultaneously
 - ✓ Every process has a unique identifier (PID)
- Multi-user
 - ✓ Many people can use the same machine at the same time
 - ✓ Users can share resources and processes
- Hierarchical file system



GNU/Linux

- GNU/Linux
 - ✓ Most popular UNIX-like operating system nowadays
 - ✓ Based on the Linux kernel -> developed by Linus Torvalds in 1991
 - ✓ Inspired on MINIX, an educational demo of UNIX
- Deployed in many systems
 - ✓ Computers, laptops, mobiles, video game consoles, supercomputers, etc
- Many distributions or tastes
 - ✓ Desktop / workstation: Ubuntu, Fedora
 - ✓ Server: Debian, RedHat
 - ✓ Handset: Android, MeeGo, etc



Linux advantages



Forget about viruses.



Is your system unstable?



Linux protects your computer.



Don't pay \$100 for your operating system.



No more c**pware.



Freedom!



When the system has installed, why would you *still* need to install stuff?



Forget about drivers.



Update all your software with a single click.



Why copy software illegally if you can get it for free?



Need new software? Don't bother searching the web, Linux gets it for you.



Jump into the next generation of desktops.



Does your digital life seem fragmented?



Choose what your desktop looks like.



Why does your Windows get slower day after day?



Do something for the environment.



No back doors in your software.



Enjoy free and unlimited support.



Too many windows? Use workspaces.



No big mess in your start menu.



Don't wait years for bugs to be solved; report and track them down.



Are you tired of restarting your computer all the time?



Let your old computer have a second life.



Play hundreds of games for free.



Help other countries, and your own.



Use MSN, AIM, ICQ, Jabber, with a single program.



Get a great music player.



Keep an eye on the weather.

<http://www.whylinuxisbetter.net/>

UNIX layers

- **The Kernel**

Hub of the operating system. It allocates resources for programs in response to system calls

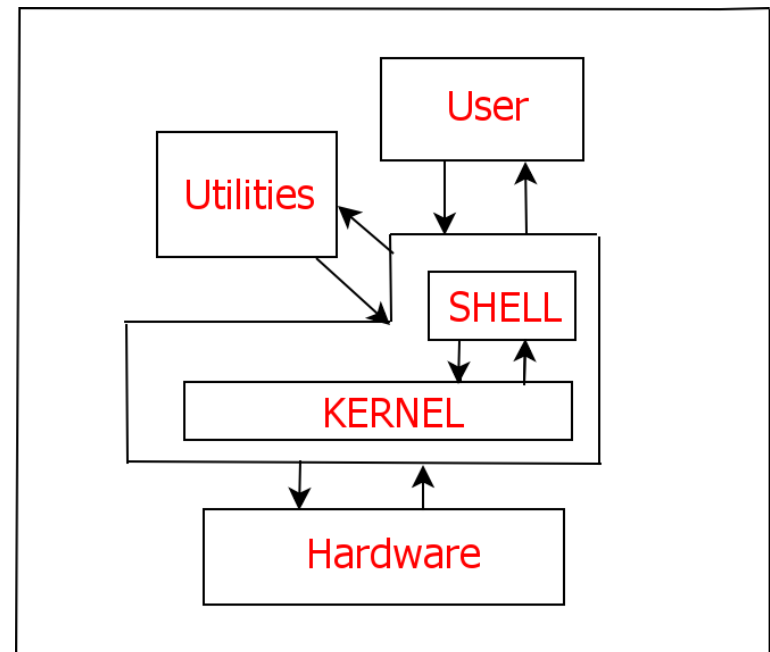
- **The Shell**

Interface between the user and the Kernel

- **Example:**

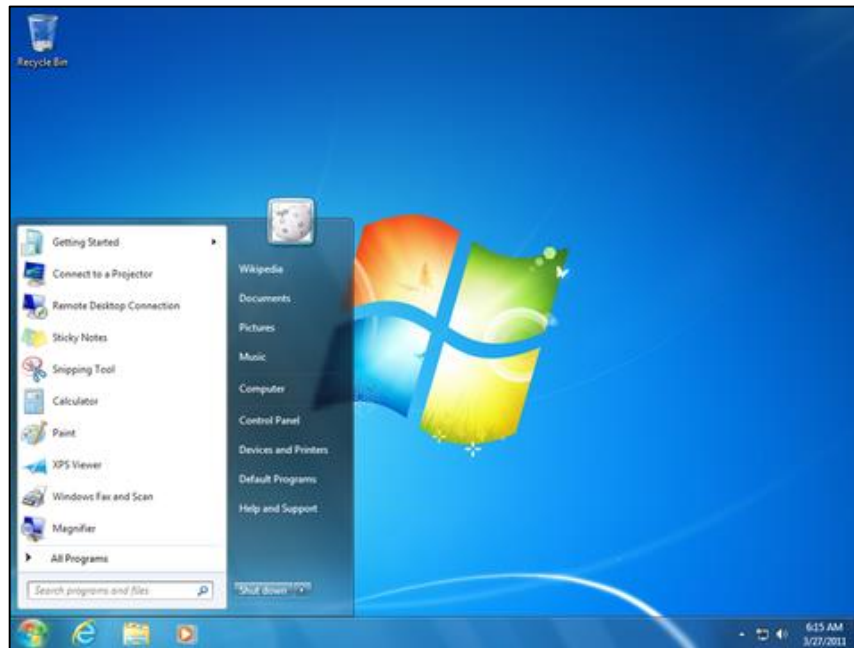
User enters `ls -al`, the shell look for this program and request the Kernel (through a system call) to execute this program.

The shell notifies the user when the `ls` process is finished so the user can launch another command



Shell (I)

- Provide an interface for users of an operative system
- Can be command line or graphical
- CLI (Command-Line Interfaces) are used to work with UNIX machines
- In CLIs the user issues commands to the programs in the form of successive lines of texts



```
msf5@kali:~$ cd /usr/portage/app-shells/bash
msf5@kali:~$ cd /usr/portage/app-shells/bash $ ls -al
total 130
drwxr-xr-x 3 portage portage 1024 Jul 25 18:06
drwxr-xr-x 33 portage portage 1024 Aug 7 22:39 .
-rw-r--r-- 1 root root 25988 Jul 25 18:06 ChangeLog
-rw-r--r-- 1 root root 27002 Jul 25 18:06 Manifest
-rw-r--r-- 1 portage portage 4645 Mar 23 21:37 bash-3.1_p17.ebuild
-rw-r--r-- 1 portage portage 5977 Mar 23 21:37 bash-3.2_p39.ebuild
-rw-r--r-- 1 portage portage 6161 Apr 5 14:37 bash-3.2_p40-r1.ebuild
-rw-r--r-- 1 portage portage 5988 Mar 23 21:37 bash-3.2_p40.ebuild
-rw-r--r-- 1 portage portage 5643 Apr 5 14:37 bash-4.0_p10-r1.ebuild
-rw-r--r-- 1 portage portage 6238 Apr 5 14:37 bash-4.0_p10.ebuild
-rw-r--r-- 1 portage portage 5648 Apr 14 05:52 bash-4.0_p17-r1.ebuild
-rw-r--r-- 1 portage portage 5532 Apr 8 18:21 bash-4.0_p17.ebuild
-rw-r--r-- 1 portage portage 5669 May 30 03:35 bash-4.0_p24.ebuild
-rw-r--r-- 1 root root 5668 Jul 25 09:43 bash-4.0_p28.ebuild
drwxr-xr-x 2 portage portage 2048 May 30 03:35 files
-rw-r--r-- 1 portage portage 468 Feb 9 04:35 metadata.xml
msf5@kali:~$ cd /usr/portage/app-shells/bash $ cat metadata.xml
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE pigmetadata SYSTEM "http://www.gentoo.org/dtd/metadata.dtd">
<pigmetadata>
  <herd>base-system</herd>
  <use>
    <flag name="bashlogger">Log RLL commands typed into bash; should ONLY be
    used in restricted environments such as honeypots</flag>
    <flag name="net">Enable /dev/tcp/host/port redirection</flag>
    <flag name="plugins">Add support for loading builtins at runtime via
    'enable'</flag>
  </use>
  <usefordev>
    <flag name="net">Enable /dev/tcp/host/port redirection</flag>
  </usefordev>
  <status> started
  <rsync src="http://www.gentoo.org/distfiles/bash-3.2_p39.tar.gz"
  <rsync src="http://www.gentoo.org/distfiles/bash-3.2_p40.tar.gz"
  <rsync src="http://www.gentoo.org/distfiles/bash-4.0_p10.tar.gz"
  <rsync src="http://www.gentoo.org/distfiles/bash-4.0_p17.tar.gz"
  <rsync src="http://www.gentoo.org/distfiles/bash-4.0_p24.tar.gz"
  <rsync src="http://www.gentoo.org/distfiles/bash-4.0_p28.tar.gz"
  </rsync>
  <version> 3.2_p39
  </version>
  <version> 3.2_p40
  </version>
  <version> 4.0_p10
  </version>
  <version> 4.0_p17
  </version>
  <version> 4.0_p24
  </version>
  <version> 4.0_p28
  </version>
  </pigmetadata>
msf5@kali:~$ cd /usr/portage/app-shells/bash $ sudo ./etc/init.d/bluetooth status
bluetooth status
bluetooth: started
msf5@kali:~$ cd /usr/portage/app-shells/bash $ ping -q -c 1 en.wikipedia.org
PING rr.esas.wiki.media.org (91.198.174.2) 56(84) bytes of data:
--- rr.esas.wiki.media.org ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 2ms
rtt min/avg/max/mdev = 49.628/49.620/49.620/0.000 ms
msf5@kali:~$ cd /usr/portage/app-shells/bash $ grep -r /dev/sda /etc/fstab | cut --fields=3
/dev/sda1 /boot
/dev/sda2 /
/dev/sda3
msf5@kali:~$ cd /usr/portage/app-shells/bash $ date
Sat Aug 0 02:42:24 MSD 2009
msf5@kali:~$ cd /usr/portage/app-shells/bash $ lsmod
Module Size Used by
rmdisk_uia 23424 0
rmdisk_host 6696 1 rmdisk_uia
cdc_ether 5672 1 rmdisk_host
usbnet 18688 3 rmdisk_uia,rmdisk_host,cdc_ether
parport_pc 38424 0
lpr 2388128 20
parport 39648 1 parport_pc
ltdc_virt 12272 0
ltdc_1981 4388 0
msf5@kali:~$ cd /usr/portage/app-shells/bash $
```

Types of shell

- There are several different shells available for Unix, the most popular are:

- ✓ Bourne shell (sh) ← original one
- ✓ C shell (csh)
- ✓ TC shell (tcsh)
- ✓ Korn shell (ksh)
- ✓ Bourne Again SHell (bash) ← most popular one

- Summary of features:

	Bourne	C	TC	Korn	BASH
command history	No	Yes	Yes	Yes	Yes
command alias	No	Yes	Yes	Yes	Yes
shell scripts	Yes	Yes	Yes	Yes	Yes
filename completion	No	Yes *	Yes	Yes *	Yes
command line editing	No	No	Yes	Yes *	Yes
job control	No	Yes	Yes	Yes	Yes

* not the default setting for this shell

Exercise 1

- Open a terminal (a.k.a shell) and figure out what type of shell you have
- Solution:
 - ✓ In Mac OS X:
 - 1) Open Applications >> Utilities subfolder >> Terminalor
 - 1) Open Applications >> Terminal
 - 2) Type `echo $SHELL` and hit enter and check what you get
(NOTE: echo is a Unix command to print something into the screen)
- Recommended terminal for Mac OS X:

<http://www.terminal2.com>

Command prompt

- Prompts the user to take action

- ✓ Structure:

[illegible]

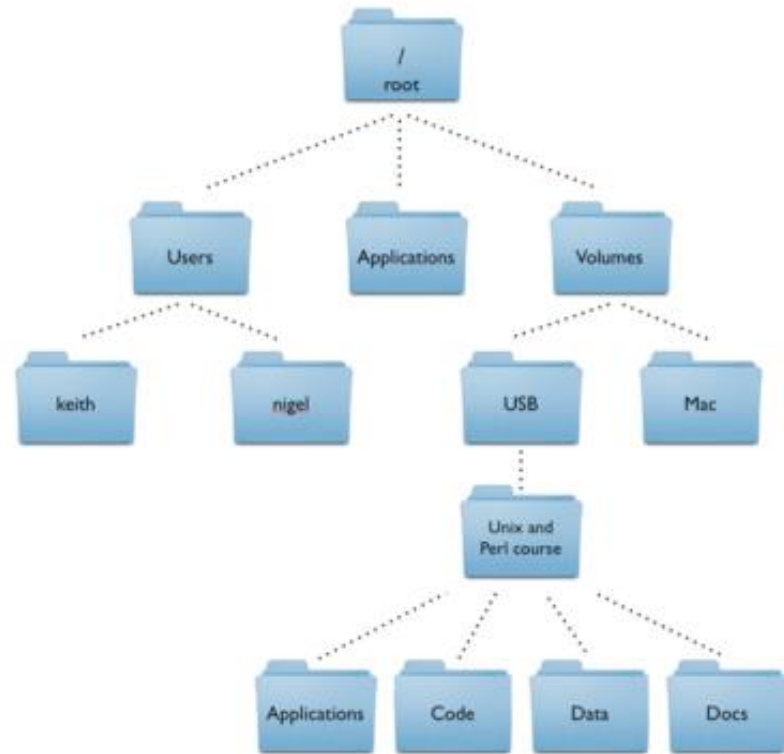
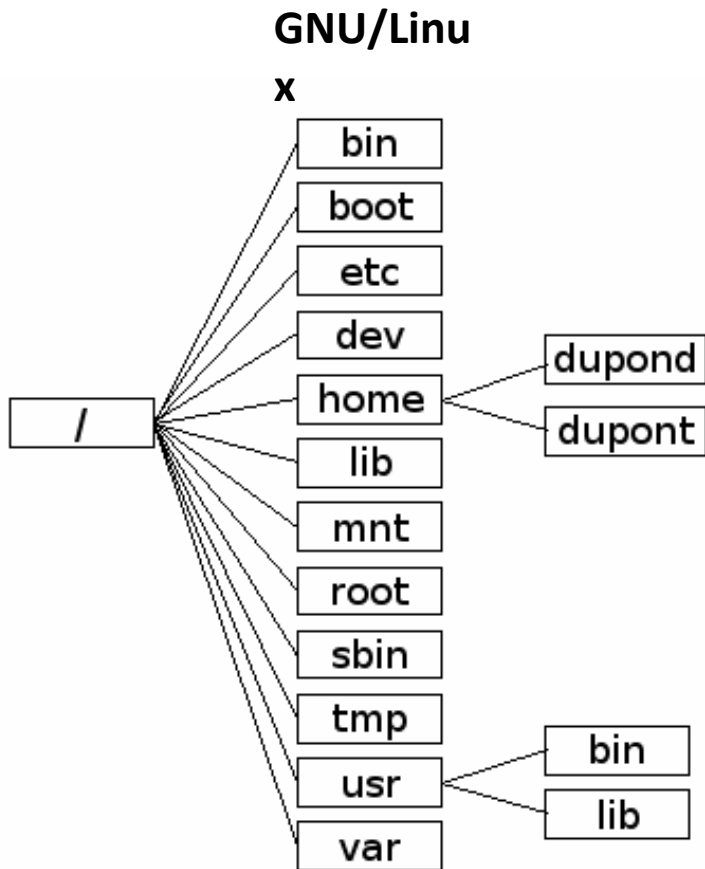
Command prompt

```
ernesto-lowys-MacBook-Pro:~ ernesto$
```

computer name user name

current dir name

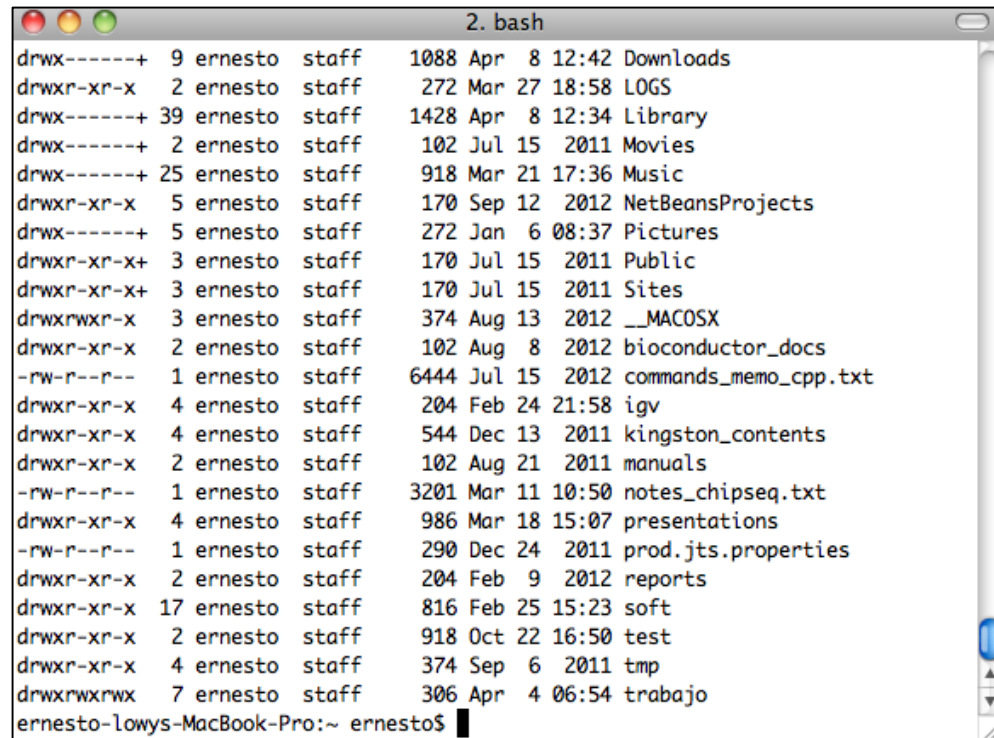
UNIX Directory tree



Mac OS X

Simple commands (I)

- ls (list the contents of a folder)
- Enter ls (what do you see?)
- Enter ls -l (what do you see?)

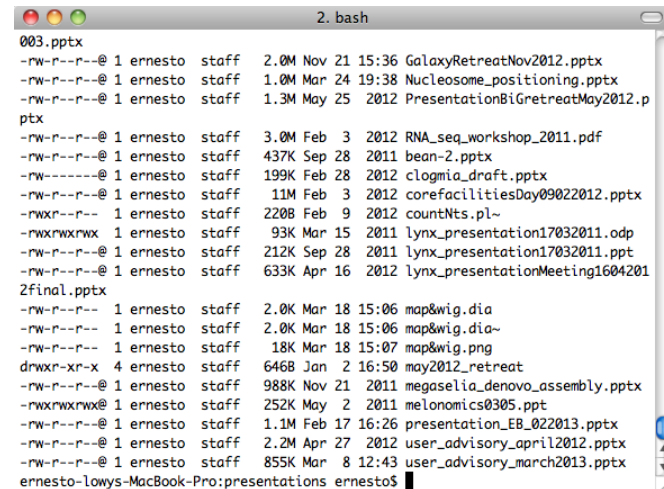


A terminal window titled "2. bash" showing the output of the `ls -l` command. The output lists files and directories with their permissions, owner, group, size, and date. The files are listed in descending order of size. The terminal window has a standard macOS-style title bar with red, yellow, and green buttons. The prompt at the bottom is `ernesto-lowys-MacBook-Pro:~ ernesto$`.

```
drwx-----+ 9 ernesto  staff   1088 Apr  8 12:42 Downloads
drwxr-xr-x   2 ernesto  staff    272 Mar 27 18:58 LOGS
drwx-----+ 39 ernesto  staff   1428 Apr  8 12:34 Library
drwx-----+ 2 ernesto  staff    102 Jul 15 2011 Movies
drwx-----+ 25 ernesto  staff    918 Mar 21 17:36 Music
drwxr-xr-x   5 ernesto  staff    170 Sep 12 2012 NetBeansProjects
drwx-----+ 5 ernesto  staff    272 Jan  6 08:37 Pictures
drwxr-xr-x+  3 ernesto  staff    170 Jul 15 2011 Public
drwxr-xr-x+  3 ernesto  staff    170 Jul 15 2011 Sites
drwxrwxr-x   3 ernesto  staff    374 Aug 13 2012 __MACOSX
drwxr-xr-x   2 ernesto  staff    102 Aug  8 2012 bioconductor_docs
-rw-r--r--   1 ernesto  staff   6444 Jul 15 2012 commands_memo_cpp.txt
drwxr-xr-x   4 ernesto  staff    204 Feb 24 21:58 igv
drwxr-xr-x   4 ernesto  staff    544 Dec 13 2011 kingston_contents
drwxr-xr-x   2 ernesto  staff    102 Aug 21 2011 manuals
-rw-r--r--   1 ernesto  staff   3201 Mar 11 10:50 notes_chipseq.txt
drwxr-xr-x   4 ernesto  staff    986 Mar 18 15:07 presentations
-rw-r--r--   1 ernesto  staff    290 Dec 24 2011 prod.jts.properties
drwxr-xr-x   2 ernesto  staff    204 Feb  9 2012 reports
drwxr-xr-x  17 ernesto  staff    816 Feb 25 15:23 soft
drwxr-xr-x   2 ernesto  staff    918 Oct 22 16:50 test
drwxr-xr-x   4 ernesto  staff    374 Sep  6 2011 tmp
drwxrwxrwx   7 ernesto  staff    306 Apr  4 06:54 trabajo
ernesto-lowys-MacBook-Pro:~ ernesto$
```

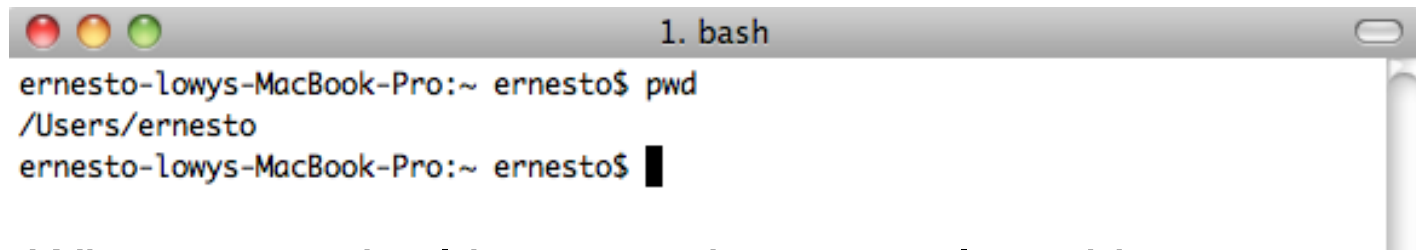
Simple commands (II)

- `ls -lh` (use unit suffixes)



```
2. bash
003.pptx
-rw-r--r--@ 1 ernesto  staff  2.0M Nov 21 15:36 GalaxyRetreatNov2012.pptx
-rw-r--r--@ 1 ernesto  staff  1.0M Mar 24 19:38 Nucleosome_positioning.pptx
-rw-r--r--@ 1 ernesto  staff  1.3M May 25 2012 PresentationBigRetreatMay2012.p
ptx
-rw-r--r--@ 1 ernesto  staff  3.0M Feb 3 2012 RNA_seq_workshop_2011.pdf
-rw-r--r--@ 1 ernesto  staff  437K Sep 28 2011 bean-2.pptx
-rw-----@ 1 ernesto  staff  199K Feb 28 2012 clogmia_draft.pptx
-rw-r--r--@ 1 ernesto  staff  11M Feb 3 2012 corefacilitiesDay09022012.pptx
-rwxr--r-- 1 ernesto  staff  220B Feb 9 2012 countNts.pl~
-rwxrwxrwx 1 ernesto  staff  93K Mar 15 2011 lynx_presentation17032011.odp
-rw-r--r--@ 1 ernesto  staff  212K Sep 28 2011 lynx_presentation17032011.ppt
-rw-r--r--@ 1 ernesto  staff  633K Apr 16 2012 lynx_presentationMeeting1604201
2final.pptx
-rw-r--r-- 1 ernesto  staff  2.0K Mar 18 15:06 map&wig.dia
-rw-r--r-- 1 ernesto  staff  2.0K Mar 18 15:06 map&wig.dia~
-rw-r--r-- 1 ernesto  staff  18K Mar 18 15:07 map&wig.png
drwxr-xr-x 4 ernesto  staff  646B Jan 2 16:50 may2012_retreat
-rw-r--r--@ 1 ernesto  staff  988K Nov 21 2011 megaselia_denovo_assembly.pptx
-rwxrwxrwx 1 ernesto  staff  252K May 2 2011 melonomics0305.ppt
-rw-r--r--@ 1 ernesto  staff  1.1M Feb 17 16:26 presentation_EB_022013.pptx
-rw-r--r--@ 1 ernesto  staff  2.2M Apr 27 2012 user_advisory_april2012.pptx
-rw-r--r--@ 1 ernesto  staff  855K Mar 8 12:43 user_advisory_march2013.pptx
ernesto-lowys-MacBook-Pro:presentations ernesto$
```

- `pwd` (where am I)



```
1. bash
ernesto-lowys-MacBook-Pro:~ ernesto$ pwd
/Users/ernesto
ernesto-lowys-MacBook-Pro:~ ernesto$
```

- When a terminal is opened we are placed into our home folder

Simple commands (III)

- cd (Change Directory)
- Move into the Desktop/ folder

- 1) Change into the Desktop folder (try the autocompletion resource)
\$ cd /Users/ernesto/Desktop
 - 2) Check that you are there
\$ pwd
 - 3) See what are the contents of the Desktop folder
\$ ls
 - 4) The . (dot) is the symbol used to represent the current working directory
\$ ls .
- Go 'upwards' one level so we reach the home folder
\$ cd /Users/ernesto/
or
\$ cd ../
- 1) Check that you are there
\$ pwd
- Move around your file system and then
 - 1) Come back home
\$ cd

Simple commands (IV)

- List the files one level up in the file hierarchy

```
$ cd
```

```
$ ls ../
```

- mkdir (create a directory)

- 1) Go home

```
$ cd
```

- 2) Create a directory named 'Course' (Case matters!)

```
$ mkdir Course
```

```
$ cd Course
```

```
$ pwd
```

- 3) Create a subdirectory named 'subCourse'

```
$ mkdir subCourse
```

```
$ cd subCourse
```

- rmdir (delete one directory)

```
$ rmdir subCourse
```

```
$ ls
```



Simple commands (V)

- touch (create an empty file)

```
$ cd  
$ touch example1.txt  
$ touch example2.txt  
$ ls
```

- mv (move one file from one point to another)

```
$ mv example1.txt Course/  
$ mv example2.txt Course/
```

- mv (rename a file)

```
$ cd Course  
$ mv example1.txt example3.txt
```

- rm (delete a file) Most dangerous command!!!

```
$ rm example3.txt
```



Simple commands (VI)

- cp (copy files)

- 1) Copy example1.txt one level up into the file hierarchy

```
$ cp example1.txt ../
```

- 2) Create an identical copy of example1.txt named example2.txt

```
$ cp example1.txt example2.txt
```

- man (getting help)

```
$ man ls
```

```
$ man cp
```

- 1) Once within man you can:

- ✓ Scroll down by pressing space
- ✓ Go back by pressing b
- ✓ Quit by pressing q

WISHING YOU ALL THE
GOOD LUCK

IN THE WORLD!

Dr. Hatem Hassanin

