

Introduction to Unix

Spring 2022

Operating System

- ◇: Software that goes-in-between user(s) + hardware
- ◇: Objective
 - ▶ Using a computing system without much hassle
 - ▶ Efficient use of the hardware
- ◇: Continual Resource Management
 - ▶ Central Processor Units (CPUs)
 - ▶ Short-term, volatile, main memory
 - ▶ Secondary or long term memory including disks, flash memories.
 - ▶ I/O devices including Network Interface Cards - NICs

UNIX OS

- ▶ Late sixties at Bell Laboratories (mostly written in assembly).
- ▶ Early seventies the system was re-written using C.
- ▶ Many changes since that time:
 1. Major revision by UC-Berkeley (in the 80s)
 2. Redevelopment for SPARCprocs by SUN Micro—*Solaris* (90s)
 3. Release of `LINUX` and ongoing development (90s, 00s and 10s)
- ▶ Unix/`LINUX` (in various versions and releases) are now used not only in servers but also in workstations, PCs, Tablets and devices.
- ▶ If you do not have it in your own machine, *get it now!*

How to Obtain LINUX/Unix?

There are 3 ways:

- ▶ *Virtualization*: from the OS of your choice install LINUX using a virtualization tool such as *Virtual Box* or *VM Player*.
- ▶ *Dual Boot*: chop a portion of your disk (possibly with *gparted*) and install LINUX on the second partition (while maintaining your initial installation).
- ▶ *The h@ck3r Way*: erase everything you have on your machine and install LINUX. Then, proceed to re-install any other OS you may want with LINUX using *Virtual Box* or *VM Player*.
- ▶ *Web Sources*:
 - *Virtual Box* and
 - *VM Player*.

Fundamental Characteristics of Unix

- ▶ Multiple Users Simultaneously
- ▶ Multi-tasking, concurrent processes, time-sharing
- ▶ Security mechanisms
- ▶ Networking support
- ▶ Monolithic structure:
 1. Kernel
 2. Shells (c, bash, bourne, korn, t, etc.)
 3. System Programs
- ▶ *System Calls* allow interaction with kernel services in terms of C functions.
- ▶ Scripting capabilities: one can “program” the shell.

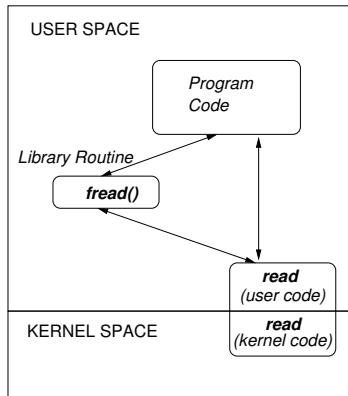
System Calls and Library Routines

- ▶ library call:

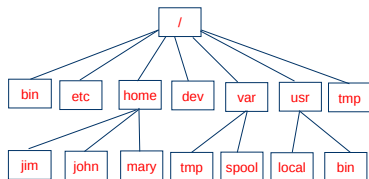
```
nread = fread(unputbuff, OBJSIZE, numberobjs, fileprt);
```

- ▶ low-level system call:

```
nread = read(filedes, inputbuf, BUFSIZE);
```



Unix File System (UFS) – Hierarchical Logical Structure



- ▶ Root directory (/)
- ▶ Current directory (./)
- ▶ Parent directory (/..)
- ▶ Absolute and relative Paths
- ▶ Files and Links
- ▶ Devices

User Account

- ▶ User name (*userid*) and password (*pass*)
- ▶ Shell is available as soon as a user gets authorized
- ▶ User groups (*users, group, others*)
- ▶ (Initial) Working directory

```
antoulas@sazerac's password:
Linux sazerac 2.6.24-23-generic #1 SMP Mon Jan 26 00:13:11 UTC 2009 i686

The programs included with the Ubuntu system are free software; the exact
distribution terms for each program are described in the individual files
in /usr/share/doc/*/copyright.
Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by applicable
law.

To access official Ubuntu documentation, please visit: http://help.ubuntu.com/
Last login: Mon Jan 7 01:25:54 2008
antoulas@sazerac:~$
```


Basic Commands in Unix

man	display manual page
ls	listing of the current dir
pwd	print working directory
cd	change current directory to
mkdir	create a new directory
rmdir	purge an existing directory
cp	copy a file/directory
mv	move a file/directory to
rm	remove a file/directory
cat	display content of a file
lpr	print out a file
vi	tty text editor

The “man” command

```
antoulas@sazerac:~/set001$ man pwd
PWD(1)                                User Commands                                PWD(1)

NAME
  pwd - print name of current/working directory

SYNOPSIS
  pwd [OPTION]...

DESCRIPTION
  Print the full filename of the current working directory.
  -L, --logical
        use PWD from environment, even if it contains symlinks
  -P, --physical
        avoid all symlinks
  --help display this help and exit
  --version
        output version information and exit

NOTE: your shell may have its own version of pwd, which usually super
sedes the version described here. Please refer to your shell's docu
mentation for details about the options it supports.

AUTHOR
  Written by Jim Meyering.
```

The “man” command

REPORTING BUGS

Report pwd bugs to bug-coreutils@gnu.org
GNU coreutils home page: <http://www.gnu.org/software/coreutils/>
General help using GNU software: <http://www.gnu.org/gethelp/>

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GPL version 3 or later <http://gnu.org/licenses/gpl.html>.
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SEE ALSO

`getcwd(3)`
The full documentation for pwd is maintained as a Texinfo manual. If
the info and pwd programs are properly installed at your site, the com
mand
`info coreutils 'pwd invocation'`
should give you access to the complete manual.

GNU coreutils 7.4

October 2009

PWD(1)

The “man -k” command

```
antoulas@sazerac:~/set001$ man -k mar
amarok (1) - The audio player for KDE
amarokcollectionscanner (1) - Collection Scanner for Amarok
amarokmp3tunesharmonydaemon (1) - Handles AutoSync for the MP3Tunes service i...
apt-mark (8) - mark/unmark a package as being automatically-installed
Glib::BookmarkFile (3pm) - Parser for bookmark files
Glib::Markup (3pm) - Wrapper for markup handling functions in GLib
ispell-wrapper (1) - smart wrapper for ispell
kbookmarkmerger (1) - A program for merging a given set of bookmarks into th...
mbadbblocks (1) - tests a floppy disk, and marks the bad blocks in the FAT
pbntonokia (1) - convert a portable bitmap to Nokia Smart Messaging For...
pnarith (1) - perform arithmetic on two portable anymaps
pnmmargin (1) - add a border to a portable anymap
sane-lexmark (5) - SANE backend for Lexmark X1100/X1200 Series scanners
sane-tamarack (5) - SANE backend for Tamarack flatbed scanners
sk98lin (4) - Marvell/SysKonnect Gigabit Ethernet driver v6.21
socketmark (3) - determine whether socket is at out-of-band mark
time (1) - run programs and summarize system resource usage
Xmark (1) - summarize x11perf results
antoulas@sazerac:~/set001$
antoulas@sazerac:~/set001$ apropos amarok
amarok (1) - The audio player for KDE
amarokcollectionscanner (1) - Collection Scanner for Amarok
amarokmp3tunesharmonydaemon (1) - Handles AutoSync for the MP3Tunes service i...
antoulas@sazerac:~/set001$
```

Command “ls” (-a -l -r)

```

antoulas@sazerac:~/set001/Samples$ ls
aaa  bbbb  Set-01.ppt  zzz
antoulas@sazerac:~/set001/Samples$ ls -a
.  ..  aaa  bbbb  .getout  .myprofile  Set-01.ppt  zzz
antoulas@sazerac:~/set001/Samples$ ls -ls
total 10348
  4 -rw-r--r--  1 antoulas  _developer           15 2010-02-15 22:45 aaa
  4 -rw-r--r--  1 antoulas  _developer          1200 2010-02-15 22:48 bbbb
10336 -rw-----  1 antoulas  _developer 10583040 2010-02-15 22:49 Set-01.ppt
  4 -rw-r--r--  1 antoulas  _developer           72 2010-02-15 22:45 zzz
antoulas@sazerac:~/set001/Samples$ ls -lsr
total 10348
  4 -rw-r--r--  1 antoulas  _developer           72 2010-02-15 22:45 zzz
10336 -rw-----  1 antoulas  _developer 10583040 2010-02-15 22:49 Set-01.ppt
  4 -rw-r--r--  1 antoulas  _developer          1200 2010-02-15 22:48 bbbb
  4 -rw-r--r--  1 antoulas  _developer           15 2010-02-15 22:45 aaa
antoulas@sazerac:~/set001/Samples$

```

File that is “interpreted” when the shell starts:

- ▶ bash \implies .bashrc/.bash_profile/.profile
- ▶ csh \implies .cshrc
- ▶ tcsh \implies .tcshrc
- ▶

Access Rights

- ▶ Every file/catalog belongs to the user that has created it.
- ▶ Every user belongs to at least one group (*postgrads*, *undergrads*, *dep*, *users*, etc)
- ▶ Every file is named with at 10 characters
 - ▶ - `rWX r-X r-X`
user group others
 - ▶ 1st character is either "d" (directory) or "-" (file)
 - ▶ Three groups of characters — read/write/execute options

Permission Rules for files/directories

	File	Directory
r	Read or Copy a file	Read content in directory
w	Change or delete a file	Add or delete entries (files) in directory using commands
x	Run executable file	Reference or move to directory (without seeing names of other files)

Command “ls” (-d -R -t)

```
pubsrv1:/tmp>ls
hsperfdata_reserv  junk                output26675        sh5720
hsperfdata_root   mysql.sock          output26935
pubsrv1:/tmp>ls -d junk
junk
pubsrv1:/tmp>ls -dl junk
drwx-----  2 antoulas other          238 Feb 16 00:07 junk
pubsrv1:/tmp>ls -R junk/
junk/:
aaa  bbbb
pubsrv1:/tmp>ls -lsRa junk/
junk/:
total 64
 16 drwx-----  2 antoulas other          238 Feb 16 00:07 .
 16 drwxrwxrwt   5 root      sys           590 Feb 16 00:45 ..
 16 -rw-----   1 antoulas other           16 Feb 16 00:07 aaa
 16 -rw-----   1 antoulas other           59 Feb 16 00:07 bbbb
```

- ▶ *Sticky bit*: When the sticky bit is set, only the file's owner, the directory's owner, or the superuser can rename or delete items in question.

Command "ls" (-d -R -t)

```
pubsrv1:/tmp>ls -ltR
.:
total 64
drwx-----  2 antoulas  other          238 Feb 16 00:07 junk
drwxr-xr-x   2 root      root           117 Feb 15 02:24 hsperfddata_root
-rw-r--r--   1 vfisikop  doctoral       0 Jan 27 14:29 output26935
-rw-r--r--   1 vfisikop  doctoral       0 Jan 27 14:27 output26675
drwxr-xr-x   2 reserv   other          177 Jan 24 16:22 hsperfddata_reserv
srwxrwxrwx   1 mysql     mysql         0 Jan 24 16:22 mysql.sock
-rw-----   1 root      root           849 Jan 24 16:22 sh5720

./junk:
total 32
-rw-----   1 antoulas  other          59 Feb 16 00:07 bbbb
-rw-----   1 antoulas  other          16 Feb 16 00:07 aaa

./hsperfddata_root:
total 0

./hsperfddata_reserv:
total 64
-rw-----   1 reserv   other          32768 Feb 14 16:58 611
pubsrv1:/tmp>
```