CA170: Week 4

More Unix

Pipes and redirections

- Very powerful features.
- Pipes - Send output of one program to input of other.
    - e.g. Search for all lines in the file that contain "DCU" in any case, except those containing "Computing" in any case, and sort the remaining lines:

```
cat file | grep -i dcu | grep -iv computing | sort
```

- Backquotes - Capture the output of a program as a string:
- `echo Current directory is `pwd` and date is `date``
- Redirection - Read input from a file, send output to a file.

```
prog < inputfile > outputfile

cat file | grep -i student > studentlist
cat file | grep -i staff   > stafflist
```

- All these are the same:

```
grep string file
grep string < file
cat file | grep string
```

- Append:

```
cat morestuff >> studentlist
```

- Unix pipeline - link in notes

Filename completion

- Start typing filename, hit special key to complete it.
- Linux - Tab
    - If typing command - will search whole PATH for matches
    - If just listing a file - will only search current dir
    - If more than one choice - hit Tab twice to show
- Solaris - Esc

Processes

```
ps                      See what processes are running
kill (process id)       Terminate some of your processes
kill -KILL (pid)        Definite kill
kill -1                 Kill all my processes

PPID              parent process of this process
```

- ps (see man) - link in notes
- kill (see man) - link in notes

```
xkill &                 Kill the next thing I click on

nice              Run something at low priority deliberately
time              Time a run of some program
```

- xkill (see man) - link in notes
- killall (see man) - link in notes

- Display of processes
  - Linux command line
    - top (see man) - link in notes
  - Linux GUI:
    - Computer - System Monitor
  - Windows: Task Manager
  - Explanation of some of the data returned: - links to these in notes
    - paging and swapping
    - Threads
    - GDI objects (Windows only)
  -

ps in DCU

1. Normal login in DCU labs:
   - You each have your own CPU and memory, sharing a central filesystem.
   - "ps" will show that the only processes running on the machine are yours and the Operating System's.
   - `ps -Tf`
     `-T  associated with this terminal`
     `-f  full details`
   - `ps -u $USER -f`
     `-u $USER  associated with this user`
   - `ps -u $USER -o user,pid,ppid,comm,args`
     `-o  Show these fields`
2. If doing ssh to `student.computing.dcu.ie`:
   - Possibly shared CPU with other users.
   - `student.computing.dcu.ie` is a Linux cluster, so some users have their own CPU, others are on shared CPUs, by chance. - link in notes
   - To see other people's processes:
     `ps -Af`

     `-A  all processes`

Interrupts

- Usage seems to vary on different variants of UNIX and Linux. You may get something like:

```
Ctrl-S                  Pause
Ctrl-C                  Interrupt
Ctrl-D                  Kill, Logout

Ctrl-Z                  EOF

q           exit man, more
```

Command line philosophy

- A computer for programmers.
- Unix philosophy
- Provide lots of tools. String together tools with Shell logic, pipes, redirection.
- If tools cannot do it alone, you can assemble a program to do it. "Program" may be just one line long.
- all lower case - fast typing, don't have to hit Shift key
- short command names - fast typing
- Silence, "low-noise environment".
- rm all my files, and it just does it. Doesn't even display a message saying they have been removed.
- Note that backquotes would be useless if all programs displayed lots of informational messages as they executed.
- Often an explicit `prog -v` "verbose" option if you want to see informational messages as it executes. But this is normally not the default.

GUI Philosophy

- A computer for non-programmers.
- (Or for a thing you want to do now for which a command-based approach is not appropriate.)
- If it is not in the pre-defined tasks and menus, then you can't do it. You cannot assemble a program to do it.
- High-noise. - rm all my files - dialog box comes up. Are you sure? OK.
    - This dialog makes no sense in Unix - where a program, not a human user, might be issuing the command to rm files.
- Note that user interface people say these dialogs are often ignored.
- From Donald Norman, The Psychology of Everyday Things, 1988, Ch.5: - link in notes

```
Human - Delete all my most important files.
System - Are you sure?
Human - Yes Yes.
System - Are you really sure?
Human - Yes Yes.
System - All your most important files deleted.
Human - Oh damnit.
```

- Compare with Unix

```
Human - Delete all my most important files.
System - (Silence.)
Human - Oh damnit.
```

Command line on Mac/Windows

- Windows always had DOS command-line, and still does.
- But for many years it was neglected, not as powerful as UNIX command-line.
- People who liked command lines tended to migrate to UNIX/Linux.
- Recently, though, more powerful command shells have been introduced on Windows.
- And now, Linux shell on Windows.
- Mac for years had no command-line at all.
- But now has UNIX command-line.
- Typical modern Mac has powerful UNIX command-line with bash, csh

Notes on File Protection

File Protection

- "ls -l" shows something like:

```
-rwxr-xr-- 1 userid  groupid  153 Nov  6 2008 filename

-     file (d for directory, l for link/shortcut)
rwx   User (u) can read,write,execute.
r-x   Other members of group (g) can read,execute only.
r--   Other people (o) can read only.


set via the "chmod" command.
see "man chmod"


    user      group      other
 [ ][ ][ ]  [ ][ ][ ]  [ ][ ][ ]

r - read
w - write
x - execute
```

- e.g. user can do everything, group/others can do nothing:

```
chmod u+rwx,go-rwx file
```

- result:

```
-rwx------ 1 userid groupid 153 Nov 6 2008 filename
```

- There is also a number that corresponds to each permission setting:
  - chmod converter (and search for more) - more in notes
- Default permissions for new files: umask

User bits

- Note if turned off, user has power to turn them on any time.
- So these can only be for some kind of temporary self-check.

[r][w][-]	Don't execute by accident. Because UNIX will try to execute any text file as shell script if name is typed. e.g. text files, web pages
[r][-][x]	write-protect for safety annoying?
[r][-][-]	both of above
[r][w][x]	normal

group/other bits

[r][w][x] [r][w][-]	Shared writable file
[r][-][x] [r][-][-]	Shared read-only file
[-][-][-]	Normal - Hidden from others

Minimum Needed for Web Files

- (Web server is "other".)

```
Web pages need r:
 -rwx---r--
PHP scripts only need r, not x:
 -rwx---r--
```

Notes on Directory Protections

```
    user       group       other
 [ ][ ][ ]   [ ][ ][ ]   [ ][ ][ ]

r - read (can do ls)
w - write
x - search (can access files given their name)
```

User bits

- Note if turned off, user has power to turn them on any time.

[r][-][x]	write-protect for safety annoying?
[r][w][x]	normal

group/other bits

[r][w][x]	shared writable directory can create/delete files
[r][-][x]	shared read-only directory can do ls
[-][-][x]	shared read-only dir can't do ls can access file if know its name can't explore without filenames Example: "share" in my home dir. You just need to know this dir exists. Example: web dir Can only browse named files. The names are *in the links*. The site advertises a starting point (a web page from which all other web pages can be found by following links).
[-][-][-]	normal - hidden

-

Raw listing of files on web servers

- It used to be that we could demo the difference between r and x for web directories.
- In my web dir:

```
drwx---r-x    readabledir
drwx-----x    executabledir
```

- readabledir/file.html - link in notes
- executabledir/file.html - link in notes
- executabledir - index.html does not exist, so it just returns error. - link in notes
- readabledir - index.html does not exist, but dir is readable, so what it used to do is return a raw listing of files. - link in notes

Raw listing of files is now turned off

- The above (raw listing of files) does not work any more on student.computing.dcu.ie.
- On Apache, the behaviour of listing directory contents or not can be controlled with `Options +Indexes` (or `Options -Indexes`) in .htaccess files.
- It is now turned off.

Minimum needed for web directories

- (Web server is "other".)

```
drwx-----x
```