



UNIX & Linux commands (Part A)

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Linux install

- ❖ Many possibilities exist to setup a UNIX-like (Linux) environment
- ❖ Among the most popular
 - Cygwin
 - Visit www.cygwin.com
 - Collection of tools that provide a Linux environment in Windows
 - Provides the main UNIX functions
 - Integrates with Windows
 - Far better command window than the standard Windows `command.com`
 - Free software

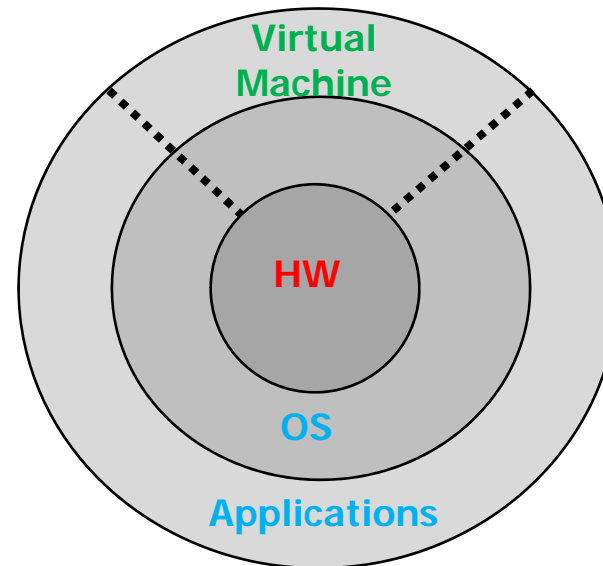
Linux install

➤ Linux LIVE versions

- LIVE CD o LIVE USB versions
- Exec Linux from CD or USB-pen
- Reduced functions

➤ Virtual Machine

- Is an emulation of a given computer system.
 - Virtualbox
 - Qemu
 - VMWare (Oracle VM)



Linux install

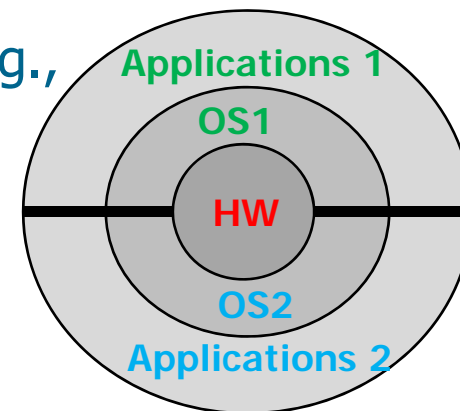
➤ Multi-boot

- It is necessary disc partitioning
- Different partitions for different OSs
- A boot-loader
 - LILO o **GRUB** in GNU Linux
 - NTLDR in Windows NT

allows selecting which OS to boot

❖ For more detailed information

- See common Linux distributions, e.g., Ubuntu (for desktop, 32 or 64 bit)
 - <http://www.ubuntu.com/>



Session

❖ Session opening

- login: <username>
- password: <password>

Linux is case
sensitive

❖ Remote connection

- ssh <username@hostname> (command line interface)
 - putty (graphical interface)
- both use a secure encrypted connection protocol.

❖ Session termination

- exit
- logout
- ctrl-d

Help manual

❖ All commands are documented in manual pages

- `man <command>`

➤ Related commands

- `apropos <command>`
- `whatis < command >`
- `whereis < command >`

❖ Available

- Automatic command completion (Tab)
- Up-down arrows for retrieving previously submitted commands

Commands

❖ Unix-like command syntax

`command [options] [arguments]`

-char or --string

❖ Command parsing

- Long commands can be continued on the next line using `'\'` as the last character of the current line
- Two or more commands can be given on the same line, separated by `';'`
 - `command1 ; command2 ; ...`
 - Commands on the same line are executed **sequentially**

Filenames

- ❖ A filename can include any character sequence
 - Some characters should not be used
`/ \ " ' * ; ? [] () ~ ! $ { } < > # @ & |`
 - Formally a file has not extension and version
 - Some meaningful extension are often used
`.c, .f, .p, .o, .a, .so, a.out, core`
- ❖ A filename beginning by `'.'` corresponds to an **hidden** file, i.e., a file that is not normally visible listing the content of a directory

File-system

❖ The Linux filesystem is

➤ Hierarchic

➤ Organized by means of tree directories

- The root tree directory is ' / ' (slash)
 - The current directory is indicated by ' . ' (dot)
 - The current directory is indicated by ' . ' (dot dot)
 - Directories are separated by means of a ' / ' (slash)
- Uniform notation (discs, directories, files, special files, ...)

Path

❖ A file is specified by its pathname

➤ Absolute pathname

- From the filesystem root
- `/dir1/dir2/file`

➤ Relative pathname

- From the current working directory
- `./subdir1/subdir2/file`
- `subdir1/subdir2/file`

- ❖ Command **ls** provides information about a file according to the specified options. If pathname is a directory, **ls** lists the files and subdirectories contained in that directory

ls [-options] [file ...]

➤ Options

- -a Shows also hidden files ('.' filenames)
- -l Long list (extended output)
- -g Included group info
- -t Sort files by date
- -r Reverse order (alphabetic/date)
- -R Recursive (includes files in subdirectories)

Example

```
$ ls -la
total 72
drwxr-xr-x  8 user1 group1 4096 Oct  7  2013 .
drwxr-xr-x 34 user1 group1 4096 Oct  3 12:37 ..
drwxr-xr-x  2 user1 group1 4096 Oct 15  2009 file
-rw-r--r--  1 user1 group1 17715 Oct  7  2013 index.htm
drwxr-xr-x  2 user1 group1 4096 Mar 22  2013 misc
drwxr-xr-x  2 user1 group1 4096 Jun 25  2009 paper
drwxr-xr-x  3 user1 group1 4096 May 30  2012 research
-rw-r--r--  1 user1 group1 18074 Apr 28  2005 stq.jpg
drwxr-xr-x 10 user1 group1 4096 Jun  5 14:56 teaching
drwxr-xr-x  2 user1 group1 4096 Jun  2 20:49 tmp
```

Example

Total Number of Blocks (default size 1024 bytes)		User (owner) name		Owner group		Entry name	
\$ ls -la							
total 72							
drwxr-xr-x	8	user1	group1	4096	Oct	7	2013 .
drwxr-xr-x	34	user1	group1	4096	Oct	3	12: 37 ..
drwxr-xr-x	2	user1	group1	4096	Oct	15	2009 file
-rw-r--r--	1	user1	group1	17715	Oct	7	2013 index.htm
drwxr-xr-x	2	user1	group1	4096	Mar	22	2013 mi sc
drwxr-xr-x	2	user1	group1	4096	Jun	25	2009 paper
drwxr-xr-x	3	user1	group1	4096	May	30	2012 research
-rw-r--r--	1	user1	group1	18074	Apr	28	2005 stq.jpg
drwxr-xr-x	10	user1	group1	4096	Jun	5	14: 56 teachi ng
drwxr-xr-x	2	user1	group1	4096	Jun	2	20: 49 tmp
Type & permissions	Number of links		Size (in byte)		Last modification date		

Example

File type

- Normal file
d Directory
s Socket file
l Link file

Three users types

u	user	(owner)
g	group	
o	others	other users

```
...  
-rw-r--r-- 1 user1 group1 17715 Oct 7 2013 index.htm  
drwxr-xr-x 2 user1 group1 4096 Mar 22 2013 mi sc  
...
```

Three base permissions

r	read
w	write
x	execute

Example

Permission can be defined as an octal value

rwX rwX rwX	→	777
rw- rw- rw-	→	666
rwX --X ---	→	710

```
...  
-rw-r--r-- 1 user1 group 17715 Oct 7 2013 index.htm  
drwxr-xr-x 2 user1 group 14096 Mar 22 2013 misc  
...
```

Alternatively by means of

- a letter: u(ser), g(roup), o(ther), a(ll)
- a symbol: +, -, = (add, subtract, untouched)
- a character: r, w, x (read, write, execute)

Regular file management

❖ Copy

- `cp [-fir] src1 src2 ... dest`

❖ Remove

- `rm [-fir] file1 file2 ...`

❖ Move (rename)

- `mv [-fi] file1 file2 ... dest`

-f = -force
-i = --interactive
-r = -R = --recursive

❖ Options

- -f does not ask confirmation (force)
- -i ask confirmation for each file (interactive)
- -r Apply command recursively on all the subdirectory files

❖ Directories can often be managed as regular files

Directory management

- ❖ Change current directory
 - `cd dir`
- ❖ Print working directory
 - `pwd`
- ❖ Create a directory
 - `mkdir dir`
- ❖ Remove a directory
 - `rmdir dir`
 - A directory can be removed only if it is empty, unless the options `-rf` are used with command
 - `rm -rf dir`

force recursive

Permissions for directories

- ❖ The meaning of the permission characters is different for directories.
 - r Directory content can be **listed**
 - w **Create, rename, or delete** files within the directory, and modify the directory's attributes only **IFF the execute bit is set.**
 - x Directory can be **crossed** or **cd** can be performed

Permission management

- ❖ It is possible to change file permissions
 - `chmod [-R] permissions file`
- ❖ Permissions can be specified in different ways
 - Absolute, by means of three octal digits
 - `chmod 775 filename`
 - Symbolic, by means of a string of three (or more) characters
 - `chmod g+r filename`
 - `chmod +x filename`
 - `chmod uo+rx filename`

Permission management

- ❖ Changing the owner of a directory entry
 - `chown [-R] user entry`
- ❖ Changing the group of a directory entry
 - `chgrp [-R] group entry`
- ❖ These command can be combined
 - `chown [-R] user[:group] entry`
 - `chown [-R] uid[:gid] entry`
- Options
 - `-R` Performed recursively on all entries of the directory tree

Output the content of a file

❖ Output and concatenate files

- `cat filename1 filename2 ...`

❖ Output the first **n** lines of a file

- `head [-n] filename ...`

❖ Output the last **n** lines of a file

- `tail [-n] [+n] [-r] [-f] filename ...`

➤ Options

- `-n` last n lines
- `+n` all excluding the first n lines
- `-r` lines are output in reverse order
- `-f` outputs appended data as the file grows

Output the content of a file

❖ Additional output commands

- pg filename ...
- more filename ...
- less filename ...

➤ Options

- | | |
|----------|--|
| ▪ space | Next page |
| ▪ return | Next line |
| ▪ b | Previous page |
| ▪ /str | Find next occurrence of string str |
| ▪ ?str | Find previous occurrence of string str |
| ▪ q | Quit |

File comparison

❖ Difference between two files

- `diff [-options] file1 file2`

➤ Lists the line number of the lines

- a added
- d deleted
- c changed

❖ Difference between two directories

- `diff [-options] dir1 dir2`

➤ Options

- -i case insensitive
- -w Ignores spaces
- -b Ignores spaces at EOL, merges the others

Counts

❖ Outputs the number of lines, words, and bytes of a file

- `wc [options] [file...]`

➤ Options

- `-l` Outputs only the number of lines
- `-w` Outputs only the number of words
- `-c` Outputs only the number of bytes

Warning: it also outputs the filename as its first line

Hard and Symbolic Links

❖ Link creation

- In [options] source [destination]

➤ Default behavior

- Creates a hard-link
- If the destination is not present, creates a link with the same filename on the working directory.

➤ Options

- -s Creates a symbolic link
- -f Force creation, removes file if already existent
- --help Displays help

Hard and Symbolic Links

➤ Examples

- `ln source alias`
- `ln -s /home/foo/tmp/bar.exe /mnt/foo/bin/`

Symbolic link, possibly to a file
in another filesystem

❖ Notice that

➤ Command **rm**

- Removes the data of a file only if its **link number is equal to 0**

➤ Command **mv**

- Performed as the sequence of commands **ln** followed by **rm**