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Introduction to Linux

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Unix / Linux OS

OS – operating system, a suite of programs which make the computer work

Unix – an operating system developed in 1960s, constant development. Unix has also a graphical user interface (**GUI**) similar to Microsoft Windows, however GUI is not always enough to operate smoothly and run jobs in particular.

Linux – a version of Unix (other versions: Mac OS, Sun Solaris)

Linux – **free and opensource** operating system released in 1991 by Linus Torvalds. More than 90% of today's 500 fastest supercomputers run some variant of Linux. **Very stable** DOS-like environment with GUI.

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Unix / Linux OS

Shell – command line interpreter

Filename Completion – by pressing the [**Tab**] key the filename (or command name) will be completed.

[up arrow] – by pressing the [**up arrow**] key the user will see previous commands.

history – by typing **history** at the shell the user will see all previous commends.

Useful links:

http://www.ee.surrey.ac.uk/Teachnig/Unix/inix8.html

http://linuxfordummies.org/8-free-linux-manualspdf-format/

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The “shell”

In UNIX/Linux, the program that interprets commands that are typed in the terminal window is referred to as a “shell”

Upon login, a “shell” is run within the terminal window.

Common shells are bash, tcsh, zsh

User accounts on the HPC machine use bash by default

The bash environment can be configured via two files:

`~/.bashrc` (used to execute commands upon login)

`~/.bash_profile` (can be used to set environment variables)

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The user

`whoami` - answers on question who am I?

`pwd` lists the **p**resent **w**orking **d**irectory

Useful when one navigates on a few machines simultaneously or uses a few usernames or has many terminals open

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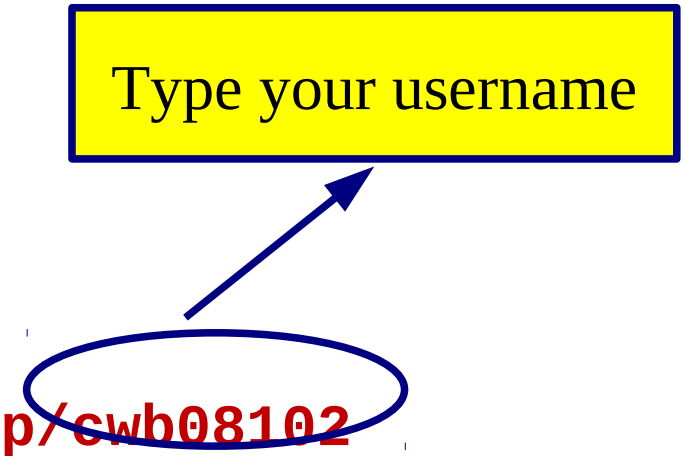
Home Directory & Changing Directories

Home Directory – the ‘default’ directory (folder) for a user’s account

cd - **c**hange **d**irectory

- **cd job-scripts**
- **cd ../NAMD**
- **cd ..**
- **cd /lustre/strath/temp/cwb08102**



cd with no argument takes the user to their home directory

Also, **~** represents the home directory, e.g.

- **cd ~**
- **cd ~/job-scripts**

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Listing Files & Directories

`ls` – **lis**ts the contents of a directory

- **`ls`** :on its own lists current directory
- **`ls ~`**
- **`ls /lustre/strath/physics/cwb089102`**

Variants:

- **`ls -a`** : lists hidden files and folders
- **`ls -l`** : long listing
- **`ll -t`** : long listing, files sorted by time

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ls -a

```
$   ls -a

.   .bash_history   .bash_profile  bin     job-scripts  .nedit       .zshrc
..  .bash_logout    .bashrc        .emacs  .mozilla     .Xauthority
```

Refers to parent directory

hidden file or folder

ls -l

```
$  ls -l

-rw-r--r-- 1 acs03114 user   524288000 Jan 28 15:01 bigfile.500M
drwxr-xr-x 3 acs03114 user        4096 Aug 17  2010 data
```

permissions user group size date/time name

d - directory

Permissions order: **user**---**group**---**others**---

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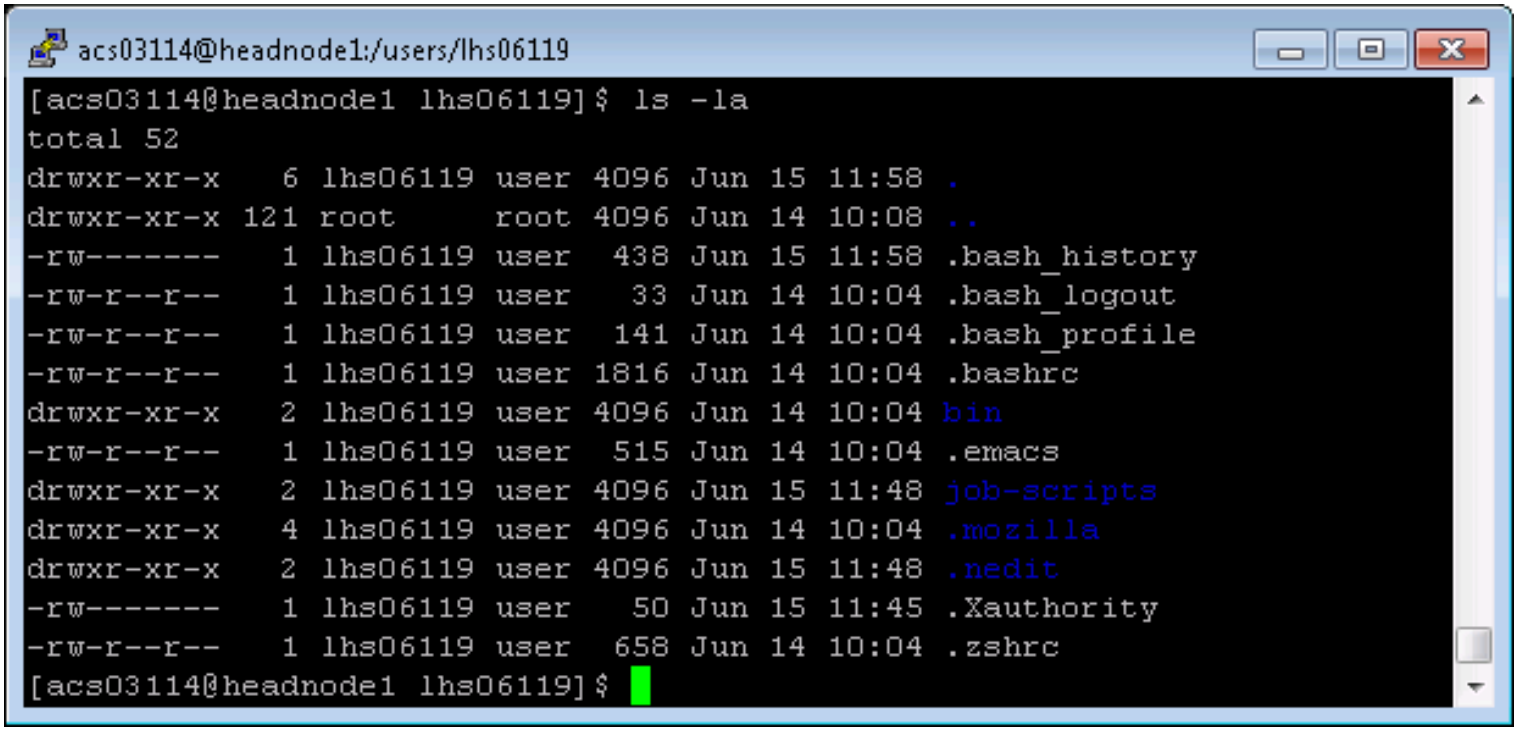
ls -al



Note: directories are coloured in this example.

sometimes they are denoted by a trailing / e.g. **directory/**

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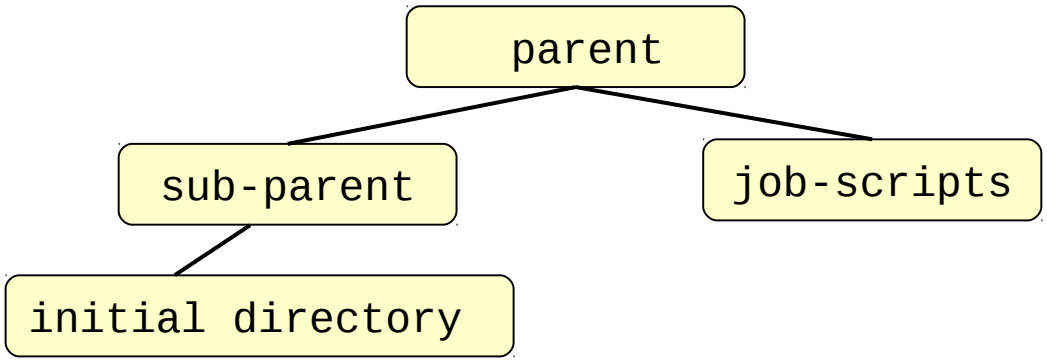
`..` (parent directory)

`cd ..` - changes to the parent directory

`cd ../..` - goes up two directory levels

`cd ../../job-scripts` - displayed below



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Creating & deleting directories/files

`mkdir` - **m**a**k**e **dir**ectory

`mkdir` ***`dir1`*** : creates a new (empty) directory (**m**a**k**e **dir**ectory)

`rmdir` ***`dir1`*** : deletes and empty directory (**r**e**m**ove **dir**ectory)

`rm` ***`file1`*** : removes (deletes) a file *file1*

`rm` ***`file1 file2 file3`*** : removes a list of files

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Creating & deleting directories/files

`rm file*` : achieves the same as the previous command **`*`** is a "wildcard". The shell 'expands' the wildcard and returns all filenames beginning with '**`file`**', **`?`** Replaces one character

`rm -rf dir1` : deletes a directory *dir1* and all of its contents

`-f` : ask no questions!'

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Copying files & directories

cp copy

`cp file1 file2` : creates a copy of *file1* and calls it *file2*

`cp -r dir1 dir2` : create a copy of *dir1* with all of its contents

`cp /lustre/strath/physics/cwb08102/file1 .`

: copies a file *file1* from another directory to the current directory (denoted by **`.`**)

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Moving files and directories

mv : **m**o**v**e a file

mv *file1 file2* : rename *file1*

mv *file1 ..* : moves *file1* to the parent directory

mv *file1 ~* : moves *file1* to the home directory

mv *dir1 dir2* : renames *dir1* (**-r** not necessary)

mv *dir1 ~*

mv *dir1 /lustre/strath/physics/cwb08102*

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Viewing files in the terminal

To quickly view the contents of text files

`more` *`file1`*

- spacebar advances through file
- **`b`** for going backwards
- **`q`** to quit
- **`/`** to search for a term

`head` *`file1`* : views the first 10 lines of the *file1*

`tail` *`file1`* : views the last 10 lines of the *file1*

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Hands on

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Viewing running processes

`top` :shows the processes (programs) running on the computer

- press **`spacebar`** to update
- press **`q`** to quit

`ps` :produces a static list of your running processes

`ps -f` :produces a “long” listing

`ps -ef` : lists all running processes (long format)

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Redirection

To redirect output from the terminal to a file:

`ps –ef  > processes.txt` : > creates the named file

To append to an existing file:

`ps –ef  >> processes.txt`

To redirect system errors as well as “standard” output:

`ps –ef  >& processes.txt`

To concatenate (merge) two files into one:

`cat file1.txt file2.txt > bigfile.txt`

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Searching a File

grep

grep error *output.txt*

find instances of error in *output.txt*

grep error *output.txt > errors.txt*

find instances of error in *output.txt* and creates a new file

grep –i error *output.txt*

case insensitive search

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Command Output Re-direction

`ps –ef | grep cwb08102` :find instances of error (standard errors) in *output.txt*

`|` re-directs the output of the command "**`ps –ef`**" and sends it to the second command **`grep`**

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Kill a process

`top` :will show the *process_id*

`kill -9 process_id` :will kill the specified process

It is not possible to kill somebody's else process

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Access rights on files....

`r (or -)` :indicates read permission (or otherwise)

`w (or -)` :indicates write permission (or otherwise)

`x (or -)` :indicates write permission (or otherwise)

and directories

`r` :allows user to list files in the directory

`w` :means that users may delete files from the directory (or move into it)

`x` :the right to access files in the directory

`-rwxrwxrwx` :a file that everybody can read, write and execute (+delete)

`-rw-------` :a file that only the user (owner) can read and write

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Changing a file mode

chmod :**ch**anges a file **mod**e. The owner can change the permission to the file

u	:**u**ser	**r**	: **r**ead
g	:**g**roup	**w**	: **w**rite (and delete)
o	:**o**ther	**x**	: e**x**ecute (and access directory)
a	:**a**ll	**+ (-)**	: add (take away) permission

chmod go-rwx *file1* :will remove read, write and execute permissions on the *file1* for the group and others

chmod a+rw *file1* :will give read and write permission on the *file1* to all

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quota

All users are allocated a certain amount of disk space

`quota -v` :will check the current quota and how much has been used (on home directory)

`df` : will print on the screen how much space is left

`du` : will display sizes of all files

`du -s*` : will display only a summary for all files and directories

`df -kh` : how much space is left in kB, what % is used, what % is available

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File compression

`gzip file1.txt` :will compress *file1.txt* to *file1txt.gz*

`gunzip file1.txt.gz` :will uncompress *file1.txt.gz* to *file1.txt*

`zcat file1.txt.gz` :reads gzipped files

Only text files can be compressed.

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File information

`file file1` : give information about the type of the data in *file1* (ASCII, pictures, compressed data...)

`file *` : information about all files in the directory

`diff file1 file2` : shows the **diff**erence between files 1 and 2

`find .-name “*.txt” -print` : will find in current directory (**`.`**) and all subdirectories all files with the extension .txt and print on the screen

`find .-size +1M -ls` : will find all files bigger than 1Mb and display results as a short listing

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History

`history` : will show command history list

Help – man pages

`man` ***`command_name`*** : help how to use the command (navigation like under **`more`** [**`spacebar`**] to page down, [**`b`**] to page up, [**`q`**] to quit

`man grep` : help about **`grep`** command.

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Text editors

There are various text editors, like **joe**, **vi**, **nano**, **pico** etc. and also notepad-like editors like **kwrite** or **gedit** (it depend on the OS version). vi editor is always installed.

gedit editor

`gedit file1.txt` will create *file1.txt* and open notepad-like window

`gedit file1.txt &` will work as above and keep the terminal active

gedit can be open also from Applications Menu

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vi editor

`Vi file1.txt` will create and open file1.txt

Command mode – is on by the default, is used to move around and edit text. Pressing the [**`Esc`**] returns to command mode.

Insert mode – it is used to type (insert) text. To enter to this mode:

`a` insert text **a**fter the cursor

`i` **i**nsert text before the cursor

`O` **o**pen a new line above the current line

`o` **o**pen a new line below the current line

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vi commends

:w - **w**rite
:wq - **w**rite and **q**uit
:q - **q**uite
:q! - **q**uite without saving changes (**!**)
:$ - go to the end of the file
:100 - go to line number 100
:r *file2.txt* - **r**ead a given *file2.txt* in the line below
:set number - print the line number
:%s/*text1*/*text2*/g - **s**ubstitute ***text1*** by ***text2*** **g**lobally

yy - copy current line
P - insert the copied line above the current line
r - **r**eplace a current character by other, given after **r**. **rA** will replace a current character by A
x - delete the character at the current cursor position
dd - delete the current line
. - repeat the last command

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Remote control

ssh - **s**ecure **sh**ell

ssh is a program for logging into a remote machine and executing commands in the remote machine.

```
ssh archie-login.hpc.strath.ac.uk -l cwb08102
```

log user cwb08102 to ARCHIE-WeSt

```
ssh -X archie-login.hpc.strath.ac.uk -l cwb08102
```

log user cwb08102 to ARCHIE-WeSt using X terminal (graphic terminal)

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Remote control

scp - **s**ecure **c**o**p**y

scp copies files over the network securely, uses ssh for data transfer.

```
scp [-r] [-p] username@host:/path/file1
  username@host2:/path/file_or_directory
```

-r - copy the entire directory (with sub-directories)

-p - preserve file attributes and timestamps

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Remote control

```
scp file1.dat
  cwb08102@archie-login.hpc.strath.ac.uk
  :/lustre/strath/physics/cwb08102/CPP/
```

will copy file *file1.dat* from current computer (and localisation) to given directory at ARCHIE, with the same name

```
scp file1.dat cwb08102@archie-
  login.hpc.strath.ac.uk:/lustre/strath/physics
  /cwb08102/CPP/file2.dat
```

will copy file *file1.dat* from current computer (and localisation) to given directory at ARCHIE, with name *file2.dat*

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Remote control

scp malpka@ce-kk-pc.chem.strath.ac.uk :/media/old_home/malpka/CPP/*file1.dat* .

Will take file *file1.dat* from comupter named ce-kk-pc.chem.strath.ac.uk and copy it to current localisation with the same name

scp malpka@rc-weir40.chem.strath.ac.uk :/home/malpka/Documents/*file1.dat* malpka@ce-kk-pc.chem.strath.ac.uk:/media/data/TEST/

Will take file *file1.dat* from rc-weir computer to ce-kk-pc computer

scp cwb08102@archie-login.hpc.strath.ac.uk :/lustre/strath/physics/cwb08102/CPP/*LYS* .

will copy all files *LYS* from ARCHIE-WeSt to current localization with the same name

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Remote control

`sftp` - **s**ecure **f**ile **t**ransfer **p**rogram

`sftp` is a program for transferring files to and from a remote computer. Sftp uses secure description of ssh.

Interactive commands to be used after loggin to the remote computer to change directories and transfer files between the local and the remote computer

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sftp

`get file1`	retrieves remote file and a stores it to local computer
`put file1`	upload local file to store on remote computer
`cd path`	change remote directory to given *path*
`ls`	lists remote files
`pwd`	prints remote working directory
`rename file1 file2`	rename remote *file1*
`rm file1`	remove remote *file1*
`mkdir path`	create remote directory
`rmdir dir1`	remove remote *dir1*

`lcd path`	change local directory to *path*
`lpwd`	prints local working directory
`lls`	lists local files
`help`	display help text (man)
`quit`	quit sftp

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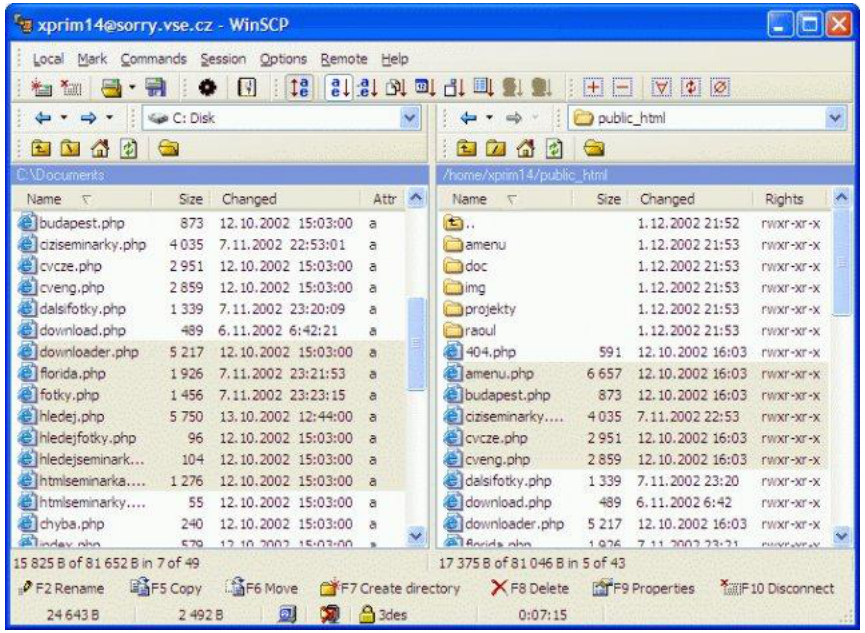
Remote control

WinSCP is a SFTP client and FTP client for Windows. Its main function is the secure file transfer between a local and a remote computer. It uses Secure Shell (SSH) and supports, in addition to Secure FTP, also legacy SCP protocol

Local Windows Machine



Remote computer

Application interface is similar to Norton Commander. To download visit http://winscp.net/eng/index.php

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Remote control

PuTTY is a free implementation (open source) of Telnet and SSH for Windows and Unix platforms, along with an xterm terminal emulator.

To download visit http://www.putty.org/

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Remote desktop

The best program to have remote desktop connection between computers is **NX.**

It is open source, works for Windows, Mac OS and Linux desktop computer and connect them to remote Linux computer.

NX server runs on ARCHIE-WeSt. Users can download the client from **http://www.nomachine.com/download.php**

Instructions: **http://www.archie-west.ac.uk/archie-access**

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Remote desktop

To have the remote desktop session please **connect directly to archie-w, archie-e, archie-s or archie-t.**

Please do not leave the session.

Please log out!

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