



Introduction to CSC Computing Environment



Introduction to Linux and Unix

A basic guide to use the shell

Motivation

- Most larger servers/supercomputers run under either UNIX or LINUX
 - Some PC's and all OS X MAC's, actually
 - In terms of computing power, LINUX and not Windows is the most distributed OS on this planet!
- There is no large scale scientific computing without UNIX/LINUX!
- LINUX is open source – availability, security, transparency

Connection

- You log into such machines using a ssh-client (e.g., [PuTTY](#))
- On Windows you need a X11 emulator to display (e.g. [Xming](#))
- Or you run a native Linux system
- Or you run a Virtual Machine (VM) with Linux inside:
 - [VM Ware](#) Player
 - [VirtualBox](#) (Oracle, former SUN Microsystems)

Logging on

- From UNIX/Linux/Darwin, simply use ssh command:

```
ssh -X userid@hippu.csc.fi
```

-x enables X11 tunneling

- From Windows: put correct settings for your session (differs, depending on program). Remember to enable something like *X11 tunneling*

What is UNIX/LINUX?

- UNIX/LINUX are multitasking operating systems
- Systems running multiple programs and hosting multiple users at a time
- usually command line shell for user input
- Possible to also use GUI (graphical user interface), like KDE and GNOME

What is a shell?

- Program that enables the user to interact with the computer
- Most common shells are called **bash** and **tcsh**
 - main differences: syntax and built-in commands
 - Determined by the administrator, what is the login shell
 - Login run-controll scripts for setting up the environment (`$HOME/.bashrc`)

What is a command?

- A command is a small program provided by the operating system/shell
- basic command structure:
command -option target
- Name usually self-explaining
 - Else man-pages: e.g., **man cp**
 - Topical search: e.g., **apropos copy**

Directory structure

- The filesystem is organized in a tree-like hierarchical directory structure
- The uppermost directory in a filesystem is called the root directory /
- Files have a place in one of the directories (tree branches)
- Command **pwd** (print working directory) will show you current working directory
- After logging in: home-directory

Moving in directory tree

- In GUI's: use the mouse to navigate within directory tree
- Shell: command **cd**
 - enter subdirectory: **cd *subdir***
 - entering parent directory: **cd ..**
 - also explicit path is possible e.g
cd */path/to/your/directory*
 - Home directory: **cd ~/** or just **cd**

Directory and file handling

- List files and directories: `ls [-ltrah]`
- Create a directory: `mkdir dirname`
- Remove (empty!) directory: `rmdir dirname`
- Create empty file: `touch filename`
- To erase a file: `rm`
 - recursively remove a directory branch: option `-r`
 - !!! there is no recyclebin in your shell !!!
- Directory-/filenames should not contain special characters, like `* ? ! # $ ö ä å`

Copying and moving

- Copying: **cp oldname newname**
 - Recursively copying whole directory:
cp -r olddir newdir
- Moving: **mv oldname newname**
 - works with both, directories and files
- Paths: names can contain whole paths
 - If only a existing path is given, the destination file will have the same name as the original
 - Relative paths, e.g., `../.. /` (2 levels up)

File permissions

- UNIX distinguishes between users and groups
 - Check your groups: `groups`
- Each user belongs to at least one group
- `ls -l` displays the attributes of a file or directory

```

-rw-r--r-- 1 userid groupid 0 Jan 29 11:04 name

```

type
r w - r - - - -

user
1

group
userid

others
groupid

0

Jan

29

11:04

name

`r` = read, `w`=write, `x`=execute

The above configuration means: user can read + write, group and all others only read

File permissions

➤ Changing permissions with **chmod**

```
> ls -l name
```

```
> rw-r--r-- 1 userid groupid 0 Jan 29 11:04 name
```

```
> chmod o-r g+w u+x name
```

```
> ls -l name
```

```
> rwxrw---- 1 userid groupid 0 Jan 29 11:04 name
```

➤ Changing group **chgrp** and user **chown**

```
> chgrp othergrp name
```

```
> chown otherusr name
```

```
> ls -l name
```

```
> rwxrw---- 1 otherusr othergrp 0 Jan 29 11:04 name
```

Text utilities

- Contents of files: `cat /etc/group`
- Contents of long files: `less /etc/group`
- Re-directing: `cat /etc/group > mygroup`
- Search inside file: `grep elmeruser /etc/group`
- Find a file:
`find /path/start -name "*name.???" -print`
- Wildcards:
 - * for arbitrary alpha-numerical sequence
 - ? For a single alpha-numerical letter

Managing jobs

- By default commands (jobs) are run in foreground
- Launching to background: **command &**
- Suspending foreground job: **Ctrl + Z**
 - Thereafter bringing back to foreground: **fg**
 - Or sending to background: **bg**
- Listing jobs of shell: **jobs**
- Killing job: **kill -9 %1**

Environment variables

- Globally defined variables
- Referenced by `$`
- Most prominent ones:
 - `$HOME` (your home directory path)
 - `$PATH` (default path for binaries)
 - `$LD_LIBRARY_PATH`
(default path for libraries)
- You can set and use them (e.g., bash):
`export PATH="$HOME/bin:$PATH"`