



Berner Fachhochschule
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CS Basics 3.2) Linux

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1

Linux

- Linux
Presentation
- Shell
Main Functionalities
Rights Management
Install software
- Conclusion

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2

Linux

Presentation

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3

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4

Linux

▶ Unix Family

- ▶ Multi-task and multi-user Operating Systems
- ▶ First version in 1969
- ▶ Very popular for servers in the 1980s
- ▶ Many different versions:
FreeBSD, NetBSD, OpenBSD, Solaris, OSX, iOS, GNU/Linux
et Dalvik/Linux (Android).

▶ Linux (or GNU Linux)

- ▶ Free and Open Source Operating System
- ▶ Multitask and Multiuser
- ▶ Kernel was developed by Linus Torvald in 1991
- ▶ Free software, source code is available
- ▶ Available in different distributions
Red hat, Slackware, Debian, Ubuntu ...
- ▶ Available for PCs, but more used on servers, smartphones and tablets.

Install Linux

▶ Install the operating system

- ▶ Download the system from a server
- ▶ Burn a DVD or a CD
- ▶ Boot from this disk
- ▶ Follow the instructions (choice of the language, keyboard, users)

▶ root

- ▶ One user is specific: `root`
- ▶ Super-user
- ▶ Can do everything on the system
- ▶ Normal users can not change config files or install / configure applications

Shell

Main Functionalities

Command Shell

- ▶ **Linux can be manipulated using a Graphical interface**
 - ▶ Each distribution has its own interface
 - ▶ Quite useful for administration tasks
- ▶ **Shell : Much more useful**
 - ▶ Direct access to information
 - ▶ Clear commands (no ambiguities)
 - ▶ Standard for all Unix systems (including Mac OSX, Linux, ...)
 - ▶ There is no alternative to manage a server
 - ▶ Problem: you need to know some commands by heart.

Visit directories

- ▶ **See the content of the current directory** `ls`

```
emmanuel@emmanuel-VirtualBox:~$ ls
Desktop    Downloads      examples -php  ↘
→Pictures  Templates
Documents  examples.desktop  Music          ↘
→Public    Videos
```

The color allows you to distinguish files from folders.

- ▶ **Print the working directory** `pwd`

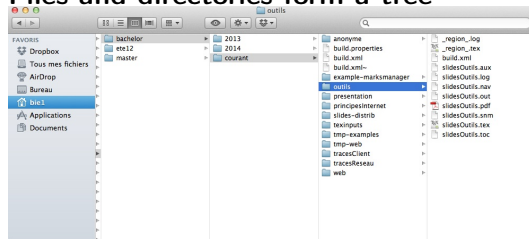
```
emmanuel@emmanuel-VirtualBox:~$ pwd
/home/emmanuel
emmanuel@emmanuel-VirtualBox:~$
```

- ▶ **Change the working directory** `cd`

```
emmanuel@emmanuel-VirtualBox:~$ cd Videos
emmanuel@emmanuel-VirtualBox:~/Videos$ pwd
/home/emmanuel/Videos
```

Directory tree

- ▶ **Files and directories form a tree**



- ▶ **To visit a directory**
`cd myDirectory`
- ▶ **To visit parent directory**
`cd ..`
- ▶ **One can move many levels in one command**
`cd ../../myDirectory`

The file hierarchy (Cont.)

```
emmanuel@emmanuel-VirtualBox:~$ pwd
/home/emmanuel
emmanuel@emmanuel-VirtualBox:~$ ls
Desktop    Downloads      examples -php  ↘
→Pictures  Templates      Videos
Documents  examples.desktop  Music          ↘
→Public    tmp
```

```
emmanuel@emmanuel-VirtualBox:~$ cd examples -php ↘
→/
emmanuel@emmanuel-VirtualBox:~/examples -php$ ls
base  basic.zip
emmanuel@emmanuel-VirtualBox:~/examples -php$ cd ↘
→ base
emmanuel@emmanuel-VirtualBox:~/examples -php/ ↘
→base$ pwd
/home/emmanuel/examples -php/base
emmanuel@emmanuel-VirtualBox:~/examples -php/ ↘
→base$ cd ../../Downloads/
emmanuel@emmanuel-VirtualBox:~/Downloads$ pwd
```

Manipulate directories

- ▶ **Create a directory:** `mkdir myDirectory`
- ▶ **Copy one or many files :** `cp originalFile copyFile`
 - ▶ You can use jokers
 - ▶ * anything (many characters)
 - ▶ ? one single character
- ▶ **Remove a file:** `rm myFile`
 - ▶ The same jokers can be used
- ▶ **Remove a directory:** `rm -r myDirectory`

Directories (Cont.)

- ▶ **Example:**
 - ▶ Create a directory `tmp`
 - ▶ Visit this directory
 - ▶ Copy the file `basic.zip` from the directory `../examples-php/` into `tmp`.

```
emmanuel@emmanuel-VirtualBox:~$ mkdir tmp
emmanuel@emmanuel-VirtualBox:~$ cd tmp
emmanuel@emmanuel-VirtualBox:~/tmp$ cp ../\
→examples-php/basic.zip .
emmanuel@emmanuel-VirtualBox:~/tmp$
```

Rights Management

Rights on a file

- ▶ **Each file belongs to one user and one group**
 - ▶ To see the details: `ls -l` ou `ll`

```
emmanuel@emmanuel-VirtualBox:~$ ls -l
total 52
drwxr-xr-x 2 emmanuel emmanuel 4096 Feb 17  ↘
→21:57 Desktop
drwxr-xr-x 2 emmanuel emmanuel 4096 Feb 17  ↘
→21:57 Documents
drwxr-xr-x 2 emmanuel emmanuel 4096 Feb 17  ↘
→21:57 Downloads
-rw-r--r-- 1 emmanuel emmanuel 8445 Feb 17  ↘
→21:51 examples.desktop
drwxrwxr-x 3 emmanuel emmanuel 4096 Feb 18  ↘
→10:21 examples-php
drwxr-xr-x 2 emmanuel emmanuel 4096 Feb 17  ↘
→21:57 Music
drwxr-xr-x 2 emmanuel emmanuel 4096 Feb 17  ↘
→21:57 Pictures
drwxr-xr-x 2 emmanuel emmanuel 4096 Feb 17  ↘
```

Rights (Cont.)

► Different rights

- Read - r
- Write - w
- Execute - x

► Different users

- user owner of the file (user - u)
- users belonging to the group (group - g)
- any other user (other - o)

► Representation of the rights

```
rwxr-xr--
 \  \  \  /
  v  v  v
  |  |  rights for other users (o)
  |  |  rights for the group (g)
  |  |  rights for the user (u)
```

Change Rights

- sudo to execute a command as the root
- Change Owner - chown

```
emmanuel@emmanuel-VirtualBox:/var/www$ ll
total 8
-rw-r--r-- 1 root root 178 Feb 17 22:04 index.
→html
emmanuel@emmanuel-VirtualBox:/var/www$ chown
→emmanuel index.html
chown: changing ownership of 'index.html':
→Operation not permitted
emmanuel@emmanuel-VirtualBox:/var/www$ sudo
→chown emmanuel index.html
[sudo] password for emmanuel:
emmanuel@emmanuel-VirtualBox:/var/www$ ll
total 8
-rw-r--r-- 1 emmanuel root 178 Feb 17 22:04
→index.html
emmanuel@emmanuel-VirtualBox:/var/www$
```

Change Rights (Cont.)

► Change Group - chgrp

```
emmanuel@emmanuel-VirtualBox:/var/www$ ls -l
total 8
-rw-r--r-- 1 emmanuel root 178 Feb 17 22:04
→index.html
-rw-r--r-- 1 root      root 177 Feb 17 22:01
→index.html~
lrwxrwxrwx 1 root      root  22 Feb 17 22:16
→phpmyadmin -> /usr/share/phpmyadmin/
emmanuel@emmanuel-VirtualBox:/var/www$ chgrp
→emmanuel index.html
emmanuel@emmanuel-VirtualBox:/var/www$ ls -l
total 8
-rw-r--r-- 1 emmanuel emmanuel 178 Feb 17 22:04
→index.html
-rw-r--r-- 1 root      root      177 Feb 17 22:01
→index.html~
lrwxrwxrwx 1 root      root      22 Feb 17 22:16
→phpmyadmin -> /usr/share/phpmyadmin/
```

Change Rights (Cont.)

► Change the rights on a file or a directory - chmod

```
emmanuel@emmanuel-VirtualBox:/var/www$ cp index
→.html test.html
cp: cannot create regular file 'test.html':
→Permission denied
emmanuel@emmanuel-VirtualBox:/var/www$ cd ..
emmanuel@emmanuel-VirtualBox:/var$ ls -l
total 48
...
drwxr-xr-x 2 root root 4096 Feb 17 22:16
→www
emmanuel@emmanuel-VirtualBox:/var$ chmod og+w
→www
chmod: changing permissions of 'www': Operation
→not permitted
emmanuel@emmanuel-VirtualBox:/var$ sudo chmod
→og+w www
emmanuel@emmanuel-VirtualBox:/var$
```

Install software

Install software

- ▶ **At the beginning of Unix**
 - ▶ Download source files
 - ▶ Read the documentation
 - ▶ Configure system
 - ▶ Install new libraries
 - ▶ Compile
 - ▶ Install
- ▶ **Package managers**
 - ▶ You can download and install any application in one sentence
 - ▶ Manages dependences automatically
 - ▶ Very easy to manage software
 - ▶ Automatic update of the programs (for patching management)

Install software (Cont.)

- ▶ **Install a package**
`sudo apt-get install apache2`
- ▶ **Remove a package**
`sudo apt-get remove apache2`
- ▶ **Update Package Index** for the list of available packages
`sudo apt-get update`
- ▶ **Update packages** for patching all the software you have (all the programs at once)
`sudo apt-get upgrade`

Conclusion

Conclusion

▶ **Command Line Instructions**

- ▶ It is possible to manipulate file with clicks and Drag and Drop.
- ▶ It is much easier to do it with command line instructions
- ▶ Parameters can be adjusted
- ▶ Precision is much better

▶ **Install software**

- ▶ Use package managers
- ▶ Easy to install any software
- ▶ Management of update is automatical
- ▶ Very important for security

```
$ sudo apt-get update
```

```
$ sudo apt-get upgrade
```