



Berner Fachhochschule  
Haute école spécialisée bernoise  
Bern University of Applied Sciences

# CS Basics 3.2) Linux

*Emmanuel Benoist*  
Fall Term 2016-17

# Linux

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

# Linux

# Presentation

# 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
```

La couleur permet de voir les répertoires et les fichiers.

- ▶ **Voir le répertoire courant** `pwd`

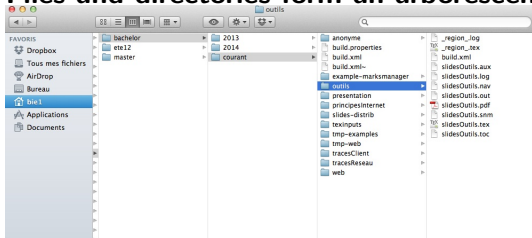
```
emmanuel@emmanuel-VirtualBox:~$ pwd
/home/emmanuel
emmanuel@emmanuel-VirtualBox:~$
```

- ▶ **Changer de répertoire** `cd`

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

# Directories arborescence

## ► Files and directories form an arborescence



## ► To visit a directory

```
cd myDirectory
```

## ► To visit parent directory

```
cd ..
```

## ► One can move many levels in one command

```
cd ../../myDirectory
```

# The arborescence (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
/home/emmanuel/Downloads
emmanuel@emmanuel-VirtualBox:~/Downloads$
```

# 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 21:57 Public
drwxr-xr-x 2 emmanuel emmanuel 4096 Feb 17 21:57 ↘
→Templates
drwxrwxr-x 2 emmanuel emmanuel 4096 Feb 18 15:01 tmp
```



# 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
```

```
| | droits des autres utilisateurs (o)
```

```
| droits des utilisateurs appartenant au groupe (g)
```

```
droits du propriétaire (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\
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
```