Introductory Course to Linux

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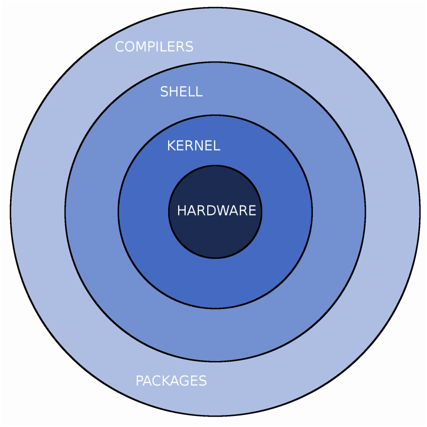
Table of contents

Linux OS

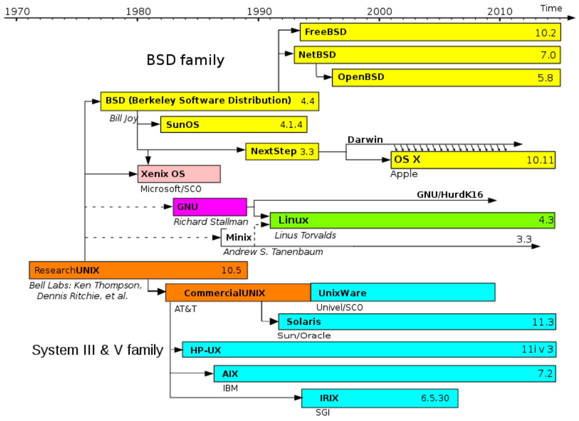


Linux OS components.

Linux

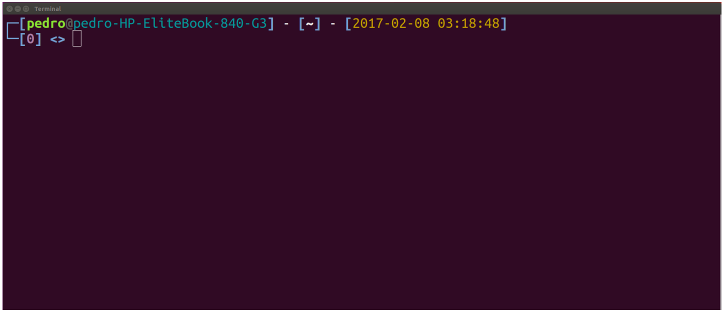
- UNIX-like OS
- used in modern Android smartphones
- the difference between all UNIX-like OS is small

Linux timeline



source: wikipedia

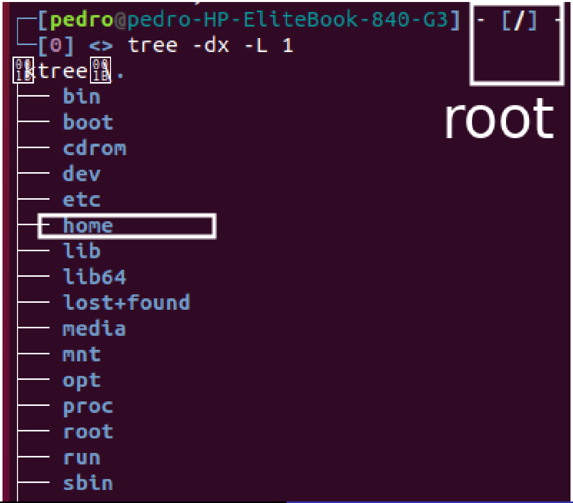
The Linux terminal



```
┌[pedro@pedro-HP-EliteBook-840-G3] - [~] - [2017-02-08 03:18:48]
└[0] <>
```

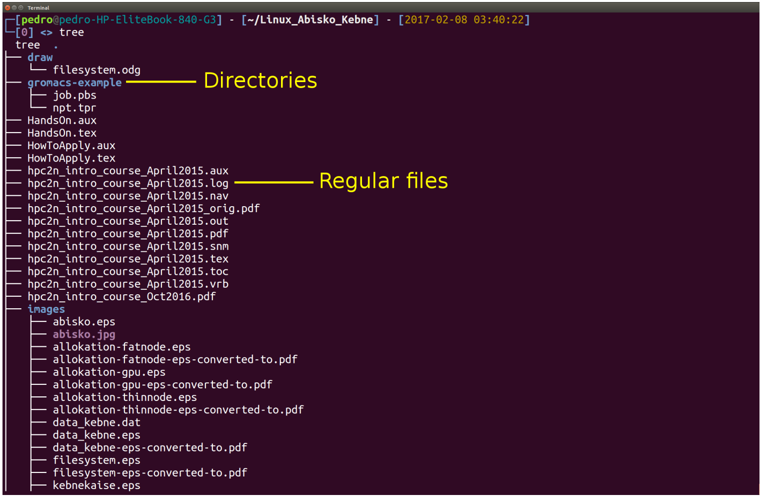
- on the terminal you can see the so-called Prompt
- here you can control your PC/account or even a remote server

Files organization



```
┌─[pedro@pedro-HP-EliteBook-840-G3] - [/] -
└─[0] <> tree -dx -L 1
tree .
├── bin
├── boot
├── cdrom
├── dev
├── etc
├── home
├── lib
├── lib64
├── lost+found
├── media
├── mnt
├── opt
├── proc
├── root
├── run
├── sbin
```

Files organization



```
┌[pedro@pedro-HP-EliteBook-840-G3] - [~/Linux_Abisko_Kebne] - [2017-02-08 03:40:22]
└[0] <> tree
 tree  .
├── draw
│   └── filesystem.odg
├── gromacs-example
│   ├── job.pbs
│   └── npt.tpr
├── HandsOn.aux
├── HandsOn.tex
├── HowToApply.aux
├── HowToApply.tex
├── hpc2n_intro_course_April2015.aux
├── hpc2n_intro_course_April2015.log
├── hpc2n_intro_course_April2015.nav
├── hpc2n_intro_course_April2015_orig.pdf
├── hpc2n_intro_course_April2015.out
├── hpc2n_intro_course_April2015.pdf
├── hpc2n_intro_course_April2015.snm
├── hpc2n_intro_course_April2015.tex
├── hpc2n_intro_course_April2015.toc
├── hpc2n_intro_course_April2015.vrb
├── hpc2n_intro_course_Oct2016.pdf
├── images
│   ├── abisko.eps
│   ├── abisko.jpg
│   ├── allokation-fatnode.eps
│   ├── allokation-fatnode-eps-converted-to.pdf
│   ├── allokation-gpu.eps
│   ├── allokation-gpu-eps-converted-to.pdf
│   ├── allokation-thinnode.eps
│   ├── allokation-thinnode-eps-converted-to.pdf
│   ├── data_kebne.dat
│   ├── data_kebne.eps
│   ├── data_kebne-eps-converted-to.pdf
│   ├── filesystem.eps
│   ├── filesystem-eps-converted-to.pdf
│   ├── kebnekaise.eps
```

man

Manual pages.

- **man command: man nano**

```
NANO(1)                    General Commands Manual                   NANO(1)

NAME
       nano - Nano's ANOther editor, an enhanced free Pico clone

SYNOPSIS
       nano [options] [[+line,column] file]...

DESCRIPTION
       nano  is  a small, free and friendly editor which aims to replace Pico,
       the default editor included in the non-free Pine package.   On  top  of
       copying  Pico's  look  and  feel, nano also implements some missing (or
       disabled by default) features in Pico, such as "search and replace" and
       "go to line and column number".
```

Navigating the File System

ls

List the content of a directory

```
$ls
1CD9

$ls -l
total 24843644
drwxrwxr-x  2 pedro pedro        4096 nov  9 11:17 1CD9

$ls -la
total 24844368
drwxr-xr-x 44 pedro pedro        4096 feb 13 13:19 .
drwxr-xr-x  3 root  root         4096 sep 19 11:05 ..
drwxrwxr-x  2 pedro pedro        4096 nov  9 11:17 1CD9

$ls -lah
total 24G
drwxr-xr-x 44 pedro pedro 4,0K feb 13 13:25 .
drwxr-xr-x  3 root  root  4,0K sep 19 11:05 ..
drwxrwxr-x  2 pedro pedro 4,0K nov  9 11:17 1CD9
```

ls

```
$ls -laht
total 24G
drwxr-xr-x 44 pedro pedro 4,0K feb 13 13:29 .
-rw-------  1 pedro pedro 431K feb 13 13:29 .zsh_history
drwx------  6 pedro pedro 4,0K feb 13 13:28 Linux_Abisko_Kebne

$ls -lahrt
total 24G
-rw-r--r--  1 pedro pedro  655 sep 19 11:05 .profile
```

chmod

Change permissions.
Useful cases:

- chmod Y+Z
- Y=u,g,o
- Z=r,w,x

cd

Change directory.
Useful cases:

- cd directory
  move to "directory"
- cd
  move to $*HOME* directory
- cd -
  move to previous visited directory
- cd ..
  move to upper directory in the hierarchical tree
- pwd prints out the local directory path

cp

Copy files.
Useful cases:

- cp text.txt directory/
  copy text.txt file to "directory"
- cp -r test/ directory/
  copy the directory test into directory/.
  cp overwrites existing files!

touch/mkdir

Create files.
Useful cases:

- touch text.txt
  creates text.txt file
- mkdir test
  creates the directory test

rm

Remove files.
Useful cases:

- rm text.txt
  deletes text.txt file
- rm -rf test/
  deletes the directory test
  deleted files cannot be recovered!

Wild cards

- ?
  it represents a single character
- *
  it represents a string of characters
- $[0-9]\,,[A-B]$
  it represents a range of numbers or characters

Pipes

- One can use the output of some command as the input for another command:

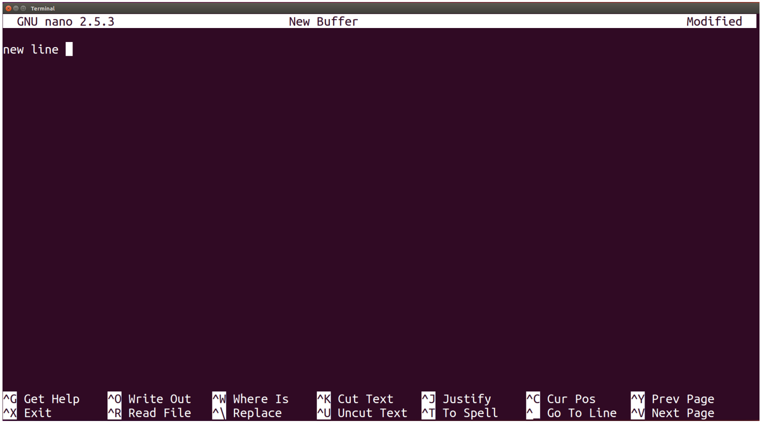
```
grep 'string' file.txt | wc
grep 'string' file.txt > file.out
grep 'string' file.txt >> file.out
```

Exporting variables

- some programs or libraries require environment variables to work
- they allow the program to follow different schemes without being re-compiled
- some variables such as $*HOME* are intrinsic to Linux OS
- we need to export the variables for further use:

```
$export NUMBER_OF_THREADS=6
```

Editing files



```
  GNU nano 2.5.3                  New Buffer                            Modified

new line 

^G Get Help   ^O Write Out  ^W Where Is   ^K Cut Text   ^J Justify    ^C Cur Pos    ^Y Prev Page
^X Exit       ^R Read File  ^\ Replace    ^U Uncut Text ^T To Spell   ^_ Go To Line ^V Next Page
```

Data Handling

Compress/decompress files

Compressing files:

```
$gzip file      --->  file.gz
```

Decompressing files:

```
$gunzip file.gz
```

Generating archives

Generate tar-ball:

```
$tar -cvf directory.tar directory
```

Opening tar-ball:

```
$tar -xvf directory.tar
```

ssh

Command for connecting to a remote computer.
Useful cases:

- ssh username@abisko.hpc2n.umu.se
  connecting to abisko machine
- ssh -Xl username abisko.hpc2n.umu.se
  if you want to enable graphical display.

sftp (scp)

Protocol for data transfer.

```
$sftp username@abisko.hpc2n.umu.se

$get file

$put file
```

rsync

Protocol for synchronizing data.

```
rsync source target
```

```
rsync -az user@kebne.hpc2n.umu.se:/home/proj/ proj/
```

Finding patterns

grep

This command searches for patterns in text files.
Useful cases:

- grep 'word' file
  it searches for pattern 'word' in file
- grep -rine 'word' home
  pattern word is searched recursively in the directory */home*

awk

This command finds patterns in a file and can perform arithmetic/string operations.
Useful cases:

- awk '/gold/ $\{print \$1\}$' file
- it searches for pattern 'gold' in file and prints out the first column

Scripting

Scripting

- allows to perform complex tasks without user intervention
- all Linux commands can be used in a script including wild cards

Scripting

analysis.sh

```
#!/bin/bash

grep 'ABCD' file.pdb >  file_filtered.pdb

program < file_filtered.pdb > output.dat
```

execute script with ./analysis.sh

Scripting

```
$ls -lah
total 24G
drwxrwxr-x  2 pedro pedro 4,0K nov  9 11:17 1CD9
```

- permissions are set of "user", "group", or "others"
- we can change permissions with chmod command

For instance,

```
$chmod u+x analysis.sh
```

```
$execute script with ./analysis.sh
```

Working with the Prompt

- ctrl+a: Go to the beginning of the line
- ctrl+e: Go to the end of the line
- ctrl+l: Clean the terminal

Configuring .bashrc file

Exploring the history:
by typing "ctrl+r" you will be prompted to introduce text which bash will use to make a search in the list of commands you have typed previously. That list is saved in the .bash_history file in your home directory.
One can control the behavior of the history file by setting environment variables in the .bashrc file as follows:

```
export HISTCONTROL=erasedups
export HISTSIZE=100000
export HISTFILESIZE=100000
shopt -s histappend
```

Configuring .bashrc file

Using aliases:
if you need to type a long command several times, you may add it as an alias in your .bashrc file:

```
alias ldir='ls -lahrt | egrep "^d"'
```

Specific commands on our cluster

- projinfo: information of the usage of the project resources
- squeue -a -u username: status of the jobs for username
- sbatch script.sh: for job submission
- scancel jobid: for cancelling a job
- quota: information of the /home and /pfs disk usage

Linux Cheat Sheet

- https://www.hpc2n.umu.se/documentation/guides/linux-cheat-sheet