

Introductory Course in Linux

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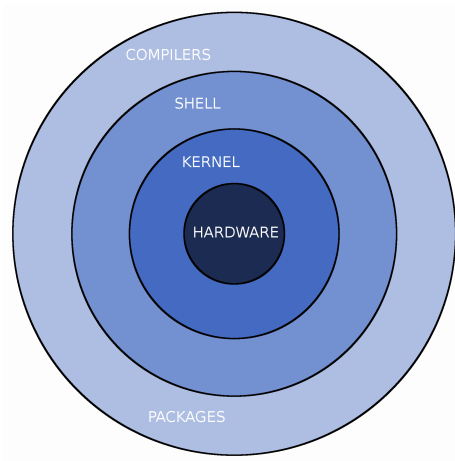
February 20, 2017



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Linux OS

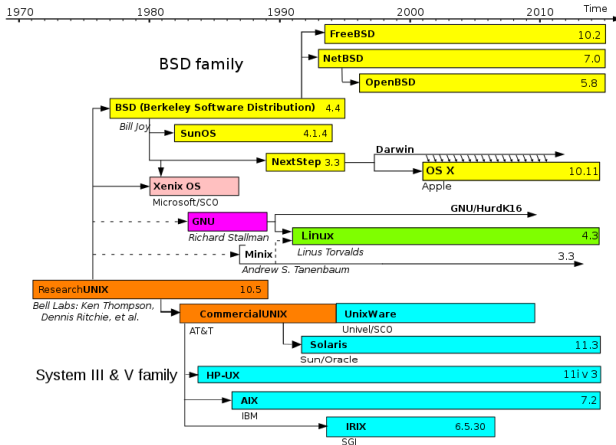




Linux OS

- Based on UNIX OS
- used in modern Android smartphones
- the difference between UNIX OS is small

Linux timeline



The Linux terminal



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

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

Files organization

```
[pedro@pedro-HP-ElliteBook-840-G3] - [~/Linux_Abisko_Kebne] - [2017-02-08 03:40:22]
[0] <=> tree
tree .
.
├── draw
│   ├── filesystem.odg
│   └── gromacs-example ─── Directories
│       ├── job.pbs
│       ├── npt.tpr
│       ├── HandsOn.aux
│       ├── HandsOn.tex
│       ├── HowToApply.aux
│       └── HowToApply.tex
├── hpc2n_intro_course_April2015.aux ─── Regular files
├── 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
    ├── alloktion-fatnode.eps
    ├── alloktion-fatnode-eps-converted-to.pdf
    ├── alloktion-gpu.eps
    ├── alloktion-gpu-eps-converted-to.pdf
    ├── alloktion-thinnode.eps
    ├── alloktion-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
```



Useful commands: 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".
```



Useful commands: 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
```



Useful commands: 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
```



Useful commands: 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

Useful commands: 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!

Useful commands: touch/mkdir

Create files.

Useful cases:

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

Useful commands: 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

Useful commands: 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*

Useful commands: `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

Useful commands: 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.

Useful commands: sftp

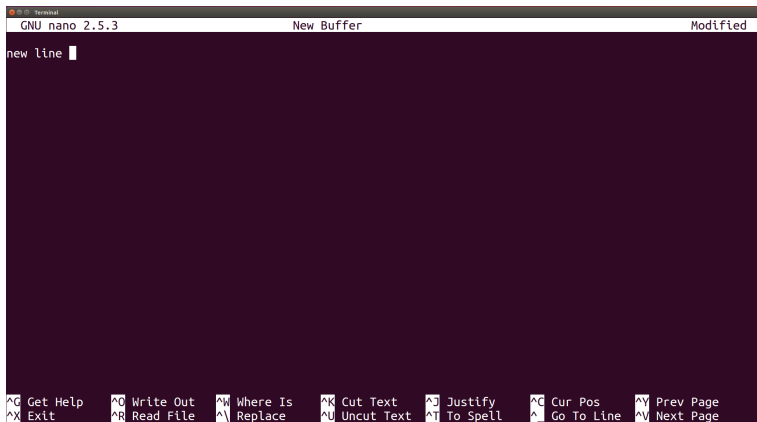
Protocol for data transfer.

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

```
$get file
```

```
$put file
```

Editing files

A screenshot of a terminal window running the GNU nano 2.5.3 text editor. The window title is 'Terminal'. The editor's status bar at the top shows 'GNU nano 2.5.3', 'New Buffer', and 'Modified'. The main editing area is dark purple and contains the text 'new line' followed by a cursor. At the bottom, a light-colored bar displays various keyboard shortcuts for navigation and editing, such as ^G for Get Help, ^O for Write Out, ^W for Where Is, ^K for Cut Text, ^J for Justify, ^C for Cur Pos, ^V for Prev Page, ^X for Exit, ^R for Read File, ^_ for Replace, ^U for Uncut Text, ^T for To Spell, ^_ for Go To Line, and ^V for Next Page.

```
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   ^V Prev Page
^X Exit      ^R Read File ^_ Replace   ^U Uncut Text ^T To Spell  ^_ Go To Line ^V Next Page
```




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
```



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
```



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
```

Announcement

NBIS (National Bioinformatics Infrastructure Sweden) and Elixir Slovenia are offering an "Introduction to Linux" course targeted at life scientists to extend their skills and knowledge. The course provides a basic introduction to Unix/Linux commands for bioinformatics and covers how Unix/Linux commands can be used to manage and inspect your data and results, and how to generate and run bioinformatics pipelines and work-flows using basic shell scripting.

Dates: Monday 27th to Wednesday 29th March, 9 am - 5 pm

Registration: To register, please fill in the form

<https://goo.gl/forms/jiyZc4BcTanJvrdl2> before March 10 at 10am