

Introductory Course to Linux

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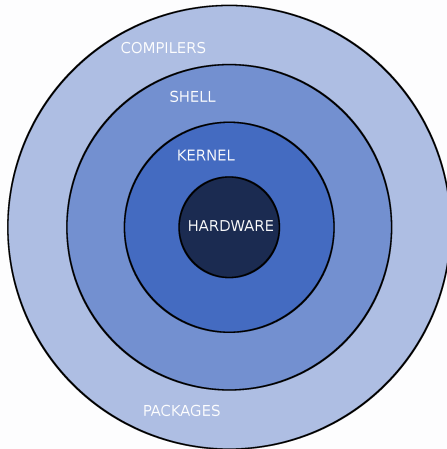
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Table of contents

- 1 Linux
- 2 Navigating the File System
- 3 Data Handling
- 4 Finding Patterns
- 5 Scripting
- 6 Extra tips

Linux OS



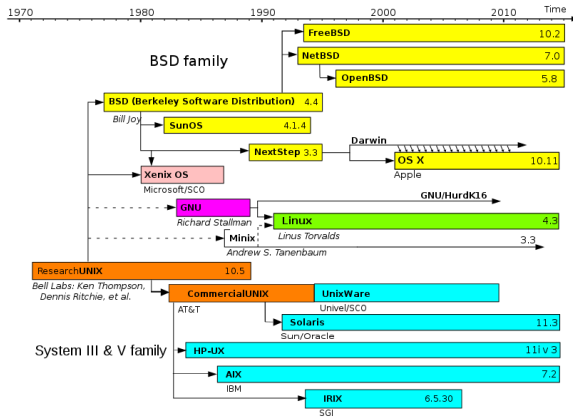


Linux

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



Linux timeline



source: wikipedia



The Linux terminal

A screenshot of a Linux terminal window. The title bar at the top reads 'terminal'. The terminal content shows a prompt: `[pedro@pedro-HP-EliteBook-840-G3] - [~] - [2017-02-08 03:18:48]`. Below the prompt, there is a cursor and a double arrow symbol `[0] <>`, indicating that the user can navigate between terminals.

- 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-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
├── hpc2n_intro_course_April2015.log ───────── Regular files
├── 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_0ct2016.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

A screenshot of the GNU nano 2.5.3 terminal editor. The window title is 'Terminal' and the editor title is 'New Buffer'. The text 'new line' is visible on the first line. The bottom status bar contains various keyboard shortcuts: ^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, ^M Replace, ^U Uncut Text, ^T To Spell, ^_ Go To Line, and ^N 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  ^M Replace   ^U Uncut Text ^T To Spell  ^_ Go To Line ^N 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 -r '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+r`: Make a reverse search

```
export HISTCONTROL=erasedups
export HISTSIZE=100000
export HISTFILESIZE=100000
shopt -s histappend
```
- `ctrl+a`: Go to the beginning of the line
- `ctrl+e`: Go to the end of the line



Linux Cheat Sheet

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