The GNU/Linux

Contents

1 Introduction to GNU

GNU is an Unix-like computer operating system. "GNU" is pronounced g'noo. GNU is a recursive acronym for "GNU's Not Unix!". It was publicly announced by Dr. Richard Stallman on January 5, 1984.

The goal was to bring a wholly free software operating system into existence. [1]

The GNU logo

1.1 GNU project outlines

"Free software" is a matter of liberty, not price. To understand the concept, you should think of “free” as in "free speech", not as in "free stuff".

Free software is a matter of the users freedom to run, copy, distribute, study, change and improve the software. More precisely, it refers to four kinds of freedom, for the users of the software:

1. The freedom to run the program, for any purpose (freedom 0).
2. The freedom to study how the program works, and adapt it to your needs (freedom 1). Access to the source code is a precondition for this.
3. The freedom to redistribute copies so you can help your neighbor (freedom 2).
4. The freedom to improve the program, and release your improvements to the public, so that the whole community benefits (freedom 3). Access to the source code is a precondition for this.

The Hurd, GNU's own kernel [2], is some way from being ready for daily use. Thus, GNU is typically used today with a kernel called Linux. This combination is the GNU/Linux operating system. GNU/Linux is used by millions, though many call it "Linux" by mistake. [3]

1.2 The Linux kernel

The Linux kernel was initially started by Linus Torvalds. Linux rapidly accumulated developers and users who adapted code from other free software projects for use with the new operating system. The Linux kernel has received contributions from thousands of programmers. [4]

Today, Linux kernel runs super-computers, servers, mobiles, tablets, TVs, set-top boxes and many consumer electronics.

The Linux logo

1.3 GNU/Linux distributions

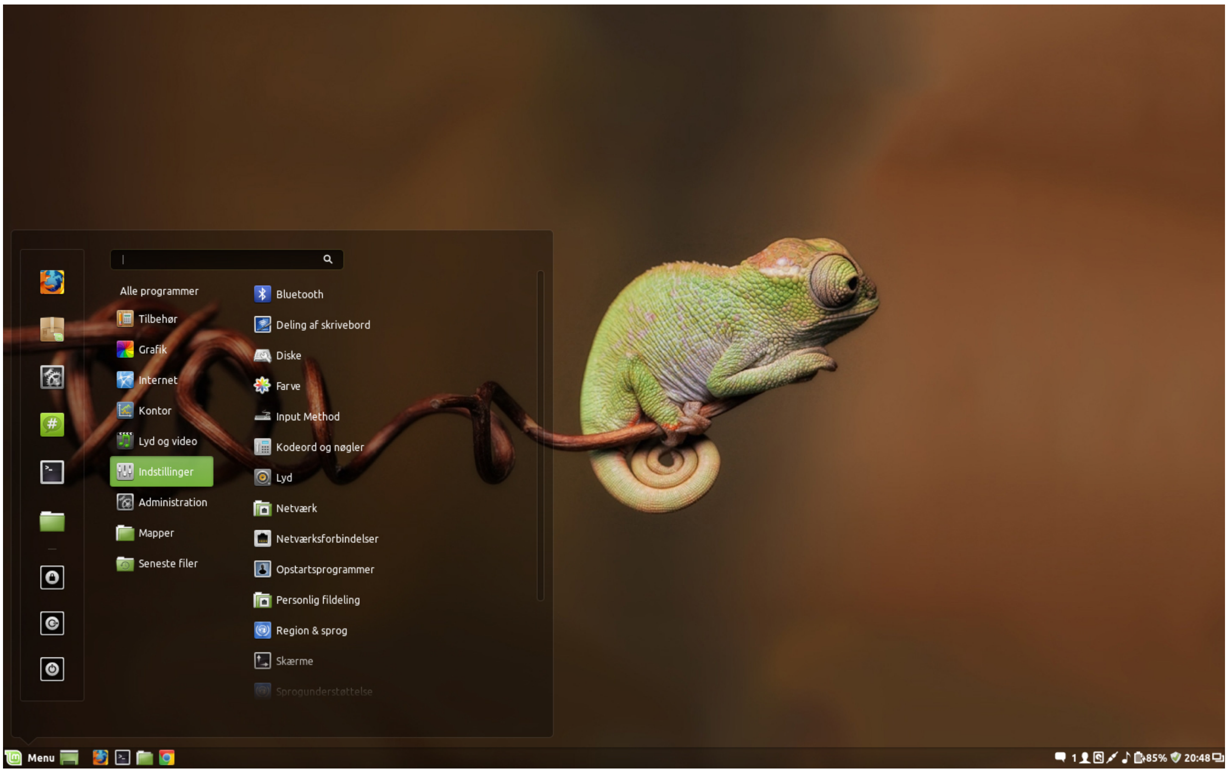
Unlike other operating systems, GNU/Linux doesn't have only one flavor. In fact, there are more than thousand variants available. The most popular are listed in distrowatch.com. You may also be interested in the Linux_distributions wikipedia page. This page showcase the history and development of popular GNU/Linux distributions.

logos of some GNU/Linux distributions

We will be using **Ubuntu** for rest of the discussion. The only reason for Ubuntu is its popularity and support. There are many distributions which are arguably more productive than Ubuntu.

Ubuntu is based on one of the oldest distribution **Debian**. There are many variants of Debian too, Ubuntu is most favoured by beginners.

On the other hand there are many sub-distributions of Ubuntu too. LinuxMint is most popular among them.



Linuxmint Desktop

In fact, anyone with good understanding of internals of GNU/Linux, can either customize or start his own distribution. More comprehensive details are available at linuxfromscratch.org

2 GNU/Linux applications

2.1 Text based and X-window application

Any GNU/Linux application can be broadly classified into **text based** and **X-window based**.

Text based applications are also known as **command line applications**. Usually, these command line applications run inside a Console. In modern GNU/Linux desktops, these applications are often accessed through **terminal-emulator** programs.

For example, *vim* is a popular command line application to view/edit text files, similarly

gedit is the popular X-window based application for text processing.

2.2 Shell and Bash

In computing, a **shell** is a user interface for access to an operating system's services.

Generally, operating system shells use either a command-line interface (CLI) or graphical user interface (GUI). We will work with CLI based shell only.

Bash, also known as *Bourne-again shell*, is an advanced Unix shell, which comes pre-installed in all modern GNU/Linux distributions.

Bash can also read commands from a file, called a script (commonly known as Bash script). Like all Unix shells, it supports filename wildcarding, piping, command substitution, variables and control structures for condition-testing and iteration. The keywords, syntax and other basic features of the language were all copied from *sh*. Other features, e.g., history, were copied from csh and ksh. [5]

We will concentrate on more command line applications. The rest of the tutorial assumes that you have a *terminal-emulator* running *bash*.

2.3 Why text based applications ?

Its an obvious question occur to all. With all these user friendly graphical X-window based applications, why one need command based applications ?

The reasons could be the following :

- The output of one application could be sent to other (mostly).
- Low on RAM, CPU and other resources. Ideal for batch conversions and remote access.
- Applications can be called inside a shell script efficiently.
- Easy to develop and debug.

3 GNU/Linux text based applications

The following commands are tested in terminal-emulator and Console. The give precise output with `Bash`.

Do not just copy-paste them, read `man` pages, `--help` to explore more about each command(application).

3.1 Help, manual and command search

1. Print manual page of the application

```
man man
```

2. Search your *keywork* in all man pages

```
apropos copy
```

3. Access quick help

```
apropos --help
```

3.2 Basic directory and files

1. Change directory

```
cd /tmp
```

2. Print present working directory

```
pwd
```

3. List files and directories

```
ls -l /tmp
```

`-l` long listing

4. Create directories

```
mkdir dir src-dir dest-dir
```

5. Create files

```
touch 1.txt 2.txt
```

6. Remove file(s)

```
rm -v 1.txt
```

`-v` show verbose

7. Remove directory

```
rm -rv dir/
```

`-r` recursive (only for directories and sub-directories)

8. Move/Rename directory

```
mv -i src-dir/ dest-dir/
```

`-i` prompt before overwrite

3.3 Read, search and find

1. Print file content on standard output (STDOUT) and exit

```
cat /etc/lsb-release /etc/bash.bashrc
```

2. Read and search through text file

```
less /etc/bash.bashrc
```

3. Print first line of the file and exit

```
head -n1 /etc/bash.bashrc
```

`-n[K]` Print first *K* lines of the file `-c[K]` Print first *K* bytes of the file

4. Print last line of the file and exit, command line flags similar to *head*

```
tail -n1 /etc/bash.bashrc
```

5. Find files in the directory

   ```
   find ~/Downloads -iname \*.pdf -size +4M
   ```

   `-iname` name of the file (ignore case) `-size` file size larger than 4MB

6. Search lines in text file

   ```
   grep 'nobody' /etc/passwd
   ```

7. Search recursively in the directory

   ```
   grep -ri 'printf' /usr/include/
   ```

8. Pipe (send) the output of one application to other

   ```
   ls -l | grep 'rw'
   ```

   Piping STDOUT of `ls -l` to `grep` command to search *rw*

3.4 User and permissions

1. Know the current user

   ```
   whoami
   ```

2. Show all logged in users

   ```
   w
   ```

3. Change permission to write for others (other than users and groups)

   ```
   chmod -R o+w dest-dir/
   ```

   `-R` recursively to all directories.

4. Only read and execute permissions to all

   ```
   chmod -R a=rx dest-dir/
   ```

5. Change permission to `rwxrwxr-x`

   ```
   chmod -R 775 dest-dir/
   ```

6. Change ownership to root user

   ```
   sudo chown -R root.root dest-dir/
   ```

   `sudo` is the command which allows user to run command as administrator

3.5 Network and installations

1. Check network connectivity

   ```
   ping -c 5 127.0.0.1
   ```

   Use correct IP address. Localhost will always show replies.

2. Show connected networks

   ```
   ifconfig
   ```

3. Download a file(s) from internet

   ```
   wget -c http://ftp.gnu.org/gnu/wget/wget-1.14.tar.xz
   ```

   `-c` continue, or resume download operation

4. Login to remote shell

   ```
   ssh -Y root@localhost
   ```

   `-Y` enable trusted X11 forwarding, which means one can view remote X-window programs

5. Secure copy to remote machine

   ```
   scp -r /etc/udev root@localhost:/tmp
   ```

   `-r` recursive

3.6 Attributes and monitoring

1. Know the file type

   ```
   file /bin/ls
   ```

2. List all filesytem disk space usage

   ```
   df -h
   ```

   `-h` human readable form

3. Estimate file space usage

   ```
   du -h /tmp
   ```

4. Check the memory usage

   ```
   free -m
   ```

   `-m` display amount of memory in megabytes

5. Check all the mounted filesystems

   ```
   mount
   ```

6. Add custom path for binary

   ```
   export PATH=$PATH:/tmp/bin
   ```

This concludes the Basic introduction to GNU/Linux command line applications.

[1] http://en.wikipedia.org/wiki/GNU

[2] http://en.wikipedia.org/wiki/Kernel_(computing)

[3] http://www.gnu.org/#content

[4] http://en.wikipedia.org/wiki/Linux_kernel

[5] http://en.wikipedia.org/wiki/Bash_%28Unix_shell%29