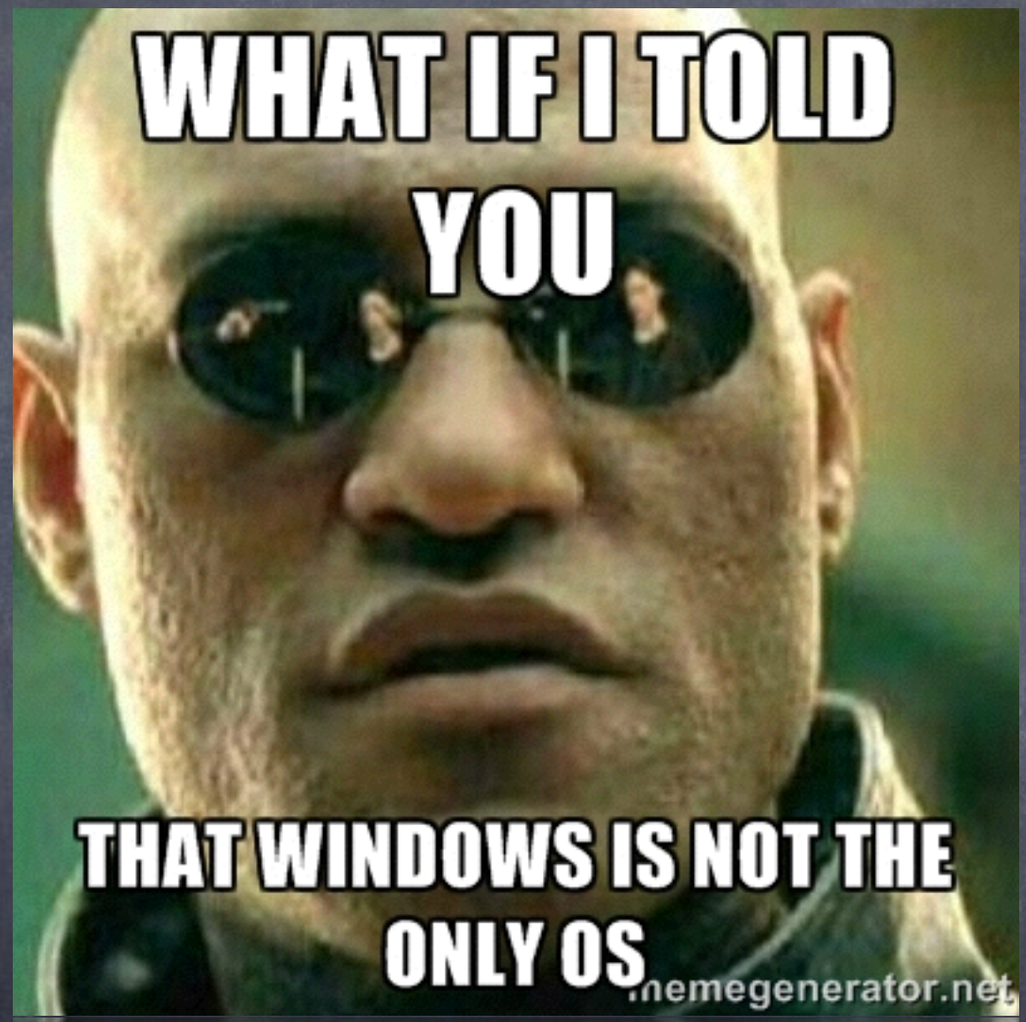
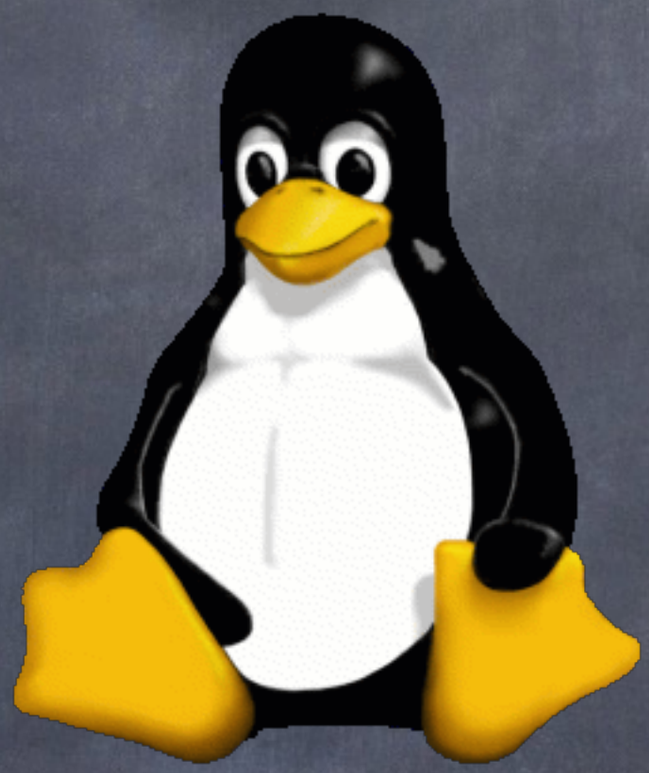
Introduction to Linux

powered by

ACM AUTH Student Chapter

Presented by Stefanos Laskaridis


WHAT IF I TOLD YOU
THAT WINDOWS IS NOT THE ONLY OS
memegenerator.net



Linux Tux

Index

- Linux history
- Free software
- Linux today
- Installation process
- Linux boot process
- Desktop Environments
- Bash Shell
  - Basic commands
  - Basic scripting
- Package managers
- Programming under Linux

I promise, it's interesting ...

Some History ...

Multics, Unix

- Bell Labs needed an OS to run batch jobs. Along with General Electrics and MIT they create Multics (Multiplexed Information and Computing Service)
- Multics is withdrawn and Ken Thomson with Dennis Ritchie create Unix (UNiplexed Information and Computing Service)

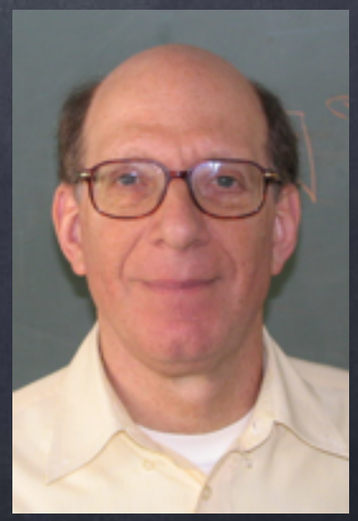
Creators of Unix

- Ken Thomson (1943-)
  (works @ Google, B language, Go language)
- Dennis Ritchie
  (1941-2011)
  (C language, worked @ Bell labs, Lucent Technologies)

Jointly awarded with the ACM Turing Award in 1983 for UNIX OS

Minix

- Minix: Unix-like operating system with microkernel architecture
- Created by Andrew S. Tanenbaum for educational purposes (first release: 1987)
- Currently free and open-source under the MIT licence.



Linux

- Linux kernel started as a university project by Linus Torvalds in 1991 at the University of Helsinki.

- Linus Torvalds was dissatisfied with the licensing. Minix was not free.

- Linus Torvalds decides today on what gets incorporated inside the Linux kernel and what is not.

"Hello everybody out there using minix - I'm doing a (free) operating system (just a hobby, won't be big and professional like gnu) for 386(486) AT clones... I'd like to know what features most people would want. Any suggestions are welcome, but I won't promise I'll implement them :-)"

"

-Linus Torvalds, 25th August 1991

The GNU Project

- The GNU Project, started in 1983 by Richard Stallman.
- Its goal is creating a free* UNIX-compatible Operating System.
- GNU is a recursive acronym for "GNU's Not Unix"
- Richard Stallman is head of the Free Software Foundation (FSF)

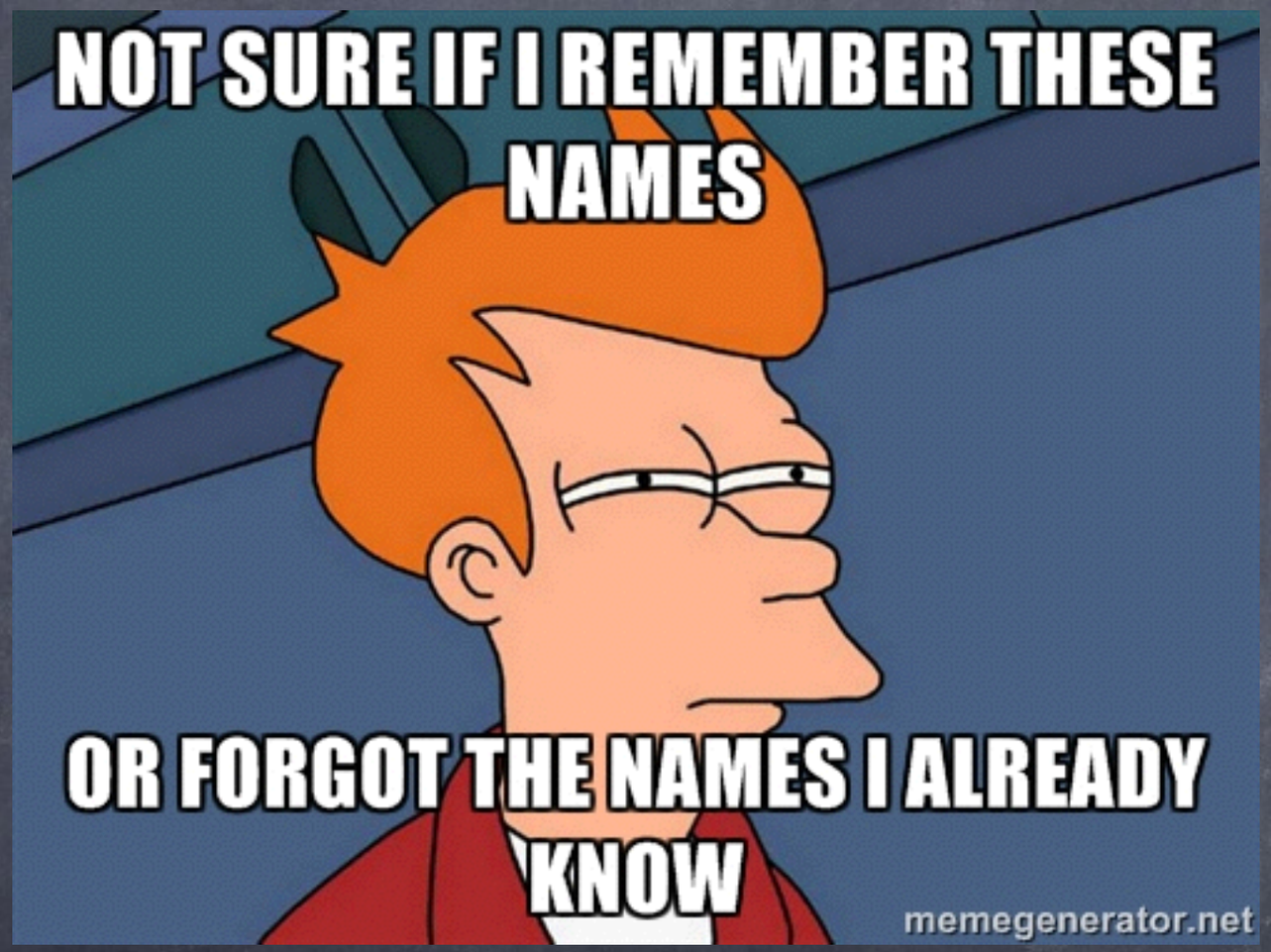
The definition of Free

" "Free software" means software that respects users' freedom and community. Roughly, it means that the users have the freedom to run, copy, distribute, study, change and improve the software. Thus, "free software" is a matter of liberty, not price."

-gnu.org

Free vs. Open-Source

- A free software is, in most cases, open-source.
- Open-source software is not necessarily qualified as free software.


NOT SURE IF I REMEMBER THESE NAMES
OR FORGOT THE NAMES I ALREADY KNOW
memegenerator.net

A quick revision

- Ken Thomson:
  Bell labs, B language, Go language
  Now works @ Google, co-creator of UNIX
- Dennis Ritchie:
  Bell Labs, C language, co-creator of UNIX
- Linus Torvalds:
  Creator of Linux kernel, University of Helsinki
- Richard Stallman:
  GNU project, FSF, software freedom activist

Linux today ...

Linux today

- Linux Kernel is a free project and one of the largest open-source projects ever existed, head of which is Linux Torvalds. Currently licensed under GPL.
- There are many Linux distributions, though. Distribution (aka distro): Collection of software built on top of the Linux kernel but are not necessarily free.

Choosing Distribution

Linux families

RPM based:

- Fedora
- RHEL (Red Hat Enterprise Linux)
- Centos (RHEL Fork)
- Oracle Linux
- Scientific Linux
- openSUSE
- Mandriva

Debian based:

- Debian
- Ubuntu
- Mint
- Crunchbang
- Element OS

Pacman based:

- Arch Linux
- Manjaro

Other:

- Slackware
- Gentoo

Factors to consider

- Architecture support (i386, x86_64, arm)
- Kernel edition used
- Stability
- Updates intervals
- Support lifecycle (long-term?)
- New features integration

We will use Ubuntu for our presentation

Installing Linux

Linux Installation

- Linux installation was a deterrent for most users.
- The situation has definitely changed and is much easier now

- You can install Linux:
  - Natively in dual boot (EFI bootloaders need some special care) :P
  - Inside a Virtual Machine

1. Download the .iso image of the distribution of your choice

2. In case of native installation:
   Burn it on a DVD
   or
   Make a bootable pendrive

   In case of VM installation:
   a. Create new VM
   b. Select resources of the VM (CPU, RAM, Disk)
   c. Pick the CD/DVD drive to point to the .iso image you downloaded.

3. Boot your machine (check the boot order)

4. Follow the wizard (by clicking on install)
   You can also try out the Linux distribution you dowloaded, if it's a live cd.

5. Beware of the partitioning!
   Mistakes here could lead to loss of data (in case of dual boot)

Some Jargon

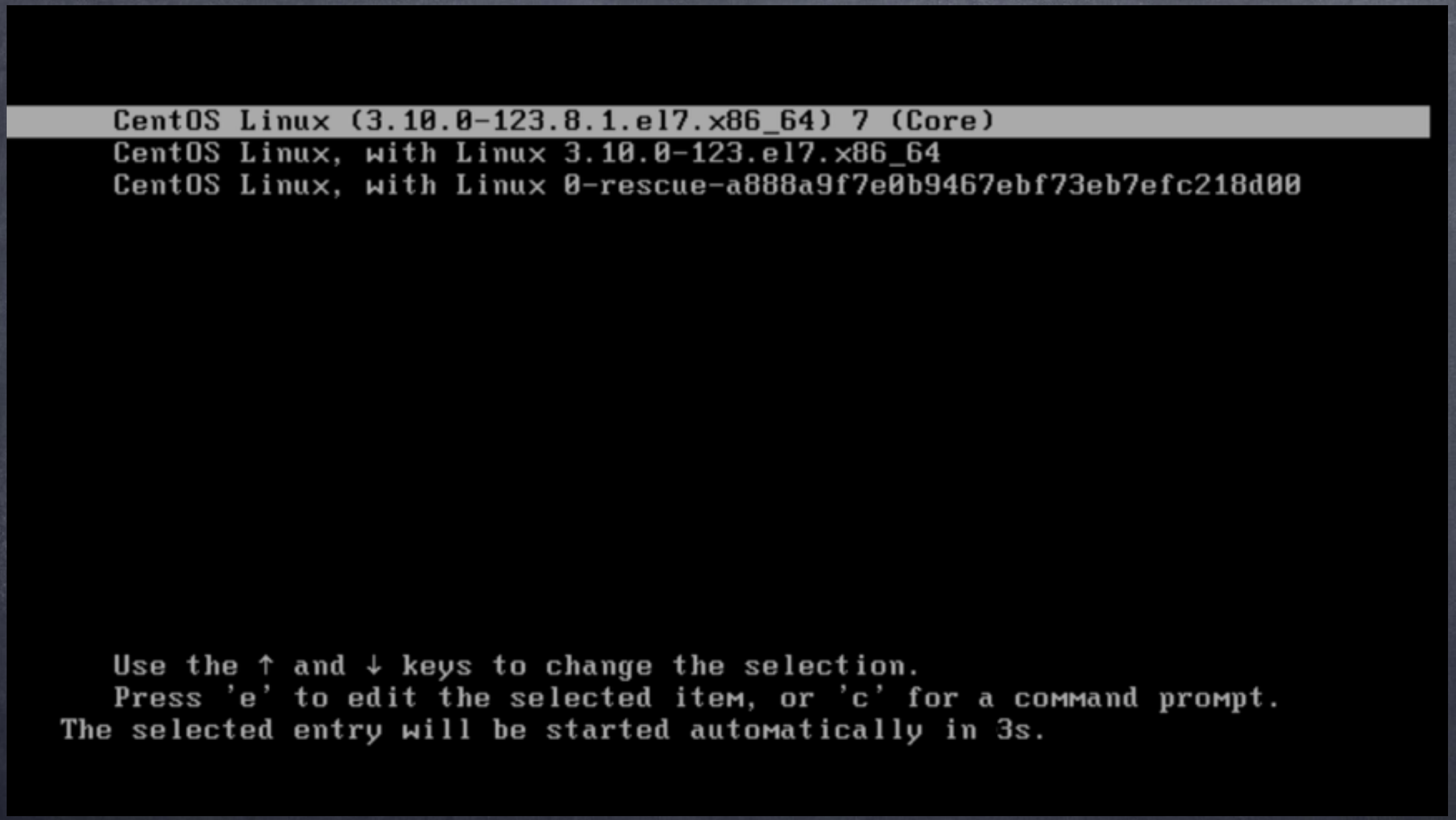
- Kernel: The brain of the OS
- Distribution: Software stack built on top of the Linux kernel packaged as one OS
- Bootloader: A program that is responsible for booting OSs
- Service: A program that runs in the background (otherwise known as daemon)
- Filesystem: A method for storing and organizing files
- Window System: provides a toolkit and protocol for building graphical user interfaces

Booting Linux

- BIOS points to phase1 bootloader
- Phase1 Bootloader (from MBR) may point to phase2 Bootloader (GRUB2, LILO)
  - Bootloader provides alternatives according to partitions
  - Loads the kernel
  - Starts initab (or systemd*)
  - All processes are children of init process

* Debian, Arch, Fedora, OpenSUSE, RHEL 7 have moved to systemd
Topic of great discussion ...

BIOS	Basic Input/Output System executes MBR
MBR	Master Boot Record executes GRUB
GRUB	Grand Unified Bootloader executes Kernel
Kernel	Kernel executes /sbin/init
Init	Init executes runlevel programs
Runlevel	Runlevel programs are executed from /etc/rc.d/rc*.d/

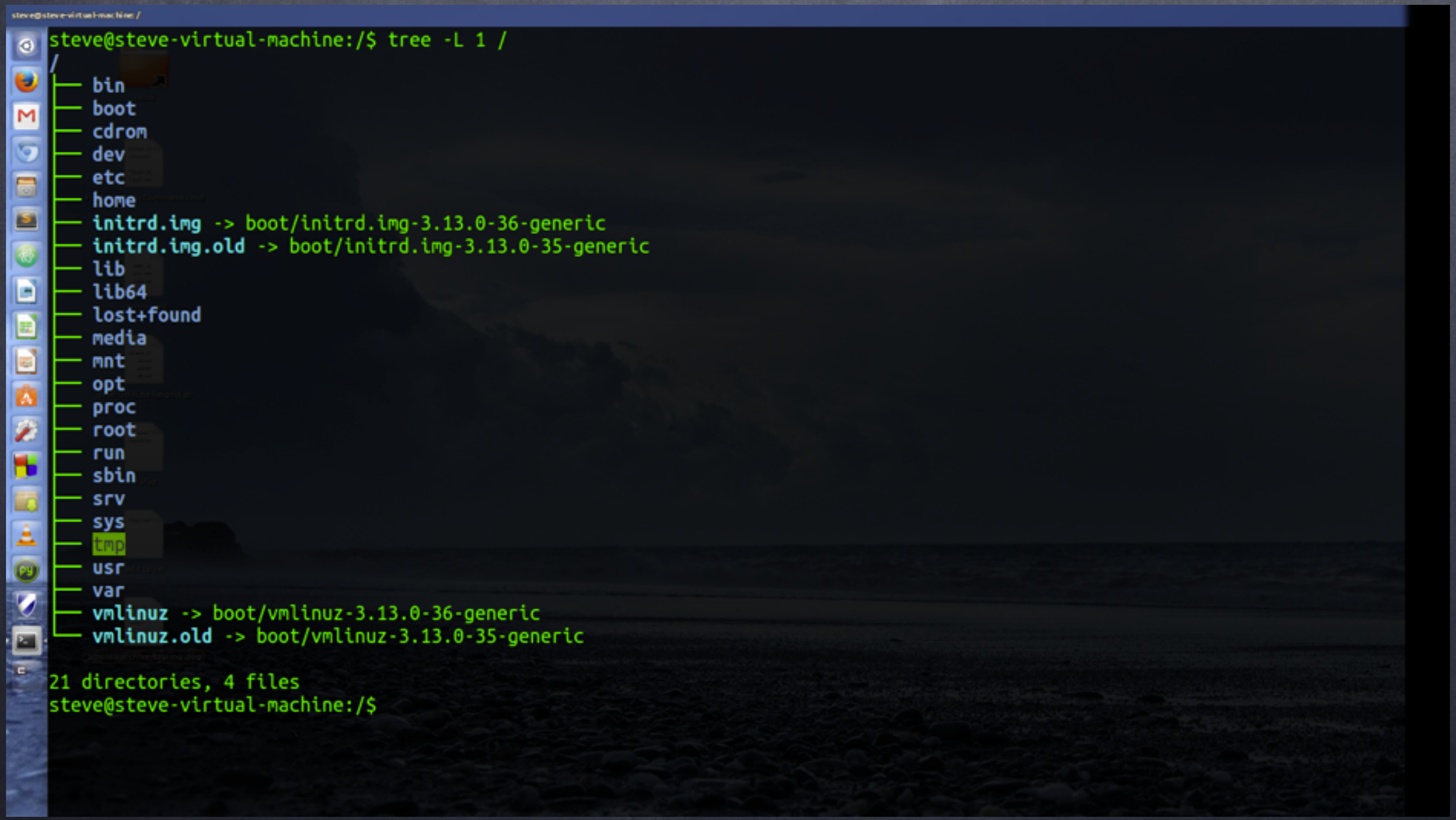

CentOS Linux (3.10.0-123.8.1.el7.x86_64) 7 (Core)
CentOS Linux, with Linux 3.10.0-123.el7.x86_64
CentOS Linux, with Linux 0-rescue-a888a9f7e0b9467ebf73eb7efc218d00
Use the ↑ and ↓ keys to change the selection.
Press 'e' to edit the selected item, or 'c' for a command prompt.
The selected entry will be started automatically in 3s.

Filesystems

Linux filesystems

- A method for storing/organizing files
- Conventional Linux fs:
  Native: ext2, ext3, ext4, Btrfs
  Other-OS: NTFS, vfat, hfs
- Flash fs:
  ubifs, JFFS2, YAFFS
- Database fs
- Special purpose fs:
  procfs, sysfs, tmpfs

Linux filesystems



Linux filesystems

- What is saved under which repository in under the programmers/sysadmin opinion.
- To eliminate this and have a general standard, there is the Filesystem Hierarchy Standard (FHS)

Desktop Environments

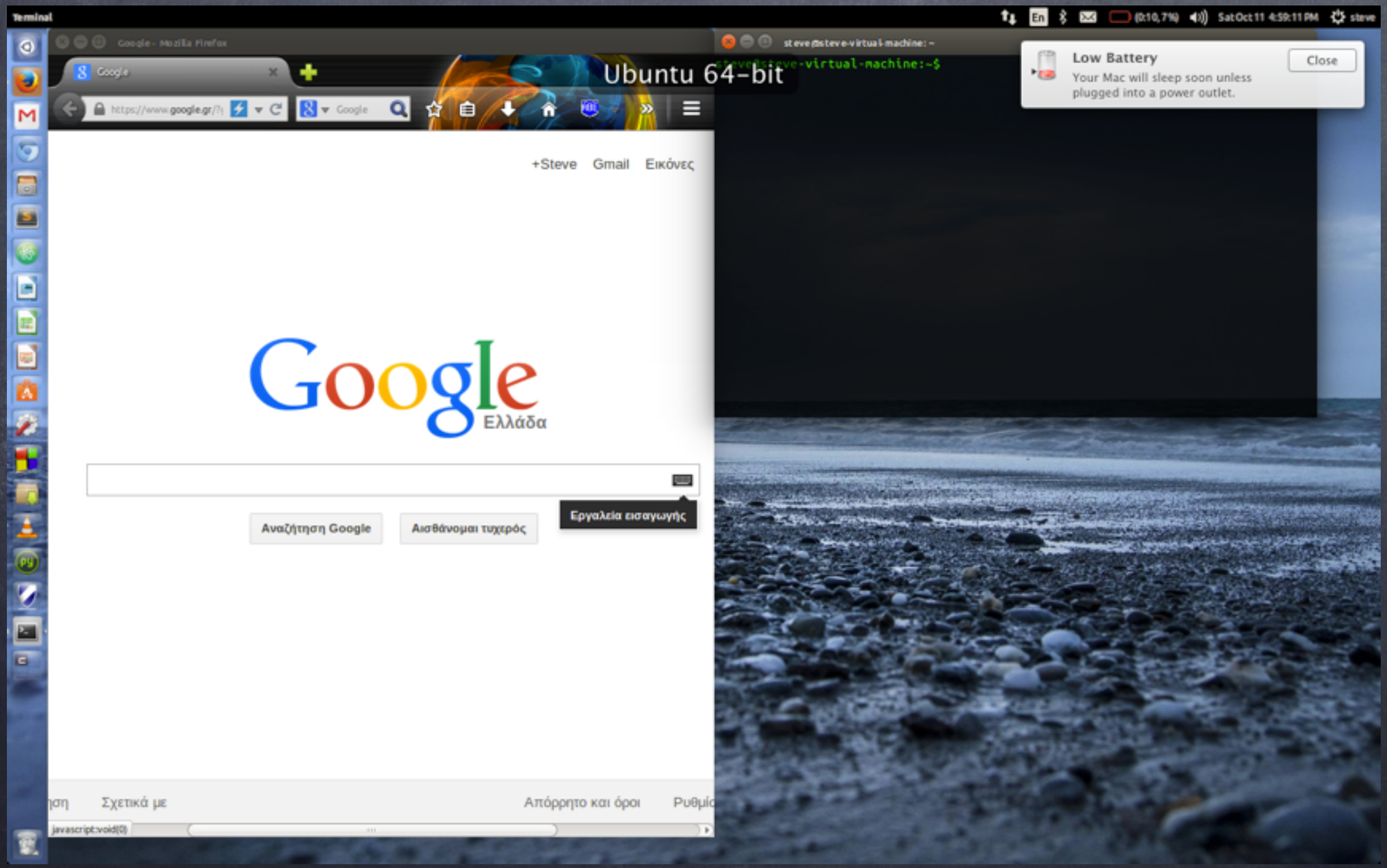
- Kernel and GUI are clearly distinct in Linux
- Linux does not necessarily come with a Desktop Environment installed
- Alternatives:
  - Gnome 2/3
  - Unity (comes with Ubuntu - based on Gnome)
  - Cinnamon (comes with Mint - based on Gnome 2)
  - KDE
  - xfce

* Different Desktop Environments may come with different applications

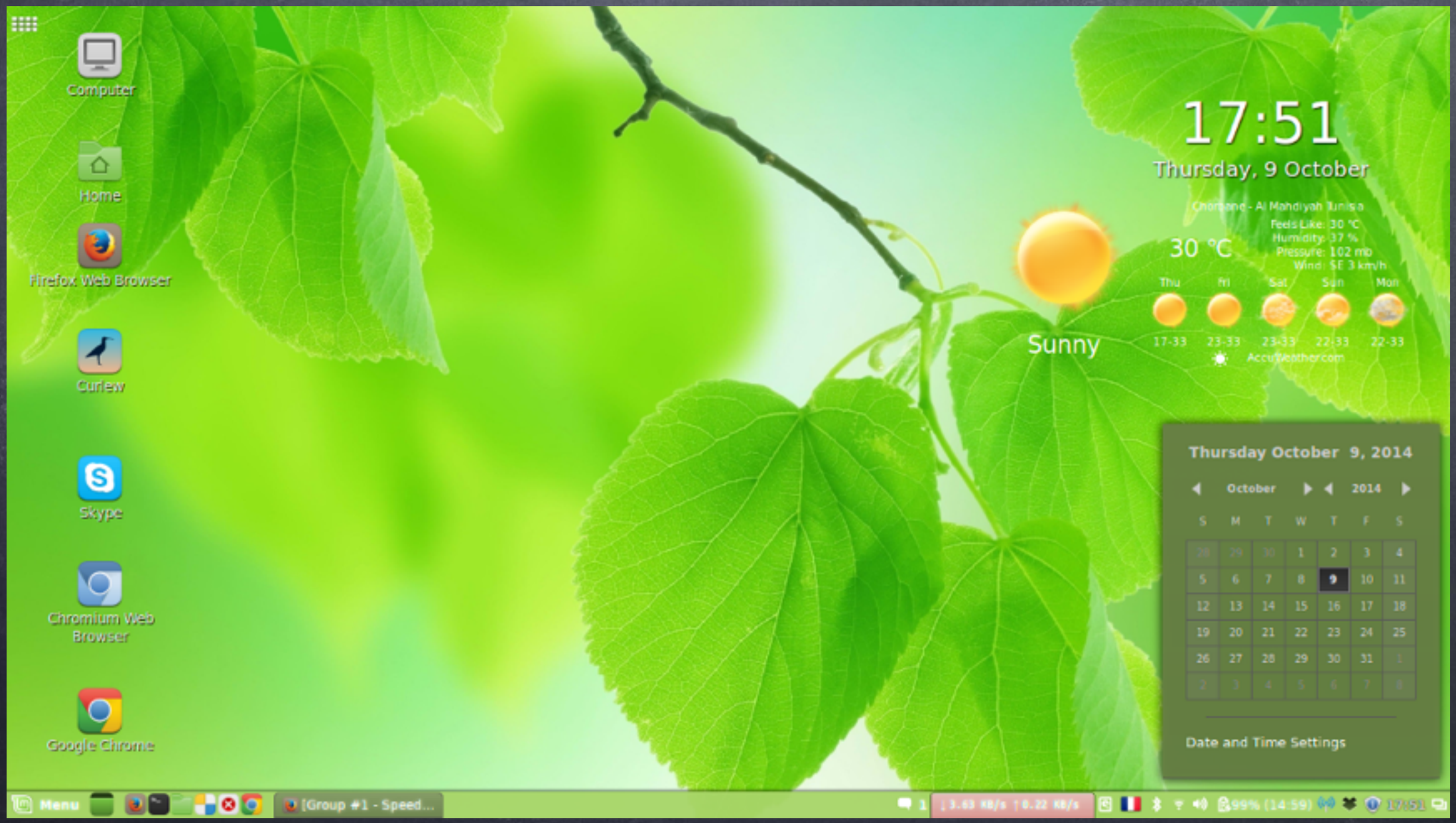
Desktop Environments

- All GUI functionality is built on top of X Window Server (which is old enough)
- Different Desktop Environments (GUI shells) have different display managers
  - Gnome - gdm
  - Unity - lightdm
  - KDE - kdm

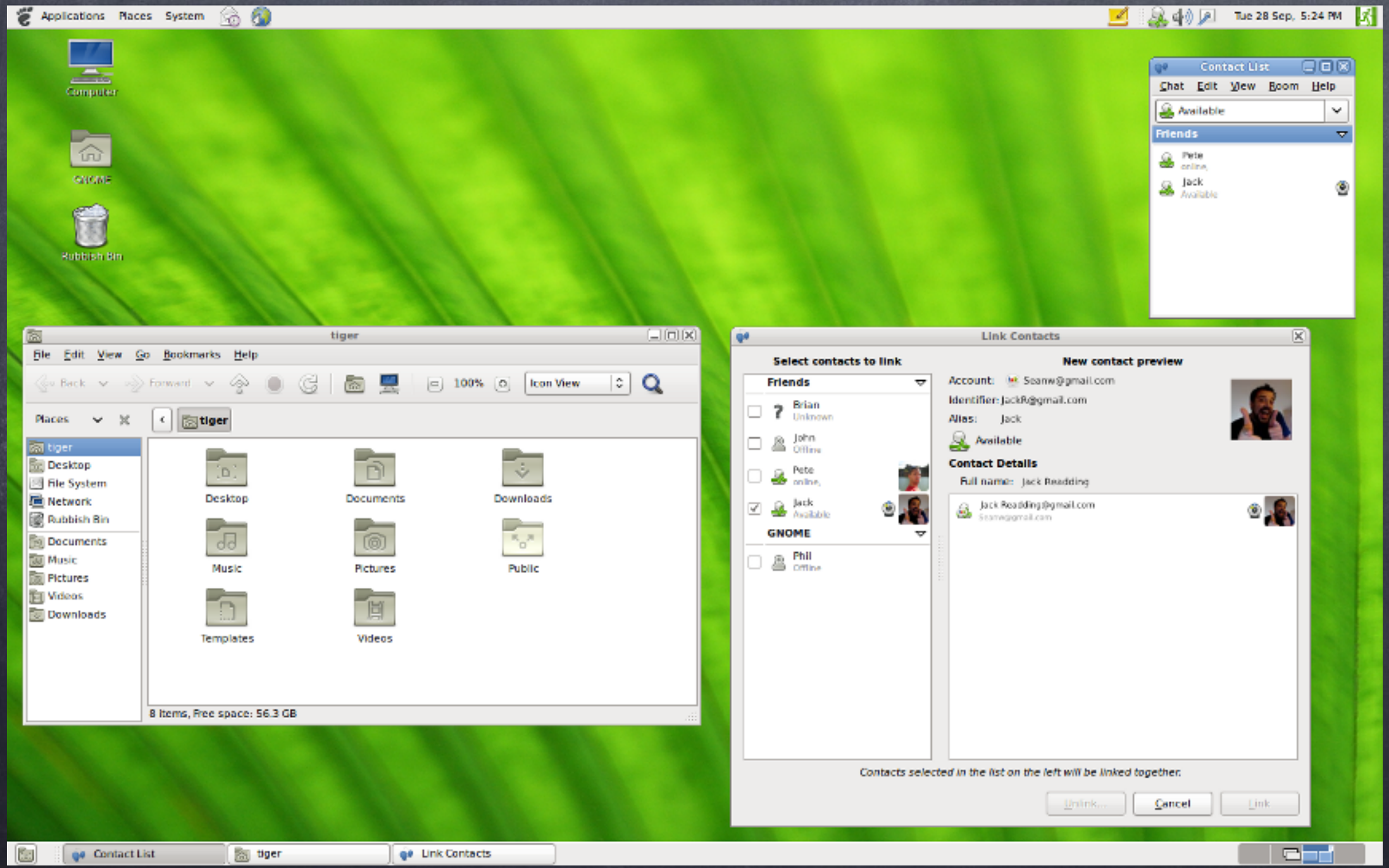
Unity


Terminal
En
(0:10, 7%)
Sat Oct 11 4:59:11 PM
steve
Google - Mozilla Firefox
Google
https://www.google.gr/?
Google
Ubuntu 64-bit
steve@steve-virtual-machine: ~
steve@steve-virtual-machine:~$
Low Battery
Your Mac will sleep soon unless plugged into a power outlet.
Close
+Steve
Gmail
Εικόνες
Google
Ελλάδα
Εργαλεία εισαγωγής
Αναζήτηση Google
Αισθάνομαι τυχερός
Σχετικά με
Απόρρητο και όροι
javascript:void(0)

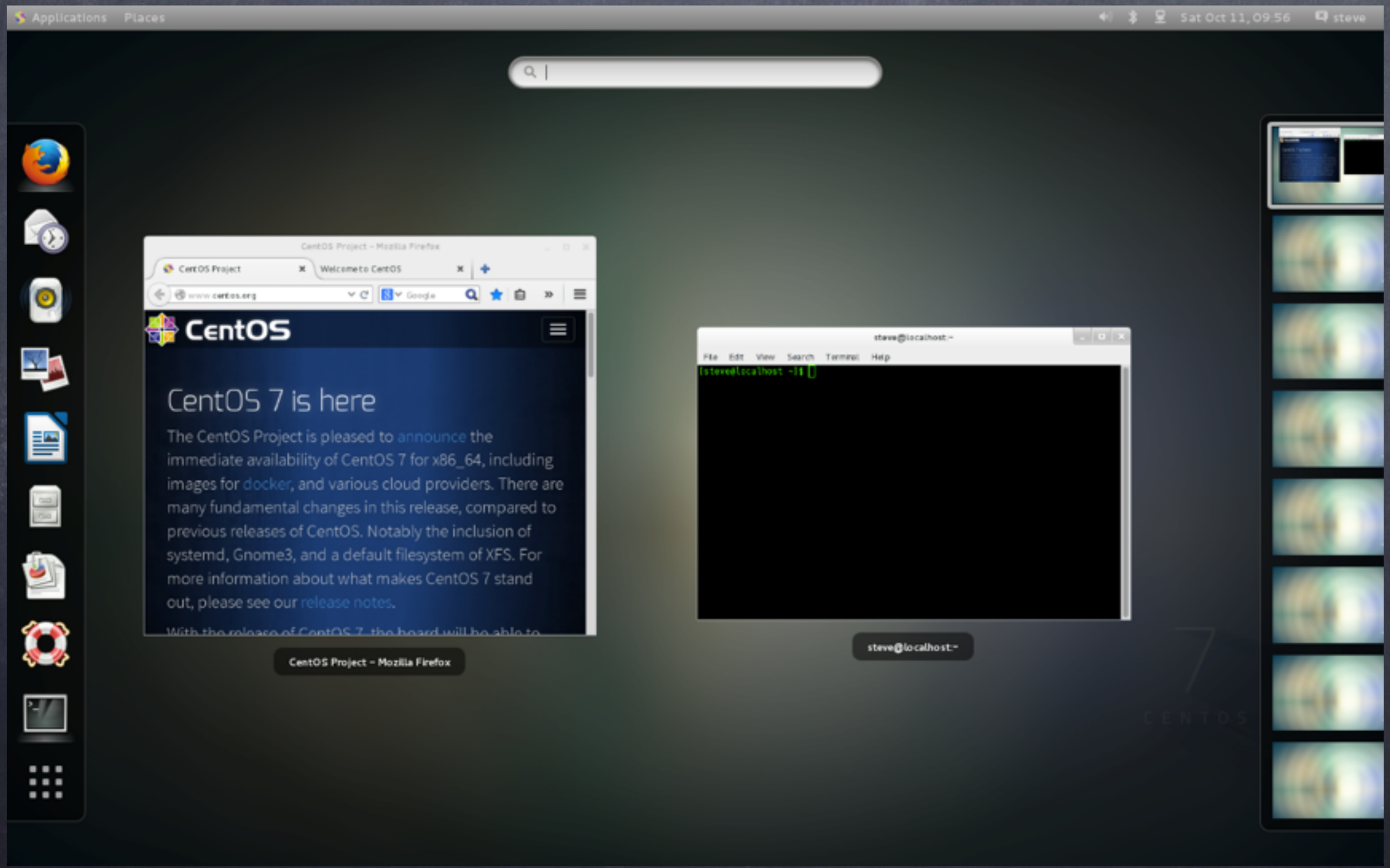
Cinnamon


Computer
Home
Firefox Web Browser
Curlew
Skype
Chromium Web Browser
Google Chrome
17:51
Thursday, 9 October
Chorbane - Al Mahdiyah Tunisia
Feels Like: 30 °C
Humidity: 37 %
Pressure: 102 mb
Wind: SE 3 km/h
30 °C
Sunny
Thu
Fri
Sat
Sun
Mon
17-33
23-33
23-33
22-33
22-33
AccuWeather.com
Thursday October 9, 2014
October
2014
S M T W T F S
Date and Time Settings
Menu
[Group #1 - Speed...
99% (14:59)
17:51

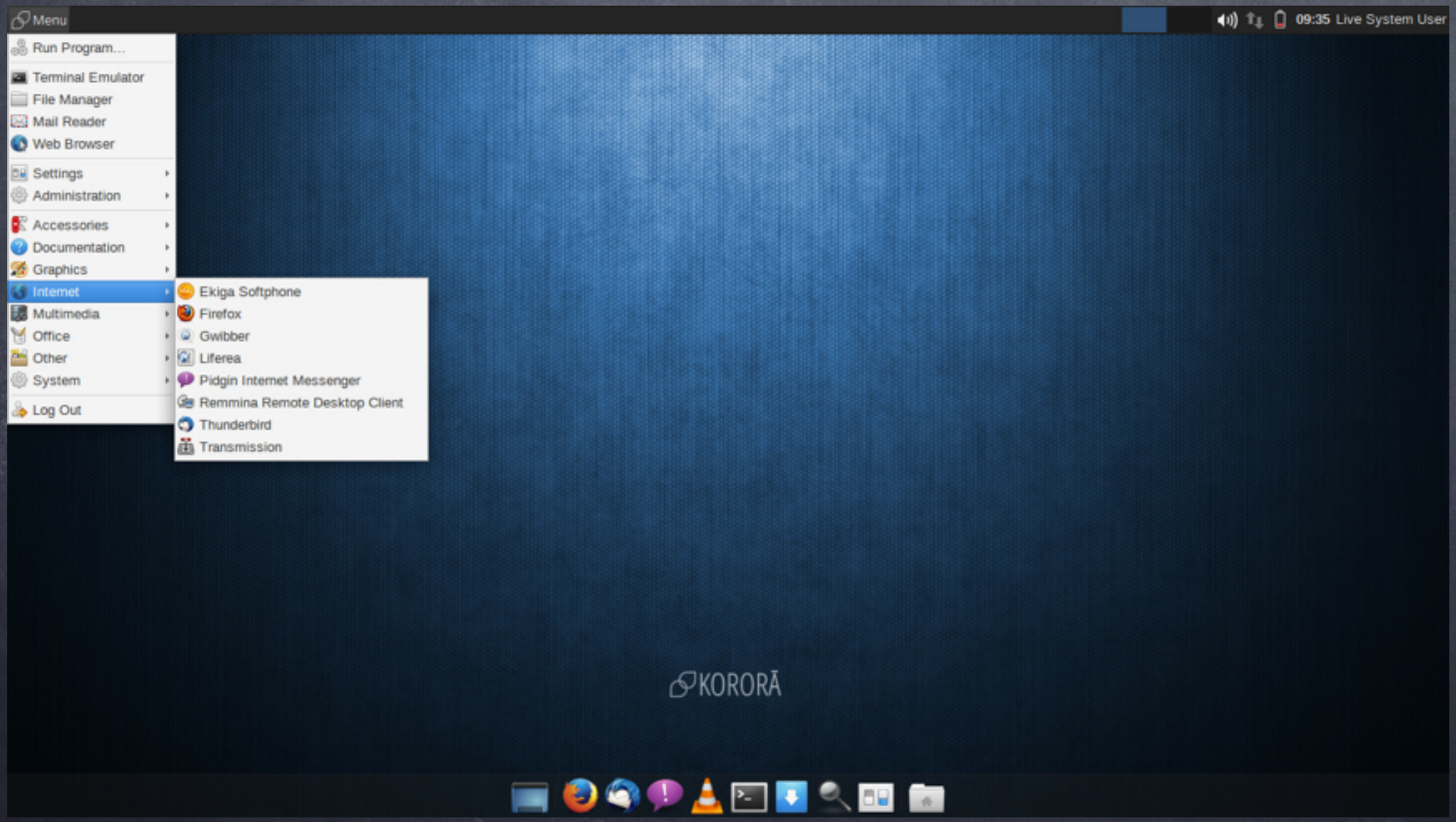
Gnome 2


Applications
Places
System
Tue 28 Sep, 5:24 PM
Computer
Rubbish Bin
Contact List
Chat
Edit
View
Boom
Help
Available
Friends
Pete
online
Jack
Available
tiger
File
Edit
View
Go
Bookmarks
Help
Back
Forward
100%
Icon View
Places
tiger
Desktop
File System
Network
Rubbish Bin
Documents
Music
Pictures
Videos
Downloads
Templates
Public
8 items, Free space: 56.3 GB
Link Contacts
Select contacts to link
Friends
Brian
Unknown
John
Offline
Pete
online
Jack
Available
GNOME
Phil
Offline
New contact preview
Account:
Identifier:
Alias:
Jack
Available
Contact Details
Full name:
Jack Reading
Contacts selected in the list on the left will be linked together.
Unlink...
Cancel
Link
Contact List
tiger
Link Contacts

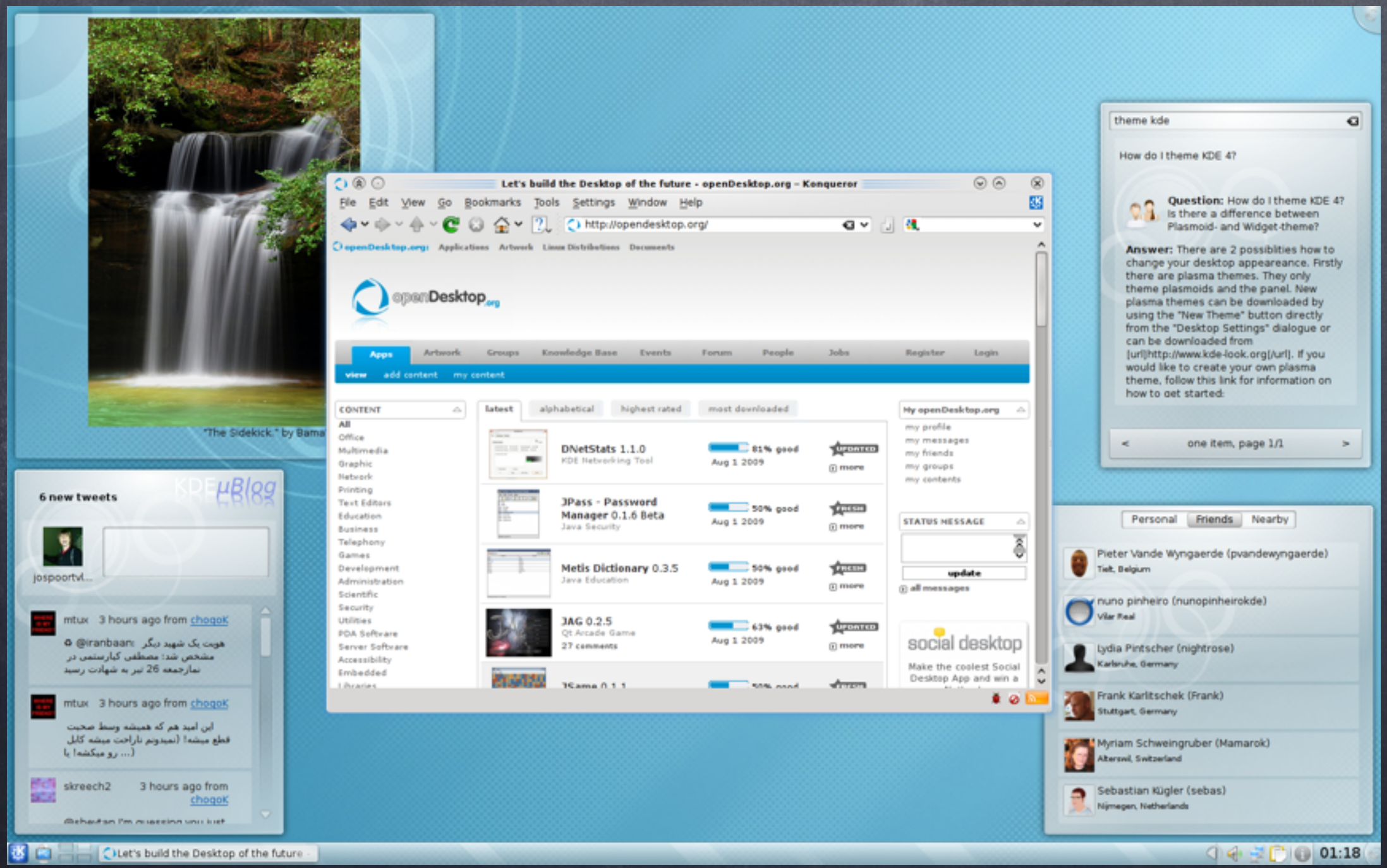
Gnome 3


Applications
Places
Sat Oct 11, 09:56
steve
CentOS Project - Mozilla Firefox
CentOS Project
Welcome to CentOS
www.centos.org
Google
CentOS
CentOS 7 is here
The CentOS Project is pleased to announce the immediate availability of CentOS 7 for x86_64, including images for docker, and various cloud providers. There are many fundamental changes in this release, compared to previous releases of CentOS. Notably the inclusion of systemd, Gnome3, and a default filesystem of XFS. For more information about what makes CentOS 7 stand out, please see our release notes.
CentOS Project - Mozilla Firefox
steve@localhost:~
File Edit View Search Terminal Help
[steve@localhost ~]$
steve@localhost:~

XFCE


Menu
09:35 Live System User
Run Program...
Terminal Emulator
File Manager
Mail Reader
Web Browser
Settings
Administration
Accessories
Documentation
Graphics
Internet
Multimedia
Office
Other
System
Log Out
Ekiga Softphone
Firefox
Gwibber
Liferea
Pidgin Internet Messenger
Remmina Remote Desktop Client
Thunderbird
Transmission
KORORĀ

KDE

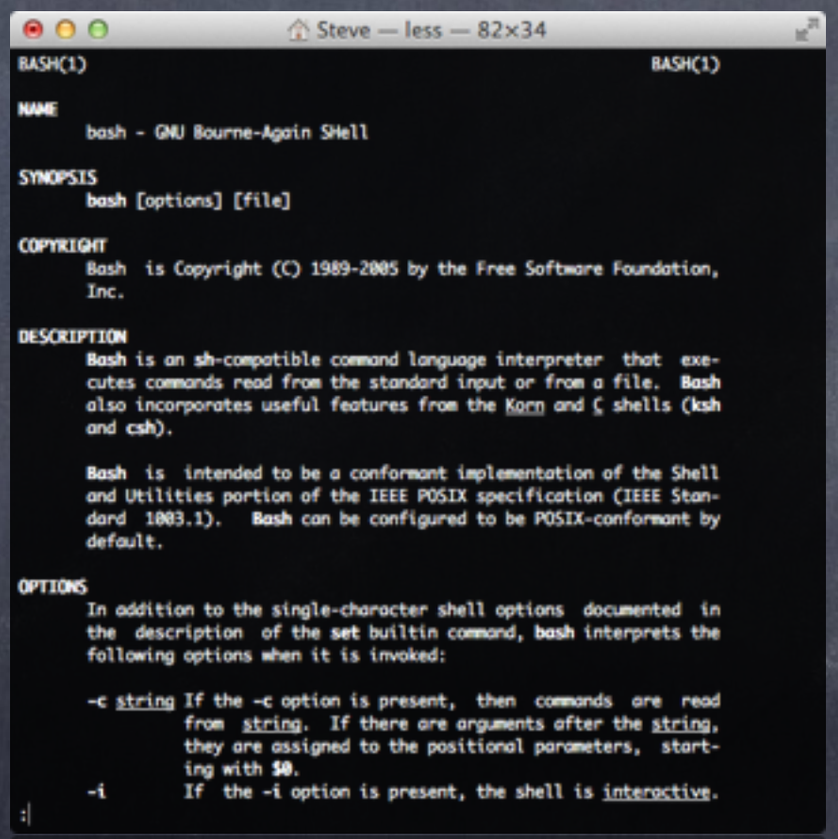

"The Sidekick." by Bama
Let's build the Desktop of the future - openDesktop.org – Konqueror
File Edit View Go Bookmarks Tools Settings Window Help
http://opendesktop.org/
openDesktop.org
Apps Artwork Groups Knowledge Base Events Forum People Jobs Register Login
view add content my content
CONTENT
All
Office
Multimedia
Graphic
Network
Printing
Text Editors
Education
Business
Telephony
Games
Development
Administration
Scientific
Security
Utilities
PDA Software
Server Software
Accessibility
Embedded
latest alphabetical highest rated most downloaded
DNetStats 1.1.0
KDE Networking Tool
81% good
Aug 1 2009
JPass - Password Manager 0.1.6 Beta
Java Security
50% good
Aug 1 2009
Metis Dictionary 0.3.5
Java Education
50% good
Aug 1 2009
JAG 0.2.5
Qt Arcade Game
27 comments
63% good
Aug 1 2009
My openDesktop.org
my profile
my messages
my friends
my groups
my contents
STATUS MESSAGE
update
all messages
social desktop
Make the coolest Social Desktop App and win a
theme kde
How do I theme KDE 4?
Question: How do I theme KDE 4? Is there a difference between Plasmoid- and Widget-theme?
Answer: There are 2 possiblities how to change your desktop appeareance. Firstly there are plasma themes. They only theme plasmoids and the panel. New plasma themes can be downloaded by using the "New Theme" button directly from the "Desktop Settings" dialogue or can be downloaded from [url]http://www.kde-look.org[/url]. If you would like to create your own plasma theme, follow this link for information on how to get started:
one item, page 1/1
KDE μBlog
6 new tweets
jospoortvl...
mtux 3 hours ago from chogoK
@iranbaan: هویت یک شهید دیگر مشخص شد: مصطفی کیارستمی در نمازجمعه 26 تیر به شهادت رسید
mtux 3 hours ago from chogoK
این امید هم که همیشه وسط صحبت قطع میشه! (نمیدونم ناراحت میشه کابل رو میکشه! یا ...)
skreech2 3 hours ago from chogoK
Personal Friends Nearby
Pieter Vande Wyngaerde (pvandewyngaerde)
Tielt, Belgium
nuno pinheiro (nunopinheirokde)
Vilar Real
Lydia Pintscher (nightrose)
Karlsruhe, Germany
Frank Karlitschek (Frank)
Stuttgart, Germany
Myriam Schweingruber (Mamarok)
Alterswil, Switzerland
Sebastian Kügler (sebas)
Nijmegen, Netherlands
Let's build the Desktop of the future
01:18


SO MANY OPTIONS
I CAN'T CHOOSE DISTRO AND SHELL
memegenerator.net

Basic GUI Software

- Terminal
- Graphical Text Editors
  Gedit
  Sublime
  Atom
- Browsers
  Firefox (usually comes preinstalled)
  Chromium
- Thunderbird (e-mail client)
- GIMP (GNU Image Manupulation Software)
- LibreOffice (Office Suite)
- Synaptics Package Manager
- Transmission (bitorrent client)

Linux CLI Shell



Shell, Console, Terminal

- Terminal:
  a user point of entry to manage a system
  (physical, may be a KVM)

- Virtual Terminal:
  users have access to multiple terminals offered
  by the OS, but are not physical

- Terminal Emulator:
  GUI program that runs inside a desktop
  environment and create a CLI environment.
  (e.g. xterm, gnome-terminal, konsole, etc.)

Shell, Console, Terminal

- Console:
  Essentially what's running inside a terminal

- Shell:
  The program that processes the commands and returns output

Linux CLI Shell

- Interaction with Operating System using Command Line Interface
- Bash: Bourne Again Shell
  The default shell for Linux.
  Alternatives: csh, sh, ksh, zsh, etc.
- Enables you to accomplish tasks in batch, non-interactively and asynchronously (cronjobs)
- You can write scripts that you can run multiple times, just like a interpreted language

Basic CLI Software

- Text Editors:
  vim, emacs, nano, cat, more, less, tail

- Network:
  ping, netstat, host, dig, nslookup, ipconfig ,traceroute, tcpdump, route, wget, curl, ssh, ...

- Git

- Text manipulation
  awk, sed, sort, cat, join, split, diff, patch

- Compression & archiving
  tar, zip, gzip, bzip2, xz

- Man pages

- Compilers, interpreters
  gcc, g++, javac, java, python, etc.

Bash

The Bourne Again Shell

Your tools

- If you have Linux installed, that's great!
- If you don't, then
  1. There is a DVD circulating with Linux images
  2. You'll connect to a vm I have created for this event

SSH on Windows

- If you have a Windows host OS, download Putty from here: http://the.earth.li/~sgtatham/putty/latest/x86/putty.exe
- Open it and connect to: snf-610211.vm.okeanos.grnet.gr with username: demo_user[0-4] and password: opt6\bumping
- There will be no GUI!

Index

- POSIX Operating Systems
- Basic commands
- Text processing with vim

Some key remarks

- Initially written by Brian Fox, co-developed by Richard Stallman
- Free software replacement for the Bourne shell (sh)
- Distributed with Linux, Unix and ported to Windows (Cygwin), Android (Terminal Emulators), DOS (DJGPP)
- Bash is a POSIX Shell with a number of additional extensions

POSIX Operating Systems

- POSIX: Portable Operating Systems Interface
- Standarized by the IEEE
- POSIX defines the application programming interface (API), along with command line shells and utility interfaces, for software compatibility with variants of Unix and other operating systems.
- For Unix-like OSs

POSIX Compliant OS

Fully-compliant:
Solaris
Unixware
OS X
HP-UX
BSD
A/UX

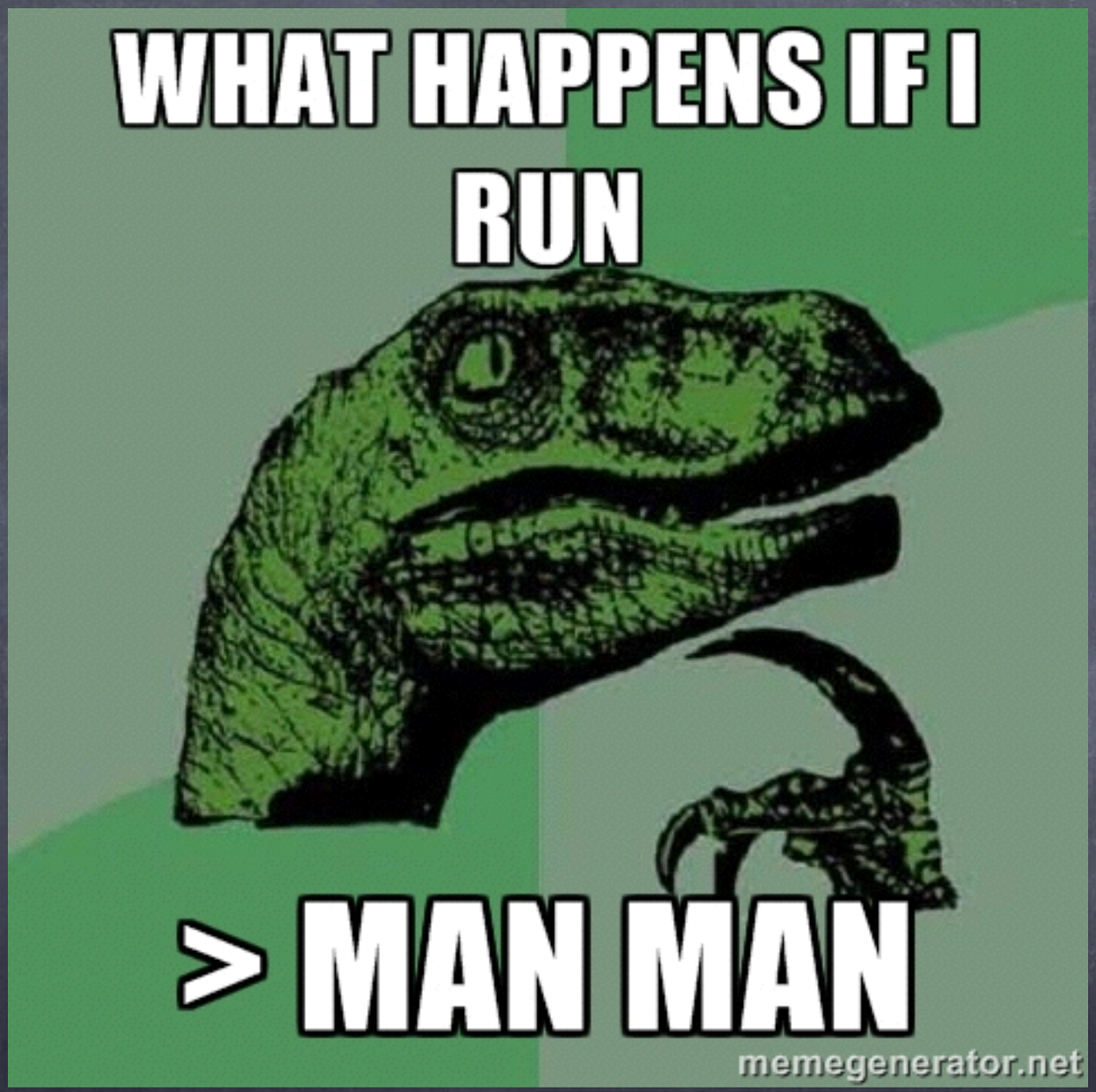
Compliant via Compatibility feature:
SymbianOS
Windows NT kernel

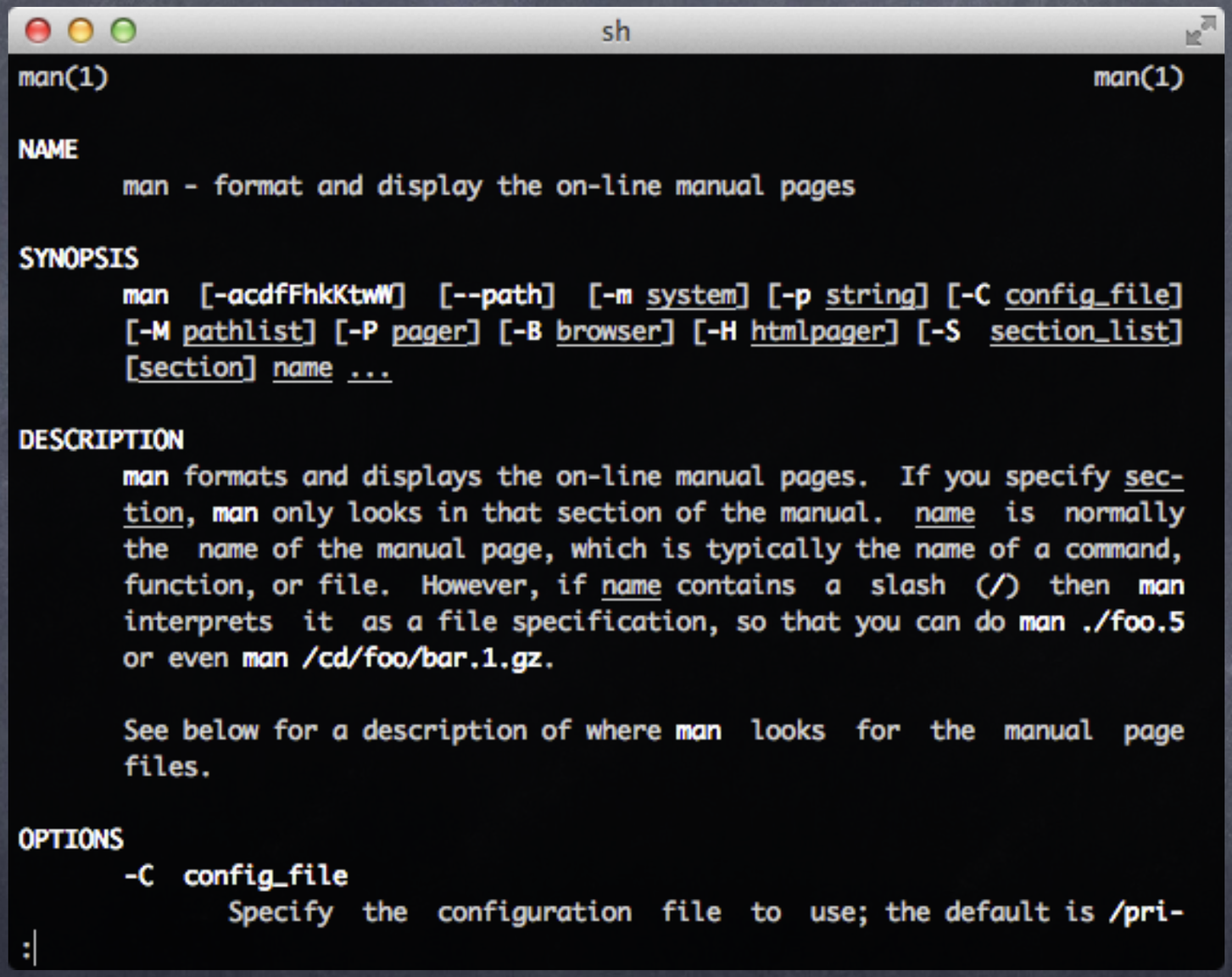
Mostly-Compliant:
FreeBSD
Darwin (part of OS X)
Linux
MINIX
NetBSD
OpenBSD
OpenSolaris

The most essential command

```
> man <program_or_command>

# shows the integrated manual for the specified program-command
```


WHAT HAPPENS IF I RUN
> MAN MAN
memegenerator.net


sh
man(1) man(1)
NAME
man - format and display the on-line manual pages
SYNOPSIS
man [-acdfFhkKtwW] [--path] [-m system] [-p string] [-C config_file]
[-M pathlist] [-P pager] [-B browser] [-H htmlpager] [-S section_list]
[section] name ...
DESCRIPTION
man formats and displays the on-line manual pages. If you specify section, man only looks in that section of the manual. name is normally the name of the manual page, which is typically the name of a command, function, or file. However, if name contains a slash (/) then man interprets it as a file specification, so that you can do man ./foo.5 or even man /cd/foo/bar.1.gz.
See below for a description of where man looks for the manual page files.
OPTIONS
-C config_file
Specify the configuration file to use; the default is /pri-
:

Navigation

if you press <Tab> when writing a file in a directory, the bash system auto-completes it

```
> cd <directory>

> cd .. # go back

> ls # list files in the directory

> ls -al # show all files in list
```

File permissions

- In every Operating System, security is of vital importance, especially in multi-tenant ones.

- User rights on a file are saved in the file metadata.

- 3 user categories: owner, owner's group, other

- 3 rights per category: read (r), write (w), execute (x)

ls -l details

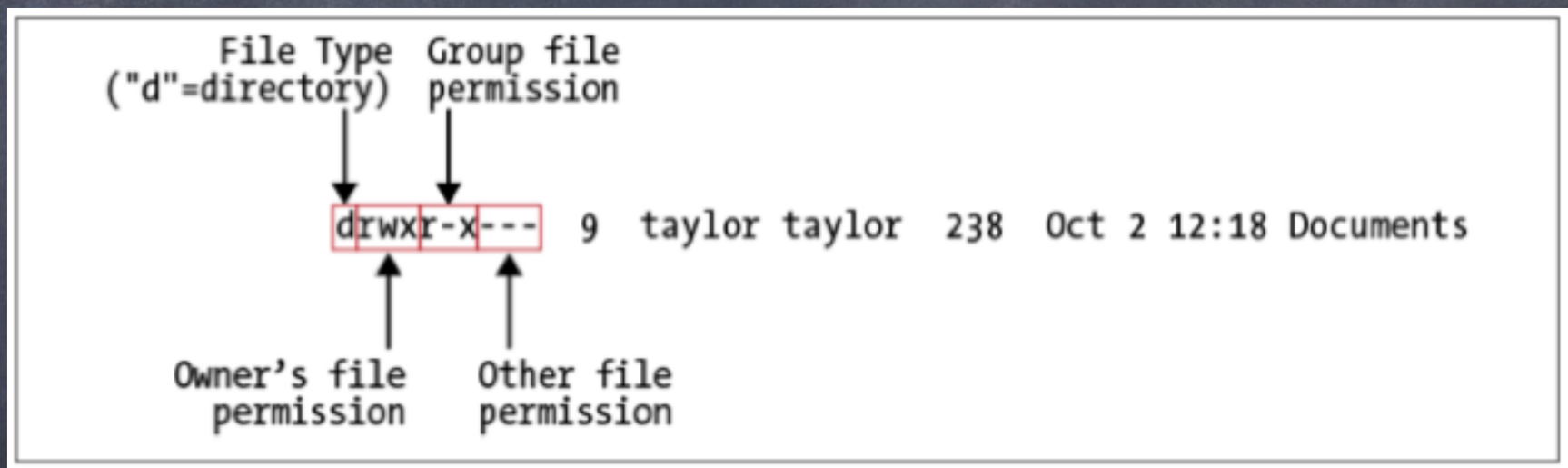


Figure 3-7. A detailed look at file permissions

Changing file permissions

In order to change permissions of a file, you have to be its owner.

```
# Change owner of the file
$ chown <user>:<group> <filename>

# Change rights
$ chmod <###> <filename>
or
$ chmod <{u,g,o}{+,-}{r,w,x}> <filename>
```

File manipulation

```
# Create a new text file
$ touch newfile.txt

# Create a new directory
$ mkdir myFolder

# Copy file
$ cp <fileToCopy> <pathToBeCopiedTo>

# Move/Rename file
$ mv <fileToCopy> <pathToBeCopiedTo>

# Delete file
$ rm <fileToDelete>

# Delete folder
$ rm -rf <folderToRemove>
```

View file details

```
# show file statistics
$ stat <fileToCheck>

# show file statistics more verbosely
$ stat -x <fileToCheck> # this is valid in OS X
bash (not wrong after all)

# show specific for each type of file
$ stat -F <fileToCheck>
```

View disk usage

```
# Show disk usage for the current directory
$ du
$ du -s # summary
$ du -h <(Byte, Kilobyte, Megabyte, Gigabyte,
Terabyte, Petabyte)>

# Show disk usage information for each mounted
volume in the system
$ df
$ df -i # inodes
```

View running processes

```
# Show current processes running in the computer
$ top
$ top -pid <PID_value> # for specific process
$ top -o <sortByValue> # sort by the specified attribute

or
==

# shows a snapshot of the processes running
$ ps -f # uid, pid, parent pid, recent CPU usage, process
start time, controlling tty, elapsed CPU usage, and the
associated command, with -u show the user (no uid)
$ ps -j # user, pid, ppid, pgid, sess, jobc, state, tt, time,
and command.
```

Pipelining

```
# Pipelining enables you to have the output of a
command as the input of another

$ ps -aux l grep firefox
$ ls -la l grep <filename>
$ rpm -qa l grep vim
```

Redirection

```
# Redirect the output of a command to a file
$ ls . > someFile.txt #overwrite
$ ls . >> someFile.txt #append

# Redirect stderr to stdout
$ command 2>&1

# Suppress output
$ command &>/dev/null
```

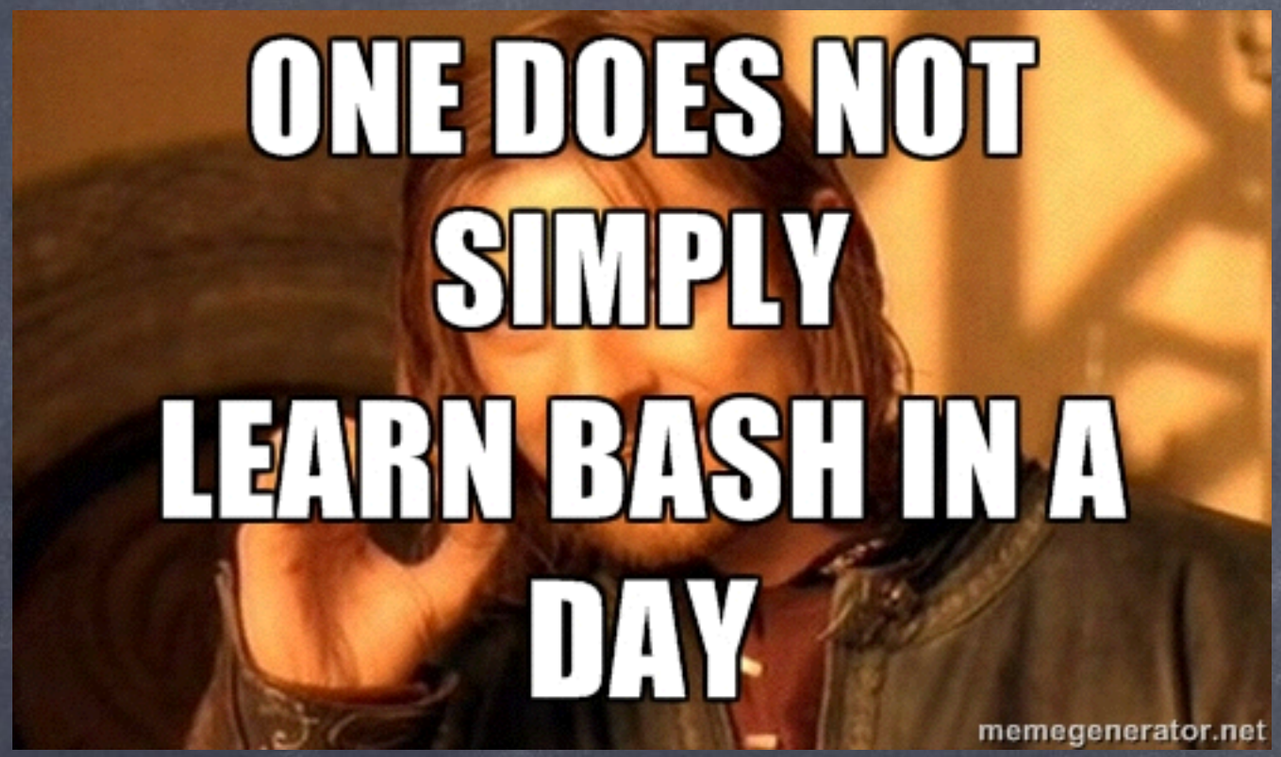
Text Processing

There are various ways to handle text through bash terminal:

- cat
- more
- less
- tail
- vim
- emacs

Elevated rights

- In linux, you may need elevate rights to run some commands or access certain files
- The root user is the administrator of the system
- With the sudo, you run the following command as root (provided you are a sudoer)


ONE DOES NOT
SIMPLY
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Bash Scripting

Shebang

- It's the symbol #!
- In the first line of your script (not necessarily bash)
- Defines the "interpreter" of the script
- For bash scripts:
  #!/bin/bash

Environment Variables

```
# There are variables in bash where you can save
values or outputs of programs
$ MY_VARIABLE=<some_number>
$ MY_OTHER_VARIABLE="Hello World"

# Note the absence of spaces surrounding "="

# In order to get the value of a variable:
$ echo $MY_VARIABLE
```

Environment Variables

```
# To make variable available to sub-processes
$ export $MY_VARIABLE

# There are also built-in variables
$ env
$ printenv
$ declare -p[x]
```

Arithmetic operations

```
# expr
$ MY_VAR=`expr 10 + 10` # note spaces

# let
$ let MY_VAR=(10+10)
$ echo $MY_VAR

# C-syntax
$ MY_OTHER_OTHER_VAR=$((10+10))
$ echo $MY_OTHER_OTHER_VAR
```

Conditionals

```
if <condition>; then
    <statement>
elif <condition>; then
    statement
else
    <statement>
fi
```

Conditions

Full list of conditions:
$ man list

File Conditionals

-e file - Check if the file exists

-d file - Check if the file is a directory

-f file - Check if the file is regular (not symbolic link)

-s file - Check if the file is of non-zero size

-g file - Check if the file has the **sgid** set

-u file - Check if the file has the **suid** set

-r file - Check if the file is readable

-w file - Check if the file is writable

-x file - Check if the file is executable

String Conditionals

STRING1 = STRING2

STRING1 != STRING2

Numerical Conditionals

-eq - equal

-ne - not equal

-gt - greater than

-ge - greater or equal

-lt - lower than

-le - lower or equal

Conditions

```
# if file exists
if [ -e myFile ]; then
      cat myFile
else
      echo "File does not exist"
fi

# string comparison
if [ string1 = string2 ]; then
      echo "Same string"
else if [string1 != string2 ];then
      echo "Different strings"
fi

# numerical comparison
if [ 1 -eq 2 ] then;
      echo "There is something wrong \
with your math"
fi
```

Case Statement

```
case <expression> in
      pattern1) <commands>;;
      pattern2) <commands>;;
      pattern3) <commands>;;
      pattern4) <commands>;;
      ...
      * ) <commands>;; #default
esac
```

Loops

```
# for each
for <var_name> in <list>;do
      <commands>
done

# C-syntax
for ((i=0;i<10;i++))
do
      <commands>
done

# while
while <expression>;do
      <commands>
done

# until
until <expression>;do
      <commands>
done
```

Functions

```
fun foo()
{
    <commands>
}

# the function must precede the call
# functions cannot be empty
```

Exit code

```
# exit command
exit <exit_code>

# get exit code of last command
$?
```

Debugging

- In the whole script
  #!/bin/bash -x

- In specific part of the script
  set -x (starting point)
  set +x (ending point)

Bash scripting

- What we have been seeing hitherto is done synchronously and attended
- What if we need to perform some task many times or in an unattended manner in order to automate it?

Package Managers

Package Manager

- The way you add/remove programs in Linux is really different from the one in Windows ...
- Most mainstream programs installed in a Linux OS, can be installed via the package manager, provided you have included the necessary repositories.
- There are both a CLI and a visual way to accomplish your goals.

Package manager in Ubuntu

- Name: dpkg (Debian packager)
- It can install, remove and build packages locally downloaded.

Package manager in Ubuntu (dpkg)

- List all packages installed in your system:
  > dpkg -l (| grep <name_to_search>
- List the files installed by a package:
  > dpkg -L <package_name>
- Check which package installed a file:
  > dpkg -S <filename>
- Installing a package:
  > sudo dpkg -i <package.deb>
- Uninstalling a package:
  > sudo dpkg -r <package_name> # does not handle dependencies (not recommended)

In reality, apt-get program is used most times.

apt stands for Ubuntu's Advanced Packaging Tool

Package manager in Ubuntu

- Name: apt
- It can install new software, upgrade existing packages, update the package index and even upgrade the entire Ubuntu system
- The apt package index is basically a db of available packages from enabled repos (/etc/apt/sources.list)

Package manager in Ubuntu (apt)

- Install a package:
  > sudo apt-get install <package_name>

- Remove a package:
  > sudo apt-get remove <package_name>
  > sudo apt-get remove -- purge <package_name> # removes the package configuration (use only when necessary)

- Update package index:
  > sudo apt-get update

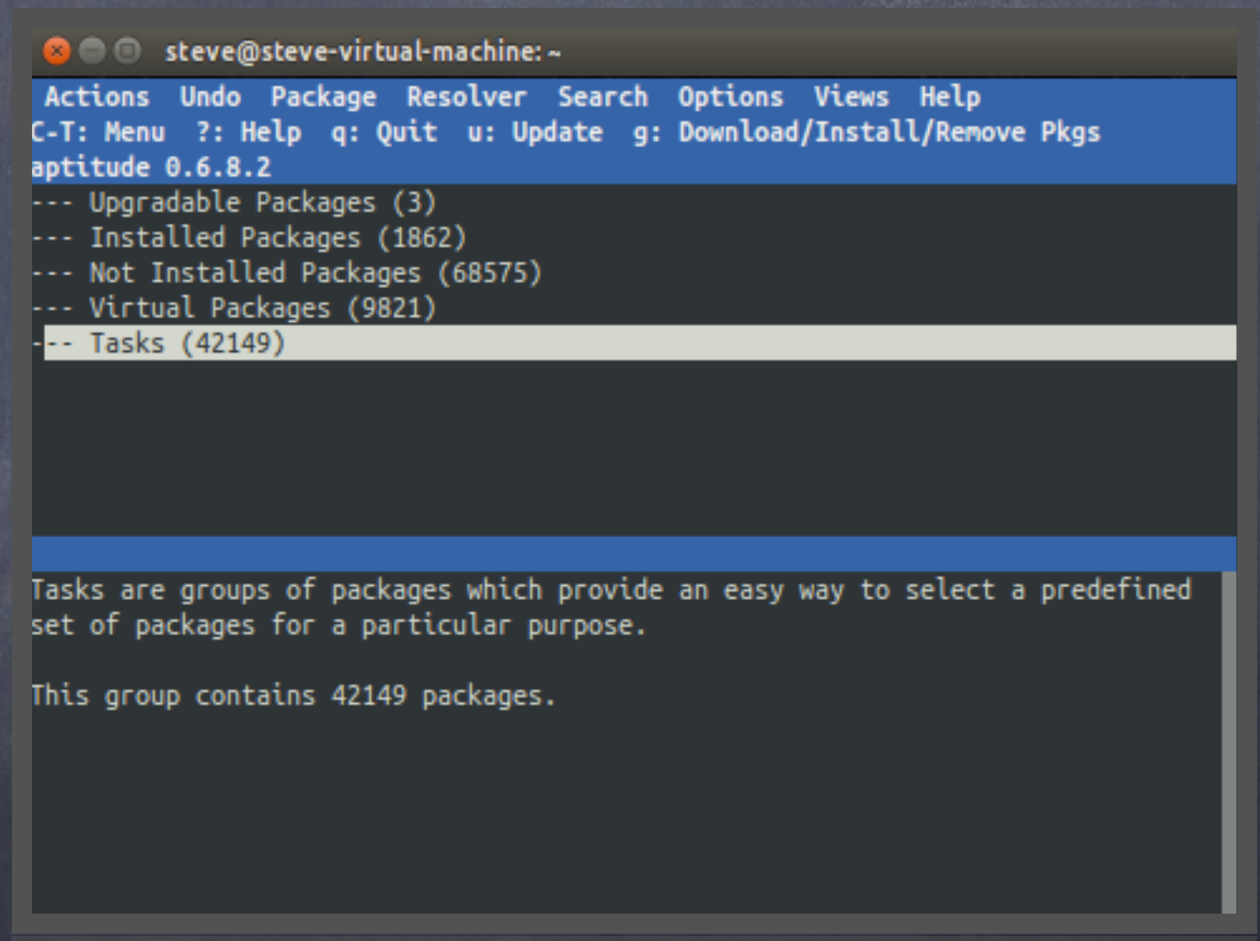
- Upgrade packages:
  > sudo apt-get upgrade

There is something more called Aptitude ...

Essentially it is a text-based front-end to the apt system.

Aptitude

- > sudo aptitude



Programming under Linux

"Linux is great for programming!"

Index

- Programming in C
- Programming in C++
- Programming in Java
- Programming in Python
- Programming in bash (scripting)

C

```
> gcc <source.c> -o source
[<flags>]

> chmod u+x source

> ./source
```

C++

```
> g++ <source.cpp> -o source
[<flags>]

> chmod u+x source

> ./source
```

Java

```
# If you have a jar file

> java -jar program.jar

# Compile and run

> javac -d <bin> -sourcepath <src> -cp <lib/
lib1.jar;lib/lib2.jar> <src/com/example/
Application.java>

> java -cp <bin> <lib/lib1.jar;lib/lib2.jar>
<com.example.Application>
```

Python

```
# Invoke python interpreter

> python

# Python script

> chmod u+x
python_script.py

> ./python_script.py

# Python application
```

If you want to use python 3, and have it installed, use python3 instead of python

Bash Script

```
> chmod u+x script.sh

> ./script.sh
```

IDEs

- C/C++:
  Netbeans, Eclipse with plugins, Codeblocks
- Java:
  Netbeans, Eclipse, IDEa
- Python:
  PyCharm, IDLE
- Ruby:
  Aptana, Ruby Mine
- Octave:
  Octave ...

I don't like IDEs.
Emacs is the best!

Richard Stallman,
GNU project

Questions?

Thank you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Links

- Linux Foundation
  http://www.linuxfoundation.org

- Linux Kernel
  http://www.kernel.org

- GNU
  http://www.gnu.org

- EdX MOOC on Linux
  https://www.edx.org/course/linuxfoundationx/linuxfoundationx-lfs101x-introduction-1621

Links

- 50 best Linux Distros
  http://www.techradar.com/news/software/operating-systems/best-linux-distro-five-we-recommend-1090058

- Unix, Linux and variant history
  http://www.computerhope.com/history/unix.htm

- Revolution OS
  https://www.youtube.com/watch?v=jw8K460vx1c

Links

- What is the difference between shell, console, and terminal?
  http://superuser.com/questions/144666/what-is-the-difference-between-shell-console-and-terminal

- Advanced Bash-Scripting Guide
  http://www.tldp.org/LDP/abs/html/

- Linux Boot Process
  http://www.thegeekstuff.com/2011/02/linux-boot-process/

- X Window Server
  http://en.wikipedia.org/wiki/X_Window_System

- Exit-codes with special meaning
  http://tldp.org/LDP/abs/html/exitcodes.html