

### A Brief Introduction to Linux

What is it? What can I use it for?

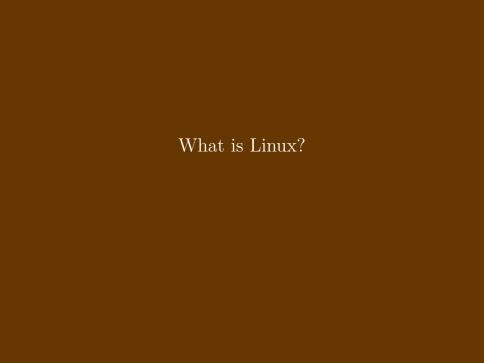
Alexander B. Pacheco LTS Research Computing September 8, 2015

### Outline

1 What is Linux?

2 Linux Components

3 Live Demos of a Linux System



### History I

- Unix was conceived and implemented in 1969 at AT&T Bell labs by Ken Thompson, Dennis Ritchie, Douglas McIlroy, and Joe Ossanna.
- First released in 1971 and was written in assembler.
- In 1973, Unix was re-written in the programming language C by Dennis Ritchie (with exceptions to the kernel and I/O).
- The availability of an operating system written in a high-level language allowed easier portability to different computer platforms.
- The GNU Project, started in 1983 by Richard Stallman, had the goal of creating a "complete Unix-compatible software system" composed entirely of free software.
- 386BSD released in 1992 and written by Berkeley alumni Lynne Jolitz and William Jolitz. FreeBSD, NetBSD, OpenBSD and NextStep (Mac OSX) descended from this
- Andrew S. Tanenbaum wrote and released MINIX, an inexpensive minimal Unix-like operating system, designed for education in computer science
- Frustated with licensing issues with MINIX, Linus Torvalds, a student at University of Helsinki began working on his own operating system which eventually became the "Linux Kernel"
- Linus released his kernel for anyone to download and help further development.

### History II

### Linus's message to comp.os.minix on Aug 26, 1991

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. This has been brewing since april, and is starting to get ready. I'd like any feedback on things people like/dislike in minix, as my OS resembles it somewhat (same physical layout of the file-system (due to practical reasons) among other things).

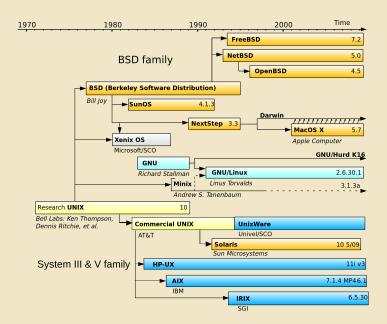
I've currently ported bash(1.08) and gcc(1.40), and things seem to work. This implies that I'll get something practical within a few months, and I'd like to know what features most people would want. Any suggestions are welcome, but I won't promise I'll implement them:-) Linus (email address)

PS. Yes - it's free of any minix code, and it has a multi-threaded fs. It is NOT protable (uses 386 task switching etc), and it probably never will support anything other than AT-harddisks, as that's all I have :-(.

https://groups.google.com/forum/?fromgroups=#!msg/comp.os.minix/dlNtH7RRrGA/SwRavCzVE7gJ

- Linux is only the kernel, an Operating System also requires applications that users can
  use.
- combined with free software available from the GNU project gave birth to a new Operating System known as "GNU/Linux"
- GNU/Linux or simply Linux is released under the GNU Public License: Free to use, modify and distribute provided you distribute under the GNU Public License.

http://en.wikipedia.org/wiki/Linux



### What is Linux?

- Linux is an operating system that evolved from a kernel created by Linus Torvalds when he was a student at the University of Helsinki.
- It's meant to be used as an alternative to other operating systems, Windows, Mac OS, MS-DOS, Solaris and others.
- Linux is the most popular OS used in a Supercomputer

OS Family	Count	Share %
Linux	488	97.6
Unix	10	2
Mixed	1	0.2
Windows	1	0.2

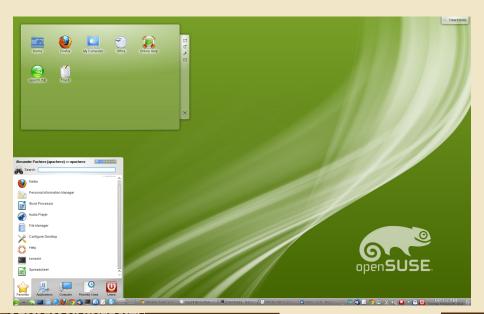
• If you are using a Supercomputer for your research, it will be based on a \*nix OS.

http://www.top500.org/statistics/list/ June 2015 List

### What is Linux?

- Many software vendors release their own packaged Linux OS (kernel, applications) known as distribution
- Linux distribution = Linux kernel + GNU system utilities and libraries + Installation scripts + Management utilities etc.
  - Debian, Ubuntu, Mint
  - 2 Red Hat, Fedora, CentOS
  - 3 Slackware, openSUSE, SLES, SLED
  - Gentoo
- Application packages on Linux can be installed from source or from customized packages
  - 1 deb: Debian based distros e.g. Debian, Ubuntu, Mint
  - 2 rpm: Red Hat based distros, Slackware based distros.
- Linux distributions offer a variety of desktop environment.
  - K Desktop Environment (KDE)
  - 2 GNOME
  - Xfce
  - 4 Lightweight X11 Desktop Environment (LXDE)
  - Cinnamon
  - 6 MATE

### openSUSE KDE Desktop



# CentOS GNOME Desktop



### LXDE Desktop



## Debian MATE Desktop



# Linux Mint Cinnamon Desktop



### What is Linux?

- Linux distributions are tailored to different requirements such as
  - Server
  - 2 Desktop
  - Workstation
  - Routers
  - 6 Embedded devices
  - 6 Mobile devices (Android is a Linux-based OS)
- Almost any software that you use on windows has a roughly equivalent software on Linux, most often multiple equivalent software
- e.g. Microsoft Office equivalents are OpenOffice.org, LibreOffice, KOffice
  - For complete list, visit http: //wiki.linuxquestions.org/wiki/Linux\_software\_equivalent\_to\_Windows\_software
  - Linux offers you freedom, to choose your desktop environment, software.

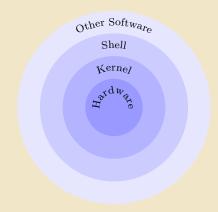
### Popularity of Linux Distributions

- DistroWatch provides news, popularity rankings, and other general information about:
  - various Linux distributions,
  - free software/open source Unix-like operating systems such as OpenSolaris, MINIX and BSD.
- DistroWatch is NOT an indication of market-share or quality nor is it an indication of how many users but it is clearly an indication of what users are looking at.

Rank	Distribution	Hits	
1	Mint	2427	
2	Ubuntu	1830	•
3	Debian	1597	
4	openSUSE	1420	
5	Fedora	1322	
6	Mageia	1138	
7	CentOS	1116	
8	Arch	1035	V
9	elementary	969	
10	Android-x86	832	A



- Kernel
- Shell
- $\bullet$  Applications/Programs



#### Kernel

- The kernel is the main component of most computer operating systems
- It is a bridge between applications and the actual data processing done at the hardware level.
- The kernel's responsibilities include managing the system's resources (the communication between hardware and software components).
- provides the lowest-level abstraction layer for the resources (especially processors and I/O devices) that application software must control to perform its function.
- It typically makes these facilities available to application processes through inter-process communication mechanisms and system calls.



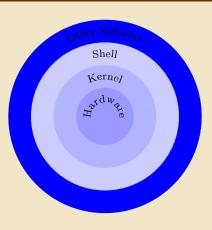
#### Shell

- The command line interface is the primary interface to Linux/Unix operating systems.
- Shells are how command-line interfaces are implemented in Linux/Unix.
- Each shell has varying capabilities and features and the user should choose the shell that best suits their needs.
- The shell is simply an application running on top of the kernel and provides a powerful interface to the system.



#### Applications/Programs

- Linux provides a vast collection of application software, both free (open and closed source) and commercial, for research, teaching and every day leisure activities.
- Almost any software that you use on windows has a roughly equivalent software on Linux, most often multiple equivalent software
- Most, if not all (open source) software, that you need will be available from the distribution repositories.
- RedHat Family: yum install packagename
- openSuSE Family: zypper install packagename
- Ubuntu Family: apt-get install packagename
- Users can also install by downloading and installing from source.
   Usually involves three steps: configure,
   make, and make install



### Files and Processes

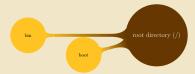
- Everything in Linux/UNIX is either a file or a process
- A File is a collection of data, created by users using text editors, running compilers, etc.
- Examples of Files:
  - document such as collection of ascii text as in report, essay, etc.
  - 2 program written in some high level programming language
  - instructions comprehensible to machine but not a casual user such as executable, binary file
  - directory containing information about its contents such as subdirectories or other files
- A process is an executing program identified by a unique process identifier or PID.



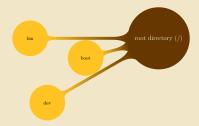
- All files are arranged in a hierarchial structure, like an inverted tree.
- The top of the hierarchy is traditionally called **root** (written as a slash / )



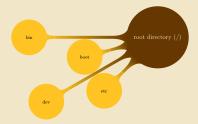
• contains files that are essential for system operation, available for use by all users.



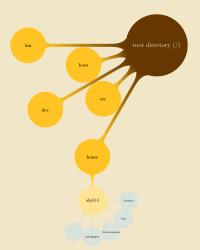
• contains bootable kernel and bootloader



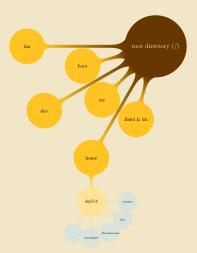
• contains various devices such as hard disk, CD-ROM drive etc



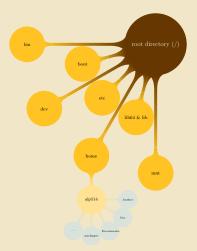
• contains various system configurations



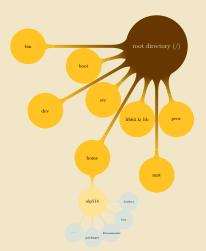
• contains home directories of all users. This is the directory where you are at when you login to a Linux/UNIX system.



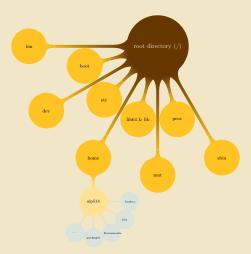
• contains libraries that are essential for system operation, available for use by all users.



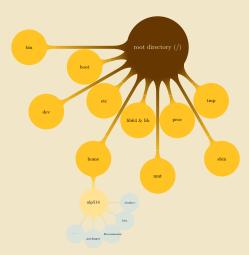
• directories where disk drives are mounted



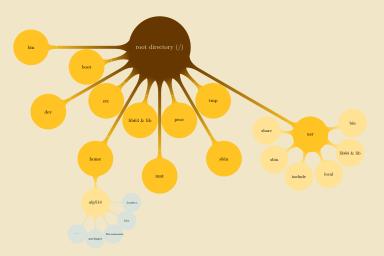
- process information pseudo-file system containing runtime system information (e.g. system memory, devices mounted, hardware configuration, etc).
- can be regarded as a control and information centre for the kernel.



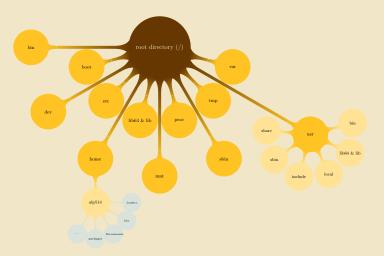
• same as bin but only accessible by root



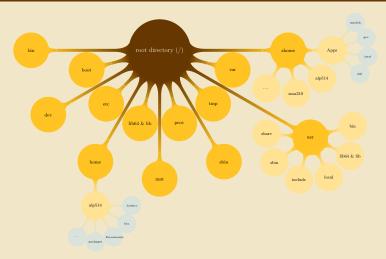
• temporary file storage



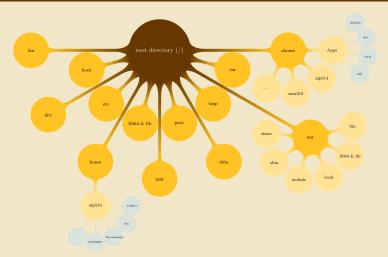
• contains user documentations, binaries, libraries etc



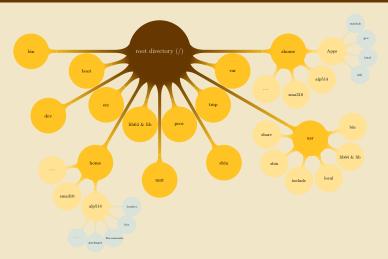
• used to store files which change frequently (system level not user level)



• where we install applications common to all HPC systems



• Installing your own OS: /bin,/lib{64},/etc,/dev and /sbin must be on the same partition.



- UNIX like OS's are designed for multi user environments i.e. multiple users can exist on the system.
- ullet Special user called **root** is the administrator and has access to all files in the system.

Live Demos of a Linux System