

Introduction to Linux

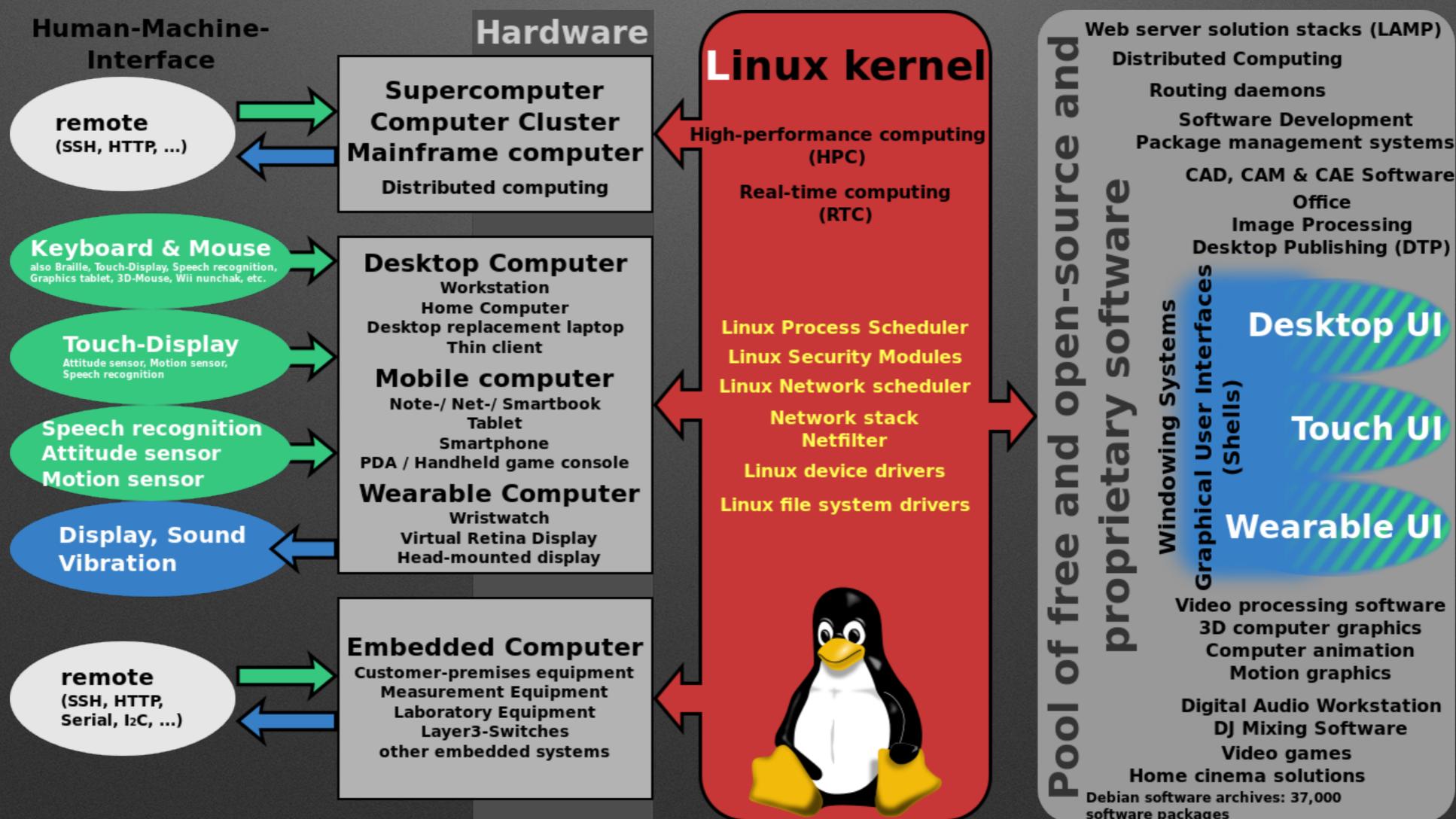
Linux System Administration
COMP2018 Fall 2019

Linux Defined

- In 1991, Linus Torvalds created a kernel program, based on Tannenbaum's Minix project (an educational version of AT&T UNIX software), as a personal project while working at the University of Helsinki in Finland
- He named it Linux and made it open source
- The combination of the kernel, free open source software (primarily from the GNU project), package management software, and a user interface is known as a Linux distribution (or distro)
- It has undergone many updates and revisions since and has become as popular as it is varied in incarnations
- <http://futurist.se/gldt/wp-content/uploads/12.10/gldt1210.png>

Linux Implementations

Linux is open source and runs on all significant hardware platforms and all major CPUs, and supports the vast majority of hardware devices and network protocols



Linux Components

- The Linux kernel is the software platform everything else runs on - it provides the means for software to use hardware
- System programs and configuration files along with system libraries (reusable program elements) create the computing environment for user programs
- Core utilities such as shells, editors, and file management programs provide the basics of user programs
- The X Window System adds graphics capabilities and a desktop environment software suite provides additional user programs
- A software package management toolset allows administrators to install, maintain, and modify software in the system

User Programs and Desktop Environment



Kernel

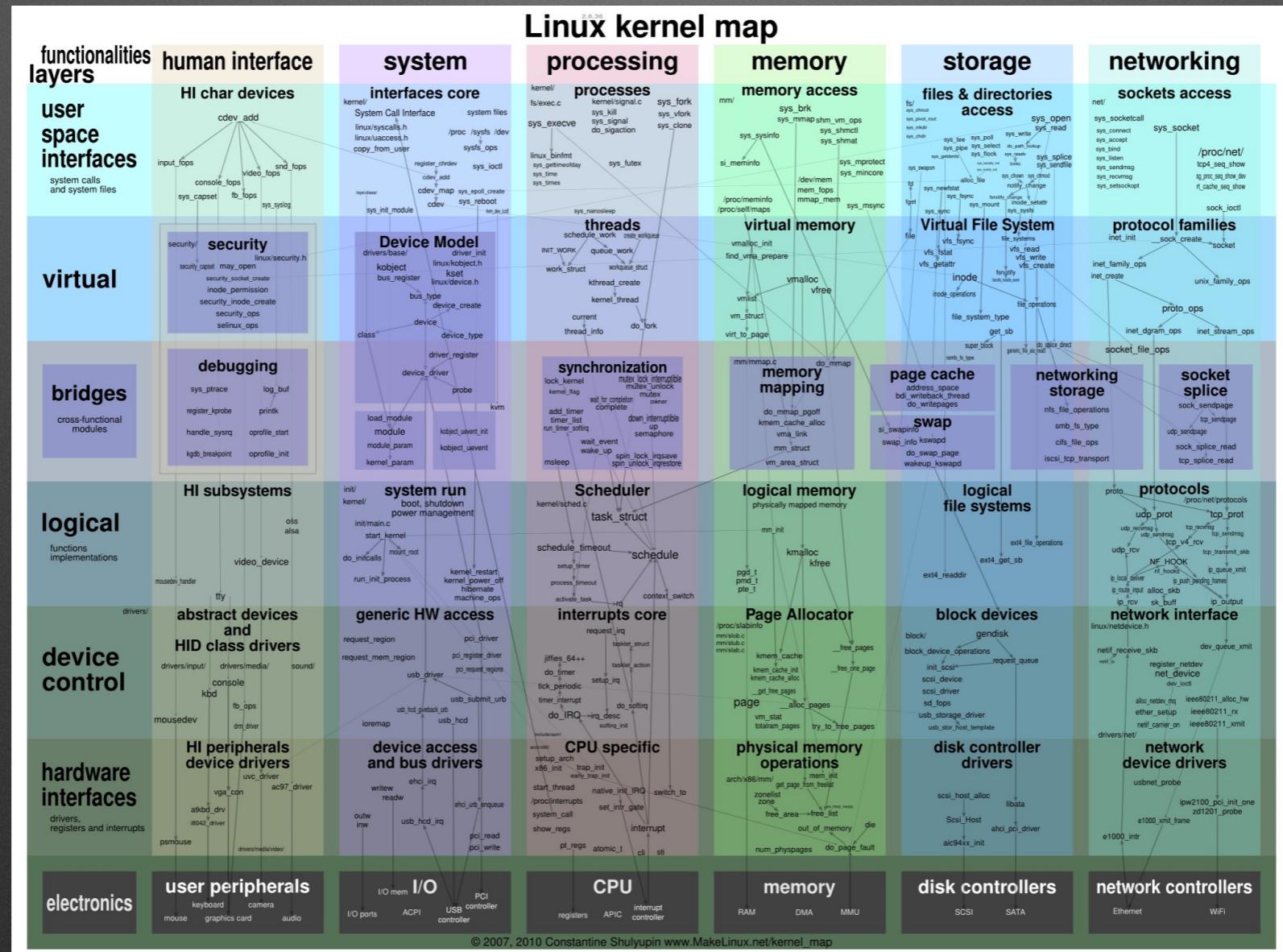
Hardware

The Linux Kernel

- The kernel is the core program in most operating systems
- It is started by a boot program and does not exit until the operating system is shut down
- After initializing itself, the kernel starts the init program which starts all other programs (processes), init has recently been replaced by systemd in many Linux distributions
- Processes that use resources make requests of the kernel to access or manipulate those resources

Kernel Map

- The kernel performs many tasks, managing and controlling access to system resources, both physical and virtual



GNU



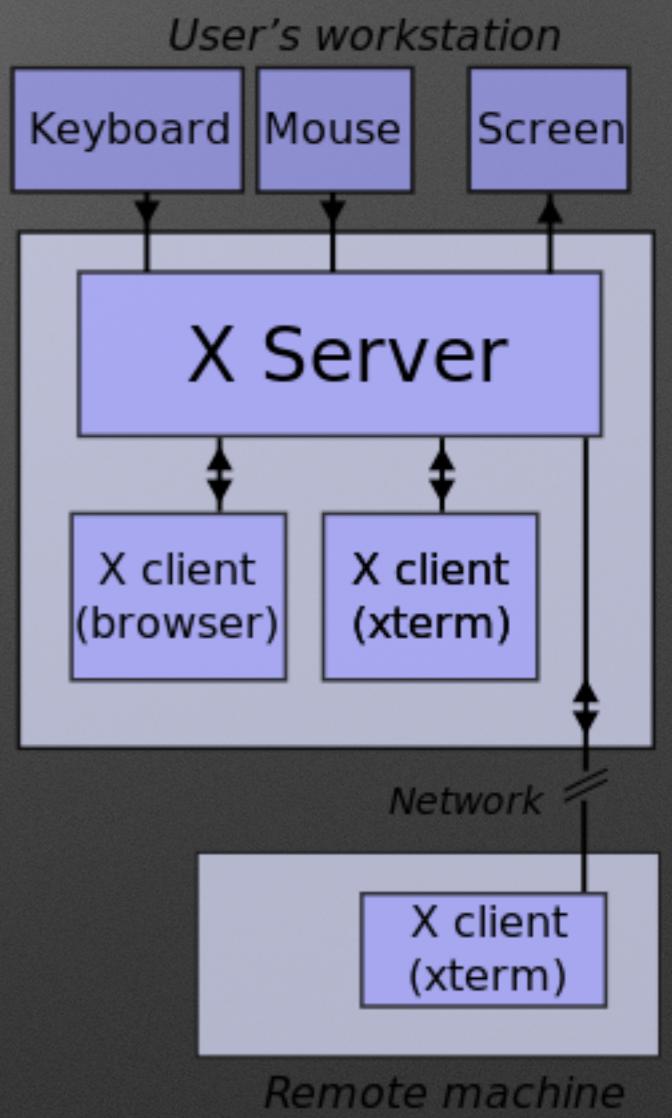
- UNIX is a trademark of The Open Group, and an operating system must be certified to be called UNIX (e.g. MacOSX, Solaris, AIX, HP/UX are UNIX)
- The GNU project was started by Richard Stallman in 1984 to create a UNIX-like operating system that was free (unencumbered by commercial licensing, not requiring UNIX certification)
- The GNU project created the system programs, core utilities, and basic configuration mechanisms used by Linux-based operating systems, including development tools
- A Linux system could more properly be called a GNU/Linux system, Linux is not UNIX because it is not certified by The Open Group (opengroup.org)
- GNU is a recursive acronym that stands for GNU's Not UNIX, see gnu.org for more information

Package Management

- Packaged software is distributed in a format that simplifies installing, updating, and removing that software
- 2 of the most commonly implemented formats in the Linux world are Debian (.deb) and Redhat (.rpm) packages, a possible successor to both may be the snap packaging format
- Along with the distribution formats, these package management schemes also include the tools (dpkg/apt for the debian scheme, rpm/yum for the redhat scheme, or snap for the snap scheme) to manage what software is on your system
- There are a number of other software management schemes with their own package file formats and management tools

User Interface

- Linux servers usually use a text-only terminal interface, and often run web-based applications for graphical administration of servers
- Linux workstations provide a graphical interface based on the X Window System
- The X Window System implements a client-server architecture for graphics which allows graphical programs to be abstracted from graphical hardware and operating system details
- The X Window System handles hardware and draws things
- The X client programs decide what is drawn and how input is handled within their display space



Window Manager

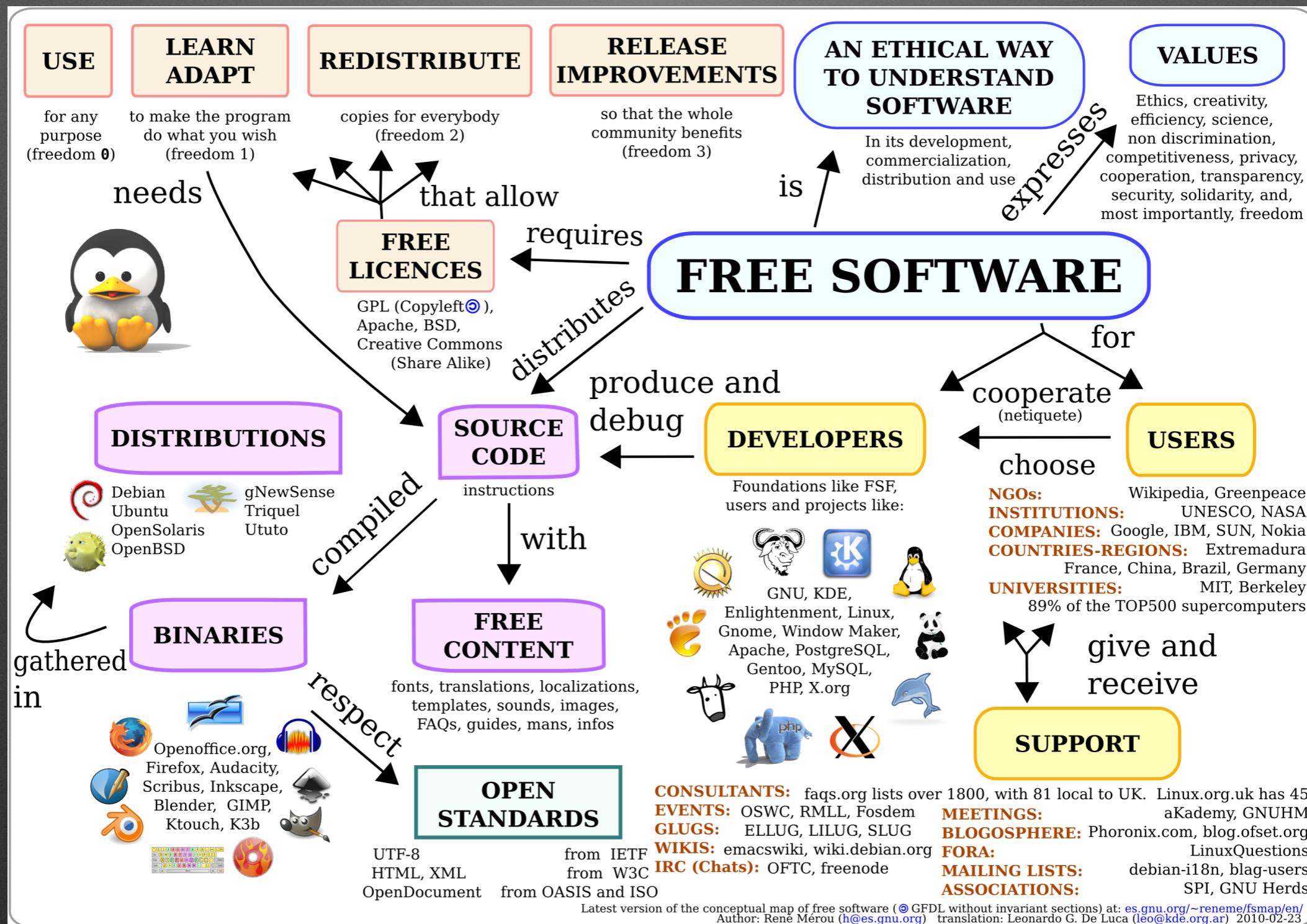
- How multiple windows are handled, how input switching between clients is performed, how applications are started and how displays are managed is functionality provided by a window manager
- Window managers also provide the chrome for the display and control (initiation, manipulation, termination) of graphical applications
- There are many window managers, each with a different set of goals - some distributions let you choose window managers during operating system installation
- Window Managers are often bundled with a desktop environment which is a set of common graphical programs including office productivity tools, email tools, web browsing tools, and system management tools

Linux Distributions

- Linux has been free and open source for over 25 years
- In that time, many individuals and organizations have ported a great variety of software to the Linux system as well as created a lot of software specifically for the Linux system
- People who go to this effort do not want to keep doing it over and over, so they create their own versions of Linux with the bundled software and installation methods they want - we call these creations distributions
- The older distributions have themselves been modified and used as the base for other distributions (e.g. Debian -> Ubuntu -> Mint)
- Licensing is an important part of any distro, some are completely free, some are not
- See https://commons.wikimedia.org/wiki/File%3ALinux_Distribution_Timeline.svg



Free Software Visual



credit: <http://allswalls.com>

Desktop Environments

- There are many different desktop environments
- Some are designed to be Windows-like, some are Mac-like, and others have design features distinguishing them from either of those consumer products
- Popular desktop environments include Unity, Gnome (with derivatives including Mate, Mint, and Cinnamon), Xfce, LXDE, Enlightenment, and KDE
- Some distros are built to support a specific desktop environment (e.g. ElementaryOS), others allow the installer to choose one or more desktop environments to install



Distribution Selection

- Choosing a distribution involves identifying the intended use of the machine
- A server will use a distro with good documentation, support, and a long life cycle
- A desktop will often be chosen on the basis on which desktop environment is included and to otherwise mesh easily with existing systems
- Sites like distrowatch.com can help you research your options



Distribution Life Cycle

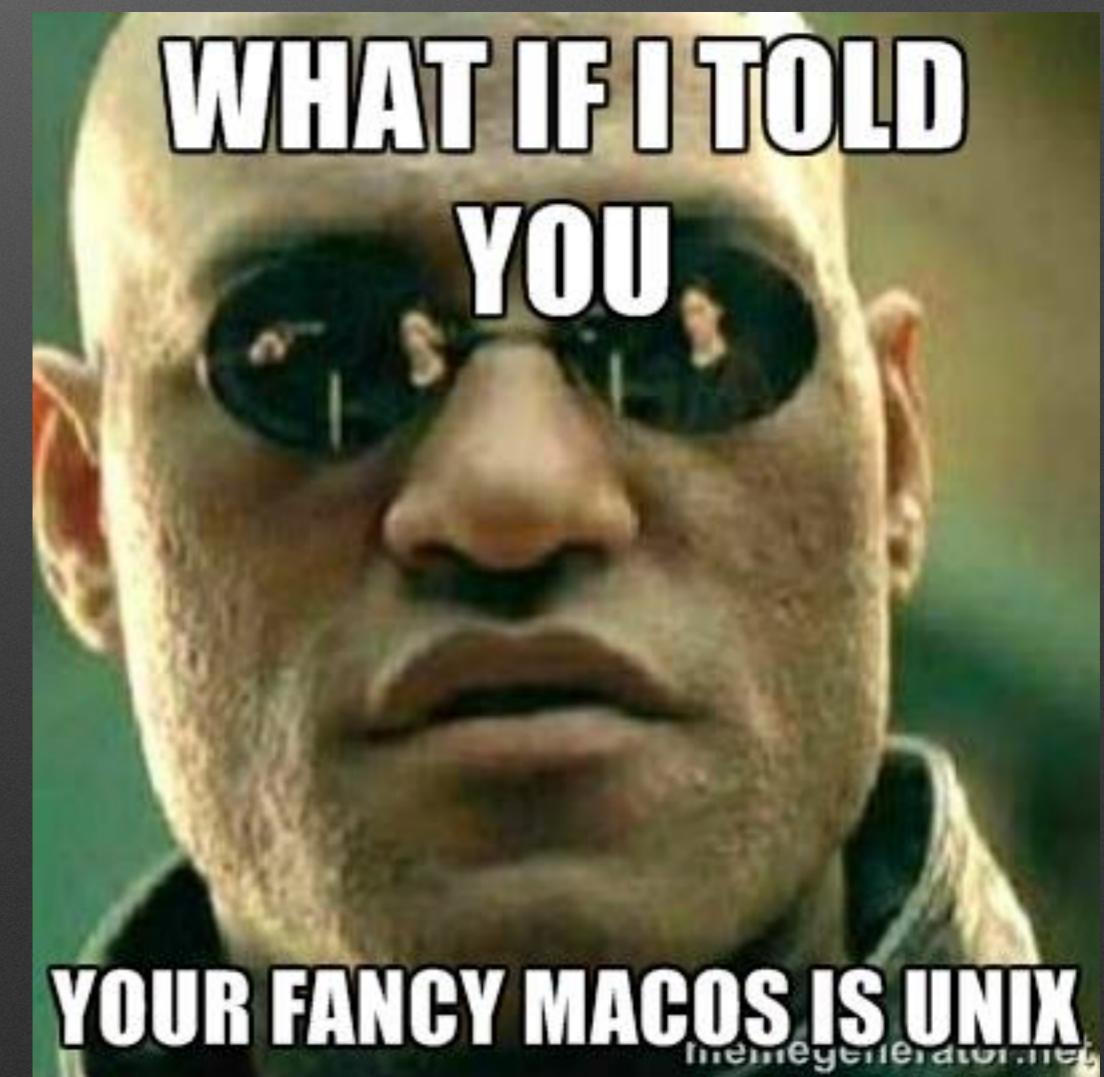
- Distros suitable for server use have a defined life cycle which is published with support provided by companies as well as individuals or user communities
- Distros for hobby use have no defined life cycle and may or may not be updated or supported at all
- Software goes through stages known as the life cycle
 - Alpha - development and proof of viability, only used by developers and experimenters
 - Beta - feature definition and stability testing, provides opportunities to test applications prior to production deployment
 - Stable - released for production use, bugs fixed, features well defined, actively developed
 - Bug Fix - production stage, bugs fixed, no new features
 - Security Fix Only - no longer actively supported, only security fixes ported to it
- Longer life cycles are good for production use, but integrate new features more slowly

Linux Support

- Major distros suitable for production use are supported by companies that sell support services
- They have long life cycles to allow their customers to enjoy the use of their systems for business purposes instead of spending time and money just keeping the systems running and up to date
- Redhat and Ubuntu are good examples of commercially supported production distros
- They issue long term releases which are supported for 5 years, and issue minor releases every 6 months for those needing newer features more regularly while benefiting from support services
- Community support is also a viable option for companies that invest in in-house support staff and many Linux distro communities are very active and responsive (e.g. Ubuntu, Fedora, Debian, Centos, Mint, etc.)

Linux vs. Windows vs. Mac OSX

| LINUX | WINDOWS | MAC OSX |
|---|---|---|
| Free, open source, open security model | Not free, closed source and security | Bundled with hardware, closed source and security |
| Designed for 24/7 operation | Designed for intermittent use | Designed for 24/7 operation |
| Many versions, highly customizable, fast releases | Several versions, sort of customizable, slow releases | Few versions, not customizable, annual releases |
| Commercially supported by multiple vendors for several years | Microsoft supported for up to 15 years or more | Apple supported for several years |
| Runs on almost anything | Runs on PC compatible computers | Runs on Apple hardware |
| Unfamiliar to most computer users, can be challenging to learn | Familiar to most computer users | Loyal fan base, easy to learn |
| Applications may not be familiar ones, inconsistent in implementation | Applications familiar if inconsistent | Consistent application operations |



Lab 1

Linux VM build

Install VMWare if needed
Install Ubuntu 18.04 desktop
Add software

Software can be chaotic, but we make it work



Expert

Trying Stuff
Until it Works

O RLY?

The Practical Developer
@ThePracticalDev