

Linux and Freedom of Software In Education



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Trademarks



- Linux is a trademark of Linus Torvalds
- Unix is a trademark of X/Open
- Micro\$oft would like to own everything else



Agenda

- Free and Open Source
- The evolution of free software
- What is Linux?
- Why Linux Now?
- The many faces of Linux
- How to learn more

Software Livre!



- The word “free” has a slight problem
- Livre vs Gratis
- Freedom to:
 - Read source code
 - Change source code
 - Redistribute source code
- Licenses enforce rights and obligations



GPL Basics

If you take someone else's code, change it, and re-distribute it, you are not allowed to restrict the next person's rights to less than you had.

The Evolution of Free Software

- At one time you did not buy “shrink wrap” software
 - All software was written under contract
 - you owned the software
 - Often you owned the source code
 - Hardware vendors supplied LOTS of information
- 1969 – DECUS gave away “free software”
- 1969 – Unix started on PDP-7 at Bell Labs
- 1969 – Linus Torvalds born in Helsinki
- 1977 – Computer Fairs

The Emergence of Shrink-Wrap



- 1980 – shrink-wrapped software began to emerge
- 1983 – computer vendors started to bring out binary versions of UNIX
 - USENIX hissed
- 1984 – GNU project started
 - Emacs
 - Compilers, libraries, shells, etc.
- 1991 – Free Software Foundation founded
- 1991 – Linus Torvalds gets his new computer
- 1991 – Estonia declares freedom

What Is An Operating System?



- Kernel
 - Controls devices
 - Allocates memory
 - Schedules programs
 - Sends and Receives Messages
- Compilers and Libraries
- Command Interpreters
- Text editors and other utilities
- Windowing Systems and Desktops

By 1991 Most Existed

- Command Interpreter – bash (et. al.)
- GNU “C”, C++, f77, Pascal, lisp
- Xfree86 Windowing System
- GNU tools
- Sendmail, BIND, Postgres
- BSD
 - *What was missing was the kernel*

Linus Had a New i386!

- The OS that came with it was clunky
 - Could not make use of 386 features
- BSD tangled up in legal issues
- Proprietary Unix systems too expensive
 - No source code!
 - He decided to write his own.....
 -and give it away.



Linus Says:

“The smartest technical decision I ever made was to make the operating system free.”

Why Linux Now?



- Low cost of hardware
 - Sophisticated hardware needed sophisticated OS
- High cost of proprietary software
 - Software now cost 2-3 times what machine cost
- Learning and research tool
- Internet made it possible
- Internet made it necessary
 - Binary only code.....it is just so *eighties!*

Care To Have A Fix?



- Proprietary Shrink-wrapped Software
 - Bug Fixes and Enhancements
 - Small number of engineers
 - Large number of customers
- Open Source solves problem:
 - Support can be from any one competent
 - Business logic can now be applied

www.sourceforge.net



- 45,790 projects
 - Audio, Video, Teleconferencing, graphics, etc., etc.
- 450,000 registered developers
- What if only 10%?
- What happens when India and China come on board?
- What happens when the whole world is on the Internet?

The Many Faces of Linux: From Embedded to Supercomputer

- Desktop
- Beowulf Systems (Supercomputers)
- Low and mid-range Servers
- Embedded Systems



Desktop

- Traditional single-user system
- “Volkscomputer”
 - Four video cards in one system
 - Four keyboards, four mice, all USB
- “Thin clients” - applications run on server
 - No disk; Boot off floppy or CD-R(OM)
- “Smart clients” - applications run on client
 - Same as thin client, but more RAM

Desktop (Cont.)



- Office Packages
 - Open Office
 - Star Office
 - Applixware
 - MS Office (on top of WINE)
- Accounting
- Graphics Manipulation

Supercomputers



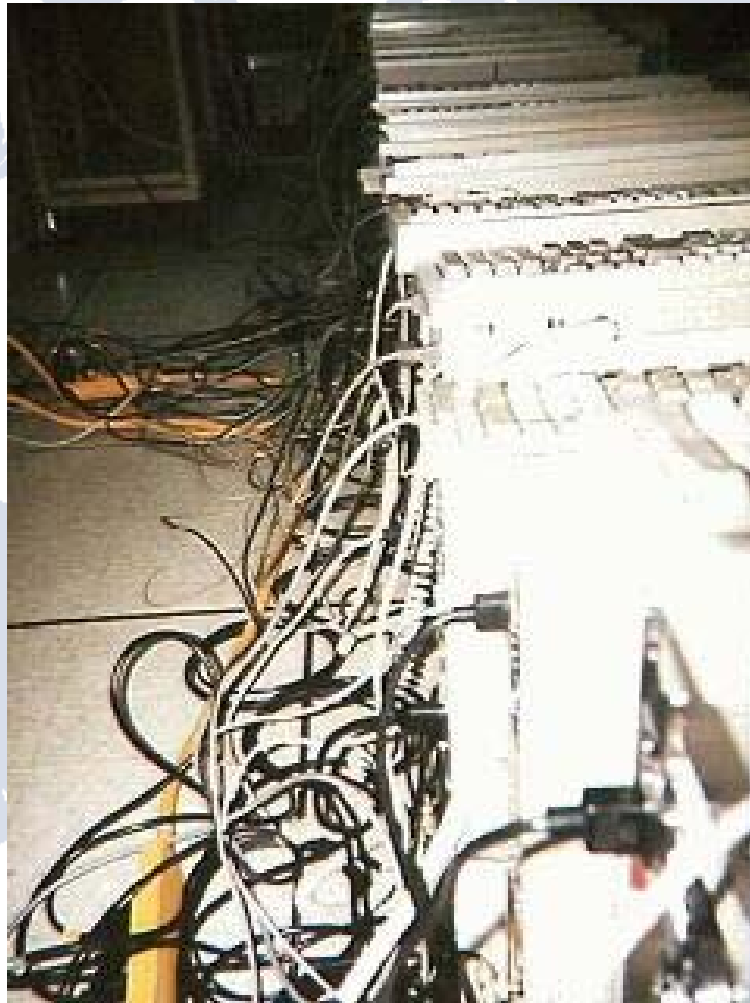
- 1995 – Thomas Sterling and Donald Becker
- Supercomputers made of COTS – (PCs)
 - High speed networking
 - Parallelization of code
- Extreme Linux
- Supercomputers at $1/40^{\text{th}}$ of the price.....
 -and you can get applications!

Stone Soupercomputers

- Oakridge National Labs
- 48 “obsolete” computers
- 10 Mbit/sec Ethernet
- Did “real” work



“We Start To Win When You Login”



Low and Mid-range systems



- Perfect ISP machine
 - Ftp
 - Apache
 - DNS
 - Sendmail, etc.
- File and print server
 - SMB
 - Appletalk
- Database engine platform

Embedded Systems: The Problem



- Lots of small vendors, each with own OS
 - Self-written device drivers
 - Self-written network stacks
 - Self-ported to different architectures
 - Different programming interfaces
 - Often single tasking
-
- Expensive!

Enter Linux



- Multi
 - Tasking
 - Architecture
 - User
 - Devices
 - Networks
- Modular
- Stable
- Secure – What happens if your toaster is hacked?

A Complete Server System 5 Watts Power (Peak)

- StrongARM processor
- ETHERNET
- USB
- 32 Megs RAM
- Serial Line
- Parallel Line
- LCD controller
- 1 GB disk



Not Flexible Enough?



- x486 processor
- 2 Mbytes Flash
- 8 Mbytes RAM
- ETHERNET
- Serial Lines
- Parallel Lines
- LCD controller
- Breadboard development system



Too Big?

- Motorola Dragonball
- 30-pin SIMM
- ETHERNET
- 2 Megs FLASH
- 8 Megs RAM
- Serial, Parallel, LCD

Still Too Big?

Talk To IBM Research

- 2 Megs FLASH
- 8 Megs RAM
- IR and RF networking
- Roller wheel
- Speaker

How Is All This Possible?

Trust the Source, Luke!



What Are Duties of University?

- Create a thinking electorate
- Educate workers for business and industry
- Research and publish new ideas



Why Linux for Universities?



- Widely used operating system
 - Allows students to work on OS that they might use when they graduate
 - Students see how REAL system, compilers, etc. works
- Source code
 - Allows investigation, collaboration
 - Reduces contamination issues
- Runs on variety of hardware
- Multi-vendor
- Save money

Freedom of the Source



- Source code allows freedom of competition
- Source code allows for good support
- Source code allows business decisions to be made
- Source code allows software to meet more than 80% of your needs
- Source code allows minorities
- Source code lowers barriers to entry for new companies
- *Would you buy a car with the hood welded shut?*

Open Source and Free(dom) Software

- Trade of paying for IP vs paying for integration
- Brings local jobs
- Allows better solutions
- Creates more stable software
- Allows more innovation

If Source Is Not Completely Open...



- “Shared Source”
- Only 30 countries (not 200)
- Only top research universities (not tech colleges and high schools)
- Best business partners (does this include Oracle, Sun?)
-it is *more* than completely closed.

Where To Begin?



- Here!
- Websites
 - www.linux.org
 - www.linux.com
 - www.sourceforge.net
 - www.linuxresources.com
- Local bookstore
- User groups



Linus Says:

“The Linux philosophy is to laugh in the face of danger. Oops. Wrong one. 'Do it yourself.' That's it.”

Questions?

