

Introduction to Linux

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What is Linux?

- Multi-architecture, Unix-like Operating System
 - Official kernel supports 20 processor families
 - Most existing Unix software ports easily
- Open Source
 - Source code is freely distributed
 - Source code can be modified by anyone
- Both community and corporate supported
 - Large development and support community
 - Major corporate development and support
- Server operating system
- Desktop operating system

History of Linux

- Started by Linus Torvalds in 1991
 - Originally started as a terminal emulator, grew into an operating system replacement for Minix
- Requests for features (and offers to help implement them) grew
- Version 1.0 released in 1994
- Current Stable version is 2.6.4
 - Most distributions are still running 2.4.x
 - This laptop runs 2.6.1
- Grown to become a respected OS in industry, education, and research.

Why Linux?

- Free – always libre, sometimes gratis
 - You always get the source code
- Interoperability
 - Designed to work with as many protocols and as much hardware as possible
- Reliability
 - Displays enterprise level reliability and stability
- Security
 - Robust (and proven) security model
 - Any vulnerabilities are fixed VERY quickly
- Performance
 - Becoming the OS of choice for high performance computing

Why Not Linux?

- Application Support
 - Many commercial vendors do not support Linux
- Complicated
 - Administration requires knowledge of operating systems, networking, security, etc. Not a point and click system (although this is improving)
- Community Supported
 - No warranty, implied or otherwise
- Options, options, options!
 - Perhaps there is too much choice in software, desktop environments, etc.

Linux Distributions

- Redhat
 - Most popular, good all around choice
 - Fedora – community supported
 - Enterprise Redhat – corporate supported
- Debian
 - Completely non-commercial
 - Massive package selection and easy management
 - Not as user friendly, but improving
- Mandrake
 - Very user friendly, desktop oriented
- SuSe
 - IBM Preferred Linux – z/Series Linux of choice

More Linux Distributions

- Gentoo
 - Completely source based Linux
- Slackware
 - Oldest Linux distribution still in production
- Caldera
 - Discontinued – Purchased by SCO (more later)
- Security Enhanced Linux
 - Created by the NSA – advances Linux security
- Knoppix
 - Runs from CD, very easy to try out

Included Software

- **Server**
 - Web Server
 - FTP Server
 - Java Application Servers
 - NFS & AFS
 - Samba (MS dfs)
 - SSH
 - Database Servers
- **Workstation**
 - Office Applications
 - Programming IDEs
 - Graphics Tools
 - Internet Clients
 - Games
 - Compilers
 - Documentation
 - Media Players

The Kernel

- The core of the Operating System
- Provides system calls, memory management, scheduling, and device drivers
- Actively maintained by Linus Torvalds, Alan Cox, and around 100 others. Patches contributed by a cast of thousands
- Licensed under the GPL
- Multitasking
 - Every task has its own memory space, improves stability
- Multiuser

The GPL

- General Public License
 - Created by Richard Stallman
- Designed to grant rights to users
 - Right to copy and distribute source code
 - Right to modify and distribute source code
 - So long as modifications are returned to the community
- Viral License
 - Incorporating GPL code into a program requires the entire program be licensed under GPL
- LGPL
 - Allows for linking of GPL libraries to non-GPL programs

Graphical Interface

- Xwindows System – Xfree86
- Window Managers
 - GNOME
 - KDE
 - Others
- Network Transparency
- DEMO

Networking

- Unix built the Internet
- Support for nearly all protocols
 - Ipv4, Ipv6 802.11b, WAN, ATM, etc
- Robust Firewall and NAT
- Linux is a very popular web server, DNS, application server, authentication server, and file server platform
 - Linux/Apache most popular web server combo
- Linux powers many network devices
 - Routers, firewalls, wireless access points, etc
- Most server programs run as unprivileged users (for security)

Remote Access

- SSH – The Secure Shell
 - Encrypted shell session (replaces telnet)
- SFTP – Secure File Transfer Protocol
 - Encrypted FTP
- X Windows
 - Allows remote sessions, for security can be tunneled over SSH
- Web based administration utilities
 - Webmin
- Network file systems
 - NFS, OpenAFS, Coda, Samba

File Systems

- Several Options
 - ext2: standard file system – Automatic defragmentation
 - ext3: journaling add on to ext2
 - ReiserFS, XFS, JFS: Journaling file systems
- Linux can also read and write to a number of other file systems
 - Fat32
 - NTFS
 - Dozens more

File System Layout

- Everything is a file
 - Devices
 - Symlinks
- All file systems mounted from root (/)
- Permissions
 - Read, Write, and execute permissions
 - Set separately for user, group, and everyone
- Executables can be setuid and setgid

File System Layout

- / - Root filesystem
 - /bin & /sbin – essential user and system binaries
 - /etc – configuration
 - /dev - device files
 - /boot – kernel and misc boot files
 - /home – user's home directories
 - /lib – system libraries and kernel modules
 - /proc – file system interface to memory
 - /var – variable data. Logs, spools, caches, etc.
 - /tmp – temporary files, frequently cleaned
 - /usr – unix system resources.
 - User and system programs, libraries, header files, documentation, program data, etc.

Users and Security

- Root User
 - Superuser, can run, write to, and modify anything
 - Password NOT recoverable
 - Should be strongly protected (do not share this password)
 - Servers should not run as root
 - Should not be used unless necessary
 - And then, only as long as needed
- Regular Users
 - Each has a home directory with full permissions
 - Cannot edit system data
 - Should be used for all day to day operations

Popular Server Programs

- Apache - <http://apache.org>
 - World's most popular webserver
 - As of November 1st, 67.21% market share
- Samba - <http://samba.org>
 - Windows network file system client/server
 - Can also act as a windows domain controller
- Sendmail - <http://sendmail.org>
 - Most popular email server
- Tomcat - <http://jakarta.apache.org/tomcat>
 - Java Application Server
- MySQL - <http://mysql.com>
 - Powerful and scalable database server

Popular Desktop Application

- OpenOffice - <http://openoffice.org>
 - Complete MS Office replacement
 - Word processor, spreadsheet, presentation package
 - StarOffice is a commercial version of OpenOffice
- Evolution - <http://ximian.com/products/evolution>
 - Outlook-like email, calendar, and contact management program
- Mozilla - <http://mozilla.org>
 - Web Browser
- GnuCash - <http://gnucash.org>
 - Financial management program
 - Similar to Quicken

More Desktop Applications

- Gaim - <http://gaim.sourceforge.net>
 - Multi protocol instant messaging client
- Gnumeric - <http://gnumeric.org>
 - Powerful spreadsheet
- Anjuta - <http://anjuta.sourceforge.net>
 - C/C++ integrated development environment
- Eclipse - <http://eclipse.org>
 - Extensible Java development environment
- GnuPG - <http://gnupg.org>
 - Public key encryption package
 - OpenPGP compliant
- GIMP - <http://gimp.org>
 - Graphics program, comparable to Photoshop

Installing Applications

- Binary packages
 - RPM and DEB are most popular package formats
 - Command line and GUI tools are available
 - See your distribution's documentation
- Source Packages
 - Generally something.tar.gz or something.tar.bz2
 - Requires some knowledge of compilers
 - Basic steps:
 - ./configure
 - Make
 - Make install

Community Support

- Help is only a google search away
 - HOWTOs, FAQs, mailing list archives, etc.
- Linux User Groups
 - Penn State LUG - <http://lug.cac.psu.edu>
 - Mailing List and IRC
- Newsgroups
 - comp.os.linux.*
 - alt.os.linux.*
- freshmeat.net & sourceforge.net
 - Open source program repositories
- Most useful command:
 - Man programname

Programming Languages

- Compilers
 - Most Linux distributions ship a wide variety of compilers and language support tools
 - C/C++
 - Java
 - Fortran
- Scripting Languages
 - Literally hundreds are available
 - Perl – popular text “swiss army knife” language
 - PHP – Web scripting language
 - Python – Object oriented scripting languages
 - Various shell scripting languages

Resources

- <http://linux.org> Linux portal
- <http://kernel.org> Official kernel site
- <http://linuxdoc.org> Documentation repositories
- <http://freshmeat.net> Program repository
- <http://sourceforge.net> Program repository (developers)
- <http://oreilly.com> Linux & open source books
- <http://gnu.org> Official GNU site
- <http://carroll.cac.psu.edu> PSU Open Source Mirror
- <http://lug.cac.psu.edu> PSU Linux Users Group
- <http://redhat.com> Linux distribution
- <http://debian.org> Linux distribution
- <http://linuxsecurity.com> Security News
- <http://google.com/linux> Linux Search Engine

Community Quirks

- Like any community, Linux (and open source in general) has its quirks
- It is hard to generalize, but I am going to do it anyway
 - Strong “do it yourself” attitude
 - Generally willing to help anyone, PROVIDED they show initiative (RTFM)
 - Anti-proprietary (software, protocols, specs, etc)
 - Strong spirit of giving back, community service
 - Obviously, none of this would exist otherwise
 - All walks of life, education levels, nationalities, etc.

Linux in the News

- SCO
 - Claims to hold IP on parts of Linux
 - Has been stalling to prevent disclosure of IP
 - Stated goal is to discredit GPL
 - Legal community (and industry) has been less than impressed with their claims
- Sun & China
 - China has licensed Sun's Linux based “Java Desktop” as official operating system of China
- Redhat's changes
- Novell enters market

Questions

- Ask away...
- Email mxe20@psu.edu
- Presentation
 - <http://www.personal.psu.edu/mxe20/linux.pdf>
 - Also on the ITS training site (eventually)
- Thank you :)