Linux

An Introduction to Foundations and Technology

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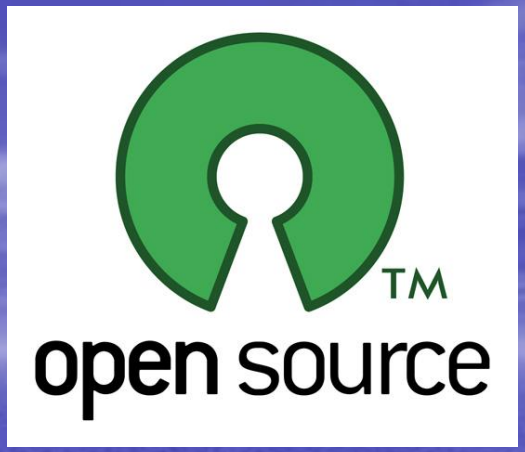
Brief History

- 1985: GNU software foundation founded by Richard Stalman. This foundation provides the fundamentals behind Linux development, as nearly all Linux distributions consist of GNU tools
- 1991: Linus Torvalds releases version 0.02 of a Minix-like kernel with GNU tools, and names it Linux
- 1994: Version 1.0, the first stable kernel version, is released
- 1996: Los Alamos National Laboratory clusters 68 PC's running Linux to achieve the 315th most powerful supercomputer. The cost was 1/10th the price of a commercial solution.
- That's ½ of a Linus on the side

Present Day

- Linux is being actively developed under the open source model by developers worldwide
- An increasing number of Academic, Financial, and Research institutions are implementing Linux based servers, and clusters for High Performance Computing
- Long established proprietary Unix distributors are offering Linux alongside their proprietary solutions (IBM, SUN, HP)
- Two Linux cluster systems are on the top 10 fastest supercomputers list (Los Alamos National Lab is 6th fastest, Lawrence Livermore National Lab comes at 7th)
- Various Internet based companies are based entirely on Linux. For example http://www.google.com, a popular search engine which I suspect many of you are familiar with has a cluster of SEVERAL THOUSAND machines, the largest ever Linux Cluster. All of them run Redhat's Linux distribution. Another example is the shopping site http://www.amazon.com, replaced its SUN Solaris servers with an all Linux based solution about two years ago.

The Open Source Development Model



- Based on free exchange of information
- Anyone can read the source code
- Anyone can contribute their modifications to the project manager, who then accepts or rejects the changes to the main code base
- The decision of what features are important now lay directly in the hands of the end users, not corporate executives
- Nobody needs to do a cost/benefit assessment to see whether a modification will be profitable. If a feature is important to somebody they will write it and allow everyone else to use it
- A good software solution no longer must wait months for a vendor to release a new version with wanted features; Open Source software is constantly updated (depending on the project manager, and how many developers are involved in the project)

Total Cost of Ownership (TCO)

- The choice of a platform basically boils down to one industry term. Total Cost Of Ownership (TCO)
- In most cases, the choice of platform determines the ONGOING costs of maintaining a system
- You buy hardware once, but hardware alone wont get work done
- TCO includes cost of software, licenses, support, and utilities.
- Different solutions contribute to TCO in different ways. Here are some examples:
  - SUN Microsystems sells hardware at a high premium. However, they do not charge for software licenses on their operating system. They also provide many software applications for free, and their level of support is generally high
  - Microsoft based solutions are expensive from a licensing aspect (e.g. Licenses for a server OS plus client licenses for each connecting workstation). However their management tools are very evolved thus reducing the costs of system administration
  - Many Linux Distributions are free, however these free software distribution do not come with any form of support, and generally the system administrators are on their own
- NOTE: Actual level of support varies from vendor to vendor. The above examples are borderline extreme (before someone throws a tomato at me)

Why Linux?

- The Linux kernel has grown to be a robust and stable system
  - Very efficient Memory Management
  - Modular kernel design, along with its Open Source development allows users to compile kernels for specific tasks, which meet strict specifications.
  - No copyright restrictions, no restrictive licensing agreements
    - You may install Linux on as many machines as you want without breaking the law
  - Source code has been ported to many of the common hardware systems in use. Examples are
    - Intel x86 Architecture (IA-32), Intel Itanium Architecture (IA-64)
    - PowerPC
    - SUN Sparc & Alpha
    - ARM & MIPS
    - Various Others
- Linux behaves much like the proven Unix platforms, which have been around for decades.
- Because of these facts, many companies are using Linux in embedded devices, such as Cameras (Axis Corporation), network routers (Linksys Corporation), and PDAs.
- (Anyone get the picture on the top Right? That is Linus Torvalds, behind a broken WINDOW... Perhaps the Window was made by Microsoft?)

The Downside

- Linux, while a great system for servers, is a little lacking as a Desktop
- Designing a server operating system, while it requires truly remarkable coding skill, is technically easier than designing a good desktop operating System
  - Underlying hardware is generally similar (aside from the CPU itself)
  - Servers usually need to do a few things very well; Desktops usually have a myriad of interesting items connected to them (DVD burners, PDAs, Digital Cameras, Calculators, Scanners, Data Acquisition systems, TV Cards, Keyboards (the musical kind), etc
  - A user demands much more “Visual Appeal” out of their operating system than a machine does out if its operating system
- That’s not to say the Linux doesn’t have great desktop support, however it is not as “integrated” as Windows users are accustomed to (take that to be good or bad, there are arguments to both). There are many that are very happy with using Linux only on their machines
- Although there have been some giant leaps in the recent months, Linux is also a little behind in Hardware support for peripheral devices, although that is also largely attributed to proprietary protocols in certain devices, for which certain companies aren’t eager to give out specifications

The Good Stuff

- Linux operating systems are less prone to Virus attacks
  - Linux Users are generally more technically savvy
  - Most tasks do not require a user to be “Root” or “Administrator” to be done; when they do it is easy to switch users briefly without having to log out completely.
    - If a user activates a virus, only that users files can be corrupted.
    - If a super-user (“Root” or “Administrator”) activates a virus, then all files on the machine can be corrupted.
    - Most Windows users perform day-to-day tasks as Administrators; Most Linux users work with their regular user accounts, and only switch to “root” briefly, and for specific tasks.
  - The slightly less integration in Linux can be argued as a good aspect. In Windows, if you open up Internet Explorer and go to certain Web pages, malicious code can read your Outlook address book, while sending Instant Messages to your friends, while emailing nasty things to your Boss, all the while playing pacman against itself in the background
  - Perhaps the Pacman Reference was a bit much…
- Much of the software that is most commonly used is already included in many of the distributions. They are all under the General Public License (GPL), and as such are distributed for free.
- Linux is starting to get the attention it deserves from Vendors. Even mainstream computer games are starting to appear on the Linux platform (For example Unreal Tournament 2003)

What you get

- Most users who install a Linux distribution for the first time opt for the graphical interface
  - From a user's perspective, a Graphical User Interface (GUI) is a good way to get the feel of how Linux is laid out
  - Most have used Windows their entire computing lives, so it would be natural to start with another GUI
- Unlike Windows, which gives one option for a GUI, X-Windows (the Unix/Linux equivalent) offers developers the ability to create their own GUIs
  - There are two commonly used GUIs in Linux. KDE, and Gnome
  - They both offer the basic "START" button feel that windows users are familiar with
  - Various different movies with "high tech" themes in them have shown KDE on their screens for effect
- Most distributions will also provide applications such as Open Office, which is similar to Microsoft Office. Many of the commonly used Windows based programs have their equivalents in Linux. For instance a good Photoshop clone is included in many distributions and is called "Gimp"
  - This is another advantage of running Linux. All of these applications are free and licensed under the GPL

Best of both worlds

- For those interested in trying Linux out, without the loss of their Windows environment, it is possible to install BOTH Windows and Linux on a computer
- This is called a Dual Boot configuration, and allows one to choose which operating system to load when the computer is started/restarted
- Good way to expose yourself to Linux, without sacrificing the applications/environment that you are used to
- Not particularly difficult to do, and with Hard Drives being as large as they are nowadays, its very feasible.
- There are many documents online describing how to successfully create a dual boot configuration with nearly any two operating systems (for Intel x86)
- For those interested, the Linux Course website (Lecture 6, Assignment step 3) explains the process. (Link provided on reference page at the end of the presentation)

Linux at Rutgers

- Math and Science based disciplines have much use for High Performance Computing (HPC)
  - The School of Engineering runs a Computational Cluster of more than 70 machines (mphase cluster)
  - Mechanical Engineering has two clusters of their own (Professor Doyle Knight about 15 machines [Rimsky cluster], Professor Stephen Garofalini about 65 machines [nanopac Cluster])
  - Various other clusters owned by their respective departments exist
- Dr. Alexei Kotelnikov (System Administrator for the School of Engineering) teaches a course titled "Linux for Engineering and IT Applications", which focuses on System Administrator and High Performance Clustering.
  - For some do-it-yourself coursework, you can visit the course website at http://linuxcourse.rutgers.edu
  - Great content for learning Linux from a System Administration or applied topic (Clustering) application
- The Rutgers University Student Linux Users Group (RUSLUG) is a great source of general information regarding Linux from a user's point of view
  - Although I am not affiliated with them, I believe they are eager to help people with Linux related questions
  - Their website is http://ruslug.rutgers.edu
  - Wow I just realized they have a Link to WCS, which in turn has my name all over it
  - The Graphic on the top right was stolen from them… Without permission. I didn't have time to ask. So if any of you are from RUSLUG… Sorry? Hopefully it's GPL'd
- There are many in the School of Engineering that run Linux desktops as their primary Operating System.

Q&A Session

I would now like to take this opportunity to open the forum up to questions. In the meantime here are some interesting links

- A fast FTP server to download various Linux distributions (for free of course) ftp://ftp.cse.buffalo.edu
- Don't forget to visit the Linux Course Website http://linuxcourse.rutgers.edu
- Redhat has been the leading Linux distribution, and they are a market leader. Their website is http://www.redhat.com (Note: They recently stopped developing new consumer distributions of Linux, so it may not be a good idea to get a RedHat distribution anymore)
- Suse Linux and Debian Linux are two other common Linux distributions. I would recommend Debian from word of mouth although I have not used either of them (I personally run a Redhat 9 machine). Their websites (respectively) are http://www.debian.org and http://www.suse.org
- For general Linux information, http://www.linux.org is a great site to visit. There is a very large repository of documentation and "how-to's" which can steer you in the right direction if you are stuck trying to get something done
- The greatest geek site in the world. It is titled "Slashdot: News for nerds, stuff that matters". This site is extremely well known among the IT community. It has been cited in the news during various times, and is as common with geeks as google is among non-geeks. http://www.slashdot.org. If its tech news, its on slashdot.

Santa Clause Operations (SCO): History of Unix

- So somebody brought the SCO topic up. Figures.
- Unix invented around 30 years ago by AT&T's Unix Systems Laboratories
- AT&T then sold Unix to Novell Networks
- Novell Networks then sold Unix to Santa Cruz Operation (the real definition of SCO, although I like Santa Clause Operations better).
- SCO sold Unix to Caldera, who then changed names to "SCO Group", which is the SCO of today.
- SCO Licenses out Unix "Intellectual Property" (IP) to various Unix distributors, such as IBM (AIX), SUN (Solaris), etc

Santa Clause Operations (SCO): Let the Lawsuits begin

- March 2003: SCO files suit against IBM alleging that IBM illegally contributed IP to Linux. Suit is filed for $3 billion
- March 2003: SCO also alleges that since it's IP exist in ALL current versions of the Linux Kernel, any Linux user must pay licensing fees to continue using it, or face legal action
- June 2003: SCO terminates IBM's perpetual license to sell AIX (their Unix OS), on the grounds that they violated the licensing terms by contributing licensed code to Linux
- August 2003: SCO reveals a licensing plan for all users of Linux which describes the cost schedule of obtaining licenses to legally continue to use Linux (These have been largely ignored). Furthermore SCO states that it will begin suing Linux users should they choose to not buy these licenses (this is where SCO vs. The World begins)
- August 2003: IBM files a counter-suit against SCO, bringing the fact that SCO distributed Caldera, a Linux distribution, under the open-source GPL. Since the GPL clearly states that any code released under the GPL becomes Open Source, SCO can no longer claim IP rights on the code they claim is infringing. In addition, the suit goes on to allege that SCO is in violation of 4 IBM patents
- August 2003: Red Hat, concerned about the market implications, files suit against SCO so that a judge can decide whether or not Linux infringes upon the SCO IP. Red Hat is primarily seeking a preliminary injunction against SCO to stop making claims that are not yet proven under the terms that it is an unfair business practice, and false advertising
- January 2004: SCO files suit against Novell for alleging that it still controls the Unix IP after the sale to SCO
- There is a nice amount of stuff I left out here. The concept is pretty much SCO wants to sue everyone

Santa Clause Operations (SCO): Some interpretation

- This is actually the first true test of the GPL, which is a foundation of Open Source development
- SCO began this game after a long stretch of quarterly losses
- The key questions in this matter, and what the law breaks down into, are these:
  - To what extent does SCO own Linux IP
    - What is Unix?
    - How much of this “Unix” is owned by SCO
    - Do Unix licensees have obligations towards SCO
    - To what extent are these Obligations
  - Was SCO IP used in Linux illegally
    - Did SCO themselves release Caldera and thus release their IP?
    - Did IBM contribute code that was illegally obtained into Linux?
    - Is there even any SCO IP in Linux?
- SCOs extent of ownership can be understood from the Novell sale of Unix to SCO.
  - SCO is under the impression that the terms of the sale granted it full control over the Unix IP. Full control is defined as the same control that AT&T had before it sold Unix
  - Novell claims that the sale was not of full control over Unix IP, and instead was over enough control for SCO to be able to freely sell their own version of Unix under whatever license they wished. E.G. the IP was not actually sold
  - Novell purchased Unix for $800 Million. The Novell sale to SCO was for only $100 Million. This can mean everything, or this can mean nothing

What it all boils down to

- Again, this is all Legal Stuff, which can only be left up to the interpretations of the Judges involved
- Its not quite as simple as just stating that SCO is crazy, and they will never win
- The previous slides are rather simplified versions of what is going. I am not a lawyer, and a lot of the content here is my interpretation, which has been formed based on other's interpretations and articles available concerning the matter
- A good summary (and one I referred to various times for making these SCO slides) is available from a ZDNet editor at the following link: http://techupdate.zdnet.com/techupdate/stories/main/What_did_SCO_buy.html, and was written by David Berlind

Second Q&A Session

Okay, so now that we went through the SCO introduction, I would again like to take this opportunity to open the forum up and take some more questions. In the meantime here are some interesting links

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- The greatest geek site in the world. It is titled "Slashdot: News for nerds, stuff that matters". This site is extremely well known among the IT community. It has been cited in the news during various times, and is as common with geeks as google is among non-geeks. http://www.slashdot.org. If its tech news, its on Slashdot.
- The ZDNet article concerning the SCO case, which I think is a very good explanation of what is going on: http://techupdate.zdnet.com/techupdate/stories/main/What_did_SCO_buy.html