

Appraisal and Dissemination of Open Source Operating Systems and other Utilities

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Abstract

Purpose: In recent years there has been a substantial development in the arena of open source software (OSS) development. Both, academia as well as industry are focusing on developing their software in the open source genre. This paper presents a survey of the Open Source Operating System GNU/Linux and discusses its intricacies at length. It also throws light on some of the extremely popular open source utilities used in diverse sub-domains of Computer Science and Engineering.

Methodology: A profound survey and analysis has been undertaken with regard to the open source to build this compilation.

Findings: The appraisal and dissemination has found that there is a square increment in the usage of OSS in both academia as well as in the industry. It also throws light on the near future of OSS usage.

Research Implications: Any appraise or survey that is conducted today is bound to be superannuated tomorrow. Nevertheless, OSS will continue to remain in the market with newer trends coming in. The paper can be a motivation for further contributions to OSS.

Originality/ Value: The paper conglomerates diverse domain OSS that are used in the market, and highlights their usage with emphasis on their other features as well.

Keywords: Open Source; GNU/ Linux; Utilities; Debian; Mozilla; Apache Web Server; My SQL.

Paper Type: Survey

Introduction

There has been a gigantic rise in the use of computers and eventually the software used in them. Computers have predominantly made their presence in almost all the domains of mankind. Name any field, and we are bound to find the influence of computers in it. As such, when computers grew, the software required for them also started rising at an exponential pace, and today the scenario is such that the development of software have been *ad nauseam*.

With a galore rise in the computer industry, novel products keep on creeping in the market adding complexities to the diligent customers or

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end users. Now, the end user has an array of options available at his service which can be used for his needs and/ or business purpose. Engineers and developers have assiduously been in the quest of pushing the boundaries of Engineering and developing high quality software. This development has mainly revolved around two broad categories, viz. open source and closed source softwares. A recent trend in the arena of software development is the open source genre.

OSS are the software which are publicly available in the form of source codes and are distributed under software licenses that allow its users to study the software, make changes to it as per the users' requirement and convenience, improve the software in terms of quality or to cater the users' necessity, even distribute the software with due diligence to the owner, and conforming to the license of the software. The rationale behind the open source code of the software is that the user requires access to un-obfuscated source code because it is exceedingly implausible to evolve programs without modifying them. Since the main motif behind the software development is to make evolution easy, it is mandatory that the modification be made easy. As such there are numerous kinds of software being developed using the terminologies of open source. Open source development has not left any aspect of software untouched. Right from operating systems to benign utilities, open source holds a prevalent share may it be any field.

It would not be an exaggeration to say that the number of open source utilities available are much more efficient than those of the propriety ones. The prime reason behind this is that, in most cases, there is scarcely any monotony across the software development, quality and usage.

One of the path-breaking developments that happened was the development of GNU/Linux Operating System, an open source operating system. Its underlying source code can be used freely, modified and redistributed, both commercially and non-commercially, by anyone under licenses such as the GNU *General Public License*. GNU/Linux which falls under the UNIX-like operating system family continuously evolves, with various releases in play along with support for multi-lingual environments. This paper provides a survey of this operating system and the intricacies that are involved in its development, distribution, usage and market shares.

Open source has also made its presence felt in other domains of software technologies, like that of web browsers, database management systems, web servers, web application development, data mining, artificial intelligence, virtualization, network related tools, proxy servers, office suites, web cache daemons, bug trackers, etc. Some of the widely known software in the above mentioned technologies are: Mozilla Firefox web browser, MySQL database management system, Apache Web Server,

LAMP software package or suite for web development, Oracle Virtualbox as a virtualization suite, Weka data mining tool built in Java, Squid proxy server, Open office suites and fields like dynamic and light web application development using AJAX. The paper presents an introduction to some of the above listed technologies in the form of a survey and also explicates the involutions of the same.

Open Source Technologies

➤ GNU/Linux

GNU/Linux falls under the category of UNIX family of operating systems. It is the most popular open source software, of which the underlying source code can be used, freely modified as per the users' requirements and also redistributed, both in commercial as well as non-commercial domains. The license on which this is built is GNU General Public License (**About GNU, 2009**). Linux was first gestated by a Finnish software engineer and hacker, *Linus Torvalds* in the year 1991. The name *Linux* comes from the *Linux Kernel* written by him. Later, the primary user space system tools and libraries were taken from the GNU Project.

Even after coming a long way after Linux development, the naming issue still remains controversial. The Free Software Foundation has *vox populi* that the Linux distributions that use GNU software be referred to as GNU/Linux or Linux-based GNU system. But, the media and most population around refer to it as simply, Linux. Authors have no biased opinions to any of sides, and here onwards, GNU/Linux and Linux should refer to the same.

Typically, Linux is distributed in the packaged format called the Linux distributions. Linux distribution refers to the monolithic Linux Kernel which handles process control, networking and file system access along with its supporting utilities and libraries. Linux has undoubtedly made its spectacular presence on a wide variety of computer hardware that range from handheld mobile devices, phones and tablet machines to mainframes and high end servers that use supercomputers. It is typically available in two variants, one for the desktop machines and other for the high end servers. **Henry (2010)** lists Linux as the leading server operating system and flawlessly runs the 10 fastest supercomputers in the world without any compromise and without any degradation or devolvement in its performance.

As regards the development taking place in Linux, Linus Torvalds still continues to direct the development of the Linux Kernel. The Linux kernel (**Torvalds, 1992**) has undergone legion versions the current stable version being: 3.1.1. For years together, the Linux kernel had versions with 2.6.x, with x being a numeric value representing the release. The version 3 kernel has brought in a significant paradigm shift in the frames of kernels

(Linux Kernel, 2011). *Richard Stallman*, initiator of the GNU Project, heads Free Software Foundation which supports the GNU components in Linux distributions. Countless programmers worldwide develop third party components that are integrated in the distributions.

With respect to the user interface amenities also, Linux stands at the apex. It provides a powerful command-line interface as well as a graphical user interface with many outstanding features which are built on KDE Desktop, GNOME, etc. and popular one being the X system.

Today, Linux distributions hold a major share in most of the domains. It is successful in securing a place in the server installations both in homes and academia. Various local and national governments have also started supporting and promoting Linux. In India, Kerala state has also enforced that all high schools and other academic organizations run Linux on them. The market shares of Linux are shooting up at a high pace with a gigantic increase in the revenue of servers, desktops and packaged software. Linux shares an overall 12.7% market share with more than 60% web-servers running Linux as against many leading operating systems (**IDC Report, 2009**). Also in many surveys conducted worldwide, seniors in this domain, recommend Debian Linux distributions for servers because of their sturdiness and power. Analysts and proponents of Linux attribute this success to the security, reliability and low cost with freedom.

➤ **Debian: The Universal Linux Distribution**

As mentioned earlier, Debian is one of the Linux distributions available today in abundance. It is a distribution composed of software packages release under the GNU General Public License and other free software licenses. Debian OS is very well known for its conformity to the UNIX and free software terminologies as well as using collaborative software development and testing processes. Debian was first inception in August 1993, and since then it has earned wide popularity because of its ease in the user operations. Aesthetic beauty of the graphical user interfaces has been the charm of Debian and its variants. The most promising feature that Debian offers is that currently it is available in more than 65 languages, along with support for many Indian vernacular languages. This has contributed to end the tyranny of linguistic burdens of the masses. Debian also uses Monolithic Linux kernel and the current release of it is 6.0.3 which is named as "*Squeeze*". Debian managers strictly follow the bugs and perform rigorous testing on the product and do not release their product unless it is bug-free from their perspective (**Distro Watch, 2008**)

Software in Debian is available in the form of packages named *.deb packages* and can be downloaded and installed lucidly. Even a novice user of the Linux box can easily cope up with it. The reason of wide

popularity of this OS is its package manager. The package manager here is named as “*dpkg*” and is the simplest of all the package managers available. Debian simply maintains a repository at various geographical locations in the world, and the users can download the software they require merely by one command or one click, which proves that this is a classic example of *simplicity at its best*.

One of the major variant of Debian is Ubuntu Operating System. Ubuntu is primarily designed for desktop, notebook and server usage. It follows the Debian philosophy and inherits their style. Ubuntu is one of the most popular and favorite operating system amongst the student community because of its ease of use, its free availability and simplicity of software development (**Ubuntu, 2011**). Web statistics portray that Ubuntu shares more than 50% of the market share of Linux desktop usage in the world. Ubuntu is also gaining rise in the server editions as well (**Stat Owl, 2010**). Recently, Ubuntu has also stepped in the world of Cloud Computing which is at its peak today. It allows its users to build their own cloud infrastructure, be it public or private clouds. Its sophisticated orchestration tools assist the users in deployment, managing and scaling their cloud related services within seconds, thereby reducing the total down time of any enterprise; which can then, in a long run, increase the capital costs of the enterprise (**Debian FAQ, 2008**).

➤ **The Mozilla Project**

As their tag line says, “*We are building a better Internet*”, Mozilla project is focused more on the development of internet based software. Their primary and most popular used software being open source web browser, the Mozilla Firefox. The current version of Mozilla Firefox is 8.0 and in a matter of few days, the downloads of the browser have exceeded more than hundred million, which has been a path-breaking record of its kind. Statistics point to the fact that that no other browser has ever achieved such a high acclaim in such a short span of time. It enjoys a world popularity of more than 25% usage (**Synder, 2011**). Also, Mozilla Firefox has been the first web browser that has rolled out rapid releases/ versions to its users. The aim of this faster-speed process is to get new functions to the users faster.

The primary factor which has contributed to such a high popularity of this browser is that, it is based on open source, users and programmers can customize it as per their requirements and one of the vivid features being the availability of add-on features to the browser. Programmers from all around the world, write some add-on features for the browser which can be freely downloaded from the World Wide Web and can be lucidly integrated with the current browser. The aesthetic beauty of the browser is far ahead of comparison with others in this domain. The charm of open

source development can be clearly seen in case of this browser. Mozilla Foundation sets the policies that govern the development, operates key infrastructure and controls trademarks and other intellectual property of it. The Mozilla Foundation was founded by the Netscape-affiliated Mozilla Organization and was incepted in the year 2003. Since then, the growth of it has been magnificent due to its ideas of open source releases and user satisfaction.

The most significant contribution that Mozilla Foundation has given to the world is that, it is dedicated in preserving and promoting a healthy online space by developing versions of Firefox. Mozilla Foundation has partnered with Knoxville Zoo in effort to raise awareness about endangered Red Pandas (**Knoxville Zoo, 2011**).

➤ **Apache: The Open Source Web Server**

Apache HTTP Server Project is developed to design and implement an open source HTTP server for the modern operating systems including all the families of UNIX as well as Windows operating systems (**Apache, 2011**). The main aim of the project is to provide a secure, efficient and extensible server that provides HTTP services in synchrony with the current HTTP standards. Its initial release was way back in 1995, and since then it is shaping the web accordingly. Its current stable release is 2.2.17. Apache Web server is written in C language and is a cross-platform server. The license under which it is distributed is Apache Software Foundation's very own, *Apache License 2.0*.

It is a web server that has made significant contributions in the tremendous growth of the World Wide Web. In 2009, Apache was regarded as the only web server software to surpass the 100 million website milestone (**NetCraft, 2009**). Studies have revealed that Apache is undoubtedly the server that has the maximum market share having more than 60% servers in the world running Apache on UNIX machines (**Servers, 2011**). The combination of Apache and UNIX has proved to be the most efficient in deployment of Web servers in the world since a long time.

The main reason that has led to the wide spread acceptance and usage is the ease and simplicity of deploying the web server software on the machines. The configuration steps of the same are such that a benign user can also set up a web server on his/her desktop machine and serve the web pages. Apache web server also provides a strong security backup. There are no severe attacks reported till date, with regard to the security involvement while using the Apache Web server.

In nutshell, statistics show that Apache web server has been the most promising and reliable web server till now. Recent study (**Web Server, 2011**) reveals that Apache has served over 59.13% of all websites and

more than 66.62% of the million busiest ones.

➤ **MySQL Database Management System**

In the domain of database management systems, MySQL stands out at an apex. MySQL which is also referred to as “*My Sequel*” is a relational database management system that runs as a server providing multi-user access to a number of databases within it. It was developed by MySQL AB, which is now a subsidiary of Oracle and was first incepted in the year 1995 and its current stable release is 5.5.18. MySQL was successful in capturing the open source database management system market since then. It is primarily written in C and C++ and is also a cross-platform software system. The license under which it is distributed is GNU General Public License.

MySQL stands as the world’s most popular open source database (**MySQL, 2011**) which has a very high download rate as compared to the others in this domain. MySQL also offers high performance and scalability in all aspects related to relational database management systems as well as many other enterprise databases. Recently, MySQL Query analyzer has also been conceived which is built for Java and .Net applications for performance optimization. MySQL also offers many profiling tools to generate reports or profiles of the back-end databases.

MySQL has been so successful in its domain because of its ease and simplicity in usage as well as administration. MySQL is offered in the form of both character as well as graphical user interface. The graphical user interfaces are built on top of MySQL servers and are used to manipulate the data in the back-end database servers. The current releases of MySQL claim that there has been a 1500% faster performance of MySQL on Windows operating system (**MySQL Stats, 2011**), plus 37.0% faster performance on Linux operating systems. Moreover, the scalability, performance schema and partitioning options are enhanced in such a way that they are way ahead of many other such softwares. MySQL also offers a superior protection to the database and uses strong authentication facilities while providing strong internal security algorithms. This is reason, till date there have been no severe database related attacks reported with the usage of MySQL.

MySQL powers the most often required Web, E-Commerce and Online Transaction Processing applications very sophisticatedly. It is a fully integrated transaction-safe, ACID compliant database management system. It delivers the ease of use, scalability and performance that has made it the world’s most popular open source database. Some of the world’s most trafficked websites run MySQL for their business and other critical applications.

Future Enhancements and Conclusion

Since the inception of the idea of developing software in an open source way, the concept has come a long way, yet the awareness about the open source terminologies and technologies is not up to the mark as it should have been. One of the lacuna of open source development is that, the source code being available in the hands of multiple personnel, there are many bolts for the same nut; everyone comes up with their own approach of software development and this, number of times, might result in a chaos. No doubt there are versioning systems and profiling systems available, still there needs to be more management in this domain so that the influence of it will surely be more than what it is today. There is a need for enhancement with due respect and due diligence to the current perfectly working community, OSS systems. Open source has still to travel a very long distance and will eventually minimize the software monopolies of some propriety giants in the software world. Open source technologies are now being made mandatory in most of the academic as well as government organizations, but still their use is not up to mark. The ideas and terminologies of developing software in the open source way need to be inculcated amongst the masses from a benign level itself. If this is done, then surely the end-users will get more effective and user convenient software. The main beauty of open source is that, users are able to edit and play with the source code of the system as they wish. When any user is given the privilege of editing the source code of the system as per their convenience and requirements, then obviously there is a high probability of the acceptance of the software system on a large scale. Understanding the users' perspective and needs is the main key factor that renders open source development on the golden crown.

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