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A Comparative Study of the Better Operating System In School Computer Laboratories Between Linux OS and Windows OS

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Abstract. This paper aims to discuss the assessment on which is a between operating system between Linux OS and Windows OS in a computer laboratory environment. Also, a comparison between the cost, maintenance, security, and updates between those Operating system will be made. Also, the common types of application software being used on a computer laboratory will be also tackled. Availability of these kinds of application software between these Operating system will be undertaken last. Aside from that, the advantages and disadvantages of using this application software over the other will be the thing to study on this paper

Keywords: **Linux; Windows;Operating System**

1. Introduction

Computer laboratory is a room or space equipped with computers (networked or not) devoted to pedagogical use in a school (UNESCO.org). A computer laboratory is important in every private and government school to enhance the scientific and technological research and invention capacity of students (Klient Solutech, 2019). The computer lab serves as a place where students can come to learn different technological applications, such as coding, virtual design or even excel spreadsheets. It can also serve as a place for students who don't have personal devices to do homework, research, or work on other online assignments (Nicolas Poggi, 2023). These computer laboratories are commonly configured depending on what is the purpose that it serves. Nowadays, there are different configurations of computer laboratories, depending on what the purpose that it serves. Some computer laboratories are being used for general computer purposes like office productivity works, some are used in learning graphical editing tools, and programming, and the others are being used for local network infrastructure learning.

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An operating system, or "OS," is software that connects with the hardware and allows the operation of certain programs. It comprises of device information, or the essential files that your machine requires to boot up and run. Since the operating system acts as the basic user interface for a machine, it influences dramatically how you communicate with the device. A lot of users also tend to use a single operating system. For e.g., one user may prefer using a Linux machine rather than a Windows based PC. The main task an operating system carries out is the allocation of resources and services, such as allocation of: memory, devices, processors and information. The operating system also includes programs to manage these resources, such as a traffic controller, a scheduler, memory management module, I/O programs, and a file system.

Windows is an operating system designed by Microsoft. The operating system is what allows you to use a computer. Windows comes preloaded on most new personal computers (PCs), which helps to make it the most popular operating system in the world(edu.gcfglobal.org). Windows OS is not only popular in personal computing environment, but also in computer laboratories.

Linux is a family of open source operating systems based on the Linux kernel. First released on September 17, 1991, built by Linus Torvalds. Linux is usually packed in a Linux distribution. These distributions contain the Linux kernel, supporting system software, and libraries, which are provided by the GNU Project. Many Linux distributions include the word “Linux” in their name, but the Free Software Foundation uses the name GNU/Linux to emphasize the contributions of GNU software, which causes some controversy.

Debian, Fedora, and Ubuntu are some of the most popular Linux distributions. It also has commercial distributions like the Red Hat Enterprise Linux, and SUSE Linux Enterprise Server. Desktop Linux distributions include a windowing system, and a desktop environment such as GNOME or KDE Plasma. Server intended distributions may remove the graphics related tools or include a solution stack such as LAMP. Since Linux is freely redistributable, anyone can create their own distribution for any purpose. Aside from that, there are also lightweight versions of the Linux distribution which can be used for older device, bringing a new life to the old hardware.

2. Methodology

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The steps and methods in determining which is better Operating System between Windows OS and Linux OS in a computer laboratory environment will be revealed in this section. Determining the differences between Windows OS and Linux OS in the computer laboratory environment in terms of Cost, Maintenance, Updates, and Security would be the first step. Next step is to look for available software applications in each Operating System for Office Productivity, Graphical Editing, Programming and Network related tools. As mentioned before, this kind of software application are the most common being installed to a computer laboratory. From this list of application software, a comparison will be made, to determine whether the available application software on each operating will be effective to use as a teaching material. (Odun-Ayo et al., 2021)

3. Results and Discussion

Cost

Windows Operating System usually cost between $99.99 to 199.00 USD for each licensed copy. Windows 10, which is the latest version of the Operating System family, originally being offered as a free upgrade for owners of Windows 7 or Windows 8.1 if they upgraded before July 29, 2016.

In contrast, The Linux kernel, and the GNU utilities and libraries, which are part in most distributions, are entire free and open source. You can download and install GNU/Linux distribution for free. Some Linux distributions offer paid support, but the underlying software are free to download and use (Garre et al., 2014).

In this comparison, the Linux OS would be the better choice between the two operating system. Generally, a school can have a total of around 100 units of computers in all its laboratories and paying for a licensed copy of an Operating System would drastically impact the cost of made by the school to its computer laboratories (Oleksiuk, et al., 2024).

Security

Microsoft has made a lot of security improvement to Windows Operating System throughout the years. But since the operating has the largest number of user base, and most of its users are novice, it was a main target of malicious coders. Due to this, Windows OS is most likely a victim of viruses and malwares (Akinde et al., 2021)

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Linux is a highly secured operating system. Although vulnerabilities on this OS are still discovered, since its source code is open and available for the community to review, it makes easier for the community to identify the cause and repair those issues. (Vyas et. al., 2021)

On this part, the clear winner would be the Linux Operating System. Since the source code of the OS is open, community can easily identify any issues or vulnerabilities in the OS. Aside from that, anyone in the community can participate and support the OS by submitting their patches, which makes them one of the collaborators. In case of Windows OS, this can't be done.

Updates

Windows OS allows the user to choose when and how to the latest updates for their computer. These updates are mainly latest fixes or security improvements, which will make the device to run efficiently and be protected against malwares. (Umar, A. U., & Wakili, A., 2023)

The standard release cycle of Linux OS is often release at fixed point of time, every six months or two years. Important security updates are being pushed in between standard releases; this are called Major updates, but this kind of updates rarely happens. Updates are limited to bug fixes no new feature are being introduce in between releases. (Brierley et al., 2021)

Based on this, both Operating System is clearly draw on this part. Both operating system supports and regularly gives an update of the OS to its users.

Ease of Use

Windows is one of the easiest desktop operating systems to use. User friendliness and simplicity of basic system tasks is one of the primary characteristics of this operating system. Its ease and lack of difficulty to use is considered a positive trait by the users who want their system to run. But more capable users might get unsatisfied due to oversimplification of the system tasks. (Sanayev, M. E., 2024).

Latest distributions of the Linux are easier to use than the later variants. Some Linux distributions includes a GUI, similar in Windows OS, permitting for ease of use for regular computer user. Linux GUI distributions are more user-friendly and do not have any bloatware. Ubuntu and Linux Mint are one of the

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best examples of Linux distribution in terms of ease of use and user-friendliness. (Oleksiuk, et al., 2024).

For the ease of use, both operating system would have the same score in this area. Over the years, both operating systems, focuses on improving their user experience, allowing users to easily cope on using their environment.

Office Productivity Tools

Microsoft has its own office productivity tool called Microsoft Office or simply Office. Office is packed in numerous versions targeting different end-users and computing environment. These configurations ranging from Home, Business, Enterprise and Education. Depending on the selected configuration, the application included on it can change but it always contains the Word, Excel, PowerPoint, Outlook and OneNote. The Microsoft Office suite is not free, but it can be tried using the free trial version. Since 2012, Microsoft Office user's breaches over a billion people worldwide. (Gudimetla, S. R., 2024).

Microsoft Office is not available on the Linux OS, but it has a similar tool that can be used, the LibreOffice Productivity Suite. LibreOffice is a powerful office suite, a successor to OpenOffice(.org), and being used by millions around the world. This free office productivity suite comes from the not-for-profit, The Document Foundation. It has a clean and feature-rich tools that will help anyone to unleash their creativity and boost their productivity. This office suite includes applications like Writer, Calc, Impress, Draw, Base, and Math. (Badjie, M., 2022).

Based on the comparison above, Microsoft office is more popular compare to LibreOffice suite. This clearly shows that it why the Microsoft Office suite currently being taught in schools, instead of LibreOffice. It was being used by over a billion people worldwide and can be considered as the standard for office productivity tool.

Graphical Related Tools

Adobe Photoshop is one of the leading photo editing software tools. It was developed and published for by Adobe Inc. for Windows and macOS. It is also being used for both mobile and web design. It is also considered as the industry standard for both raster graphics editing and digital art. Unfortunately, this tool is not available in Linux environment.

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Adobe Photoshop isn't ported in Linux OS, but it still has its alternative tool that can be used, the GIMP. GIMP is a cross-platform image that can be used to edit, retouch, and draw. It provides tools for high-quality image manipulation. It can also create, restore retouch images. Even though GIMP is a powerful tool, it is still lagging behind the Adobe Photoshop in terms of tools and features.

Clearly, since Adobe Photoshop is far greater compared to GIMP, the Windows OS has the advantage on this area. Even if GIMP shares the same experience and tools with the Adobe Photoshop, Adobe Photoshop is far more popular and even considered as an industry standard and must be also used as standard when teaching graphical editing and digital arts.

Programming

Windows is doing everything to retain its loyal base of developers. In Windows 10, the Developer Mode is being introduced, which allows developers to test their apps, modify the settings and even have access to advanced features that isn't available for regular users . Windows Developer Mode is an OS extension that brings a unique user experience element specifically designed for developers. A wide range of support provided for developers is the main selling point that attract developers to continue using Windows OS as their environment. Also, Windows 10 introduces the WSL or Windows Subsystem for Linux, which allows developers to have a complete terminal environment from the Linux environment. With this feature, it will allow the developers to have the native power of Linux Terminal while enjoying the Windows Environment. (Park, S., & Lee, S., 2022).

Linux supports almost all the majors programming languages. It also comes with most of the compilers and interpreters, no need to download them. Aside from that, it offers a lot of applications that is useful for programming purpose. One of these tools is the Linux Terminal. Linux terminal is far superior compared to Window's Command line. Many libraries being used for programming are natively developed for the Linux OS. Also, the package manager, helps the programmers a lot to get things done easily. Another, good things about Linux is the native support of SSH, and the ability of bash scripting. (Ward, B., 2021).

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In terms of programming environment, both Operating systems shows that they are sharing the same ground which allows programmers and developers to enjoy using both operating system.

Networking Related Tool

Both operating system shares one of the great tools used for creating network topologies and imitate modern computer networks, the Packet Tracer. This tool is a cross-platform visual simulation tool that is designed by the CISCO Systems. Using this tool will allow students to design complex and large networks, which is not possible with the use of physical hardware due to costs. It can be useful for understanding abstract networking concepts, by animating these elements in visual form.

4. Conclusions

Picking the operating system that you wanted to use is easy but picking what will fit for what you need is a difficult one. Hopefully this paper will offer some guidance and help you frame you on making the right decision on picking the operating system for your computer laboratories.

First, regarding the operating system itself, based on the facts stated above using Windows OS can cost you more compare on using Linux OS. This only for the license of the operating system alone, another cost can be acquired for other application software needed. Using Linux OS would be ideal for those who are conscious about their budget when setting up their laboratory. Also, there are lightweight Linux distributions that only needs minimal hardware requirement, bringing the cost of setting up even lower.

In terms of security, Windows OS mostly being used by novice users which attracts malicious individual by targeting them with malwares and virus. Due to this security attacks and threats, Linux shines on this category. Having the community to help and improve the Linux environment why it is much secured compared to Windows. Linux also implements a lot of security feature within its environment preventing the malwares to get infected by malwares and viruses.

Regarding regular updates, both Operating system has their own strategy on delivering and pushing updates to their users. Having regular updates patches any vulnerabilities in the system, that will help prevent malwares and viruses from infecting the system.

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Talking about the ease of use, both operating system possesses a good user experience. Both are increasingly getting better each over the years. Aside from that, having almost the same User Interface will allow anyone to easily cope using the both operating system.

For the learning tools, sticking on the industry standard is still recommended. Using the industry standard tools will help students to easily cope with what the industry is looking for. Using a not so popular tool just to save some cost, will not help for both the instructors and students. Due to this, Windows OS dominates the Office Productivity and Graphical Editing tools because both tools on those areas are being considered as the industry standard and only available in this operating system. For the programming and network related tools, both the operating system shares the same tools, having the same capability, but there is one thing that separates them, ensuring the legitimate source of this tools. Because of this, Linux OS shines for both programming and network related tools.

Based on the facts stated above, both operating systems would be a great choice to be used for Computer Laboratory environment, but they would not have the same treatment. First, Windows OS would be advisable to be used on newer devices, since Windows OS requires better specs in order to run compared to Linux. Since tools like Adobe Photoshop and Microsoft Visual Studio which requires a better set of hardware requirements, then it would be fair to run this program on the newer devices. Microsoft Office is not requiring high specs in order to operate but this tool is only available on Windows OS.

Linux OS would be fit for slower or older devices, allowing the hardware to run more efficient compared on using Windows OS in them. Aside from that, using Linux OS will take advantage of the Linux Terminal, which is very effective when used in programming. With Linux Terminal, almost all of the programming tools and libraries would be easier to integrate, or already integrated natively. It would also better for the students to get familiar early using the terminal, since it is also one of the standards being used in the industry right now. Also, the networking related tools mentioned before has a version compatible to Linux OS, making a ton of use for the OS.

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