UNIVERSITI TEKNOLOGI MARA
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FACULTY OF COMPUTER AND MATHEMATICAL SCIENCES

DIPLOMA IN COMPUTER SCIENCE

CSC204
PRACTICAL APPROACH OF OPERATING SYSTEMS

TITLE: SIDE EFFECTS OF OPEN-SOURCE OPERATING SYSTEM

GROUP: T5CS1103B

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1.0 INTRODUCTION

The phrase ‘open source’ refers to applications or computer software whose owners or copyright holders allow users or third parties to see, use, and alter their source code. An open-source operating system is an OS where the source code is completely open which is visible publicly and editable from its original design free of charge. In other words, everyone in the world could customize it, see it and understand its logic. It is the opposite of Microsoft Windows, which is a closed source OS where the source code is kept private and unavailable to other parties by the various corporations (owners).

Basically, by using an open-source OS you may legitimately obtain someone else's code and alter it, adding or removing specific items or features, creating a different UI, and naming it anything you like. As an example, when you want to create a whole new operating system, instead of starting from the scratch, you can use open-source code and completely modify it. Nobody will ever question that you copied something.

There are a variety of open-source OS available, but Linux is by far the most popular. The Linux Kernel is the foundation of the Linux Operating System family. Linux is an operating system that runs on top of all other software on a computer, taking requests from other programs and sending those requests to the hardware. Many developers have examined the source code and developed numerous supporting plug-ins and operating systems to meet their requirements. Although Linux is the most popular operating system, other open-source alternatives include Ubuntu, Linux Mint, Elementary OS, Solus, and more are also free to use.

2.0 GOOD SIDES OF OPEN-SOURCE OS

2.1 LOWER COST

As we already know, most of the open-source OS is technically free. However, there might be long-term costs for implementation, innovation, and support. Open-source OSes such as Linux or FreeBSD do not cost anything, though some Linux companies, such as Red Hat, provide a supported version for a fee. Despite having to pay for the fee, open-source software is way cheaper than closed source software.

First thing first, we can look at license cost for both open-source OS and closed source OS. Ubuntu, Debian and Fedora are one of the Linux-based OS that did not charge for license fee at all. But, if the company need Linux support and vendor-

accountability, they should consider buying licensing product from Red Hat or SUSE. Red Hat Enterprise Linux for Virtual Datacentres starts at $2,499 per year.

In contrast, Windows Server 2022 Datacentre starts at $6,155 – keep in mind that this listing price and Microsoft Partner pricing price varies. It is a one-time payment, but if you do not have Enterprise Agreement (EA) or Software Assurance (SA), you need to pay for the upgraded version when your Windows OS end its service. In addition, the subscriptions do not include Client Access License (CAL). A single user CAL for Windows Server 2016 costs $38. If you need to add 10 users, that is $388 more dollars you need to pay for the server software licensing.

Next, we should also consider the software support cost. For open-source OS, free Linux distros like Ubuntu, CentOS, or Debian might not need software support if your environment consists of 100s of Linux virtual machines. Despite that, a competent company should ensure that they have the ability to deal with almost every Linux issue that may arise in the future. Thus, it is advised for the company to buy subscriptions from Red Hat or SUSE, it will be a perfect choice as they not only included license fee, but also software support in their subscription's plan.

On the other hand, Software Assurance (SA) cost for Windows Server varies depending on the agreement made with your Microsoft Partner. For the purpose of simplicity and clarity, we can assume the SA has a yearly cost about 25% of the list price. For example, if you subscribe Windows Server 2022 Datacenter at $6,155, the SA price will be approximately $1,525.

		Year 1	Year 2	Year 3	Year 4	Year 5	Total	Delta
	License	Support						
Red Hat		$2,499	$2,499	$2,499	$2,499	$2,499	$12,495	
Windows	$8,055	$1,525	$1,525	$1,525	$1,525	$1,525	$15,680	25%

Figure 1: On-Premises License and Support over 5 Years.

Note: Windows = (Datacenter license at $6,155) + (50 user CALs at $38 each) = $8,055

By comparison, we can strongly agree that open-source OS has lower cost or even free of charge, compared to closed source OS. Therefore, open-source OS is not only functioning the same as closed source OS, but also cost-effective.

2.2 HIGH RELIABILITY

Software reliability is defined by the American National Standards Institute as "the probability of failure-free software execution for a certain period of time in a specified environment." Informally, reliability is defined as how the system achieved their stated specifications.

Eric S. Raymond, an American software developer and the author of The Cathedral and the Bazaar has mentioned that: "The most effective way to achieve reliability in software is to publish its source code for active peer review by other programmers and by non-programmer domain experts in the software's application area."

His statements indicate that open-source code outlives its original authors because it is regularly updated by active open-source communities. This implies that there are many pairs of eyes that can look for bugs, and also fix them and then report it to the maintainers as well as issuing an updated version of the software on their own authority. As stated in Linus Law: "*Given enough eyeball, all bugs are shallow.*"

Doesn't that make open-source OS trustworthy software? Just imagine hundreds of experts contributing to build a software — how innovative and extraordinary it would be?

2.3 SIMPLE LICENSE AGREEMENT

Open-source licenses consist of its term of use, modification and distribution which permits the code to be shared and edited by other parties. Open Source Initiative is an organization that works to promote open-source software. They have approved over 80 open-source licenses worldwide since their beginnings in 1998. Surprisingly, most of these licenses fall into one of two categories: permissive licenses and copyleft licenses.

The permissive license is the most basic type of open-source license. Permissive license requires users to have a freedom to use, modify and redistribute the code at their own risk, as long as they acknowledge the author of the original code. Examples of permissive licenses are the MIT, Berkeley Source Distribution (BSD), and Apache 2.0.

On the other hand, copyleft license refers to license that allow derivative works but require them to use the same license as the original work. As an illustration, if you create a software and release it under the GNU General Public License, and then someone else modifies it and distributes it, the modified version must also be licensed under the GNU General Public License, including any new code written specifically for the modified version.

In comparison to permissive licenses, copyleft licenses have additional requirements. It requires the users to share the source code for distributed binary files and does not allow the users to apply further restrictions on the user's use of the license. Besides that, the source code's copyleft terms cannot be changed. Examples of copyleft licenses are the GNU General Public License, GNU Lesser General Public, and Mozilla Public License 2.0.

All in all, open-source OS licenses agreement does not involve anything complex and complicated requirements. Users can use open-source OS to the fullest as long as they follow the terms and conditions.

3.0 BAD SIDES OF OPEN-SOURCE OS

3.1 SECURITY RISK

A computer system must be protected against unauthorized access, malicious access to system memory, viruses, worms and many more. This is a problem when using open-source operating system since its code is open and easily provide the source code for use and its inspection by any user. The bugs in the system are patched effortlessly and are developing the quality of code. If the source code is not in protected condition, it will lead to give easier access to the data and can be easily launch an attack successfully. As a result, it gives "hacker" the information for searching the bugs and vulnerabilities.

This increases the vulnerability of any system as the openness of the source and design are vastly different. When the design is uncovered, certain logical faults in terms of security are revealed, which is the worst-case scenario. Bugs will exist in the source code regardless of how we verify or test it. Attackers, on the other hand, will investigate a source.

This disadvantage is clearly proven in Open-Source Security and Risk Analysis report, which analyzed in 2021 report shows a 9% increase in vulnerabilities from the previous year. Paralleling the increase in vulnerabilities is the increase in high-risk vulnerabilities. Year 2021 report shows an 11% increase from the previous year. The majority of these have been in the code for more than two years and have documented solutions available [**Figure 2**].

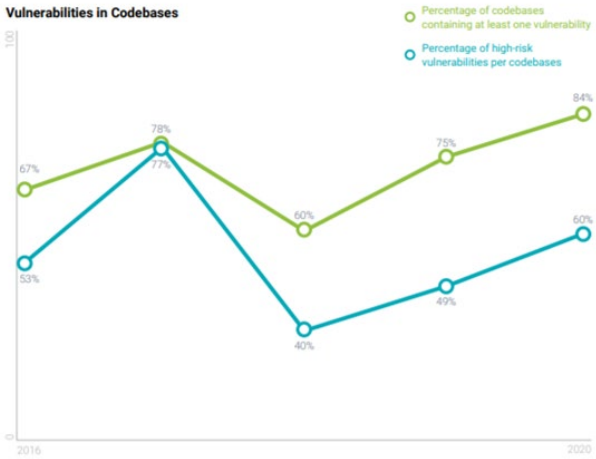

Figure 2: Vulnerabilities in Codebases

3.2 LACK OF OPERATIONAL SERVICE

The organizations on user's open-source system, have given less attention to the area of operational risk which is version currency and version proliferation. Version currency merely indicates if the code is up to date on various component versions. Today, excellent open-source projects grow and the "committers" in the open-source sector constantly improving it.

A codebase that relies on component versions that are several years old will be unable to benefit from these advancements and many "improvements" are security patches. Older code is often less secure which is why the need to update components is highly emphasized.

Next, version proliferation happened if the user does not keep the inventory of the open-source usage across all the development teams. There may have multiple different versions of open-source usage. It will lead to different teams in the development to use different versions of the same component at the same time and it will also unable to ensure visibility and transparency of the open-source operating system.

3.3 POOR DOCUMENTATION

The biggest deficiency in open-source operating systems is the lack of good free manuals that can be include in the systems such as documentation. One of the reasons for the lack of documentation may be that open- source community places more emphasis on software development than user support. Open-source projects tend to have a major problem with providing decent documentation if they provide documentation because there are possibilities that the open-source does not provide any documentation at all.

This is because open-source OS does not have a contractual responsibility to provide this documentation, it is usually intended to be a general guide rather than a complete manual that user could hand to a novice. The chances of not getting support are high and this means more work as it needs to be updated to include all required functionality before deployment.

4.0 CONCLUSION

In general, there is a trade-off between general use and versatility when it comes to computers. Majority users only want their computer to be able to read e-mail and perform other basic tasks. For these people, Mac OS or Microsoft Windows is ideal. However, your control for these closed source OSes are limited. This is because you cannot mess with the kernel, which controls the hardware-software interactions at their most fundamental level. Open-source OS, on the other hand, provide that flexibility. However, keep in mind that everything wonderful is not always good, as open-source OSes have their own drawbacks.

Finally, it is up to the user to choose which OS they want to use as many factors must be considered before deciding to pursue it as their primary driver. At the end of the day, it is all about compromising user’s experience and security in exchange for more performance, customization, and privacy.

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