

## Comparison of Operating System Performance Between Windows 10 and Linux Mint

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KEYWORDS	ABSTRACT
Windows 10 Linux Mint Time Computation Resource Usage Network	<p>This research presents the comparison of operating systems performance between Windows 10 and Linux Mint. Research is focused on determining the best operating system in term of performance between two distinguished operating system. The performance parameters that will be focused on this project are computation time, resource usage, and network. Several experimental that based on different scenario to show the differences of both operating systems in term of performance. The objective of the project to investigate the differences between Windows 10 and Linux Mint, to analyze the performance of Windows 10 and Linux Mint and to determine which operating system is better between Windows 10 and Linux Mint in term of performance. As results, research has been determined that Linux Mint is superior in term of performance compared to Windows 10.</p>

### 1.0 INTRODUCTION

Most people do not know which operating system is better in term of performance. Most people do not know to determine which OS is better for their needs in general usage. An operating system performs a wide variety of useful functions in a system, but it is helpful to think of those as falling into three general categories. First, the operating system sits on top of a physical system and talks to the hardware. This insulates application software from many hardware implementation details. Among other benefits, this provides more freedom to innovate in hardware because it's the operating system that shoulders most of the burden of supporting new processors and other aspects of the server design not the application developer. Second, the operating system specifically the kernel performs common tasks that applications require. It manages process scheduling, power management, root access permissions, memory allocation, and all the other low-level housekeeping and operational details needed to keep a system running efficiently and securely. Finally, the operating system serves as the interface to both its own user programs think system utilities such as logging, performance profiling, and so forth, and

Received April 2021; received in revised form May 2021; accepted June 2021.

applications that a user has written. The operating system should provide a consistent interface for apps through APIs (application programming interface) based on open standards (Gordon, 2016). Some of the most important system performance metrics are available memory, average bytes per read/write, average read/write time, disk reads/writes per second, network utilization, pages input per second, pages per second, processor queue length, and processor usage.

There are several related works that involve in comparing operating system performance. Brumen et al. (2016), this research comparing the performance of open source intrusion detection systems, namely Snort and Suricata. The objective of this study is to give a comprehensive analysis of both products in terms of several security related and performance related indicators. Several experiments were run to evaluate the effects of open source intrusion detection and prevention systems Snort and Suricata, operating systems Windows, Linux and various attack types on system resource usage. Maria et al. (2016), they focused on reliability issue in the Performance Monitoring Unit of recent Intel processors with Hyper-Threading enabled. A cache-coherence style protocol was implemented in the Linux kernel to address the issue by introducing cross hyper-thread dynamic event scheduling. The researcher improves event scheduling efficiency by introducing an algorithm which optimally schedules events onto hardware counters consistently. The proposed optimization do not require any user level changes. These improvements have been contributed to the upstream Linux kernel 4.1. Abdulganiyu (2017) employ a quantitative and qualitative comparative analysis of Real Time Operating systems (RTOS) of some selected operating systems in order to determine their performance in executing a task(s) over real time. The studied systems which are largely used in industrial and academic environments were selected and analyzed using a function generator and Oscilloscope connected to the analyzed system as a reference for conventional non-real-time operating system. The evaluations from the setup include real run time, worst case response times for latency, latency jittery and response time.

## 2.0 EXPERIMENTAL PROCEDURE

Linux Mint and Windows 10 will be employed in this research as the operating systems comparison. Linux Mint were chosen, compared to Ubuntu as Linux Mint is more similar to Windows-like desktop distribution. This factor will ease the new Linux users. Meanwhile, Windows 10 were chosen because of its popularity among general user. It also includes by default some applications and libraries that are better for most users. In this research, resource usage, time computation and network (application layer) are selected as the parameters to compare the operating systems performance. NZXT CAM, Gnome System Monitor, Gnome Terminal, VBScript, Google Chrome DevTools, Ccleaner and Microsoft Drive Optimizer will be assessed to monitor the performance. Several certain software are identified to be used in testing phase. The software involves are Steam, Discord, LibreOffice, Google Chrome and Mozilla Firefox. All the preliminary study phase description are depicted in Table 1. This research only uses one pc in dual-boot. The monitoring tools are progressing based on the selected parameters. Research Methodology is crucial in ensuring the success of the research. The methodology is divided into three phases which are Preliminary Study, Experiment and Analysis and Documentation phase.

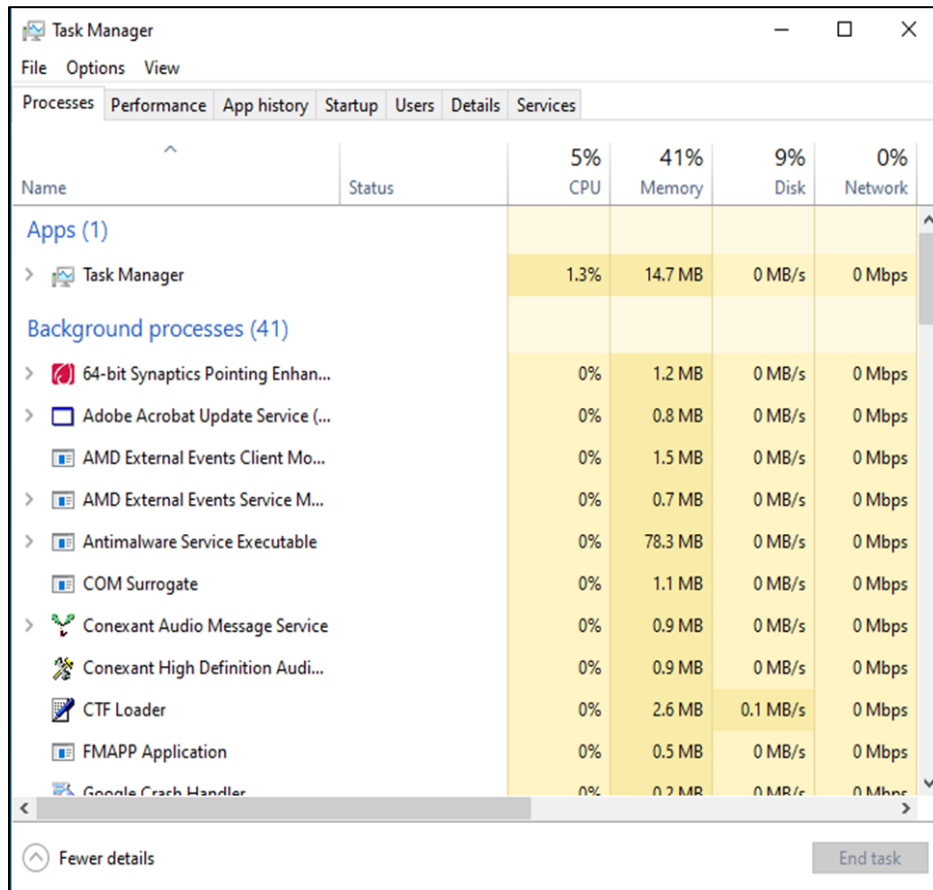
**Table 1** Preliminary Study Phase Description

Activity	Result
Identify OS version	Windows 10 and Linux Mint.
Identify monitoring tool	<ul style="list-style-type: none"> <li>• NZXT CAM</li> <li>• Gnome System Monitor</li> <li>• VBScript</li> <li>• Gnome Terminal</li> <li>• Ccleaner</li> <li>• Microsoft Drive Optimizer</li> </ul>
Identify software in testing phase	<ul style="list-style-type: none"> <li>• Steam</li> <li>• Discord</li> <li>• LibreOffice</li> <li>• Google Chrome</li> <li>• Mozilla Firefox</li> </ul>
Identify parameter	<ul style="list-style-type: none"> <li>• Resource Usage Refer to how much memory, or RAM, that computer have and how much its being used</li> <li>• Time Computation The length of time required to perform a computational process</li> <li>• Network (Application Layer) Serves as the window for users and application processes to access network services</li> </ul>

The Experiment and Analysis Phase refers to the experiment that will be performed based on its parameter for both operating systems. The purpose of this phase is to acquire the result of the experiment and to be analyzed with. Then, a comparison will be made for both operating system based on the result that has been gathered. This phase is important because it's the only phase that can achieve the objectives of projects.

### 3.0 RESULTS AND DISCUSSION

The initial background process and resource are recorded, for both operating systems. In Windows 10, there is a total of 41 programs that running in the background. All of the background programs have consumed a total of 5% for CPU, 41% for RAM. This show how many resources those background programs consumed before the start of the experimentation, as shown in Figure 1.



**Figure 1** Windows 10 Background Programs & Resources

Meanwhile, there are a total of 60 background programs in Linux Mint. All of the background programs have consumed a total of 1.8% for CPU, 24% for RAM. The results show how many resources those background programs consumed before the start of the experimentation. It also showed although Linux Mint has many background programs running compared to Windows 10, it still consumed less resources than Windows 10, as depicted in Figure 2, Figure 3 and Figure 4. Since all the preparation and installation of operating system is setup, the experimentation phase is beginning. This experimentation is split into four parts which are Computation Time, Resource Usage and Network (application layer). In this respective section, it will contain both parts of the operating systems (Windows 10, Linux Mint).

System Monitor

System Monitor

Processes Resources File Systems

Process Name User % CPU ID Memory Disk read total Disk write total Disk read Disk write Priority

systemd	user	0	947	1.4 MiB	460.0 KiB	N/A	N/A	N/A	Normal
ssh-agent	user	0	1109	320.0 KiB	N/A	N/A	N/A	N/A	Normal
(sd-pam)	user	0	948	2.9 MiB	N/A	N/A	N/A	N/A	Normal
rfkill	user	0	1507	84.0 KiB	N/A	N/A	N/A	N/A	Normal
python3	user	0	1506	4.4 MiB	N/A	N/A	N/A	N/A	Normal
pulseaudio	user	0	1271	3.9 MiB	1.1 MiB	8.0 KiB	N/A	N/A	Very High
polkit-gnome-authentication-agent-1	user	0	1396	5.2 MiB	40.0 KiB	N/A	N/A	N/A	Normal
obexd	user	0	1418	648.0 KiB	484.0 KiB	N/A	N/A	N/A	Normal
nm-applet	user	0	1401	7.2 MiB	648.0 KiB	N/A	N/A	N/A	Normal
nemo-desktop	user	0	1402	21.0 MiB	16.3 MiB	56.0 KiB	N/A	N/A	Normal
gvfs-udisks2-volume-monitor	user	0	1243	1.4 MiB	2.0 KiB	N/A	N/A	N/A	Normal
gvfs-mtp-volume-monitor	user	0	1351	464.0 KiB	N/A	N/A	N/A	N/A	Normal
gvfs-gphoto2-volume-monitor	user	0	1355	784.0 KiB	460.0 KiB	N/A	N/A	N/A	Normal
gvfs-goa-volume-monitor	user	0	1264	560.0 KiB	352.0 KiB	N/A	N/A	N/A	Normal
gvfsd-trash	user	0	1473	948.0 KiB	4.0 KiB	N/A	N/A	N/A	Normal
gvfsd-metadata	user	0	1479	632.0 KiB	N/A	52.0 KiB	N/A	N/A	Normal
gvfsd-fuse	user	0	1158	536.0 KiB	240.0 KiB	N/A	N/A	N/A	Normal
gvfsd	user	0	1153	928.0 KiB	852.0 KiB	N/A	N/A	N/A	Normal
gvfsafc-volume-monitor	user	0	1359	876.0 KiB	N/A	N/A	N/A	N/A	Normal
goa-identity-service	user	0	1344	920.0 KiB	252.0 KiB	N/A	N/A	N/A	Normal
goa-daemon	user	0	1290	5.6 MiB	18.3 MiB	N/A	N/A	N/A	Normal
gnome-system-monitor	user	0	1680	12.5 MiB	10.2 MiB	8.0 KiB	N/A	N/A	Normal
gnome-keyring-daemon	user	0	1172	972.0 KiB	N/A	N/A	N/A	N/A	Normal
dconf-service	user	0	1245	716.0 KiB	N/A	420.0 KiB	N/A	N/A	Normal
dbus-daemon	user	0	1011	1.1 MiB	8.0 KiB	N/A	N/A	N/A	Normal

End Process

Figure 2 Linux Mint Background Programs

user@user-Lenovo-G40-45: ~

File Edit View Search Terminal Help

top - 13:03:22 up 2 min, 1 user, load average: 1.02, 0.69, 0.28

Tasks: 199 total, 1 running, 134 sleeping, 0 stopped, 0 zombie

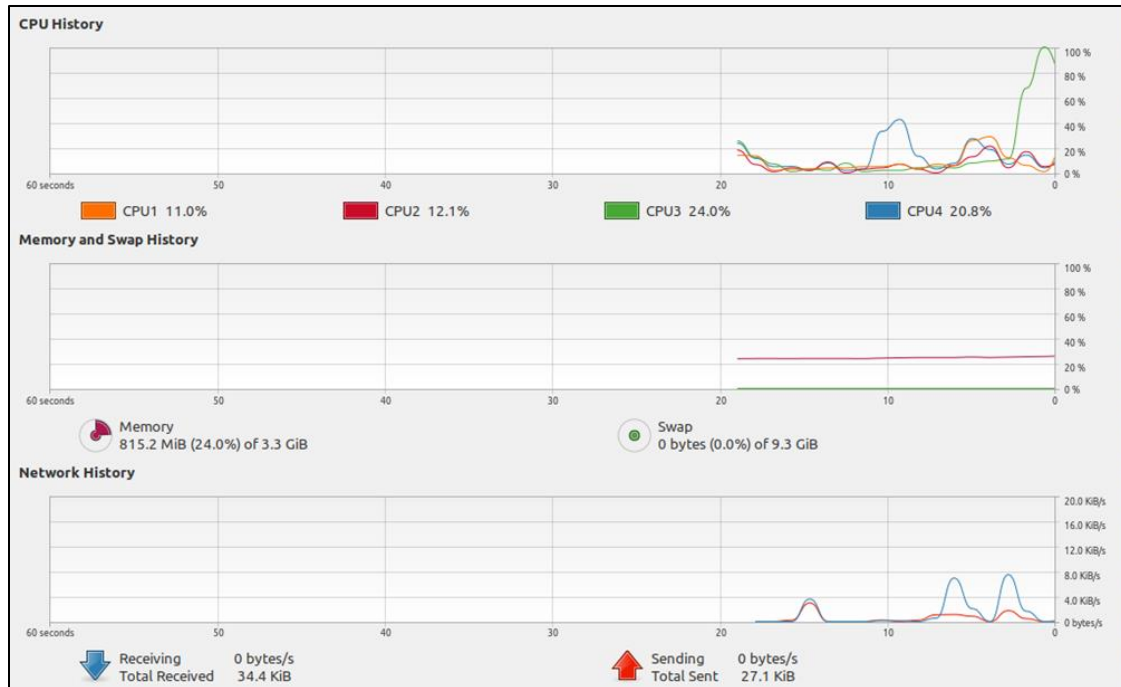
%Cpu(s): 1.0 us, 0.5 sy, 0.0 ni, 98.2 id, 0.2 wa, 0.0 hi, 0.1 si, 0.0 st

KiB Mem : 3482428 total, 2240072 free, 619644 used, 622712 buff/cache

KiB Swap: 9740284 total, 9740284 free, 0 used. 2628344 avail Mem

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
893	root	20	0	1629280	82904	55724	S	2.0	2.4	0:07.13	Xorg
1346	user	20	0	3789684	150864	84892	S	1.7	4.3	0:12.96	cinnamon
1531	user	20	0	486864	45412	33848	S	1.0	1.3	0:02.48	gnome-syst+
1776	user	20	0	44080	4104	3448	R	0.7	0.1	0:00.15	top
106	root	20	0	0	0	0	I	0.3	0.0	0:02.84	kworker/1:2
1	root	20	0	225676	9520	6828	S	0.0	0.3	0:02.50	systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kthread
3	root	20	0	0	0	0	I	0.0	0.0	0:00.00	kworker/0:0
4	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/0:+
5	root	20	0	0	0	0	I	0.0	0.0	0:00.03	kworker/u8+
6	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	mm_percpu_+
7	root	20	0	0	0	0	S	0.0	0.0	0:00.03	ksoftirqd/0
8	root	20	0	0	0	0	I	0.0	0.0	0:00.23	rcu_sched
9	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_bh
10	root	rt	0	0	0	0	S	0.0	0.0	0:00.00	migration/0
11	root	rt	0	0	0	0	S	0.0	0.0	0:00.00	watchdog/0
12	root	20	0	0	0	0	S	0.0	0.0	0:00.00	cpuhp/0

Figure 3 Linux Mint CPU Usage



**Figure 4** Linux Mint RAM Usage

### 3.1 COMPUTATION TIME

In Windows 10, the tools that will be employed in monitoring the time computation is VBScript. In Notepad, the following text is entered as in Figure 5.

```

exec_timer - Notepad
File Edit Format View Help
Set WshShell = WScript.CreateObject("WScript.Shell")
sCmd = chr(34) & "C:\Users\User\Desktop\libreOffice 6.4.1.lnk" & chr(34)
dtmStartTime = Timer
Return = WshShell.Run(sCmd, 1, true)
Wscript.Echo "The task completed in " & Round(Timer - dtmStartTime, 2) & " seconds."
    
```

**Figure 5** Command Line in Notepad

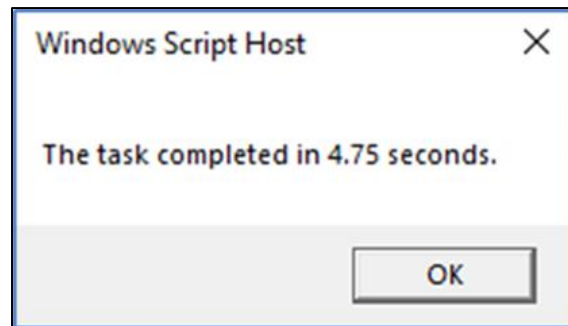
The marked part in Figure 5 is the programs that will be needed for testing. Table 2 is the respected program command line that needs to be place at the marked part. The VBScript launches the batch file, command, or the program. The total execution time will be shown (in seconds), as in Figure 6.



**Table 2** Command Line for the Programs (Windows 10)

PROGRAM	COMMANDLINE
Steam	Steam.lnk
Discord	Discord.lnk
Liber Office	LibreOffice 6.4.lnk
Mozilla Firefox	Firefox.lnk
Google Chrome	Google Chrome.lnk
Test 3112 Word	Test 3112 Word.docx

The steps are repeated as need to change the command based on the software that will be used for the testing.

**Figure 6** VBScript Execution Interface

Meanwhile, tools that used in Linux Mint is Gnome Terminal. Command “time” will be used in the terminal. Result is recorded the result, and command is replaced for the respective programs for the next testing and steps are repeated for each of the programs that will be need for testing, as in Figure 7.

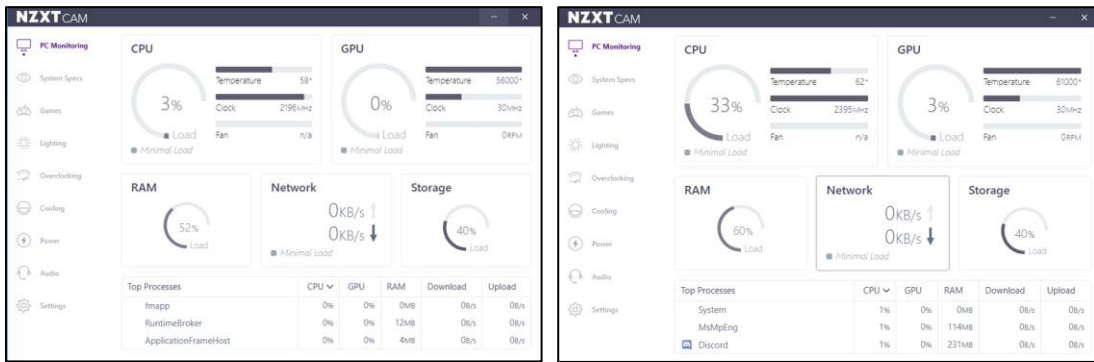
```
user@user-Lenovo-G40-45:~$ time libreoffice
real    0m9.363s
user    0m2.213s
sys     0m0.501s
```

**Figure 7** Marked Part Replaced for each Program's Command

Based on the results, Linux Mint has the edge over Windows 10 because it took less time to open a program, due to the file system in Linux Mint is very much organized. All the files are situated in portions that are very close to one another. The read-write operation becomes very swift. In contrast, Windows is sometimes known as dumpster and files are positioned all over the place. Thus, make the read-write operation tend to becomes slower than Linux.

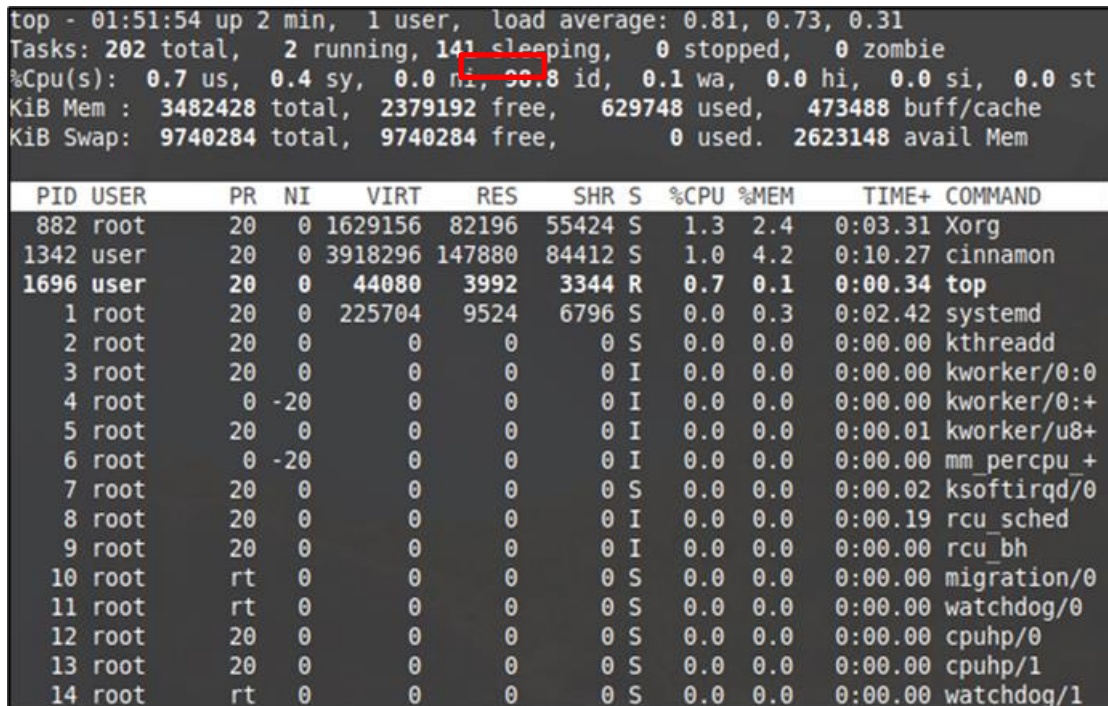
### 3.2 RESOURCE USAGE

In Windows 10, NZXT CAM tool is employed (Refer to Figure 8) to measure the resource usage, and let it in idle for a while. There will be a change between the idle situation and when the testing program is running. In testing phase, results are recorded in idle n running condition. The steps are repeated to record the differentiation.



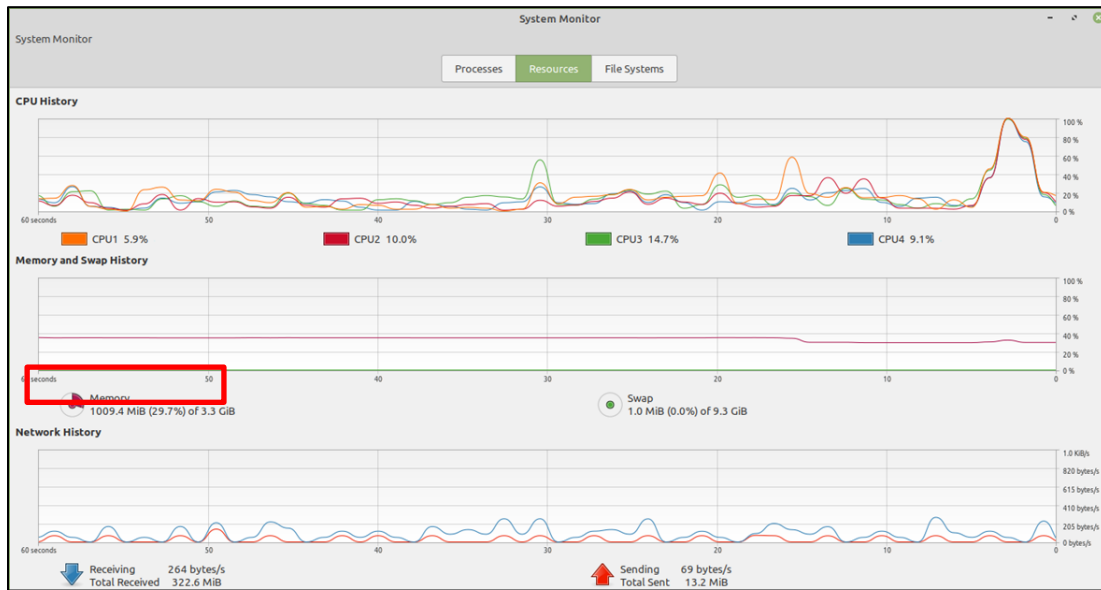
**Figure 8** Idle and Running Condition Recorded in NZXT CAM

Meanwhile in Linux Mint, two tools are required, which are Gnome System Monitor and Gnome Terminal. The Gnome Terminal will record the CPU usage, as in Figure 9 while Gnome System Monitor will record the RAM (random access memory) usage as in Figure 10. The calculated results are recorded with the RAM usage from Gnome System Monitor.



**Figure 9** Gnome Terminal (Marked Part Show Where Idle Time Located)



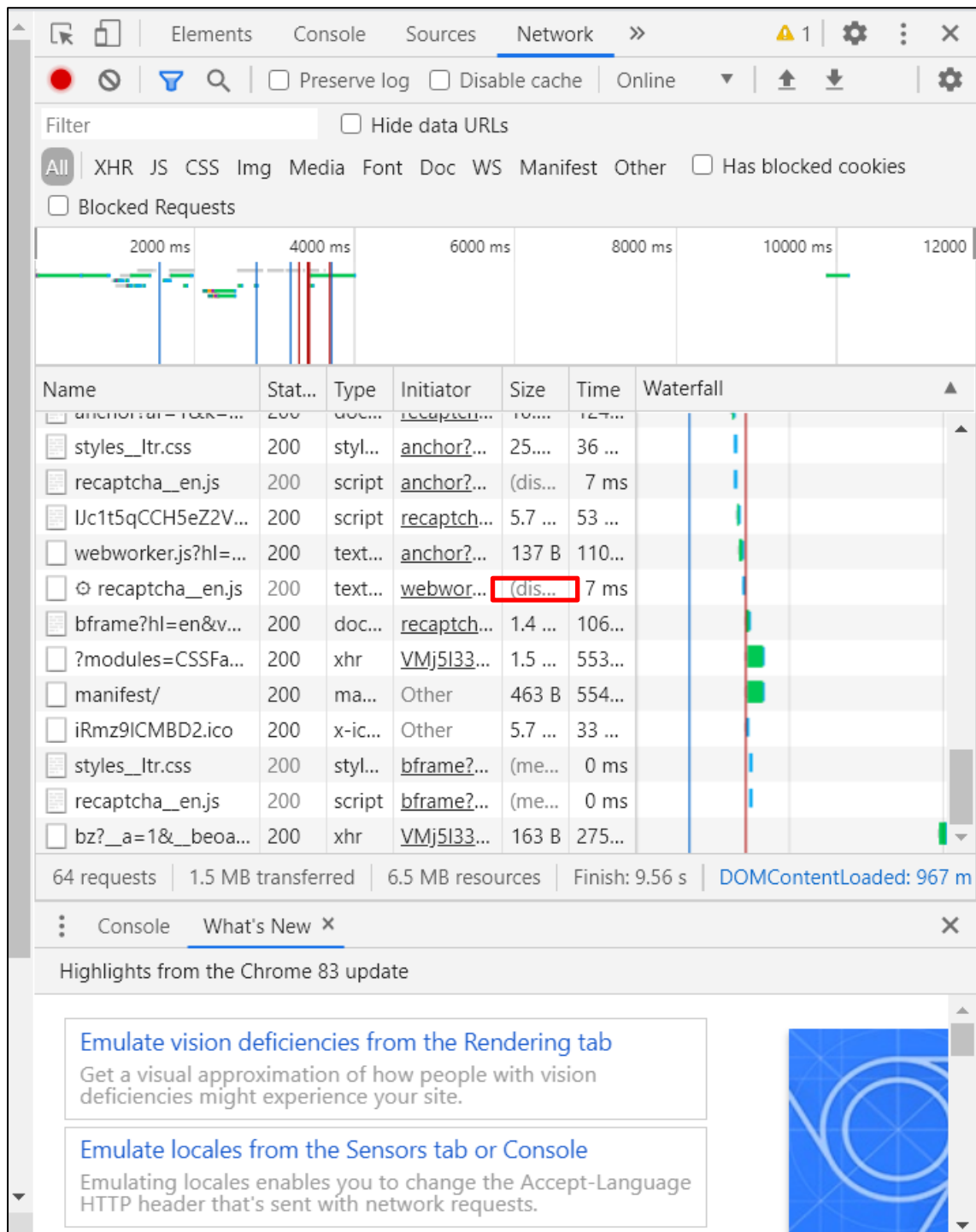


**Figure 10** Gnome System Monitor (Marked Part Shows the RAM usage)

Based on the result that has been obtained, Windows 10 consume more computer resource compared to Linux Mint. The consummation of many resources will affect the performance to some extent. Windows 10 has a lot of programs run in the background compared to Linux and they eat up the resources of the computers. This program also contributes to the user interface of the operating system. That's why Window user interface is very pretty and offers a lot of applications while Linux user interface is moderately simple and clean. It fair to be says that Windows sacrifice some of the computer resource to enhance and facilitate the experience of its user.

### 3.3 NETWORK (APPLICATION LAYER)

During this phase, research is focus to record the loading time of a webpage to fully load to the user. The utility tools that can be used on both on Windows 10 and Linux Mint is Google Chrome. This phase of experiment contains two scenarios. Those are the loading time of a single website and the loading time of a single website simultaneously with another website. The testing was conducted in the middle of night to avoid network traffic congestion and all of the browser cache and history has been cleared before testing. Websites that involved in testing are Facebook, Wikipedia, Steam, YouTube and Google Classroom. Windows and Linux Mint using the same activity to record the results of Network (Application Layer). In Google Chrome, shortcut "ctrl + shift + c" is employed to show Google Chrome's console tools. Then, switch the tab to the "Network" part. The desired URL webpage need to be entered on the search bar. Then the tools will start automatically after the website is being searched. The total loading time that situated at the bottom of the developer tools are recorded within repeated steps according to different URL, as in Figure 11. In second scenario, which involving in reloading multiple tabs in a same time, it is the first prerequisite for the browser to have an extension called "Reload all tabs". This tool will enable the reloading of all of the tabs simultaneously. The extension can be added via chrome web store, needed for testing phase.



**Figure 11** Marked Part Shows Where To Read The Time Taken For The Website To Load

After conducting the experimentation and recording its result, it can be stated that the experiment provides an obvious distinction regarding the performance on both operating systems. So, an evaluation on each of the results is needed. Based on the results, there aren't much significant differences between Windows 10 and Linux Mint. The results are separated at most 3 seconds differences between both operating systems. Windows 10 is shown to be a little slower

in loading websites compared to Linux Mint. It can be argued that Windows 10 always has some background applications like the antivirus that are regularly update their database, and access the internet. Not to mention, Windows regularly download update in the background without the user consent or notification. This will reduce the speed of the network. Other than that, it is all pretty much same with the Linux Mint in term of network performance.

There are several implications that may or may not impact the daily life of general user. Based on the result obtained in computation time parameter, it can be assumed that if the user uses computer primarily for work, they were recommended to use Linux Mint. In working environment, time is exquisite or valuable in certain working environment. Linux Mint can load most of the software or files faster compared to Windows 10. But if the user working environment is not so strict on time and more tranquil, Windows 10 is enough in achieving their necessities. In resource usage parameter, Windows 10 consumed more computer resources compared to Linux Mint. It is a big impact toward the user with a computer with low specifications. Some of the company pays no heed on their computers which may not up to the given task. Thus, to ensure the computers is reliable and to decrease the chance it crashes frequently. The employer is recommended to use Linux Mint for their company if the company preferred a cheaper alternative compared to overhaul all of the computers in the company which may give a dent on their budget. The only downside is the employee may not familiar with Linux-based operating system and may take time to familiarize with it. However, if the company can afford a high PC specs, Windows 10 is the obvious choice because most employee especially in Malaysia only familiar with Windows-based operating system. Thus, reducing the time needed to familiarize with it. Further, in network parameter, there is not much different on the result between both operating systems. The only a big difference between both operating system (based on the result) is when involving streaming or video-based website such as YouTube. If user want faster website loading, Linux Mint is recommended. Either way, each operating system provides good service and reliability in networking area.

#### 4.0 CONCLUSION

In this paper, research comprises to determine which operating system is better between Windows 10 and Linux Mint in term of performance (time computation, resource usage, and network (application layer). From the research findings analysis, Linux Mint is superior in term of performance compared to Windows 10. In future research, more efficient tool need to be discover to gain more accurate data of operating system performance to analyze the comparison.

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