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Comparison of RAM and CPU Usage Efficiency on Brave Browser and Microsoft Edge

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Abstract

The role of web browsers in today's digital age has become an integral part of daily life for internet users, with a variety of options available. Brave and Microsoft Edge are two popular browsers, each with its unique advantages, particularly in terms of performance and system resource efficiency. This study aims to compare the memory (RAM) and processor (CPU) efficiency of Brave and Microsoft Edge. The testing was conducted under two conditions: when the browser was idle and when it was actively used by the user, as well as in two scenarios with different numbers of tabs, namely 5 tabs and 10 tabs. The method used was a direct experiment using a laptop with mid-range specifications. Resource usage monitoring was conducted via the built-in Windows Task Manager. The results? Brave consistently showed more efficient RAM usage compared to Edge in all scenarios. Brave's CPU usage was also more efficient, especially when the browser was actively used. On the other hand, Microsoft Edge tended to use more resources, likely due to its strong integration with the Windows operating system and various background services running automatically, such as account synchronization and content updates. This finding could serve as a reference for users looking to choose a lighter browser, especially those using devices with limited specifications.

Keywords: *Brave; Microsoft Edge; RAM efficiency; CPU usage; System Performance*

1. Introduction

The role of advances in information technology has changed the role of web browsers from just a tool for browsing the internet to the main platform for running various web-based applications. Activities such as video streaming, online conferencing, online document editing, and cloud productivity applications are now commonly performed directly through the browser. This development has led to increased demands for efficient use of device resources, especially Random Access Memory (RAM) and Central Processing Unit (CPU) [1][2]. The browser's ability to manage RAM and CPU determines user convenience and productivity, especially on devices with limited specifications. Excessive resource consumption can slow down the system, disrupt the performance of other applications, and even increase power consumption [3], [4]. Microsoft Edge and Brave are two modern browsers that claim high efficiency in memory and processor usage. Edge, since it uses the Chromium engine, brings features such as Sleeping Tabs and Efficiency Mode that aim to save resources. Meanwhile, Brave emphasizes speed and privacy, and is known to be lighter than other Chromium browsers [1]. Although both browsers make efficiency claims, an objective and measurable evaluation is needed to determine their effectiveness in daily use. This research aims to compare the RAM and CPU consumption of Brave and Microsoft Edge under normal usage conditions, in order to provide data-based recommendations for users and developers. The advancement of information technology has changed the role of web browsers from just an internet browsing tool to the main platform for running various web-based applications. Activities such as video streaming, online conferencing, online document editing, and cloud productivity applications are now commonly performed directly through the browser. This development has led to increased demands for efficient use of device resources, especially Random Access Memory (RAM) and Central Processing Unit (CPU). The browser's ability to manage RAM and CPU determines user convenience and productivity, especially on devices with limited specifications. Excessive resource consumption can slow down the system, disrupt the performance of other applications, and even increase power consumption. Microsoft Edge and Brave are two modern browsers that claim high efficiency in memory and processor usage. Edge, since it uses the Chromium engine, brings features such as Sleeping Tabs and Efficiency Mode aimed at saving resources. Meanwhile, Brave emphasizes speed and privacy, and is known to be lighter than other Chromium browsers. Although both browsers make efficiency claims, an objective and measurable evaluation is needed to determine their effectiveness in daily use. This research aims to compare the RAM and CPU consumption of Brave and Microsoft Edge under normal usage conditions, in order to provide data-based recommendations for users and developers.

Brave is a free and open-source web browser based on Chromium (open source) developed by Brave Software Inc. Brave is a browser that focuses on privacy, one of which is by blocking online ads and website trackers [3]. On May 28, 2015, managing director Brendan Eich and director of technology Brian Bondy founded Brave Software. Brave software launched the first version on January 20, 2016, with the ability to block ads, and announced plans for an ad platform that respects privacy, where user data is stored privately and cannot be accessed by third parties. Brave's servers do not see or store browsing data, so the information remains private. A study by Professor Douglas J. Leith of the University of Dublin ranked Brave at the highest level of privacy compared to other browsers. In the study, Brave sent absolutely no identifying data or details of pages visited to third-party servers when used "out-of-the-box" [5], [6]. In October 2021, Brave announced a new privacy feature called Debouncing. This new feature is designed to turn off bounce tracking, an internet tracking method that uses an intermediate domain that is loaded when a user visits a link. Until now, there have been many features updated, with the last version being June 2025, Brave version 1.80.113 for Android, and it has more than 85 million monthly active users.

2. Research Method

Microsoft Edge is a modern web browser developed by Microsoft as a replacement for Internet Explorer. Edge was first released as the default browser on Windows 10, Windows 10 Mobile, and Xbox One operating systems. Originally developed under the codename Project Spartan, the browser was designed to be lightweight, fast, and compliant with the latest web standards [7], [8]. Unlike previous versions, Edge no longer supports old technologies such as ActiveX and Browser Helper Objects that are prone to security breaches, but instead adopts a modern extension system that can be obtained through the Microsoft Store [9]. Various excellent features are integrated into Edge, such as integration with Cortana (virtual assistant from Microsoft), annotation tools directly on web pages, reader mode (Immersive Reader), and a built-in PDF reader, all aimed at supporting user productivity and convenience when browsing the internet [10], [11].

One of the vulnerabilities faced by Edge, a security challenge that was discovered, was a cross-domain policy violation, which allows attackers to illegally embed content from one domain into another. This vulnerability risks causing remote code execution, theft of sensitive data, and unauthorized elevation of privileges. Microsoft responded quickly with a security update that ensured cross-domain policies were properly enforced [10], [11].

This research uses a quantitative testing method focused on testing the efficiency of RAM and CPU usage on the Brave and Microsoft Edge browsers to observe differences in resource consumption (RAM and CPU) to see the user's daily activities carried out through two main stages where each stage involves two different conditions, namely idle conditions (the browser is idle without user interaction) and active conditions (the browser is used directly with activities such as typing, scrolling pages, watching videos, and so on). This approach aims to simulate browser usage patterns in real situations and measure how efficiently each browser is in managing system resources. This stage is designed to simulate light and medium usage load levels as they occur in the daily activities of internet users. RAM and CPU usage measurements were performed using the Windows built-in Task Manager, and each browser was tested for 10 minutes in idle and active conditions. In this study, we used the following devices:

Table 1: *Device Specifications*

Component	**Specification / Version**
Test Device	ASUS TUF Gaming F15 Laptop
Processor	Intel Core i7-10870H CPU (2.20 GHz, up to 5.00 GHz)
RAM	8 GB DDR4
Operating System	Windows 11 Pro 64-bit
Brave Browser	Version 1.80
Microsoft Edge Browser	Version 138

As a first step in this research, we used several supporting software programs to support the testing and data recording process. Windows Task Manager was used as the main tool to monitor the use of system resources, specifically the memory (RAM) and processor (CPU) of each browser tested. In addition, the Stopwatch was utilized to ensure timekeeping during the observations, both in idle and active conditions. To document each stage and result of the test, we also used the Screenshot Tool, which serves to take screenshots as visual evidence of resource consumption in each scenario.

3. Results and Discussion

3.1. Stage 1: Testing with 5 Tabs

In the initial stage of idle mode testing, we opened 5 website tabs on Brave and Microsoft Edge browsers, namely Google Scholar, Wikipedia, YouTube, Kompas.com, and Canva. Observations were made for 10 minutes to ensure the browsers had reached stability in the use of system resources. During this period, memory (RAM) and processor (CPU) usage were monitored using Task Manager on the Windows operating system. RAM and CPU usage data were then screenshot at 10 minutes as the main evaluation point. This approach was designed to assess how much base load each browser incurs by simply running web pages, without the intervention of user activity. The following table shows the results of the analysis on 5 idle mode tabs:

Table 2: *RAM and CPU Specifications 5 Tab Idle Mode*

PARAMETERS	MICROSOFT	BRAVE BROWSER
Number of Tabs	*5*	*5*
CPU Usage	0%	0%
RAM Usage	319.0 MB	183.5 MB
Disk Activity	0 MB/s	0 MB/s
Network Activity	0 Mbps	0 Mbps
Number of Processes	10 processes	7 processes

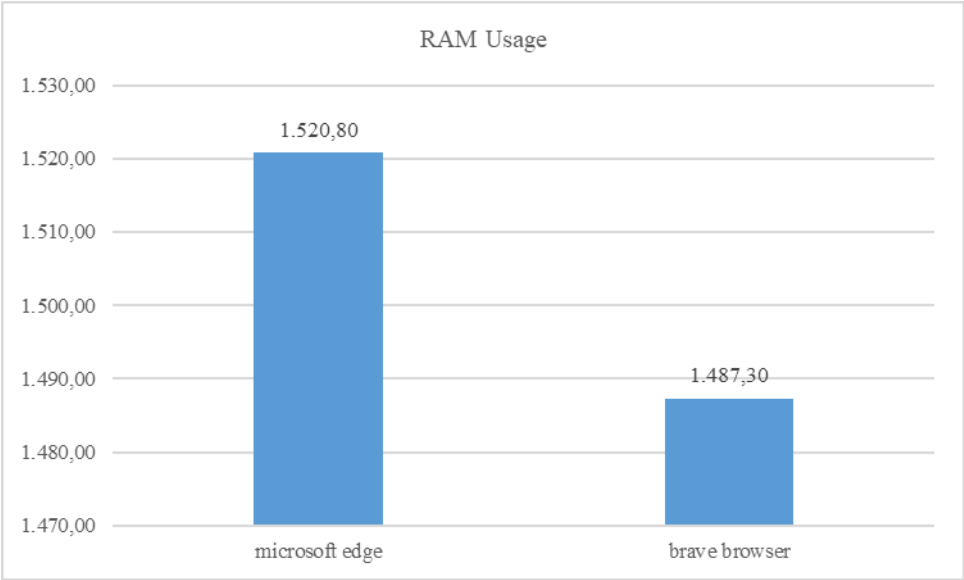

Fig. 1: *RAM Specifications 5 Tab Idle Mode*

As per the results from Table 2, Brave Browser runs 7 processes, and its memory usage is recorded at 183.5 MB, with 0% CPU consumption. This indicates that Brave is in a perfectly idle state, not processing any heavy activity or active services in the background. Meanwhile, Microsoft Edge ran 10 processes and used 319.0 MB of memory, also with 0% CPU usage. Despite not performing any activities, Edge's RAM consumption was somewhat larger than Brave's. This could be due to additional background processes that Edge runs by default, such as Windows integration services, News Feed, or account synchronization in idle state. Brave proved to be lighter than Microsoft Edge in RAM usage. Neither of them taxed the CPU, but the number of processes and memory used by Edge was higher.

After testing in idle mode, the next stage was testing in active mode, where each of the Brave and Microsoft Edge browsers were used directly by performing various real interactions within the tabs that had been opened such as typing keywords in the YouTube search field, reading the latest news on Kompas.com, and opening and browsing page content on other sites. The purpose of this step is to demonstrate daily usage by users, which usually involves tab switching, multimedia activities, and dynamic content loading processes. Observations of RAM and CPU usage were the same as in idle mode, with 10 minutes of observation time. Observations of RAM and CPU usage were made at the same time intervals as in idle mode, i.e., for 10 minutes. During the observation period, Task Manager was used to record resource consumption in real time. The data from this session was then compared with the idle mode results to determine the extent of the increase in system load when the browser is actively used. The following table shows the results of the analysis on the 5 active mode tabs:

Table 3: *RAM and CPU Specifications 5 Tab Idle Mode*

PARAMETERS	MICROSOFT	BRAVE BROWSER
Number of Tabs	*5*	*5*
CPU Usage	0% (when observed)	0% (when observed)
RAM Usage	1,053.6 MB	1,005.4 MB
Disk Activity	0.1 MB/s	0.1 MB/s
Network Activity	0.1 Mbps	0 Mbps
Number of Processes	20 processes	18 processes

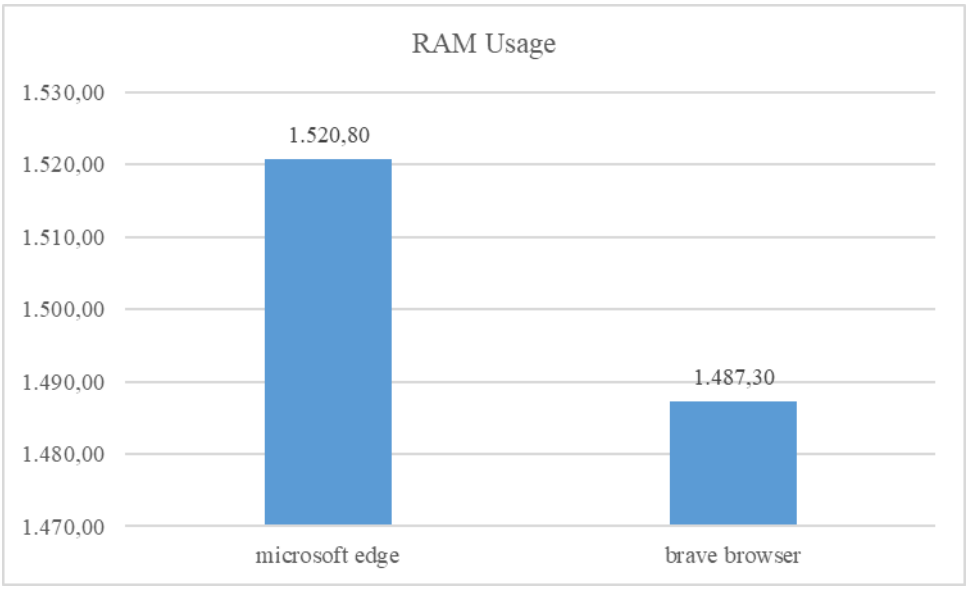

Fig. 2: *RAM Specifications 5 Tab Idle Mode*

Based on the monitoring results through Task Manager in Table 3, Brave shows a memory usage of 1,005.4 MB with 18 processes running, while Microsoft Edge records a memory usage of 1,053.6 MB with 20 active processes. Although when the screenshots were taken, the CPU usage of both browsers showed 0%, this indicates that the heavy activity of each browser occurred earlier, and the system has reached a steady state after all pages were successfully loaded. The difference in the number of running processes indicates that Microsoft Edge is running more background services or add-on modules than Brave. Although its RAM usage is slightly higher, this may be due to built-in features such as integration with the Windows system or session tracking [12], [13]. On the other hand, Brave appears to be more frugal in memory usage and efficient in process management, suggesting that it is designed with a more lightweight approach while still being actively used for heavy activities.

3.2. Stage 1: Testing with 10 Tabs

The second stage of idle mode testing was conducted by opening 10 website tabs on Brave and Microsoft Edge browsers simultaneously, namely Google Scholar, Wikipedia, YouTube, Kompas.com, Netflix, Canva, Tokopedia, Instagram, Tix.id, and PDDikti. In this mode, there are no further activities such as scrolling pages, playing videos, typing, or switching tabs. Observations were made for 10 minutes to ensure the browser had reached stability in the use of system resources.

During this period, memory (RAM) and processor (CPU) usage were monitored using Task Manager on the Windows operating system. RAM and CPU usage data were then screenshots at the 10-minute mark as the main evaluation point. This data is important to determine how efficiently the browser is in managing resources when only maintaining open pages without activity. The results of this stage form the basis of comparison between Brave and Edge's performance in idle conditions, so that it can be further analyzed regarding resource consumption when the browser is only a passive viewer of web pages. The following are the results of the analysis on 10 active mode tabs:

Table 4: *RAM and CPU Specifications of 10 Tabs Idle Mode*

PARAMETERS	MICROSOFT	BRAVE BROWSER
Number of Tabs	10	10
CPU Usage	0,2%	0,2%
RAM Usage	1,006.3 MB	980.3 MB
Disk Activity	0.1 MB/s	0.1 MB/s
Network Activity	0.1 Mbps	0 Mbps
Number of Processes	28 processes	23 processes

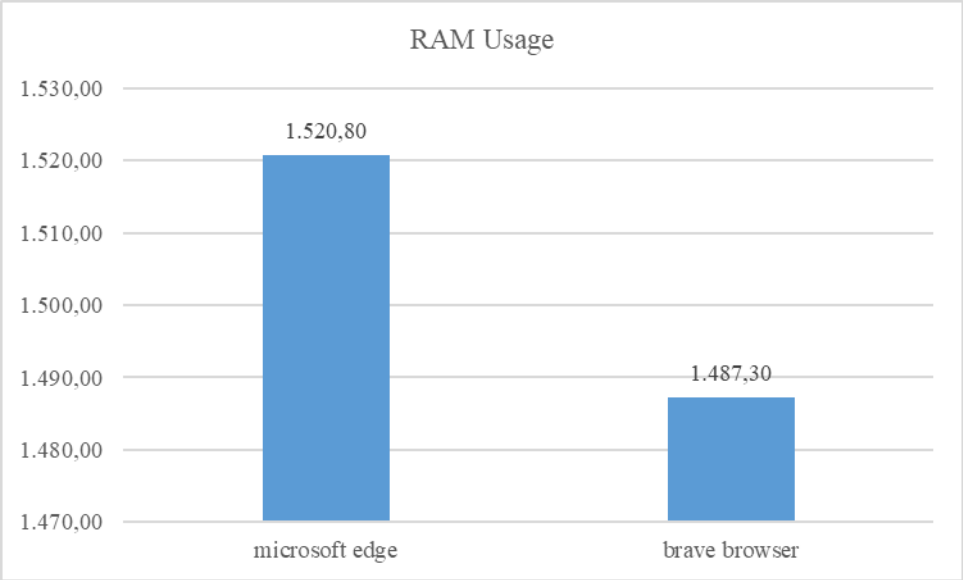

Fig. 3: *10 Tab RAM Specifications Idle Mode*

In Table 4, Brave Browser runs 23 processes, and its memory usage is recorded at 980.3 MB, with a CPU condition of 0.2%. For Microsoft Edge, it uses about 1006.3 MB of RAM and 0.2% CPU, indicating that both browsers consume quite a high amount of memory, even when they are not being actively used. However, Brave is slightly more frugal in terms of RAM usage. And while the CPU percentage is small, it's not zero, as the browsers still run light background processes such as checking for active tabs, synchronizing services (Edge), or blocking trackers (Brave). Both browsers also showed high efficiency as there was no excess activity on disk and network (all 0 MB/s and 0 Mbps), which reinforced the idle mode condition.

In the second stage of active mode testing, we opened 10 website tabs on Brave and Microsoft Edge browsers, namely Google Scholar, Wikipedia, YouTube, Kompas.com, Netflix, Canva, Tokopedia, Instagram, Tix.id, and PDDikti. The difference with the previous stage is that, after all tabs are fully loaded, users then perform active interactions on some sites. This activity reflects real usage, such as searching on YouTube, scrolling through article pages on Kompas.com, typing on Canva, or clicking on menu sections on Instagram and Tokopedia [14], [15].

During the test, the browser was left active for the same amount of time (10 minutes) while continuing to run the interactive elements of the pages that had been opened. After the observation time reached the 10th minute, data regarding RAM and CPU usage were recorded using Windows Task Manager. This stage aims to measure how much system resource consumption is required by the browser when it is in an active state, namely when the user actually interacts with the web page. The results of this observation will be compared with the results of the previous idle mode to get a complete picture of the efficiency and performance of both browsers when used in normal daily activities. The following table shows the results of the analysis on 10 active mode tabs:

Table 5: *RAM and CPU Specifications of 10 Tabs Idle Mode*

PARAMETERS	**MICROSOFT**	**BRAVE BROWSER**
Number of Tabs	10	10
CPU Usage	3,4%	0,4%
RAM Usage	1,520.8 MB	1,487.3 MB
Disk Activity	0.1 MB/s	0.1 MB/s
Network Activity	0.5 Mbps	0 Mbps
Number of Processes	24 processes	24 processes

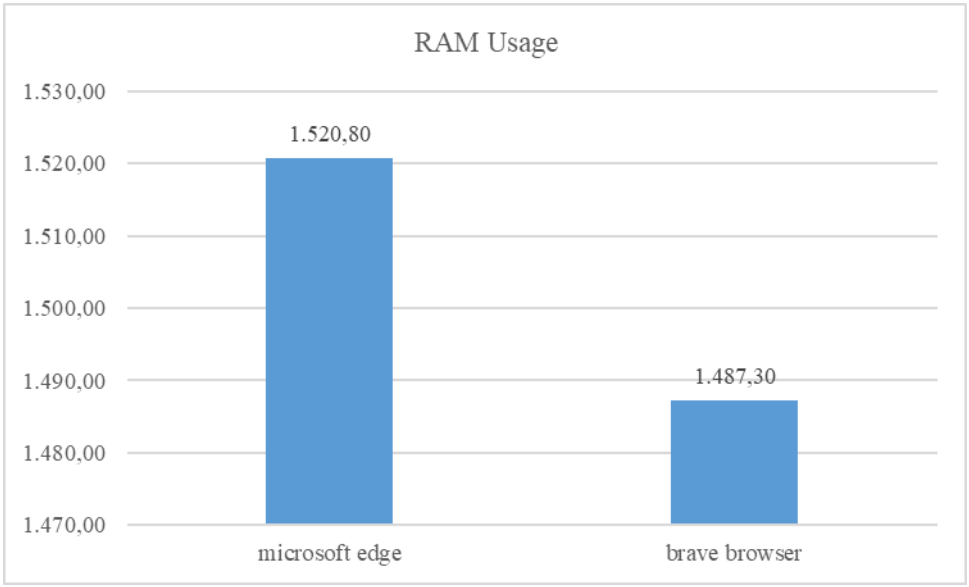

Fig. 4: *10 Tab RAM Specifications Idle Mode*

In Table 5, Brave Browser and Microsoft Edge ran 24 processes, and their memory usage was recorded at 1,487.3 MB RAM, with a CPU consumption of 0.4%. Microsoft Edge uses 3.4% CPU and 1,520.8 MB RAM. This shows that Brave is more efficient in CPU usage despite having slightly lower RAM usage than Microsoft Edge. After the browser was actively used for approximately 10 minutes, observations were made on resource consumption using Windows Task Manager. The data results from this test showed that Brave was more efficient in CPU usage despite having slightly lower RAM usage compared to Microsoft Edge. This finding is in line with Abd El Monem & Ismail's study, which measured browser performance (including Brave and Edge) using Speedometer/MotionMark and Task Manager. The results placed Edge as the most CPU- and RAM-efficient browser, while Brave took the middle position.

In addition, the Brave Blog reports that when opening 10 tabs, Brave can save up to 40-47% RAM usage compared to Chrome or Firefox, thanks to the Shields feature that actively blocks ad content and trackers [10]. Other research highlights Brave's CPU power consumption savings, especially on news sites that can be lower than browsers without built-in ad-blockers, supporting Brave's effectiveness in network and CPU resource management [11]. Based on the results from Table 5, the data in network activity also shows a striking difference. Microsoft Edge recorded a network activity of 0.5 Mbps, indicating that Edge was still exchanging data from or to the internet at the time of observation. Once it is observed that Brave is faster at completing the data loading process of a web page, or more efficient in network connection management, once the page is loaded in active mode with the same number of tabs, both have a similar amount of background activity. However, the differences in CPU efficiency and network activity suggest that Brave tends to be more lightweight.
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4. Conclusion

Based on the test results data discussed in the methodology, in terms of memory usage, it can be concluded that Brave browser consistently shows slightly lower RAM usage than Microsoft Edge in all four test scenarios. This difference indicates that Brave has a lighter memory management architecture, most likely due to features such as ad blocking and trackers that automatically disable unnecessary content, thus reducing the memory load. On the other hand, Edge tends to activate many background services, such as synchronization with Microsoft accounts, integration of news features, and so on, which also adds to the RAM load even when the browser is not actively used. In terms of CPU usage, Brave also proved to be more efficient. In active mode with 10 tabs, Brave used only 0.4% of the CPU, while Edge recorded 3.4%. This shows that Edge requires more processing power to run active user activities. Edge's high CPU usage could be due to dynamic content rendering, UI animations, as well as other external processes that keep running in the background even though they are not visible to the user.

Overall, from the results of four tests involving a combination of conditions (idle and active) and number of tabs (5 and 10), Brave consistently showed more efficient performance in managing system resources. Brave excelled in RAM efficiency in all conditions, as well as showing significantly lower CPU consumption in the active scenario. While Edge still shows solid performance, it tends to require more resources due to its feature complexity and deep Windows system integration.

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