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Comparative Analysis of Nextcloud and Owncloud Performance as Infrastructure as a Service (IaaS) Based Cloud Storage

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ABSTRACT

Physical data storage using flash drives or local computer storage continues to be used for document archiving in database laboratories. Archived documents include laboratory inventory modules, practical course modules, practitioners' attendance cards, and students' task and response files. Data storage using a local computer or flash disk has several disadvantages such as data loss caused by various factors such as file damage due to viruses, damage to the hard disk on the computer or laptop and other factors. Cloud storage can be used as a storage medium for important data for an agency or institution to avoid this risk. In other words, cloud storage can also be said to be an agency's data backup server. The use of cloud storage provides a solution to this problem, so that data can be accessed easily from anywhere via an internet connection and prevents the risk of data loss. Numerous cloud storage applications now feature advanced functionalities; however, each cloud storage company varies regarding access speed, storage capacity, security, and costs. This study aims to analyze the performance of two cloud storage applications, Nextcloud and Owncloud, using throughput as a parameter. Test results demonstrated that Nextcloud's performance in file upload throughput was higher at 1065 bps compared to Owncloud's 850 bps. Similarly, in file download throughput, Nextcloud exceeded Owncloud's throughput of 2960 bps against 2564 bps. These results indicate that Nextcloud's performance surpasses Owncloud's in both file upload and download operations.

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1. INTRODUCTION

One technology that continues to develop today is cloud computing technology, where this technology provides computing services via the internet which allows users to access computing resources such as servers, storage, databases, software, networks and other services on-demand [1]. Cloud services have developed into three main models, namely IaaS (Infrastructure as a Service) which provides infrastructure such as servers and storage. PaaS (Platform as a Service) which provides a platform for application development. SaaS (Software as a Service) which provides ready-to-use applications [2, 3].

IaaS is a cloud computing service that provides data storage services in the cloud. Cloud storage operates as a cloud computing model that provides file management services tailored to user requirements within computer networks [4]. Several advantages of cloud storage in its use, such as data availability and global accessibility where resources or data can be accessed anywhere and anytime via the internet as well as high security regarding cyber or physical security protection provided by service providers [5]. Cloud storage can be a storage option other than physical data storage using a local computer or flash where physical data storage has several weaknesses such as data loss caused by various factors such as file damage due to viruses,

damage to the hard disk on the computer or laptop and other factors [6]. In other words, cloud storage can also serve as a data backup server for an organization [7].

Physical data storage using flash drives or local computer storage continues to be used for archiving documents in database laboratories. Archived documents include laboratory inventory modules, practical course modules, practitioners' attendance cards, and students' task and response files. Data storage using a local computer or flash disk has several disadvantages such as data loss caused by various factors such as file damage due to viruses, damage to the hard disk on the computer or laptop and other factors. Cloud storage can be used as a storage medium for important data for an agency or institution to avoid this risk. In other words, cloud storage can also be said to be an agency's data backup server. The use of cloud storage provides a solution to this problem, so that data can be accessed easily from anywhere via an internet connection and prevents the risk of data loss.

The cloud storage platforms under study are Nextcloud and Owncloud. Nextcloud is a client-server software for creating and using file hosting services. It offers superior features in application management, user management, and security policies. The flexibility to customize solutions to fit specific needs provides added value, and enhances security through configurations for strong password policies and two-factor authentication (2FA), offering extra protection against data integrity breaches. Key features of Nextcloud include adaptive application management, efficient user management, and customizable security policies. In terms of file management, Nextcloud's capability to share and manage data effectively is also a significant advantage [8]. Nextcloud is a primary choice for cloud server services, particularly in large-scale data storage and collaboration to enhance overall operational efficiency [9].

Owncloud, similar to DropBox, is a free storage-sharing software that provides robust security and has a user interface that is easier for users to understand, enabling seamless data sharing and access integrated with information technology devices. Its purpose is to secure, track, and report data usage [10, 11]. Many cloud storage platforms now possess cutting-edge features, yet each cloud storage company varies in terms of access speed, storage capacity, security, and cost. Therefore, this research will analyze the performance comparison between Nextcloud and Owncloud as cloud storage based on Infrastructure as a Service (IaaS).

Previous studies on the implementation and performance comparison of cloud storage applications have been conducted. The applications used as the subjects of implementation and performance comparison are Nextcloud and Owncloud. Nextcloud is noted for its superior data storage service server in terms of features and interface, boasting more features compared to its competitors and a livelier interface. However, in terms of server lightness when running services, Owncloud excels due to its simplicity in features and interface, which impacts a lighter performance on the server. Nextcloud has an advantage in terms of appearance and features, but Owncloud is superior in terms of its lightness [12]. Other studies have compared the performance of Nextcloud and Owncloud through Quality of Services testing in the document upload and download processes on both clouds. These studies found that Nextcloud performed better than Owncloud, with equal packet loss but a smaller throughput value for Owncloud [10].

The concept of High Availability (HA) and reliability testing is used to measure the performance of the Nextcloud and Owncloud cloud storage platforms. Availability testing with scenarios involving Mean Time to Recovery (MTTR) and Mean Time Between Failures (MTBF) provides a strong indication of system reliability. The service recovery time during failures, approximately 15.46 minutes for Nextcloud and 14.39 minutes for Owncloud indicates a high level of availability, with an average availability of 98.58% for Nextcloud and 98.94% for Owncloud. These results suggest strong operational stability and a reliable user experience for both platforms. This testing, which includes MTTR, MTBF, and monitoring using Nagios, offers valuable insights related to system response and reliability, especially in emergencies. Furthermore, reliability testing of Nextcloud and Owncloud revealed differences in CPU usage during file upload and download operations. Nextcloud tends to have higher CPU usage with smaller files, while Owncloud shows better performance when downloading large files. In terms of memory usage, Owncloud proves to be more efficient than Nextcloud when handling large files in both types of operations. These differences can be an important consideration in choosing a platform based on specific usage characteristics and available resources [13].

Performance testing of Owncloud and Nextcloud was conducted to select suitable cloud storage for application at the Ponpes Mahasiswa Ar-Royyaan Baitul Hamdi in Yogyakarta. The testing methods used in this study included Beta testing, Blackbox testing, and Apache Bench testing. Beta testing results, based on questionnaires, showed that Nextcloud scored 79.9% in ease of learning, 81.7% in satisfaction, 76.2% in usefulness, and 76.4% in ease of use. Owncloud, on the other hand, scored 73.1% in ease of learning, 76.8% in satisfaction, 78.7% in usefulness, and 78.6% in ease of use. Both Owncloud and Nextcloud applications succeeded in Blackbox testing, functioning well in terms of functionality. According to Apache Bench testing, Nextcloud had an average of 654.54 requests per second and 2650 ms in the percentage of requests served within a certain time, while Owncloud achieved 469.15 requests per second and 2168 ms. The results of these three tests suggest that Nextcloud is more suitable for implementation on the server at the boarding school

[14].

Based on the benefits and advantages of the Nextcloud and Owncloud applications as storage media, highlighted by previous research, this study aims to analyze the performance of these two cloud storage applications using the throughput parameter. The results from this research will provide recommendations for the cloud storage platform to be used in the database laboratory.

2. RESEARCH METHOD

The research methodology used is the PPDIOO method developed by CISCO. This method was used for the design of the network system in this study. The implementation of cloud server development utilized the Owncloud and Nextcloud platforms. Further, the testing stage of these platforms was carried out using blackbox testing and the performance of Owncloud and Nextcloud was analyzed using throughput as a parameter. The stages of the PPDIOO method include Prepare, Plan, Design, Implement, Operate, and Optimize. Figure 1 shows the scheme of the PPDIOO method [15].

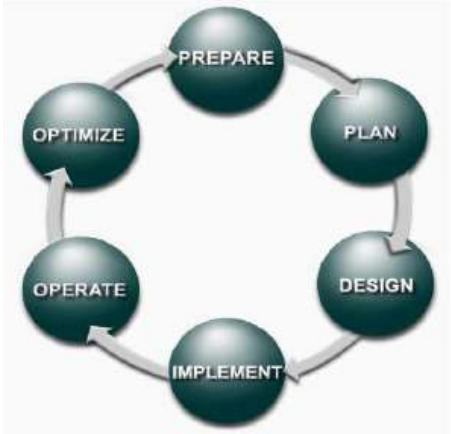

Figure 1. PPDIOO Method Scheme [15]

PPDIOO Method Scheme:

1. Prepare, this stage involves executing a work plan, both technically and strategically, used to build the Cloud Server. It also prepares the technology to meet the needs of the design and implementation process.
2. Plan, this stage involves the analysis of requirements used as parameters before designing the network system. Owncloud and Nextcloud are used as applications to build and manage cloud storage.
3. Design, this involves creating designs for monitoring virtual servers that will be implemented on the cloud computing network.
4. Implement, this is the process of building the Cloud Server using Owncloud and Nextcloud, starting from the installation and configuration processes until the Cloud Server is successfully set up.
5. Operate, this process involves operating Owncloud, such as user management, uploading and downloading documents, and sharing documents with other users. It also includes blackbox testing and performance testing using throughput as a parameter.
6. Optimize, this stage involves enhancing capacity (storage, resources) according to user needs to ensure optimal performance of Owncloud and Nextcloud.

3. RESULTS AND ANALYSIS

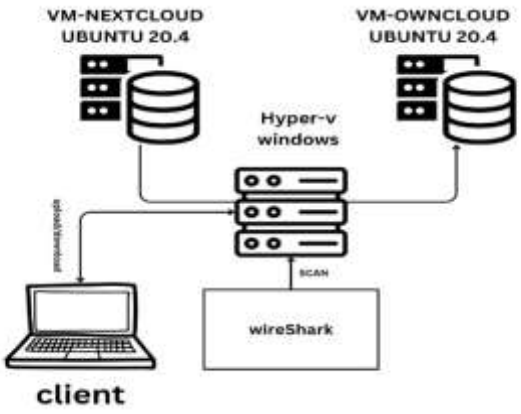

Figure 2. Network Scheme

The network scheme utilized in this study consists of two Ubuntu servers, both serving as cloud servers. Additionally, another server functions as the gateway for data ingress and egress to the cloud servers. This gateway server is Windows-based, with QoS tools such as Wireshark installed to record the processes of data transmission and reception into the cloud. On the client side, tasks include carrying out the processes of sending and receiving data. The data transmitted to both clouds involved the same file, with identical file capacities and network conditions on the client side.

Two cloud applications, Nextcloud and Owncloud, were installed for use in this research..

Nextcloud Installation

Here are the steps to install Nextcloud on VirtualBox using a Linux operating system as the server. Nextcloud is a cloud-based file storage platform, and this installation will cover setting up Nextcloud on a virtual machine running in VirtualBox.

1. Nextcloud Installation
   a. Update packages by running the following command:

Figure 3. Nextcloud package update

   b. Create a database and user for Nextcloud, flush privileges, and grant user permissions for Nextcloud.

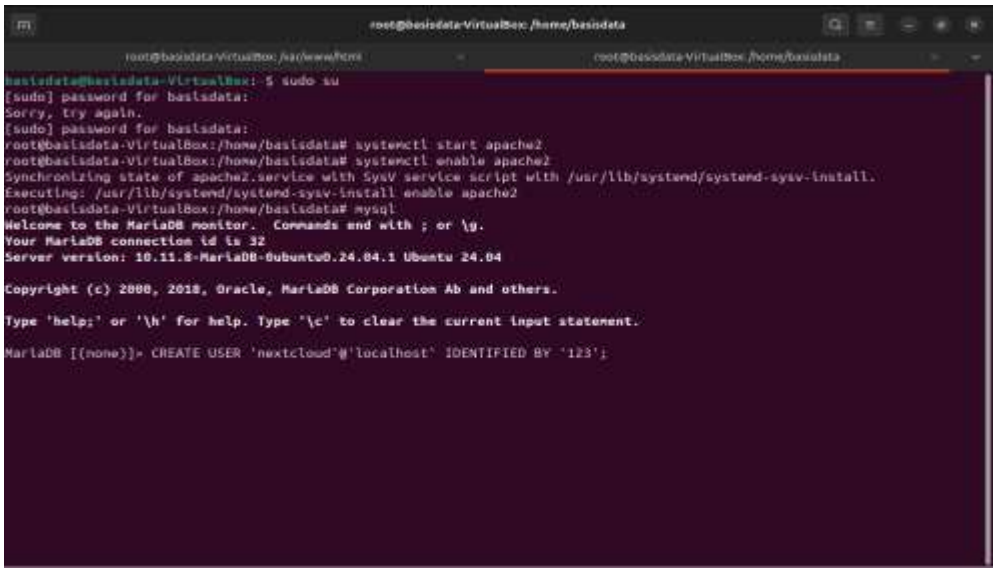

Figure 4. Creation of database and user for Nextcloud

   c. Complete the Nextcloud installation through the web interface by entering the virtual machine's IP address or a pre-configured domain name.

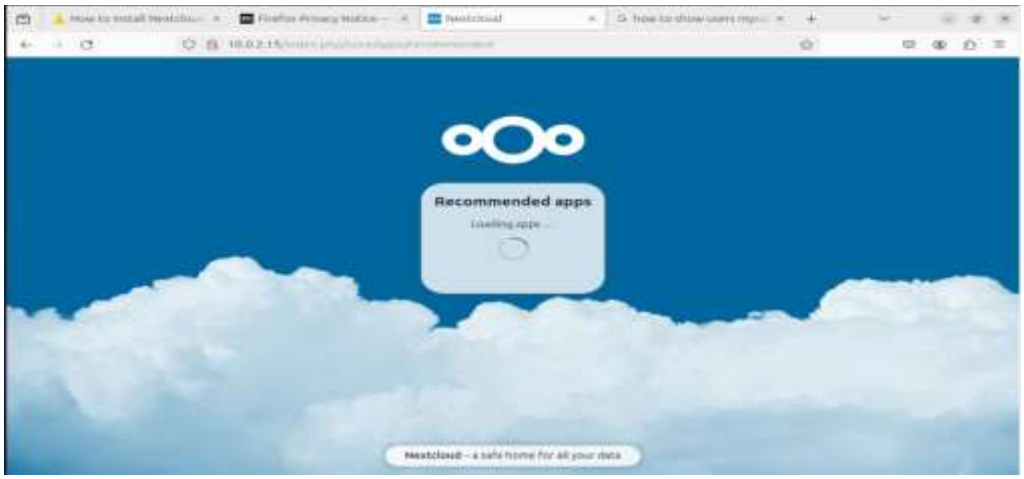

Figure 5. Nextcloud application front page

2. Owncloud Installation

a. Update packages and system:

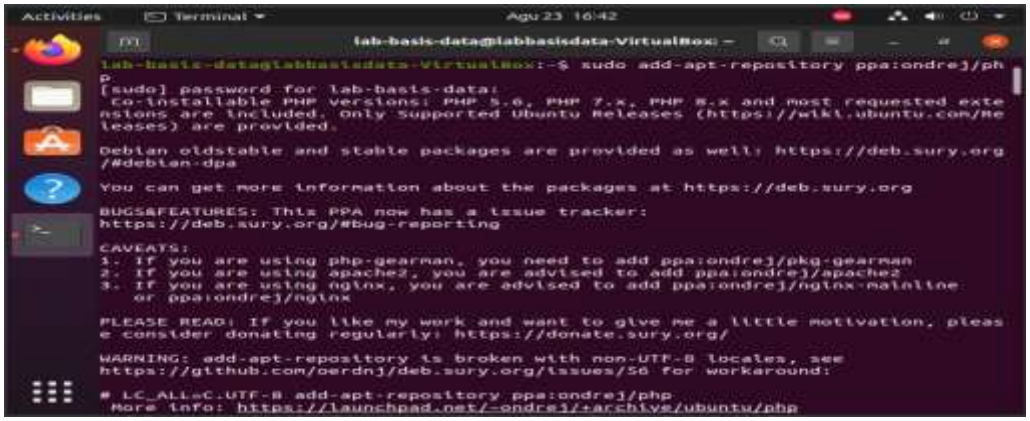

Figure 6. Package and system update process

b. Create a database and user for Owncloud:

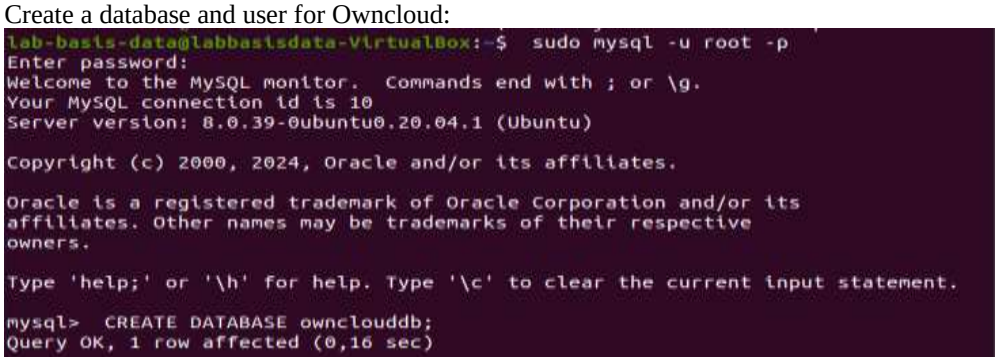

Figure 7. Creation of a database for Owncloud

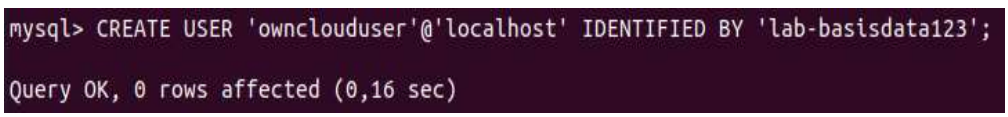

Figure 8. Creation of user for Owncloud

c. Configure Apache for Owncloud

Create an Apache configuration file for Owncloud:

Figure 9. Creation of Apache configuration for Owncloud

d. Add the following configuration to the file:

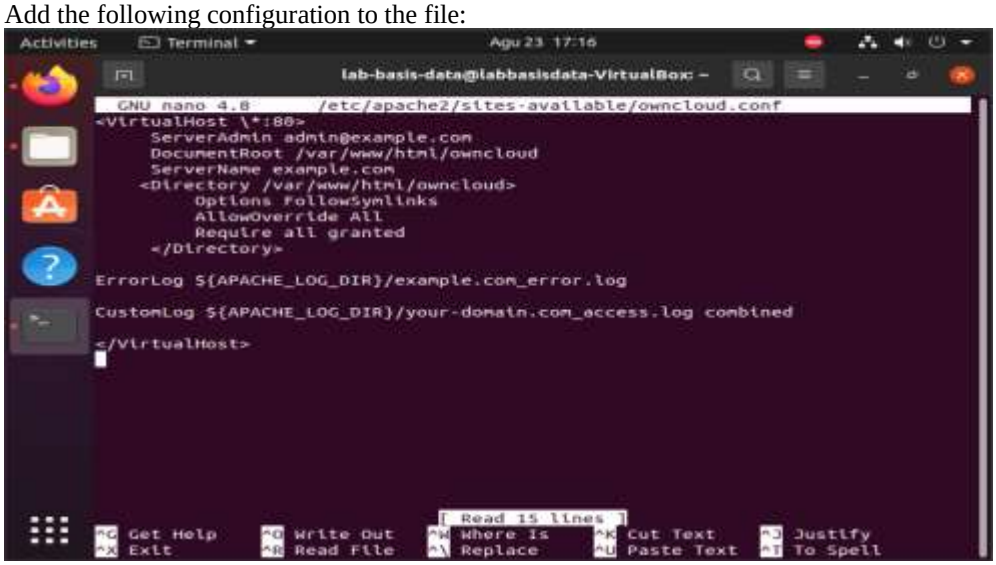

Figure 10. Addition of configuration to the file

e. Enable site configuration and Apache Rewrite module:

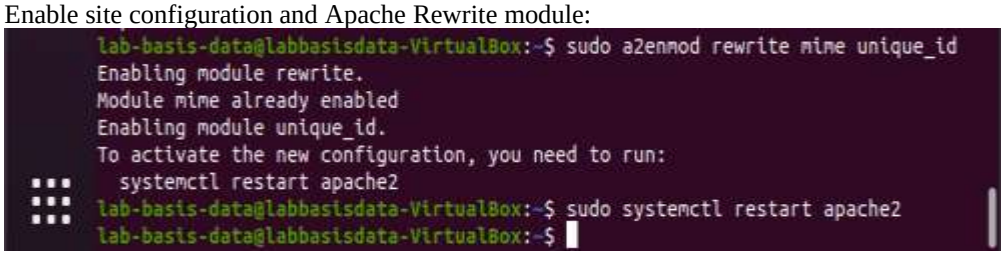

Figure 11. Activation of site configuration and Apache Rewrite module

f. Complete the Owncloud installation through the Web
Open a browser on the host computer, and access Owncloud by entering the virtual machine's IP address or a configured domain name:

Figure 12. Owncloud front page display

Testing Nextcloud and Owncloud as Cloud Servers Using Blackbox Testing

Blackbox testing was conducted to ensure that the applications function properly for users. Table 1 details the Blackbox testing results for the Nextcloud application, and Table 2 provides the results for the Owncloud application.

Table 1. Results of blackbox testing for the nextcloud application

No	Scenario	Expected Result	Test Result
1	Access the website location	Display login page	Successful
2	Successful login	Display menu	Successful
3	Press upload file button	Upload file	Successful
4	Press share file button	Display file sharing page	Successful
5	Press edit button	Display options for details, rename, download, delete	Successful
6	Press rename button	Change file name	Successful
7	Press download button	Download file	Successful
8	Press delete button	Delete file	Successful
9	Press search button	Search for file	Successful
10	Press profile button	Display edit profile page	Successful

The results of the blackbox testing on the Nextcloud application are in Table 1. Some of the application features that were tested were the access feature to the Nextcloud web location, login feature, upload files, share files, download files, search and profile features. The results of the feature testing show that the features and functionality of the Nextcloud application can run well.

Table 2. Results of blackbox testing for the owncloud application

No	Scenario	Expected Result	Test Result
1	Access the website location	Display login page	Successful
2	Successful login	Display menu	Successful
3	Select all files menu	Display all files page	Successful
4	Press upload file button	Upload file	Successful
5	Press share file button	Display file sharing page	Successful
6	Press edit button	Display options for details, rename, download, delete	Successful
7	Press details button	Display file information	Successful
8	Press rename button	Change file name	Successful
9	Press download button	Download file	Successful
10	Press delete button	Delete file	Successful
11	Press search button	Search for file	Successful
12	Press profile button	Display edit profile page	Successful

Table 2 shows the results of the blackbox testing on the Owncloud application. The application feature items that were tested were the access feature to the Owncloud web location, login feature, upload files, share files, download files, search and profile features. The results of the feature testing indicate that the features and functionality of the Owncloud application can run well.

Performance Testing of Nextcloud and Owncloud Using QoS Parameters (Throughput and Packet Loss)
This performance testing for Nextcloud and Owncloud utilizes QoS parameters such as throughput and packet loss, involving the uploading and downloading of four files, each of different types.

Nextcloud:
The outcomes of uploading four distinct file types on Nextcloud and their corresponding performance metrics as recorded by Wireshark are as follows:

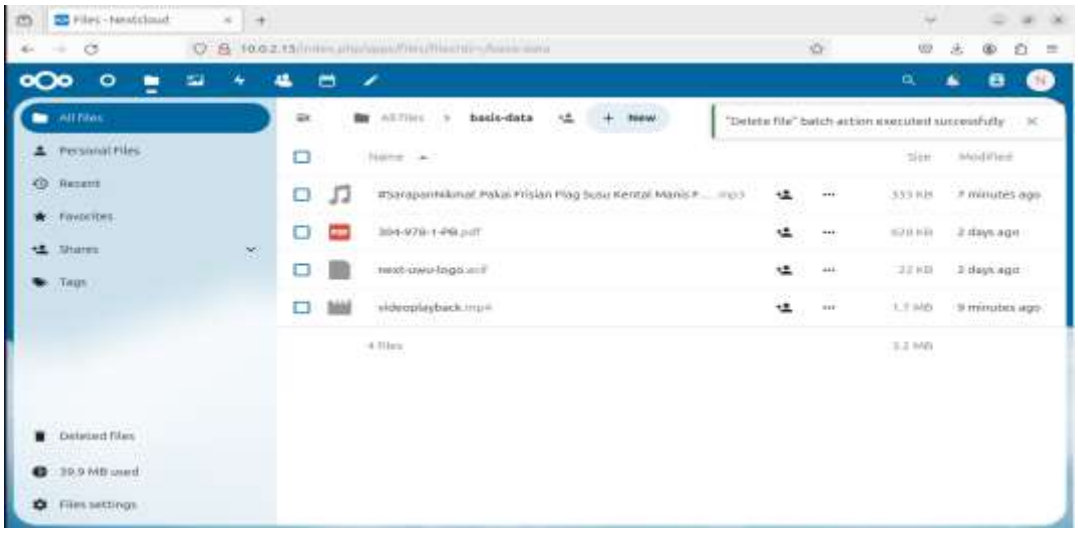

Figure 13. File upload on Nextcloud

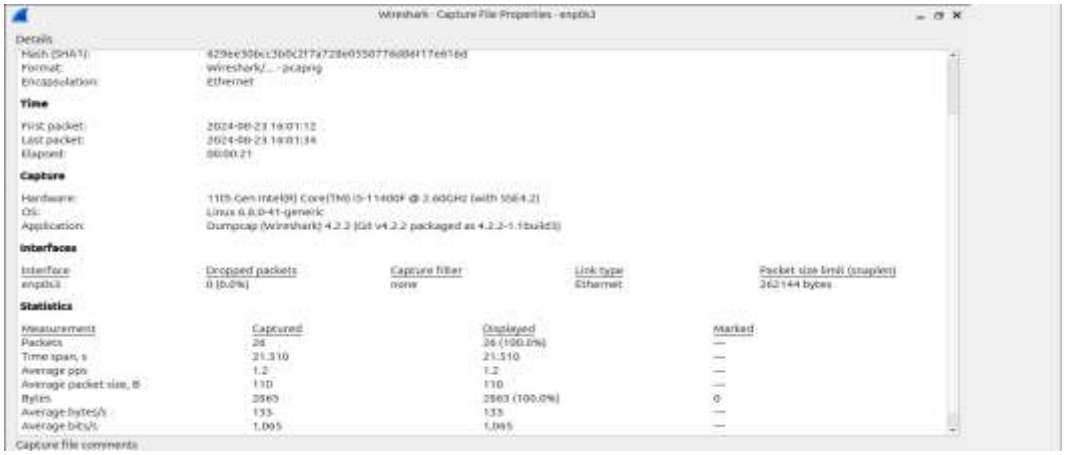

Figure 14. Throughput values for file uploads in the Nextcloud application

Owncloud:

The results from downloading four different file types on Owncloud and their performance metrics recorded by Wireshark are detailed below:

Figure 15. Throughput values for file downloads in the Owncloud application

Discussion of QoS testing results with throughput parameter

Table 3. QoS testing results with throughput parameter

Parameter	Nextcloud	Owncloud
Upload 4 files of different types	**1065 bps**	**850 bps**
Download 4 files of different types	**2960 bps**	**2564 bps**

In file upload performance, the throughput measurement for Nextcloud was higher, at 1065 bps, compared to Owncloud's 850 bps. This indicates that Nextcloud's performance is superior to Owncloud's in

terms of file upload capabilities. A higher throughput value signifies that more data can be transferred or uploaded in a shorter amount of time, indicating that the network or system has better capacity. Nextcloud demonstrates better upload performance, partly due to additional optimizations for data transfer. Nextcloud also supports "Chunking," a feature that breaks large files into smaller pieces to speed up the upload process on slow networks.

In terms of file download performance, Nextcloud also recorded a higher throughput of 2960 bps compared to Owncloud's 2564 bps. This suggests that Nextcloud performs better than Owncloud in terms of download capabilities.

In this study, the download throughput values were higher than upload throughput for both platforms (Nextcloud and Owncloud). Studies indicate that download throughput is generally higher than upload throughput on both platforms, particularly in networks with substantial bandwidth. This difference is often due to the architectural differences and the optimizations of the transfer protocols utilized by each platform.

The results of this study align with the outcomes of previous research on the comparative performance analysis of Nextcloud and Owncloud using the Throughput parameter [10, 12-14], demonstrating that Nextcloud's performance exceeds Owncloud's in both uploading and downloading files.

4. CONCLUSION

Based on the testing results, the performance of file uploads, measured by throughput, was higher for Nextcloud at 1065 bps compared to Owncloud, which recorded a throughput of 850 bps. In terms of file download performance, Nextcloud also demonstrated higher throughput, registering 2960 bps versus Owncloud's 2564 bps. This indicates that Nextcloud's performance surpasses Owncloud's in both uploading and downloading files.

REFERENCES

[1] H. Wintolo and L. S. D. Paradita, "Layanan cloud computing berbasis infrastructure as a service menggunakan android," *Compiler*, vol. 4, no. 2, 2015.

[2] P. Mell, "The NIST Definition of Cloud Computing," *Recommendations of the National Institute of Standards and Technology*, 2011.

[3] F. Liu *et al.*, "NIST cloud computing reference architecture," *NIST special publication*, vol. 500, no. 2011, pp. 1-28, 2011.

[4] A. Irawan and A. P. Sari, "Perancangan dan implementasi cloud storage menggunakan nextcloud pada smk ypp pandeglang," *PROSISKO: Jurnal Pengembangan Riset dan Observasi Sistem Komputer*, vol. 6, no. 2, 2019.

[5] E. Ataie, R. Entezari-Maleki, L. Rashidi, K. S. Trivedi, D. Ardagna, and A. Movaghar, "Hierarchical stochastic models for performance, availability, and power consumption analysis of IaaS clouds," *IEEE Transactions on Cloud Computing*, vol. 7, no. 4, pp. 1039-1056, 2017.

[6] C. Aditama and A. Priadana, "Implementation and Performance Analysis Of Private Cloud Using Openstack Swift and Rclone," *vol. III, no. Ix*, pp. 317-322, 2018.

[7] I. R. Lie, C. N. A. Prasetyo, and M. A. Naufal, "Implementasi Cloud Storage OwnCloud pada Debian VirtualBox," in *MDP Student Conference*, 2022, vol. 1, no. 1, pp. 561-568.

[8] D. Darmawan, "Nextcloud: Keamanan Data Terbaik Dengan Manajemen File dan Pengguna yang Cerdas," *Jurnal Sosial Teknologi*, vol. 4, no. 1, pp. 80-89, 2024.

[9] A. Rafsandi, "Perancangan Storage Server Menggunakan Nextcloud Pada Pt Nusa Ina," *Scientica: Jurnal Ilmiah Sains dan Teknologi*, vol. 1, no. 2, pp. 17-26, 2023.

[10] A. R. Amran, "Analisis Perbandingan Cloud Storage Pada Nextcloud Dan Owncloud," *Indonesian Journal of Data and Science*, vol. 2, no. 3, pp. 103-116, 2021.

[11] P. Haryani, E. Fatkhiyah, and F. E. Nastiti, "Pengelolaan Dokumen Arsip Laboratorium Menggunakan OwnCloud Sebagai Media Cloud Storage Berbasis Infrastructure as a Service (IaaS)," *JURIKOM (Jurnal Riset Komputer)*, vol. 10, no. 2, pp. 659-666, 2023.

[12] G. Gibransyah, L. Nurlani, and F. Arisandi, "Analisis Perbandingan Server Layanan Penyimpanan Data Pribadi Antara Nextcloud Dan Owncloud Menggunakan Linux Centos 7," in *SEMNASTERA (Seminar Nasional Teknologi dan Riset Terapan)*, 2021, vol. 3, pp. 168-182.

[13] H. Y. Prabowo, A. R. Mukti, and T. Ariyadi, "Analisa Desain High Availability dan Uji Reabilitas Cloud Storage," *Jurnal Indonesia: Manajemen Informatika dan Komunikasi*, vol. 5, no. 1, pp. 262-270, 2024.

[14] M. W. Dhamara, S. Raharjo, and P. Haryani, "Perbandingan Implementasi Private Cloud Storage Menggunakan Owncloud Dan Nextcloud Pada Pondok Pesantren Mahasiswa Ar-Royyaan Baitul Hamdi Yogyakarta," *Jurnal Jarkom*, vol. 10, no. 2, pp. 62-72, 2022.

[15] S. Wilkins, "Cisco's PPDIOO Network Cycle," *Cisco Press. Luettu*, vol. 1, p. 2013, 2011.