User Management for Cloud Computing–Based Computer Laboratory Utilization at SMK Muhammadiyah 2 Palembang

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Abstract

User management is a systematic process that regulates how users perform tasks within an information system. This process includes the creation of user profiles, the assignment of user roles, the determination of access rights, and the control of user activities. Cloud computing, as a technology that utilizes internet-based servers for data storage and processing, has become increasingly important in supporting data accuracy, speed, and efficiency in various organizational environments. However, many educational institutions still lack an optimal understanding and implementation of this technology. This study aims to design and implement a cloud computing–based user management system for the computer laboratory at SMK Muhammadiyah 2 Palembang. The proposed system utilizes private cloud storage through OwnCloud running on the Linux Ubuntu operating system. The implementation is intended to address issues related to data security, misuse of laboratory facilities, and data loss caused by shared storage media. The results demonstrate that the implemented cloud-based user management system enhances data security through authentication mechanisms, improves the efficiency of data management, and reduces operational costs related to software and hardware maintenance.

How to Cite

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Introduction

The rapid advancement of network technology and the widespread adoption of computer networks have significantly transformed information management and service delivery in various sectors, including education, business, and government institutions (Tanenbaum & Wetherall, 2011; Forouzan, 2017). Computer networks enable real-time data exchange, centralized storage, and efficient access to digital resources. In the education sector, network-based computing infrastructures have become essential to support teaching, learning, administration, and information services (Rahardjo, 2019; Sutabri, 2012). This transformation is evident in vocational schools that increasingly depend on computer laboratories and network servers to support practical learning activities.

SMK Muhammadiyah 2 Palembang is one of the educational institutions that utilizes a computer laboratory as a core facility for supporting teaching and learning activities, particularly in information and communication technology subjects. The laboratory enables students to practice software applications, access digital learning materials, and perform network-based simulations. However, as the number of users and data volume increases, the need for centralized data storage and controlled system access becomes increasingly critical (Kadir, 2014; Laudon & Laudon, 2020). Without proper server management, data integrity, confidentiality, and availability cannot be guaranteed.

The increasing demand for centralized data storage and secure application access has encouraged the adoption of dedicated server infrastructures that can be accessed by all users within the school environment (Buyya et al., 2019; Mell & Grance, 2011). A server functions as the core controller that manages file storage, user authentication, and application access across the network. In such an environment, data security and application usage must be strictly regulated from both server and client sides to prevent unauthorized access, data loss, and system misuse (Stallings, 2018; Behl & Behl, 2017).

At present, SMK Muhammadiyah 2 Palembang has not fully implemented an effective user control and data management mechanism in its computer laboratory network. As a result, all users still share the same local storage space without structured user access separation. This condition allows students to freely delete, copy, or modify data belonging to other users, either intentionally or unintentionally. Field observations indicate that several students have experienced data loss due to the absence of individual user accounts and centralized data backup mechanisms. Such conditions indicate a serious weakness in network security and data management practices (Nazir & Khan, 2019; Andress & Winterfeld, 2014).

User management is a fundamental component in any computer network system, whether wired or wireless. Effective user management enables administrators to define user access rights, regulate resource utilization, and maintain system accountability and security (O'Brien & Marakas, 2011; Kurose & Ross, 2017). By implementing authentication, authorization, and access control mechanisms, organizations can ensure that only authorized users are allowed to access specific network resources. In educational networks, proper user management is essential to protect academic data, learning materials, and system configurations from unauthorized manipulation (Setiawan, 2020).

To address these challenges, the implementation of cloud computing technology within the computer laboratory network at SMK Muhammadiyah 2 Palembang is proposed as a

strategic solution. Cloud computing enables centralized data storage, flexible access, automatic backup, and scalable resource management (Buyya et al., 2019; Santiko & Rosidi, 2018). Through cloud-based user management systems, each student and teacher can be provided with individual accounts and controlled access rights. This approach is expected to enhance data security, improve accessibility, increase management efficiency, and support sustainable digital learning infrastructure within the school environment.

Methodology
System Analysis

Network AnalysisThe network topology used in this study is the star topology, selected based on comparative analysis of several topology types. The star topology offers several advantages, including ease of maintenance, uniform data transmission speed, flexibility in cable selection, scalability, and simplified network management. In this topology, all user computers are connected through a central device, namely a hub or switch, which controls data packet distribution.

The star topology provides centralized control, where all data transmitted between nodes must pass through the hub. A failure in one communication line only affects the connected node without disrupting the entire network. This feature facilitates efficient fault isolation and network management. The applied topology enables all nodes at SMK Muhammadiyah 2 Palembang to communicate effectively via a centralized switching device.
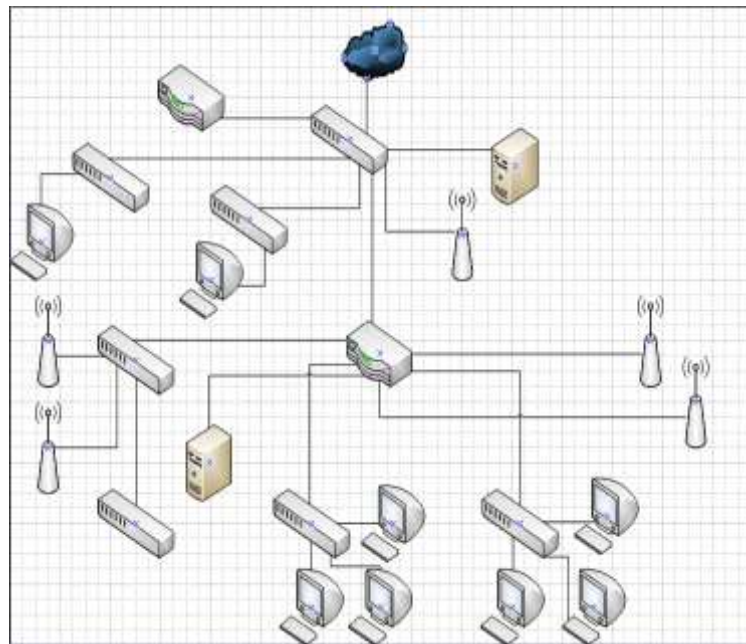

Figure 1. Topology of Muhammadiyah 2 Vocational School, Palembang

Cloud Computing System Design

The cloud storage system is designed with a front-end and back-end architecture. The front-end consists of end users (students, teachers, and administrators) who access cloud services through a web browser. The back-end comprises the cloud server and cloud services.

The cloud server operates on the Linux Ubuntu operating system, which functions as the core platform for managing cloud services. Administrators and users are provided access according to their assigned privileges. Ubuntu supports standard file hosting features, including user upload management, client capacity control, and disk quota allocation. Users access the cloud server by entering the server's IP address via a web browser and authenticating with a valid username and password.
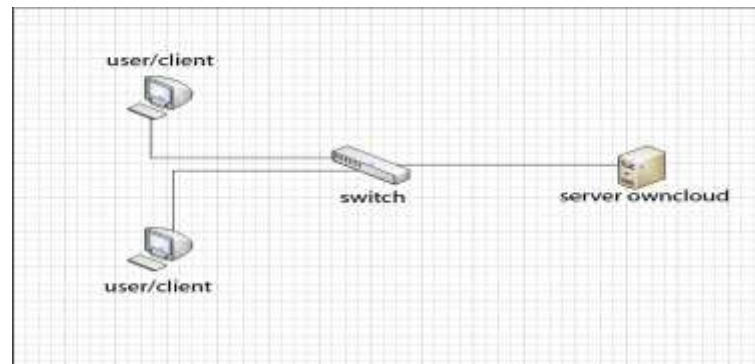

Figure 2. Cloud computing storage architecture

Tools and Materials
Hardware Requirements

Device	Specification
Processor	Intel Core i5
RAM	2 GB
Storage	512 GB SSD
Monitor	19 inches

Software Requirements

Software	Specification
Operating System	Linux Ubuntu
Web Server	Apache2, PHP 7.4, MariaDB MySQL
Cloud Platform	OwnCloud Version 10.3.2

Results
Login Interface

The login interface serves as the main access point to the cloud system. Users are required to enter a valid username and password to access the system securely. This mechanism ensures that only authorized users can utilize cloud storage services.

Dashboard Interface

After successful authentication, users are directed to the dashboard page, which displays the main control panel of the OwnCloud system. This interface allows administrators to manage system settings, users, and storage resources efficiently.

User Management Interface

Each user is allocated a predetermined storage quota based on their role:
- School Principal: 5 GB
- Teachers and Students: 1 GB

Storage capacity can be expanded as required. The OwnCloud user management feature enables administrators to create, modify, and delete user accounts, as well as manage group memberships and access permissions.

Data Sharing Functionality

The data-sharing feature allows administrators to share files and folders with the school principal, teachers, and students. Functional testing confirmed that the cloud storage system supports efficient and secure data sharing. All shared files remain protected under authentication and authorization controls.

Teacher and Student User Interfaces

Separate user interfaces are provided for teachers and students. These interfaces restrict access based on user roles. Teachers and students can upload, download, and manage their own files within assigned storage limits without affecting other users' data.

Group and User Deletion

Administrative testing also included the deletion of student groups and individual student accounts. These operations were executed successfully using administrator privileges, confirming that user and group control functions operate as expected.

Discussion

The implementation of a cloud computing–based user management system at SMK Muhammadiyah 2 Palembang demonstrates a substantial improvement in both data governance and the overall security of the computer laboratory environment. Prior to implementation, users relied heavily on physical storage devices such as flash drives and external hard disks, which posed high risks of data loss, file duplication, malware transmission, and unauthorized access. With the centralized cloud storage model, all user data are now stored

securely on a dedicated server, significantly minimizing the likelihood of data corruption and unauthorized manipulation.

From a security standpoint, the authentication and authorization mechanisms implemented in the cloud system play a critical role in ensuring controlled data access. Each student and teacher is required to log in using individual credentials, which enforces accountability and traceability of user activities. This mechanism effectively prevents unauthorized users from accessing, modifying, or deleting important files, thereby strengthening data integrity. The results confirm that user control, as emphasized in cloud-based infrastructures, is a fundamental pillar for maintaining confidentiality and system reliability.

In terms of operational efficiency, the cloud-based user management system streamlines administrative workflows. Administrators can manage user accounts, grant or revoke access rights, and monitor user activity remotely through a centralized dashboard. This significantly reduces the workload previously required to configure each client computer individually. Furthermore, centralized management allows software updates, system maintenance, and backup processes to be performed more efficiently and consistently across all client devices in the laboratory.

The adoption of ownCloud as a private cloud platform proves to be a practical and scalable solution for educational institutions. Private cloud implementation offers higher security compared to public cloud services, as the data remain under direct institutional control. Additionally, ownCloud provides flexibility in managing storage capacity, user quotas, and access policies, enabling the school to adjust resources dynamically according to institutional needs and growth.

From an educational perspective, the cloud-based system significantly improves learning support and collaboration. Students can store, retrieve, and work on learning materials directly from the cloud without relying on personal storage media. This enhances collaboration among students and teachers, as files can be shared easily and accessed from different devices within the network. Moreover, data availability at any time promotes continuity in the learning process, especially when students need to resume their work during subsequent laboratory sessions.

Overall, the application of cloud computing–based user management at SMK Muhammadiyah 2 Palembang successfully addresses the major challenges previously encountered in laboratory data security, accessibility, and management efficiency. The results indicate that cloud computing is not only a technological enhancement but also a strategic solution for improving institutional data governance and learning infrastructure in vocational education environments. Continuous system evaluation and user training are nevertheless recommended to ensure sustainable implementation and optimal utilization of cloud services in the long term.

Conclusion and Recommendations

Based on the results of this study, the following conclusions are drawn:
1. From the perspective of cloud storage utilization, the implemented system effectively supports data management in the computer laboratory at SMK Muhammadiyah 2 Palembang by simplifying centralized data management.
2. From the security perspective, the cloud computing implementation enhances data protection through authentication and access control mechanisms, ensuring that unauthorized users cannot access sensitive data.
3. From the operational cost perspective, the cloud-based system reduces expenses related to software and hardware updates.
4. The cloud computing system enables administrators to manage users efficiently and allows users to access their data anytime and anywhere using internet-enabled devices.

Disclosure Statement

The authors declare no conflict of interest related to this study.

Acknowledgments

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