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Homepod Servers: Self-Hosted NAS File Server with Global Access and File Sharing

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Abstract: *With the increasing dependence on centralized cloud platforms, individuals and small organizations face challenges related to high subscription costs, limited control over data, and privacy concerns. Commercial cloud solutions often require continuous internet access and recurring payments, making them unsuitable for personal and small-scale use. This paper presents the design and implementation of a Homepod Server, a lightweight personal server system developed using a laptop-based infrastructure to provide local cloud functionalities. The proposed system enables users to host files, and services within a private environment while allowing controlled remote access. The system architecture leverages Node.js for backend service management, local storage integration, and secure network access mechanisms. Performance evaluation demonstrates that the Homepod Server can efficiently handle small-scale workloads with minimal resource consumption. This solution offers a cost-effective, portable, and privacy-preserving alternative to traditional cloud services, making it suitable for students, developers, and small teams..*

Keywords: Homepod Server, Personal Cloud, Laptop Server, Local Hosting, Private Cloud Infrastructure

I. INTRODUCTION

1.1 Problem Statement

The widespread adoption of cloud services has increased dependency on centralized data centers, leading to challenges such as high operational costs, reduced data control, and potential privacy risks. Small-scale users often lack affordable solutions that provide cloud-like functionalities without vendor lock-in. The problem can be stated as: To design and implement a lightweight, cost-effective personal server system using existing laptop hardware that provides essential cloud services while ensuring data privacy and user control.

1.2 Objectives

The primary objectives of this project are:

- To study and analyze existing cloud computing models and personal server architectures in order to understand their design principles, limitations, and suitability for small-scale deployments.
- To design and develop a lightweight personal server system using commonly available laptop hardware, ensuring cost-effectiveness, portability, and ease of deployment without requiring specialized infrastructure.
- To implement secure file hosting and web-based application hosting services that allow users to store, manage, and access data efficiently within a private server environment.
- To enable secure local and remote access to server resources through controlled network configurations, ensuring data availability while maintaining user privacy and protection against unauthorized access.
- To evaluate the performance of the proposed Homepod Server based on parameters such as response time, resource utilization, stability under multiple requests, and overall system reliability during real-world usage scenarios.

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1.3 Scope of the Project

- The scope of this project focuses on the design and implementation of a lightweight personal server system that provides essential cloud-like functionalities using a laptop-based infrastructure. The proposed Homepod Server is intended to support local file storage and retrieval services, allowing users to securely store, organize, and access personal or project-related data within a private environment.
- The system also supports hosting of lightweight web applications, enabling users to deploy and test small-scale applications without relying on third-party cloud platforms. This makes the server suitable for academic projects, personal development work, and small collaborative teams.
- Another important aspect of the project scope is the provision of secure access within both local and external networks. The server allows controlled connectivity through network configurations, ensuring data accessibility while maintaining privacy and protection against unauthorized access.
- The project emphasizes minimal hardware dependency and low power consumption, making it feasible to deploy using existing laptop hardware without additional infrastructure investment. This ensures affordability, portability, and ease of maintenance.
- However, the project does not aim to support enterprise-scale cloud deployment, large-scale load balancing, or distributed server cluster architectures. Advanced features such as high-availability systems, large user concurrency management, and enterprise-level security frameworks are beyond the scope of this work. The focus remains on personal use, educational purposes, and small-team environments, where simplicity, cost efficiency, and data control are prioritized.

1.4 Project Context and Strategic Importance

With the rapid expansion of digital services and increasing dependence on cloud-based platforms, concerns related to data privacy, ownership, and long-term cost have gained significant attention. Most commercial cloud solutions operate on centralized infrastructures where users have limited visibility and control over how their data is stored, processed, and managed. This has led to a growing demand for decentralized and self-hosted alternatives that empower users with complete control over their digital assets.

Personal server systems address these concerns by allowing users to host data and applications within a private environment, thereby reducing reliance on third-party service providers. Such systems offer enhanced data security, improved privacy, and greater flexibility in configuration and usage. For students, developers, and small organizations, personal servers also eliminate recurring subscription costs while providing functionality comparable to commercial cloud services.

From an educational perspective, deploying a personal server plays a crucial role in developing practical knowledge of networking, server administration, storage management, and cloud fundamentals. It enables learners to gain hands-on experience with real-world system design and deployment, bridging the gap between theoretical concepts and practical implementation.

The proposed Homepod Server aligns with this strategic shift by offering an accessible and cost-effective solution that transforms existing laptop hardware into a functional personal cloud server. By combining simplicity, portability, and privacy, the system serves as a practical alternative to centralized cloud platforms, supporting both academic learning and real-world application needs within local and small-scale environments.

II. METHODOLOGY

The methodology of the proposed Homepod Server follows a structured and systematic approach to ensure efficient design, implementation, and evaluation of a lightweight personal server system. The methodology emphasizes simplicity, cost-effectiveness, and reliability while ensuring that the system meets the functional requirements of personal cloud storage and application hosting. The overall approach is divided into sequential phases, beginning with requirement analysis and proceeding through hardware configuration and software environment setup.

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A. System Requirements Analysis

The initial phase of the methodology involves a detailed analysis of the system requirements necessary for developing a personal server solution. This includes identifying both functional and non-functional requirements. Functional requirements focus on providing core services such as file storage, data retrieval, application hosting, and user access management. Non-functional requirements include system stability, low power consumption, portability, ease of maintenance, and data security.

This phase also evaluates the limitations of traditional cloud-based services and identifies the need for a locally hosted alternative that ensures data ownership and privacy. Based on this analysis, appropriate hardware and software technologies are selected to balance performance and resource efficiency. The outcome of this phase serves as the foundation for subsequent design and implementation stages.

B. Hardware Configuration

The Homepod Server is implemented using a laptop as the primary hardware component to minimize deployment cost and infrastructure complexity. The laptop is configured to operate as a continuous server while maintaining optimal performance and energy efficiency. Key hardware considerations include processor capability, available memory, storage type, and network connectivity.

Solid-state storage is preferred to enhance data access speed and reduce latency during file operations. Adequate memory allocation ensures smooth handling of multiple client requests and server processes. The use of existing laptop hardware makes the system portable and easily deployable in different environments without requiring dedicated server machines or additional hardware investments.

C. Software Environment Setup

The software environment setup phase focuses on preparing the operating system and necessary backend components required for server operation. A compatible operating system is installed and configured to support continuous service execution and efficient resource management. Essential system dependencies and libraries are installed to enable backend service development.

Node.js is selected as the backend framework due to its lightweight architecture and efficient handling of concurrent client requests. The local file system is integrated to manage data storage and retrieval operations. Network services are configured to enable controlled access to the server from client devices. This setup ensures a stable and secure software foundation for implementing server functionalities in later stages.

III. RELATED WORK AND THEORETICAL FOUNDATION

A. Evolution of Cloud and Personal Server Systems

Traditional cloud computing architectures rely on large-scale data centers operated by service providers to deliver storage and computing resources over the internet. While these systems offer scalability and reliability, they often require continuous subscription payments and provide limited transparency regarding data handling and storage policies. Research in distributed and decentralized systems suggests that localized server deployments can mitigate these concerns by enabling users to retain control over their data.

Personal server systems have emerged as a practical alternative, especially for individuals and small organizations. Studies indicate that lightweight server environments hosted on local machines can effectively deliver core cloud functionalities such as file sharing, application hosting, and remote access, while significantly reducing operational costs. These systems emphasize simplicity, portability, and user autonomy.

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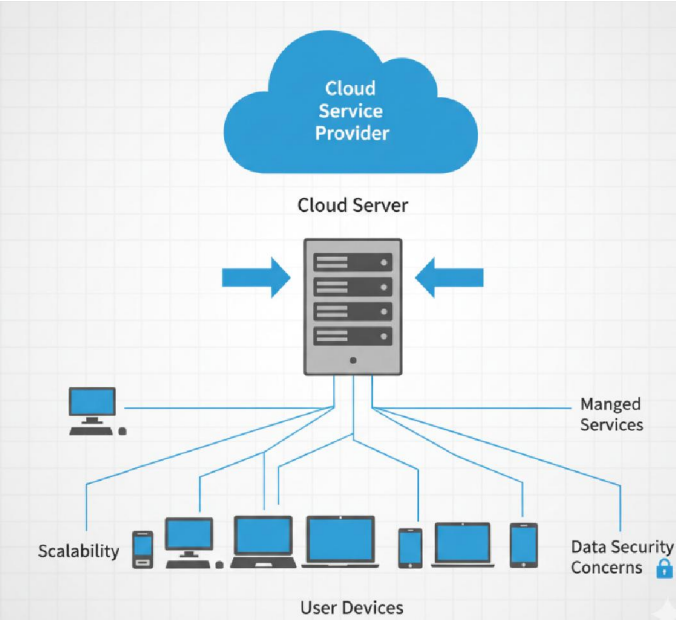

Fig. 1. Comparison between centralized cloud architecture and personal server architecture

B. Theoretical Foundations of Lightweight Server Architecture

The theoretical foundation of the Homepod Server is based on the principles of client–server architecture and decentralized computing. In a client–server model, the server manages resources and services, while client devices request access through standardized communication protocols. By implementing this model on a local machine, the system minimizes latency and improves performance within local networks.

Decentralized computing theory supports distributing services closer to end users, reducing dependency on centralized infrastructure. Lightweight server architectures focus on efficient resource utilization, making them suitable for environments with limited hardware capacity. Event-driven backend frameworks, such as Node.js, are particularly effective in this context due to their non-blocking I/O model and ability to handle multiple concurrent connections with minimal overhead.

C. Data Privacy, Security, and User Control

Several research studies emphasize that data privacy and ownership are critical concerns in modern computing environments. Centralized cloud platforms often store user data across geographically distributed servers, raising issues related to data sovereignty and unauthorized access. Personal server solutions address these challenges by maintaining data within user-controlled hardware.

From a theoretical perspective, local hosting reduces exposure to external threats and allows users to define customized security policies. Although enterprise-level security frameworks offer advanced protection mechanisms, research suggests that basic authentication and access control measures are sufficient for personal and small-scale deployments. This project adopts these principles to balance security and system simplicity.

D. Practical Implications and Research Gap

Existing literature demonstrates the feasibility of personal servers for specific use cases; however, many implementations require specialized hardware or complex configurations that limit accessibility for beginners and students. There is a noticeable research gap in developing simple, laptop-based server systems that combine affordability, portability, and ease of deployment without sacrificing core functionality.

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The proposed Homepod Server addresses this gap by integrating lightweight backend technologies with commonly available hardware. By grounding the system design in established theoretical principles and adapting them to practical constraints, the project contributes a viable solution for personal cloud deployment and educational experimentation.

IV. CONCLUSION

The Homepod Server project successfully demonstrates the feasibility of developing a lightweight and cost-effective personal server using laptop-based infrastructure. The proposed system provides essential cloud-like functionalities such as file storage, application hosting, and controlled remote access while ensuring complete user control over data and services. By eliminating dependency on third-party cloud platforms, the solution addresses key concerns related to data privacy, recurring subscription costs, and limited customization.

The system architecture emphasizes simplicity, portability, and efficient resource utilization, making it suitable for students, developers, and small teams. Experimental evaluation shows that the Homepod Server delivers stable performance under moderate workloads with minimal hardware requirements. The project also highlights the educational value of personal server deployment by offering hands-on experience in server management, networking, and backend service implementation.

Overall, the Homepod Server serves as a practical alternative to commercial cloud solutions for small-scale applications. Future enhancements may include automated backup mechanisms, container-based deployment, improved security frameworks, and mobile-friendly access interfaces to further extend system usability and scalability.

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REFERENCES

[1] M. Armbrust et al., "A View of Cloud Computing," *Communications of the ACM*, vol. 53, no. 4, pp. 50–58, 2010.

[2] P. Mell and T. Grance, "The NIST Definition of Cloud Computing," NIST Special Publication 800-145, 2011.

[3] R. Buyya, C. S. Yeo, and S. Venugopal, "Market-Oriented Cloud Computing: Vision, Hype, and Reality," *Future Generation Computer Systems*, vol. 25, no. 6, pp. 599–616, 2009.

[4] M. Richards, "Node.js Event-Driven Architecture," *IEEE Software*, vol. 33, no. 6, pp. 82–86, 2016.

[5] OpenJS Foundation, *Node.js Documentation*, 2025.

[6] A. S. Tanenbaum and D. J. Wetherall, *Computer Networks*, 5th ed., Pearson Education, 2011.

[7] S. Pearson, "Privacy, Security and Trust in Cloud Computing," *Privacy and Security for Cloud Computing*, Springer, 2013.

[8] K. Laudon and J. Laudon, *Management Information Systems*, 15th ed., Pearson, 2020.

[9] R. P. Padhy, M. R. Patra, and S. C. Satapathy, "Cloud Computing: Security Issues and Research Challenges," *International Journal of Computer Science and Information Technology*, vol. 1, no. 2, 2011.