Remote Server techniques with SSH (Secure Shell) for Managing Server Computers of The Office of General Education and Innovative Electronic Learning, Suan Sunandha Rajabhat University

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Abstract

This research aims to study methods and techniques for managing server computers using the Secure Shell (SSH) protocol, a crucial tool for enhancing security and efficiency in server access and control. The study focuses on analyzing and developing remote server management processes through SSH, including user permission management, secure connection configuration, and cybersecurity threat prevention. The research methodology involves data collection from practical testing and analysis of server operations within the Office of General Education and Innovative Electronic Learning at Suan Sunandha Rajabhat University. Additionally, a procedural manual was developed to assist personnel in effectively and securely utilizing SSH for server management. The findings reveal that the SSH-based remote server management techniques developed in this study significantly reduce system vulnerabilities, enhance data security, and improve the efficiency of server administration. These outcomes contribute positively to supporting digital learning initiatives within the university.

Keywords: Remote Access, Server Management, SSH

1. Introduction

Suan Sunandha Rajabhat University (SSRU), Thailand, is a public university located in the downtown area of Bangkok, the capital city of Thailand. The university, originally a palace about one hundred years ago, is not only an academic institution but also an archaeological site and an attraction in its own right. Each year, SSRU's main campus in Bangkok attracts numerous visitors and students alike (Chopvitayakun S.,2019).

In today's digital era, efficient and secure server management has become a critical aspect of IT infrastructure, especially for institutions that rely heavily on digital platforms to support their operations. Secure Shell (SSH) is a widely adopted protocol that provides a secure channel for accessing and managing servers remotely. It plays a crucial role in protecting sensitive data and ensuring the integrity of server operations against potential cybersecurity threats. Server remote technology enhances education by providing remote access to resources, enabling virtual classrooms, and streamlining data management in academic institutions. It supports collaboration tools, reduces costs, offers scalability, and enriches learning experiences through multimedia and interactive content. This technology is essential for modern education, offering flexibility, improved resource management, and fostering a collaborative learning environment. (Chanhom, C. et al., 2024).

The General Education and e-Learning Innovation Office at Suan Sunandha Rajabhat University faces the challenge of managing its server infrastructure to support the growing demand for digital learning and online services. Traditional server management methods often lack the security and flexibility required to address these needs effectively. This underscores the necessity of adopting advanced tools and techniques, such as SSH, to enhance server accessibility while maintaining robust security standards (Kaewsaiha, C & Kaewsaiha, P, 2020).

This research explores the application of SSH in server management, focusing on developing techniques to optimize remote access, secure connections, and system administration. The study also addresses common vulnerabilities associated with remote server access and proposes solutions to mitigate these risks. By providing practical guidelines and a comprehensive analysis of SSH's capabilities, this research aims to empower IT personnel to improve the efficiency and security of server operations, ultimately contributing to the university's mission of delivering high-quality digital education (International College, Suan Sunandha Rajabhat University, 2018).

1.1 Research Objective

This research study was aimed:

1) To study and analyze the application of Secure Shell (SSH) for remote server management
2) To develop and propose effective techniques for SSH-based server management
3) To evaluate the efficiency and security of SSH techniques in practical server management scenarios
4) To create a practical manual for personnel to effectively utilize SSH
5) To enhance the overall IT infrastructure for digital education support

2. Conceptual Framework

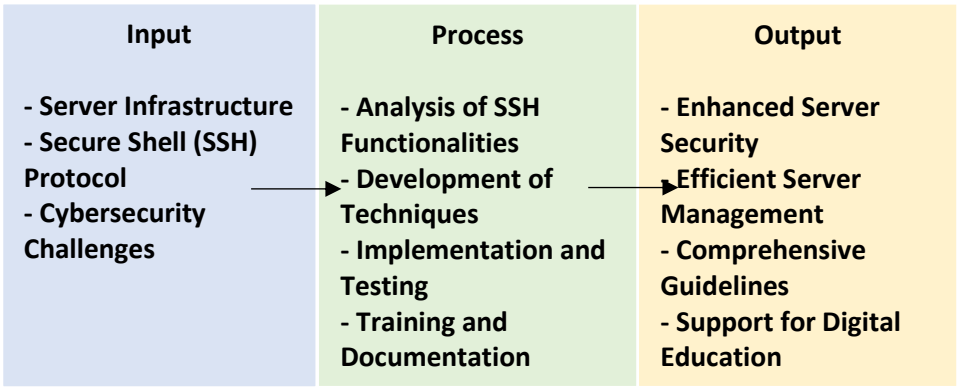

Figure 1. Conceptual Framework of the Study

The conceptual framework illustrated in Figure 1. focuses on utilizing Secure Shell (SSH) as the central tool for remote server management. The framework is structured into three key components: **Input**, **Process**, and **Output**, as outlined below:

Input

Server Infrastructure: Existing server systems at the General Education and e-Learning Innovation Office, Suan Sunandha Rajabhat University.

Secure Shell (SSH) Protocol: Features and functionalities of SSH, including authentication mechanisms, encryption standards, and command-line interface capabilities.

Cybersecurity Challenges: Potential risks such as unauthorized access, data breaches, and other vulnerabilities related to remote server management.

Process

Analysis of SSH Functionalities: Study SSH's applications in secure remote access, user management, and connection configuration.

Development of Techniques: Propose methods for SSH-based server management, including:

- Secure key authentication.
- Configuring firewall and access control policies.
- Monitoring and logging server activities.

Implementation and Testing: Apply the proposed techniques in a controlled environment to assess efficiency, scalability, and security.

Training and Documentation: Create a procedural manual and conduct workshops for IT personnel.

Output

Enhanced Server Security: A robust system resistant to unauthorized access and Potential cyber threats.

Efficient Server Management: Improved processes for remote server configuration, monitoring, and maintenance.

Comprehensive Guidelines: A practical manual for secure and effective use of SSH in managing server systems.

Support for Digital Education: Strengthened IT infrastructure to meet the demands of online learning and digital services.

The conceptual framework emphasizes integrating SSH into the server management process to address both operational needs and security challenges, ultimately supporting the university's digital transformation objectives.

3. Methodology

This study systematically investigates the use of **PuTTY** for Secure Shell (SSH) remote server management within the General Education and e-Learning Innovation Office at Suan Sunandha Rajabhat University. The methodology is divided into a series of structured phases designed to collect and analyze data related to server management performance, security, and ease of use.

Data Collection and Setup

The research begins with a systematic data collection process to gather feedback from the IT staff and users involved in server management using **PuTTY**. Data is collected from both qualitative and quantitative sources:

Participants: IT staff members and system administrators who routinely use **PuTTY** for remote server management.

Data Collection Method: Structured interviews, surveys, and observational studies to assess the challenges, effectiveness, and usability of **PuTTY** in daily operations. Additionally, server logs and performance data are collected to analyze system performance.

Setup: A test environment is configured using **PuTTY** to access multiple servers on the university's network. The servers are configured with SSH, and **PuTTY** is used to connect remotely to manage various administrative tasks such as file transfers, server configuration, and security monitoring.

SSH Configuration and Security Setup

To ensure a secure and optimized SSH setup for using **PuTTY**, the following steps were applied:

SSH Key Pair Generation: Generate a public-private key pair using **PuTTYgen**. The private key is kept securely on the client machine, while the public key is uploaded to the server for authentication.

Configuration: Modify the SSH configuration on the server to ensure that only key-based authentication is allowed, disabling password authentication for added security.

Session Settings: Configure and save **PuTTY** session settings for each server, including the host address, port (default: 22), and authentication method. Special attention is given to setting up encryption protocols and timeouts for added security.

System Testing and Performance Evaluation

To evaluate the performance of **PuTTY** in managing remote servers and ensuring efficient and secure operations, the following steps were applied:

Testing: IT staff uses **PuTTY** to execute common administrative tasks such as checking server status, managing user accounts, and transferring files via SCP.

Performance Metrics: System performance is evaluated by tracking response times during SSH connections, the reliability of connections, and the time taken to complete various tasks.

Security Audit: Regular security checks are performed to detect potential vulnerabilities, such as unauthorized access attempts or misconfigurations. Server logs are reviewed to identify any failed login attempts or suspicious activity.

Documentation and Dissemination

To create a comprehensive guide for IT staff on using **PuTTY** for secure and efficient remote server management, the following steps were applied:

Documentation: Develop a user manual outlining the installation, configuration, and best practices for using **PuTTY** with SSH. The manual also includes troubleshooting tips for common issues.

Training and Workshops: Conduct training sessions for IT staff to ensure the effective use of **PuTTY** in server management. The training covers SSH basics, security protocols, and advanced features of **PuTTY**.

User Feedback: IT staff provide qualitative feedback on the ease of use, security, and efficiency of **PuTTY** through surveys and interviews. This feedback is categorized into positive, negative, and neutral sentiments to better understand user satisfaction.

Statistical Evaluation: A comparative analysis is performed using basic statistical methods to assess the accuracy and efficiency of **PuTTY** in fulfilling server management tasks.

This methodology provides a systematic approach to evaluating the effectiveness, security, and performance of **PuTTY** in managing remote servers while ensuring that IT staff can adopt best practices for secure and efficient server management.

4. Results

The study, titled "Remote Server techniques with SSH (Secure Shell) for managing server computers of The Office of General Education and Innovative Electronic Learning Suan Sunandha Rajabhat University" yielded several noteworthy results.

Systematic evaluation

The evaluation aims to assess the effectiveness and efficiency of using **PuTTY** for SSH remote access in server management. The study will focus on evaluating the performance, reliability, and security of SSH connections through **PuTTY** in the university's server environment. The scope of the evaluation includes the system’s stability, security measures, and usability by IT staff in managing the servers remotely.

Satisfaction evaluation

The research involved a diverse group of respondents who completed a satisfaction assessment questionnaire. This group included 1,600 university students from Rajabhat University Suan Sunandha during the first semester of the academic year 2023, along with 25 staff members from the General Education Office. Most participants were students, constituting 98.46% of the total respondents, while staff members comprised 1.54%. Satisfaction Assessment: The study assessed user satisfaction with various aspects of the cloud-based question and answer repository technology. The evaluation criteria covered essential factors related to system performance, usability, and service provision. The results, as presented in Table 2, demonstrated consistently high levels of satisfaction across all evaluated criteria. The average scores ranged from 4.44 to 4.68, with standard deviations of 0.47 to 0.50. Overall, the users expressed "Very Satisfied" levels of satisfaction, with an impressive overall satisfaction score of 4.52.

These findings highlight the success and effectiveness of remote server techniques with SSH (Secure Shell) for managing computer servers, emphasizing their efficiency, reliability, user-friendliness, and the high level of service provided by both the system and staff members. The research outcomes have been actively utilized to improve and enhance Remote Server techniques with SSH (Secure Shell) for managing computer servers for the General Education Office. These improvements aim to facilitate convenient and efficient information retrieval for users. Impact of Workflow Changes: The research has brought about notable changes in workflow processes. Students have gained the ability to independently search for information, streamlining the information retrieval process. Additionally, it has provided clear and unified directions for General Education Office staff, leading to a reduction in errors related to information responses and an overall enhancement in work efficiency. Challenges encountered during the research implementation, such as data accuracy and the approval process, were acknowledged and addressed. The reliance on data from the Educational Services department necessitated careful consideration and approval from departmental heads and deputy directors to ensure the accuracy and completeness of information, ultimately facilitating swift and efficient use by students.

Table 1 Participants

Category	Number	Percentage
Student	1,600	98.46
Staff	25	1.54
Total	**1,625**	**100**

Table 2 Satisfaction results

Evaluation Criteria	Satisfaction Level	Average Score	Standard Deviation
1. System efficiency, modernity, and reliability	4.57	0.50	Very Satisfied
2. Stability, security, and accessibility of the system	4.49	0.50	Very Satisfied
3. Currency of data in the system	4.52	0.50	Very Satisfied
4. User-friendliness of the system	4.52	0.50	Very Satisfied
5. Benefits derived from the system	4.44	0.50	Very Satisfied
6. Accuracy and speed of service provision	4.51	0.50	Very Satisfied
7. Clarity and promptness of guidance for system use	4.48	0.50	Very Satisfied
8. Convenience of system use	4.46	0.50	Very Satisfied
9. Accuracy and speed of service provision by staff	4.56	0.50	Very Satisfied
10. Knowledge and ability of staff to provide system services	4.68	0.47	Very Satisfied
Overall Satisfaction	**4.52**	**0.50**	**(Very Satisfied)**

5. Conclusion

In conclusion, the study focused on remote server techniques with SSH (Secure Shell) for managing server computers at The Office of General Education and Innovative Electronic Learning Suan Sunandha Rajabhat University to enhance the operational efficiency of the General Education Department. The researchers successfully implemented and tested the system among 1,600 students and 25 staff members during the first semester of the academic year 2024.

The results indicated a high level of satisfaction among both students and staff, with an overall satisfaction score of 4.52. This suggests that Remote Server techniques with SSH (Secure Shell) for managing computer servers of The Office of General Education and Innovative Electronic Learning Suan Sunandha Rajabhat University significantly contributed to the improvement of operational efficiency within the General Education Department.

The implementation of the system led to streamlined question management for students and facilitated convenient use for both students and staff. The collaboration and knowledge exchange fostered by the system resulted in a sense of unity among different departments, promoting a cooperative learning environment.

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