International Journal of Informatics, Economics, Management and Science
http://journal.stmikjayakarta.ac.id/index.php/ijiems
E-ISSN: 2809-8471 (online), **P-ISSN:** 2809-9281 (Print)
DOI: 10.52362/ijiems.v4i2.2017
Volume 4 , Issue 2 , August 2025, pp. 87-96

Effectiveness and Efficiency of Using Shared Networks Using Thin Clients to Reduce Office Network Load

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Received: May 12, 2025; **Accepted**: July 25, 2025 ; **Published**: July 31, 2025

Abstract: The use of networks in conjunction with thin client systems has become an alternative solution for increasing the efficiency of information technology infrastructure in office environments. Several previous studies have examined the benefits of using thin clients, including cost efficiency, data security, and reduced system administration burden. For example, using thin clients can reduce bandwidth consumption compared to using conventional PCs on a local office network. Another study also stated that thin client systems can extend hardware lifespan and significantly reduce total cost of ownership. These studies emphasize the significant potential of using thin clients in creating more efficient and manageable networks. This study aims to test the effectiveness and efficiency of using a thin client-based shared network in a medium-sized office. The methods used were quantitative studies and field experiments, observing network load (bandwidth usage), server performance, and application response times between conventional PC and thin client. The results showed a 78,35% reduction in network load. In conclusion, this study demonstrates that the use of networks combined with a thin client approach not only reduces network load technically but also has a long-term impact on organizational efficiency, device sustainability, and adaptability to more resource-friendly technological developments.

Keywords: shared network, thin client, conventional pc, network load, mrtg

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1. Introduction

The use of networks in conjunction with thin client systems has become an alternative solution for increasing the efficiency of information technology infrastructure in office environments[8]. In this system, most processing is performed by a central server, while user terminals (thin clients) serve solely as user interfaces. The background to this research is the growing need for network systems that are resource-efficient, easy to manage, and do not overload the network, especially in work environments with many computer users[5]. Offices with limited budgets and IT resources require an efficient approach to maintain optimal network performance without sacrificing productivity.

Several previous studies have examined the benefits of using thin clients, including cost efficiency, data security, and reduced system administration burden. For example, using thin clients can reduce bandwidth consumption compared to using conventional PCs on a local office network[4]. Another study [2] also stated that thin client systems can extend hardware lifespan and significantly reduce total cost of ownership. These studies emphasize the significant potential of using thin clients in creating more efficient and manageable networks.

This study aims to test the effectiveness and efficiency of using a thin client-based shared network in a medium-sized office. The methods used[7] were quantitative studies and field experiments, observing network load (bandwidth usage), server performance, and application response times between conventional PC and thin client. The results showed a 78,35% reduction in network load. Discussions focused on the impact on office operations and comparisons with conventional approaches. The study concluded that the use of thin clients significantly helps optimize office networks and provides efficiency in IT infrastructure management.

While the results demonstrate significant benefits, challenges in implementing thin clients must also be considered, such as high reliance on a central server and limitations in running demanding applications. Some argue that this system is not suitable for all types of work, especially those requiring high graphics processing. However, in the context of a standard office network, the results of this study have a positive impact on network load reduction, cost efficiency, and increased ease of overall IT system management.

2. Research Method

This research was conducted using a quantitative and experimental approach, with the aim of determining the effectiveness and efficiency of using a thin client-based shared network in reducing office network load[6], The research flow diagram can be seen in Figure 1. This research was conducted in stages and systematically to ensure its ease of understanding by readers from various backgrounds. The research process began with problem identification, literature review, design of a thin client network trial system, implementation in an office environment, and analysis of network performance measurement results.

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Figure 1. Research flowchart

The subject of this study was the computer network system in a medium-sized office with 20 active users. The object of the study was the implementation of thin clients within this network environment[3], can be seen in the network architecture in Figure 2. The respondents, or users, were administrative staff and operational employees who use computers for activities such as document processing, internet access, and web-based office applications. Data collection was conducted through two methods: Direct observation of network performance, and Technical measurements of parameters such as bandwidth usage, system response time, and CPU/memory usage on the server side and user terminals.

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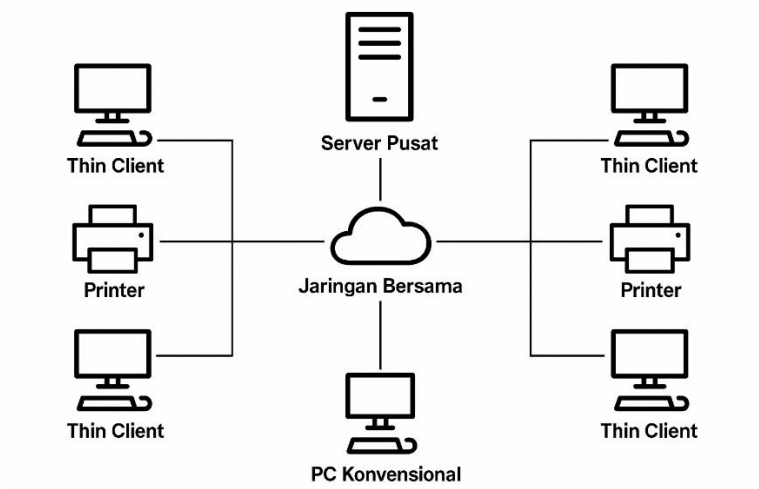

Figure 2. Network Architecture Diagram

The collected data was analyzed using a comparative method, comparing results between conventional PC and thin client. Data processing was performed using MRTG[10] to monitor network traffic and visual tables to perform simple statistical analysis, such as averages and percentage changes. Furthermore, bar charts and linear graphs were used for data visualization to make the research results easier to understand, even for non-technical readers.

The data processing results were interpreted by linking empirical findings to existing theories, such as how reduced bandwidth impacts application access. These results were then used to conclude whether the thin client system can actually deliver the desired efficiency and effectiveness in an office network environment.

3. Research Result and Discussion

This study aims to measure the effectiveness and efficiency of using a thin client-based shared network in reducing office network load[9]. In accordance with the research questions and objectives, testing was conducted by comparing network performance, including aspects of bandwidth, response time, and system resource usage[11].

3.1. Bandwidth Observation Results

Bandwidth consumption was monitored using MRTG (figure 3,4,5,6) over four weeks workdays, each with 8 hours of office operation. Data was collected under two conditions: using a conventional PC and using a thin client.

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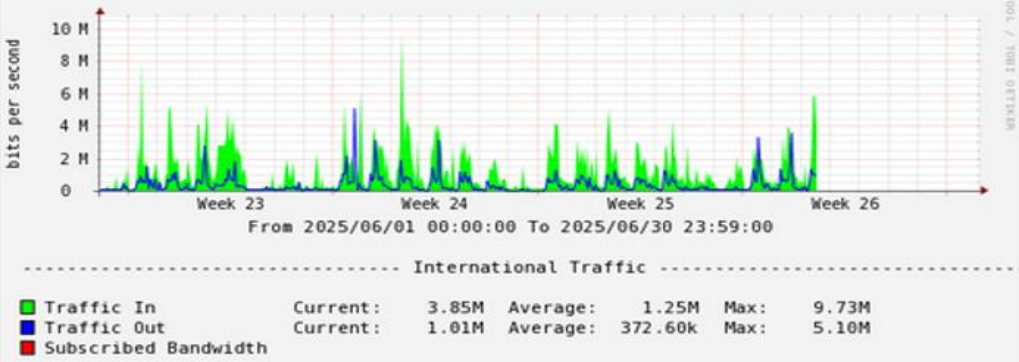

Figure 3. International Bandwidth (Mbps) Consumption Using a Convetional PC

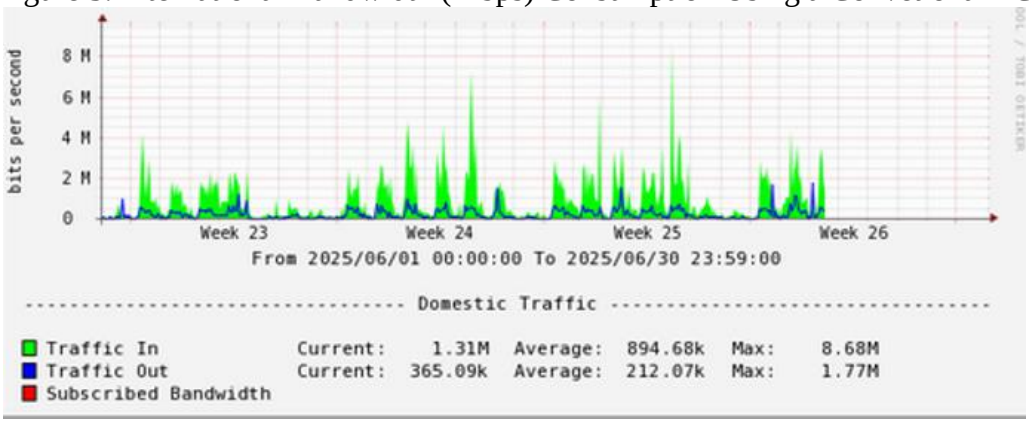

Figure 4. Domestic Bandwidth (Mbps) Consumption Using a Convetional PC

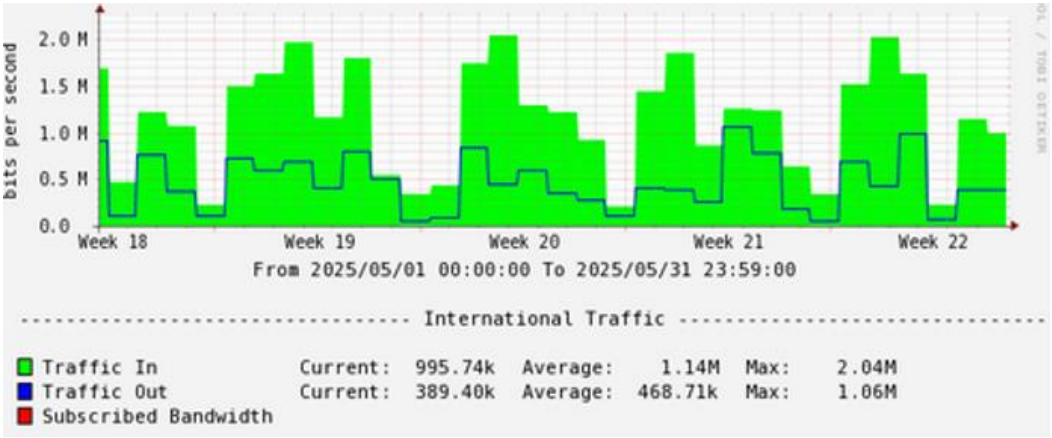

Figure 5. International Bandwidth (Mbps) Consumption Using a Thin Client

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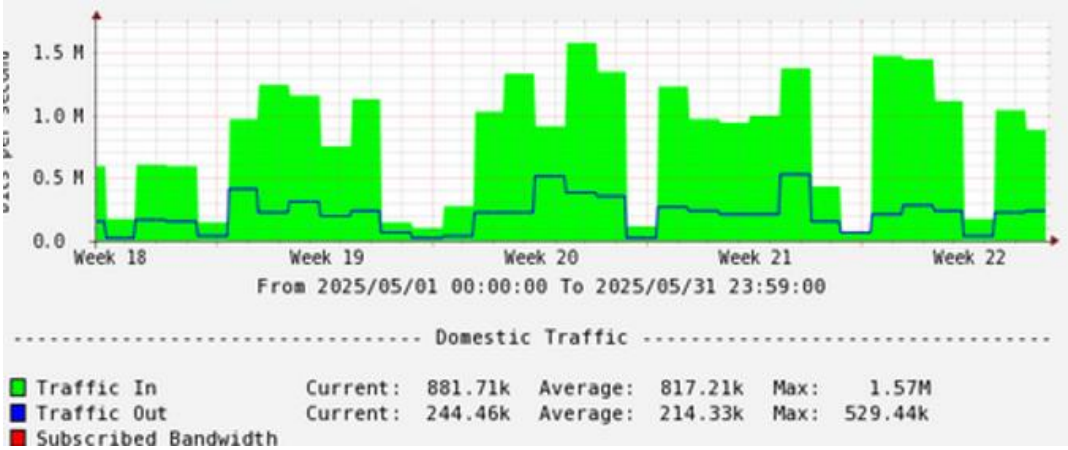

Figure 6. Domestic Bandwidth (Mbps) Consumption Using a Thin Client

Table 1. *Average Weekly Bandwidth Usage (in Mbps)*

Weeks-	Conventional PC	Thin Client	Decrease (%)
1	5	2	60%
2	7	2	71,42%
3	7	2	71,42%
4	6	2	66,66%
Average	**6,25**	**2**	**~78,35%**

These results show that the thin client system is able to reduce the network load by an average of 78,35%, because only the screen, input, and output are sent from/to the central server, not the entire application data. To calculate the percentage decrease (%) in table 1, the formula used is:

$$Decrease\ (\%) = \frac{(Bandwidth\ Conventional\ PC - Bandwidth\ Thin\ Client) \times 100}{Bandwidth\ Conventional\ PC}$$

3.2 Application Response Time Observation Results

Response times for applications such as document processing, internal web access, and management information systems (MIS) were also measured. Measurements were conducted on typical user activities.

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Table 2. *Application Response Time Comparison (in seconds)*

Activity	Conventional PC	Thin Client
Open an Excel document	2.5	2.0
Access internal SIM applications	3.2	2.1
Browsing the company intranet	2.0	1.5
Access files on the central server	3.5	2.4
Login to the server system	4.0	2.8

From these results, it can be concluded that thin clients provide faster response times for almost all basic user activities. This is due to centralized processing and reduced computational load on the user's terminal. (Some results may vary depending on the PC or server specifications used. For specific specifications, see point *3.3. Resource Usage*)

3.3 Resource Usage

For thin client server the specification its intel core i9, memory DDR4 64 GB, Storage NVMe 512 GB, Windows Server 2016 Standar with 50 CAL, and application such as office 2019 and chrome or edge, which are currently used by almost 20 users. Meanwhile, conventional PCs use processors ranging from Intel N to Core i7, memory ranging from 4 GB to 16 GB, and Windows 10 or 11, which are currently used by almost 20 users.

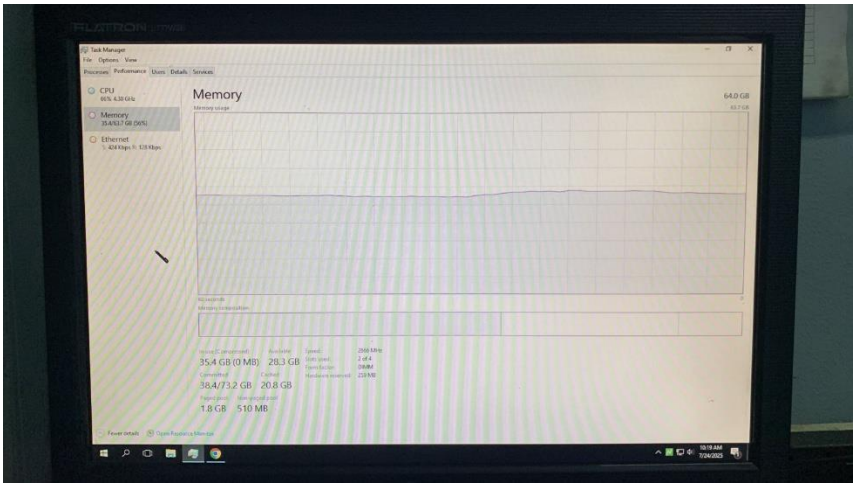

Figure 7. CPU and RAM usage (56 %) of thin client server with 20 Active User

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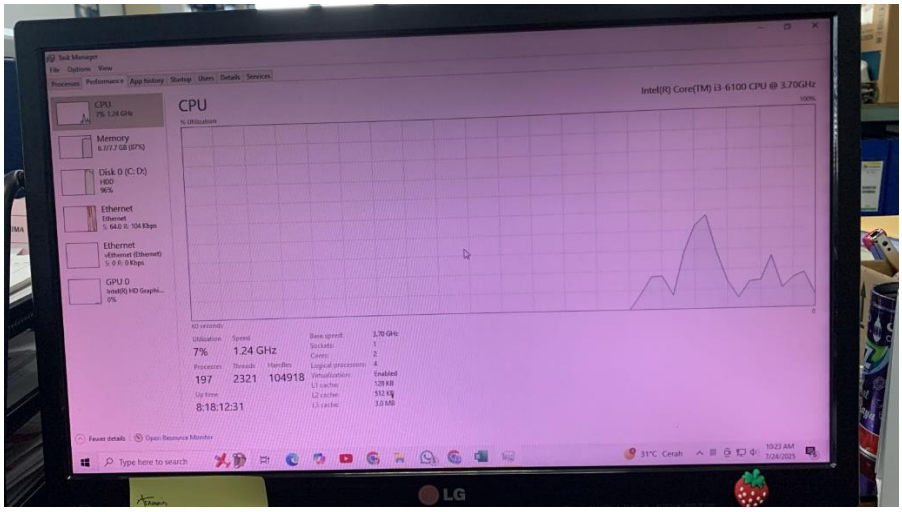

Figure 7. CPU and RAM usage (87%) of Conventional PC with 1 Active User

Analysis of CPU and memory usage indicates that the thin client device uses local processing power allocated to the server[12]. With reduced local processing, thin client devices do not require high specifications, thus extending the device's lifespan and saving upgrade costs.

3.4 Discussion of Research Results

The results of this study [4] findings, which state that the use of thin clients can reduce bandwidth consumption and IT operational costs. Furthermore, this research corroborates [2] regarding network management efficiency and longer hardware lifespan. However, this testing also found that the thin client system is highly dependent on the stability of the central server[1]. If the server experiences a failure, all terminals will be affected. This is a limitation that needs to be considered in widespread implementation.

4. Conclusion

This research was conducted to evaluate the effectiveness and efficiency of using a thin client-based shared network in reducing office network load. Based on the entire research process—from design and implementation, direct observation, to data analysis—it can be concluded that the implementation of a thin client system has a significant impact on improving work efficiency and managing information technology infrastructure in a medium-sized office environment.

One of the key findings of this research is how a simple yet strategic technology approach, such as a thin client, can significantly transform IT operations. By switching from conventional PCs to a shared network system, office IT teams can focus more on centralized maintenance, energy savings, and reducing the potential for technical disruptions that previously frequently occurred on the end-user side.

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More than just the reduction in bandwidth or improved response times, this research demonstrates that a planned digital transformation doesn't have to be expensive or complex. By adopting principles of efficiency and centralized processing, organizations can increase productivity without the need for significant investments in hardware.

This research also has an educational impact on office management teams and end users. They become more aware of the importance of IT resource management and how the right technology solutions can deliver tangible results in supporting daily activities. Furthermore, direct involvement in system implementation and testing provided practical experience that enriched the internal team's knowledge in managing network-based systems.

In conclusion, this study demonstrates that the use of networks combined with a thin client approach not only reduces network load technically but also has a long-term impact on organizational efficiency, device sustainability, and adaptability to more resource-friendly technological developments.

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