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Implementation and Training of Linux-Based Network Administration to Enhance Network Infrastructure

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ABSTRACT

This article aims to comprehensively synthesize the relationship between Linux server implementation, network administration training, and their impact on network infrastructure improvement. Linux servers are becoming increasingly important in modern network management because they support service flexibility, resource efficiency, security, automation, and high availability, while network administration training is a key factor in building the technical competencies of network administrators. This study employs a systematic review method on 35 scientific articles classified into three main topics: Linux server implementation, network administration training, and the impact on network infrastructure. The review results indicate that Linux server implementation contributes to improved performance, stability, efficiency, and reliability of network services, whereas hands-on training plays a role in enhancing administrators' operational skills and readiness. These findings confirm that improvements in Linux server-based network infrastructure depend on the integration of the quality of technical implementation and the competencies of the personnel managing it.

Keywords: network administration, network infrastructure, system implementation, technical training, Linux servers

I. INTRODUCTION

The development of digital services, distributed computing, virtualization, and container-based architectures has made network infrastructure a critical component in ensuring service continuity, responsiveness, and resilience. In this context, organizational needs no longer stop at the mere availability of connectivity but extend to demands for high performance, rapid service recovery, resource efficiency, and the ability to keep services available during disruptions. Research on high availability in Linux container infrastructure indicates that service quality is increasingly determined by the platform's ability to manage service recovery, reduce failed calls, and maintain acceptable data transfer rates and response times under load. Thus, network infrastructure improvements in the current era must be understood as a technical challenge that integrates performance, reliability, and service management into a unified framework [1].

In this landscape, Linux servers occupy a strategic position because they provide a flexible foundation for running, optimizing, and orchestrating various network services. Empirical evidence shows that Linux is not only relevant as a conventional server operating system but also as a medium for deeper architectural optimization. [2], for example, demonstrates that an approach integrating unikernel techniques into Linux can maintain Linux ecosystem compatibility while delivering tangible performance improvements, including a 26% increase in Redis throughput and a 22% reduction in tail latency. In line with this, [3] indicates that the conventional Linux network stack is beginning to face serious bottlenecks at 100 Gbps NICs and above, necessitating a redesign of Linux to meet the demands of modern networks without sacrificing application compatibility. These findings underscore that the importance of Linux servers lies not only in their popularity but in their capacity to be reconfigured and optimized to meet the needs of increasingly complex network infrastructures [2], [3].

However, the effectiveness of Linux servers in enhancing network infrastructure cannot be separated from the competence of the administrators managing them. The Linux environment requires mastery of the text-based interface, an understanding of system architecture, and the ability to perform installation, configuration, and troubleshooting directly. [4] shows that Linux Ubuntu command-line training designed through lectures, demonstrations, hands-on practice, as well as pre-test and post-test evaluations is capable of improving participants' understanding of the Linux terminal and building their readiness to meet the needs of the open-source-based industry. This argument is important because it demonstrates that Linux-based network administration is not merely a matter of software usage, but rather a process of developing technical competencies that must be systematically cultivated from the foundational level.

The urgency of training becomes increasingly clear when Linux is positioned as the foundation for more specialized network services. [5] indicates that training combining Debian installation, virtualization with VirtualBox, and local DNS configuration based on bind9 is capable of guiding participants from an introduction to the operating system to the implementation of operational network services. In this context, training no longer serves merely as an introduction to technology, but as a bridge from Linux literacy to the ability to build core network services. In other words, Linux-based network administration competencies develop most effectively when learning moves from mastering the basics of the system toward the implementation of concrete services that can be functionally tested.

In summary, previous research on implementation shows that Linux servers have been utilized in a wide variety of ways, ranging from execution path optimization, throughput improvement, and tail latency reduction to enhancing availability in container environments. Some studies position Linux as the subject of internal optimization, such as in the development of UKL and the Joyride design, while others position it as the foundation for high-availability service orchestration in Docker Swarm, Kubernetes, and Proxmox [1], [2] [3]. A common finding across these studies is that Linux delivers the best results not in its default state, but when implemented with configurations, architectures, and recovery mechanisms tailored to the characteristics of the workload and services. Therefore, Linux server implementation should be understood as a spectrum of technical strategies, not a single, homogeneous practice.

Meanwhile, a synthesis of research on training topics reveals a consistent pattern: the dominance of a hands-on approach with gradual guidance. [4] emphasizes the

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importance of CLI exercises for building Linux operational literacy, while [5] shows that practice-based training and Q&A sessions can guide participants through the installation of Debian Server and DNS configuration. This pattern confirms that the development of Linux-based network administration competencies is ineffective if it relies solely on conceptual explanations. Conversely, training that provides opportunities for hands-on experimentation, error identification, and the completion of technical tasks has proven to be more suitable for building participants' operational readiness in server and network environments.

In terms of impact, previous research has shown that the implementation of Linux servers has a significant effect on the quality of network infrastructure, both in terms of performance and reliability. [2] demonstrates that internal Linux optimizations can improve throughput and tail latency under real-world server workloads. [3] shows that limitations in the conventional Linux network stack can become a bottleneck for 100 Gbps and higher networks. Meanwhile, [1] indicates that infrastructure quality is also determined by the ability of Linux-based container platforms to restore services, minimize failed calls, and maintain low call times. This means that the impact of Linux servers on network infrastructure is multidimensional: it encompasses not only processing efficiency but also service continuity and operational resilience.

Although these findings enrich our understanding of Linux servers, previous research has tended to remain fragmented across three main areas: Linux server implementation, network administration training, and the impact on network infrastructure. Implementation studies have largely emphasized design and technical optimization; training studies have focused more on participants' skill development; while impact studies have concentrated on service performance, availability, or efficiency. This separation has prevented the formation of a comprehensive synthesis regarding how Linux servers are implemented, how the competencies of their administrators are developed, and how both collectively contribute to the improvement of network infrastructure. In practice, however, the quality of implementation and the quality of training are two interdependent factors that determine the success of Linux-based network management.

Given these circumstances, this systematic review is essential for consolidating the evidence—which has thus far been scattered across these three domains—into a more comprehensive analytical framework. This article aims to comprehensively synthesize findings regarding the implementation of Linux servers, Linux-based network administration training, and their impact on improving network infrastructure. The main contribution of this research is to provide a more holistic understanding of Linux servers, not merely as a technical platform for running services, but also as a subject of learning and a determinant of infrastructure quality. Through this synthesis, it is hoped that a stronger conceptual foundation will be established to explain implementation patterns, the characteristics of effective training, and the most consistent forms of impact on the performance, reliability, and sustainability of modern network infrastructure.

II. MATERIAL AND METHODS

This study employs a systematic review method to identify, select, analyze, and synthesize research findings relevant to the topic of Linux server-based network administration implementation and training in relation to network infrastructure improvement. This approach was chosen because a systematic review allows for the structured collection of scientific evidence, reduces bias in literature selection, and produces a more accountable synthesis compared to a standard narrative review. In the context of this study, the systematic review was used to map research trends, compare the approaches used, and formulate a more integrated understanding of the relationship between Linux server implementation, the development of network administration competencies, and their impact on the quality of network infrastructure [6], [7].

The data sources for this study consist of scientific articles from journals and conference proceedings indexed in Scopus and SINTA, with the selection focused on publications that are substantively relevant to the research theme. The literature search was conducted systematically using a combination of keywords organized around three main topics: Linux server implementation, network administration training, and the impact of Linux server implementation on network infrastructure. This strategy was employed to ensure that the identified literature not only addresses the technical aspects of implementation but also encompasses the learning dimensions and broader infrastructure implications.

TABLE 1.
Research Topic and Keywords

Topic	Keywords
Linux Server Implementation	"Linux server" AND "network implementation"; "Linux server" AND "network configuration"; "Linux-based server" AND "network management"; "open source server" AND "network infrastructure"; "Linux network administration"; "server configuration" AND Linux AND network; "Linux server deployment network"
Network Administration Training	"network administration training" AND Linux; "Linux server training"; "hands-on training" AND network AND Linux; "IT training" AND "network administration"; "learning network administration"; "technical training" AND networking; "education" AND "network administration Linux"
Impact of Network Infrastructure	"Linux server" AND "network performance"; "network performance" AND "Linux-based system"; "network infrastructure" AND Linux; "server performance" AND network AND Linux; "network optimization" AND Linux; "system performance" AND "network server"; "network stability" AND Linux server

The retrieved articles were then selected based on inclusion and exclusion criteria to ensure that the analyzed literature remained aligned with the research focus. The inclusion criteria focused on articles that explicitly discussed Linux servers and networks, whether in terms of implementation, training, or impact on infrastructure.

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Conversely, articles that did not specifically address Linux servers or originated from non-academic sources were excluded from the analysis corpus. The use of these criteria aims to maintain topic consistency while ensuring that the resulting synthesis is derived from relevant publications with a sufficient academic foundation.

TABLE 2.
Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Topic	Related to Linux servers and networking	Not relevant to the topic
Focus	Implementation, training, or infrastructure impact	Does not specifically address Linux servers
Publication type	Scientific article (journal/proceedings)	Non-scientific (blog, opinion)

This research dataset consists of 35 articles that have been classified into three main groups based on their research focus. This grouping was performed so that the analysis process could capture the interrelationships between topics more systematically, while also facilitating the identification of patterns, similarities, and differences in findings across each domain. All of these articles serve as the primary foundation for the synthesis process because they represent three key research pillars: the technical implementation aspects of Linux servers, Linux-based network administration training, and the impact of these implementations on network infrastructure.

TABLE 3.
Dataset Distribution by Topic

Topic	Number of Articles
Linux Server Implementation	15
Network Administration Training	10
Impact of Network Insfrastructure	10

Data analysis was conducted using three complementary approaches: descriptive, comparative, and literature synthesis. The descriptive approach was used to map the general characteristics of each article, such as research focus, implementation environment, type of training, or measured impact indicators. The comparative approach was used to identify similarities and differences among studies, whether at the level of methods, technologies, or reported results. Furthermore, the literature synthesis was conducted by grouping articles based on common themes, approaches, and findings across three main topics, thereby yielding a more integrated understanding of how the implementation and training of Linux-based network administration contribute to the improvement of network infrastructure. With this approach, the systematic review serves not only as a summary of previous research but also as a foundation for formulating conceptual frameworks and directions for more comprehensive future studies [7].

III. RESULTS AND DISCUSSION

A. RESULT

Based on the results of a review and analysis of 35 scientific articles, this study categorizes the findings into three main themes: Linux server implementation (15 articles), Linux-based network administration training (10 articles), and the impact of Linux server implementation on network infrastructure (10 articles). This categorization indicates that studies on Linux servers are developing across three interconnected domains: the technical domain of implementation, the domain of competency development through training, and the domain of evaluating the consequences of Linux server implementation on network infrastructure quality. The results in this section are presented descriptively and with light comparative analysis to highlight general patterns, variations in approaches, and trends in findings from each study group.

TABLE 4.
Summary of the Article on Linux Server Implementation.

No	Author & Year	Implementation Focus	Technology/Tools	Method	Key Findings
1	[8]	Power and network workload management on Linux servers	SmartNIC, CPUFreq, DVFS, Ubuntu 24.04	Implementation experiment	Significant energy savings while maintaining QoS
2	[9]	Linux kernel-based intrusion detection	eBPF, XDP, Snort, Aho–Corasick	Implementation and benchmarking	Detection throughput increased by nearly 3× compared to Snort
3	[10]	Evaluation of distros/kernels for Web API servers	Debian 11/12, kernel 5/6, NGINX, MariaDB, .NET	Comparative deployment and benchmarkin g	Distro-kernel-runtime combinations affect response time, CPU, and RAM
4	[11]	Ransomwar e detection and mitigation on Linux	GuardFS, FUSE, Go, machine learning	Security implementatio n and experiments	Data loss drastically reduced through active file system-based mitigation

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5	[12]	IoT monitoring and control system based on embedded Linux	Raspberry Pi, Node-RED, MQTT, Modbus, Apache	Integrated deployment	Cross-platform monitoring and control running stably
6	[13]	School Network Monitoring and Security	Ubuntu Server 20.04, Grafana, IPTables, Webmin	Manual configuration and NDLC	Monitoring and filtering run with low resource usage
7	[14]	School network management with a proxy	Squid Proxy, Mikrotik, Ubuntu/Linux	Manual deployment and configuration	Access filtering and bandwidth restrictions function as designed
8	[15]	Linux-based optical network	RotorNet, FPGA NIC, PTP, optical rotor switch	Hardware-software co-design	High throughput and low latency on Linux hosts
9	[16]	Analysis of Linux UDP service vulnerabilitie s	Linux kernel 6.6, BIND, Unbound, Nginx, Caddy	Systematic analysis and experimen ts	Many Linux UDP services are vulnerable to availability attacks
10	[17]	Automate d configurat ion and topology verificatio n	Netmiko, Python, SSH, Packet Tracer, GNS3	Automatio n scripts	Reducing manual processes and simplifying network verification
11	[18]	Intent-based control and flow visibility	eBPF/IO Visor, Spark, Elasticsearch, ONOS	Multilayer implementati on	Precise monitoring and successful intent policy translation
12	[19]	Playbook-based network configuration automation	Ansible, YAML, SSH, Cisco IOS-XR	Automated deployment	Successful BGP configuration and backup without errors
13	[20]	Linux server security based on defense-in-depth	LSM, OpenSSH, fail2ban, nftables, ANN	Hardening and integrated design	Offering an AI-based adaptive security model
14	[21]	Edge compute Linux for Cloud-RAN	Linux RT-Kernel, OAI, LXC, SR-IOV, iPerf3	Resource sharing experiments	CPU affinity reduces throughput and latency variability

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15	[22]	Local repository for closed networks	RHEL 8.7, reposync, httpd, HTTPS, firewalld	Staged deployment	Faster and more secure internal package distribution

The findings on implementation show that Linux servers are deployed across a very broad spectrum of services, ranging from application and web/API servers, network security systems, proxies and monitoring, repository servers, container infrastructure, to high-performance network architectures. Variations in implementation are evident not only in the types of services but also in the depth of technical intervention: some studies focus on the deployment and configuration of services such as proxies, monitoring, DNS, or repositories; others delve into the kernel level, resource orchestration, automation, and hardware-assisted networking. Generally, the emerging approaches can be divided into three major patterns: operational configuration/deployment, automation and orchestration, and advanced system optimization.

In terms of methodology, implementation articles are dominated by implementation experiments, comparative deployments, and performance testing based on real-world testbeds. Articles emphasizing operational deployment generally use manual or semi-automatic configurations, while optimization-oriented articles frequently utilize benchmarks, workload testing, and quantitative measurements of latency, throughput, resource usage, or energy efficiency. In general, implementation results show a positive trend: Linux servers are capable of supporting low-cost monitoring and security, configuration automation, more adaptive network control, software distribution efficiency, and performance improvements in specific scenarios such as IDS, Cloud-RAN, or high-speed networking [9], [12], [13], [15], [21].

TABLE 5.
Summary of Network Administration Training Articles.

No	Author & Year	Training Type	Teaching Methods	Tools	Results
1	[23]	Basic network administration training	Hand-on, mentoring	MikroTik RouterOS, WinBox	Improved understanding and configuration skills
2	[24]	Network training and troubleshooting	Theo+ practice + mentoring	LAN networks, VirtualBox, sharing tools	Operational competencies improved, village network operational
3	[25]	Linux installation training for TKJ students	Hands-on practice based on virtualization	Linux Mint, VirtualBox	The majority of participants successfully installed the system and understood virtualization

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4	[4]	Training on basic Linux Ubuntu CLI commands	Lectures, demonstrations, hands-on practice	Ubuntu, CLI terminal	Improved command-line literacy and basic Linux usage
5	[26]	Basic Linux training for high school students	Lectures, Q&A, hands-on practice	General Linux, computer lab	Expanding participants' knowledge and motivation regarding Linux
6	[5]	Training on setting up a local DNS	Step-by-step server lab	Debian, VirtualBox, bind9, dnsutils	Participants will be able to install a server and configure DNS
7	[27]	Virtual laboratory network learning	Virtual lab simulations and experiments	Netkit, UML, Debian, Apache, DHCP	Virtual network services can be built and tested
8	[28]	Network literacy training for vocational high school students	Practical exercises, simulations, discussions	Packet Tracer, GNS3, VirtualBox	Improved network literacy, interest, and confidence
9	[29]	Basic Ubuntu Linux introduction training	Lectures and hands-on installation practice	Ubuntu 22.04 LTS, bootable USB	Improved mastery of installation procedures and familiarity with Linux
10	[30]	Basic Ubuntu training at a training institution	Presentations and group exercises	Ubuntu 22.04 LTS	Participants demonstrate improved understanding of Linux

The results regarding training topics show a predominance of hands-on training, practical workshops, and training based on laboratories or virtual environments. Most training is aimed at vocational high school students, senior high school students, course participants, or non-technical staff, with the depth of the material ranging from basic Linux introduction and CLI mastery to virtualization and the configuration of network services such as DNS. The most commonly used learning approaches are a combination of short lectures, demonstrations, hands-on practice, and mentoring, while the training environments frequently utilize VirtualBox, computer labs, network simulators, and virtual servers [4], [5], [25], [27], [28].

In terms of outcomes, nearly all training articles report an increase in participants' competencies, both in cognitive and practical aspects. Some studies demonstrate measurable improvements in skills through pre-tests and post-tests, while others highlight successful completion of technical tasks, increased participation, or growing interest in networking and Linux. Virtual and simulated environments appear to be important tools for allowing participants to practice without posing high risks to primary systems, while task-based training—such as OS installation, CLI usage, or

DNS configuration—tends to yield more operational learning outcomes [4], [5], [23], [24], [29].

TABLE 6.
Summary of Articles on the Impact of Network Infrastructure.

No	Author & Year	Impact Aspect	Measurement Method	Tools	Findings
1	[31]	Linux OS Performance	Comparative benchmarks	Hardinfo, Geekbench, Phoronix	Performance varies across distributions on CPU, RAM, GPU, SSD
2	[32]	Latency, power, network efficiency	OS-centric workload experiments	DVFS, RAPL, PMCs, Dash	OS tuning can improve tail latency and energy efficiency
3	[33]	Performance observability	Tool validation and overhead analysis	Linux Perf, OpenSBI, CoreMark	Very low-overhead RISC-V performance monitoring
4	[2]	Throughput, tail latency, I/O efficiency	Microbenchmarks and application benchmarks	LEBench, fio, redis-benchmark, perf	Unikernel-style integration increases throughput and reduces latency
5	[34]	Logging, observability, maintainability	Empirical mining study	GumTree, commit analysis, extraction scripts	Extensive but uneven logging that potentially exposes risks
6	[35]	Linux supply chain security	Benchmarking tools and malware datasets	Bandit4Mal, ODB, Packj, VirusTotal, Capslock	Malware detection in Linux distributions remains limited
7	[36]	Jitter, schedulability, response time	Real-time multi-core experiments	cyclictest, oslat, SchedCAT, ftrace	Cross-core interference mitigation significantly reduces jitter
8	[3]	Network throughput and CPU efficiency	Preliminary network stack evaluation	ttcp, epoll, DPDK	The traditional Linux stack lags far behind DPDK at 100 Gbps

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9	[37]	CPU, memory, low-memory resilience	Comparative experiments	stress-ng, htop, vmstat, RAMMap	Ubuntu is more efficient than Windows in terms of processes and memory
10	[1]	Service availability and continuity	Structured HA experiments	CURL, ApacheBench	Docker Swarm excels in recovery time and failed calls

Regarding the topic of impact, the analyzed articles primarily highlight performance, stability, energy and resource efficiency, observability, availability, and infrastructure security. The measurement methods used are quite diverse, ranging from comparative benchmarks across operating systems, kernel and I/O microbenchmarks, network workload testing, measurements of latency, throughput, and response time, to logging analysis and malware detection. In general, the most frequently used metrics are latency, throughput, CPU utilization, RAM/swap usage, tail latency, recovery time, failed calls, and overhead monitoring [1], [2], [3], [32], [36].

The overall findings of this group of articles indicate that Linux server implementations tend to yield positive results when combined with configuration optimization, the selection of an appropriate distribution or stack, and adequate monitoring mechanisms. Several studies demonstrate increased throughput, reduced tail latency, better energy efficiency, and higher resilience to heavy loads or low-memory conditions. At the same time, some articles also highlight that Linux still faces challenges in certain areas, such as the limitations of traditional network stacks for modern NICs, inconsistent logging practices, or weak malware detection mechanisms within the distribution supply chain. Thus, the impact of Linux servers on network infrastructure appears to be multidimensional: positive in terms of efficiency and flexibility, but still requiring proper technical management to optimize their benefits [3], [31], [35], [37].

Overall, the results of this systematic review reveal a general pattern indicating that the three topics are clearly interrelated. The implementation articles demonstrate that Linux servers are capable of supporting various service needs and network orchestration; the training articles demonstrate that competencies for managing Linux servers can be effectively developed through a hands-on approach; while the impact articles demonstrate that the implementation of Linux servers is closely related to improvements in the performance, stability, efficiency, and availability of network infrastructure. Thus, the results of this study indicate that technical implementation, competency building, and impact evaluation are three complementary dimensions in understanding the contribution of Linux servers to the improvement of network infrastructure.

B. Discussion

The results of this systematic review indicate that the growth of Linux-based network infrastructure cannot be explained solely by the existence of Linux technology itself, but rather by the close interrelationship between the quality of technical implementation, the quality of network administration training, and the resulting operational impact. The analyzed studies show that Linux servers serve as a flexible foundation for network services, automation, security, containerization, and performance optimization, while training plays a role in building administrators' capacity to manage such complexities. At the same time, the impact on network infrastructure manifests in various forms, ranging from increased throughput and resource efficiency to enhanced availability and resilience of services [1], [21], [37].

In summary, the quality of Linux server implementations is significantly influenced by the depth of configuration and the alignment of the architecture with service requirements. Implementations that stop at basic deployment tend to yield limited benefits, whereas implementations that leverage automation, orchestration, performance measurement, and kernel or runtime optimization demonstrate more significant results. These findings are evident in studies on network automation, container orchestration, real-time kernels, and network stack redesigns, all of which confirm that Linux servers deliver the best results when treated as an engineerable platform, rather than merely a host operating system [3], [19], [36] This is crucial in modern network management because today's service workloads are increasingly dynamic, distributed, and demand a combination of performance, stability, and recovery speed.

In this context, network administration training plays a strategic role because the successful implementation of Linux servers depends heavily on the competence of their administrators. The prevalence of hands-on models, practical exercises, virtual labs, and task-based learning in training materials indicates that Linux proficiency cannot be effectively developed through a purely theoretical approach. Skills such as command-line usage, system installation, service configuration, and troubleshooting require concrete operational experience. Therefore, the effectiveness of training is determined more by the form of learning experience provided than by the amount of material delivered. Training that takes participants from basic introductions to the completion of real technical tasks has proven to be more effective in producing job readiness and implementation capabilities compared to training that is purely informative [4], [5], [27].

The relationship between implementation and training is then reflected in its impact on network infrastructure. Impact studies show that Linux servers can improve infrastructure quality through various means, such as CPU and memory efficiency, reduced jitter, increased throughput, energy savings, and accelerated service recovery. However, the extent of this impact depends on two factors: the accuracy of the implementation design and the administrator's ability to manage it. In other words, a reliable network infrastructure stems not only from Linux servers implemented technically correctly, but also from administrators who understand how to adjust configurations, monitor performance, and handle disruptions. This is where the three topics converge: sound technical implementation requires administrator competence, effective training strengthens the quality of implementation, and the quality of

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implementation, combined with the administrator's competence, determines the quality of the network infrastructure [1], [2], [32].

In practical terms, these findings imply that institutions, vocational schools, and organizations managing IT infrastructure need to view Linux servers as part of a broader strategy, not merely as a platform choice. Investment in Linux server deployment must be accompanied by investment in training models that are practical, tiered, and closely aligned with real-world work environments. Academically, the results of this review indicate the need for further research that is more integrated between implementation studies, training studies, and impact studies, as these three areas have largely been discussed separately. Thus, the main contribution of this systematic review lies in the assertion that improvements in Linux server-based network infrastructure result from the synergy between technical engineering and human capacity building, rather than from either aspect alone.

IV. CONCLUSION

The conclusions of this systematic review indicate that the implementation of Linux servers plays a significant role in improving network quality through its support for services that are more flexible, efficient, stable, and easily scalable to meet infrastructure needs. On the other hand, Linux-based network administration training has been proven to contribute to improving participants' competencies, particularly in mastering operational skills, service configuration, troubleshooting, and technical readiness in managing network environments. Together, the technical implementation of Linux servers and the strengthening of administrators' competencies form a crucial foundation for improving network infrastructure, in terms of performance, reliability, and sustainable management.

This study confirms that the quality of Linux server-based network infrastructure is determined by the interconnection between three key elements: the quality of technical implementation, administrator competence, and the operational outcomes achieved within the network infrastructure. Thus, infrastructure improvement depends not only on the selection of Linux server technology but also on the administrators' ability to effectively implement, customize, and maintain the system. The main contribution of this study lies in providing an integrated synthesis of three aspects that were previously tended to be examined separately, namely Linux server implementation, network administration training, and their impact on network infrastructure. Therefore, further studies should be directed toward more integrative research so that the relationship between implementation design, training models, and infrastructure quality can be understood more deeply.

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