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RESEARCH ARTICLE **Open Access**

Design and Simulation of a LAN Network for Optimizing IT Infrastructure at SMKS XYZ Depok Using Cisco Packet Tracer

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Abstract: Reliable and efficient computer network connectivity is essential for supporting the performance of applications and services operating within that network. Cisco Packet Tracer is a simulation tool that facilitates the design and testing of computer networks prior to actual implementation, thereby reducing the risk of errors during deployment. This study designs and evaluates two network scenarios utilizing a star topology connected to a single server, aimed at linking computers within a Local Area Network (LAN) at SMKS XYZ Depok. The design focuses on enhancing network stability and connection speed. The simulation results demonstrate that the star topology provides stable and efficient connectivity within the network environment at SMKS XYZ Depok. Additionally, this study assesses network performance in terms of latency, throughput, and reliability, and identifies areas for potential improvement to further optimize network performance. Thus, this research makes a significant contribution to enhancing the quality of the network infrastructure at the educational institution.

Keywords: Computer Networks; Cisco Packet Tracer; Local Area Network (LAN).

1. Introduction

In the contemporary educational landscape, integrating technology into school infrastructure is essential for fostering an effective and efficient learning environment. SMKS XYZ Depok, a prominent educational institution in West Java, has identified the crucial need for a reliable and robust computer network to support its diverse academic and administrative operations. The institution's mission to deliver high-quality education and facilitate seamless communication between students and staff has driven it to initiate the design of a Local Area Network (LAN) utilizing Cisco Packet Tracer software.

Cisco Packet Tracer is a sophisticated simulation tool that offers substantial benefits in the design, configuration, and testing of network topologies within a virtual environment before they are implemented in reality. This tool provides a valuable platform for network engineers and IT professionals to experiment with various network designs, diagnose potential issues, and ensure optimal performance under controlled conditions. By employing Cisco Packet Tracer, SMKS XYZ seeks to construct a network infrastructure that not only fulfills current requirements but is also scalable to accommodate future growth. This approach is supported by findings from multiple studies, which have demonstrated the efficacy of Cisco Packet Tracer in improving student outcomes in computer networking education [1][2]. The deployment of Cisco Packet Tracer within an educational framework, particularly at SMKS XYZ, has been shown to significantly enhance students' mastery of networking concepts. Research suggests that utilizing this tool as a pedagogical medium can lead to marked improvements in student comprehension and overall learning achievements, with some studies reporting a classical completeness rate of up to 86.66% [2]. Additionally, the ability to simulate networks using Cisco Packet Tracer provides students with a more thorough understanding of networking principles, even in the absence of direct access to expensive hardware [4]. This capability is especially critical in educational settings where the availability of hardware resources is often limited, posing challenges to the effective teaching of computer networking (Haryono, 2024).

Moreover, the network design and simulation at SMKS XYZ, carried out using Cisco Packet Tracer, adhere to a structured methodology, specifically the Network Development Life Cycle (NDLC). This methodology includes stages such as analysis, design, and prototype simulation [3][5]. Such a methodical approach ensures that each phase of the network design process is executed with precision, resulting in an infrastructure that is not only efficient but also reliable. Therefore, the implementation of Cisco Packet Tracer at SMKS XYZ serves a dual function: it acts as an instructional tool for students and a means to enhance the school's IT infrastructure, thereby promoting a more effective and efficient educational process [6]0. The project at SMKS XYZ entails the design and assessment of a LAN network utilizing a star topology, centralized around a single server to ensure efficient and centralized resource management. The primary objective is to interconnect various computer systems within the school, thereby improving communication, data sharing, and access to educational resources. Furthermore, the network design is intended to enhance overall stability, speed, and reliability, thereby offering a seamless experience for teaching and learning activities.

This research will provide a detailed account of the methodology and outcomes associated with the network design process, emphasizing the advantages of using Cisco Packet Tracer for pre-implementation testing. The study will also evaluate network performance in terms of latency, throughput, and reliability, while identifying opportunities for improvement. The challenges that prompted SMKS XYZ Depok to adopt this technology include determining whether the implementation of a star topology will enhance efficiency within the school, understanding the positive impacts of the technological upgrade, and addressing concerns related to potential disruptions in internet connectivity. The objectives of this technology implementation are to enhance connectivity and communication by ensuring that all devices at SMKS XYZ Depok are stably and efficiently connected, thereby facilitating smooth communication among staff, teachers, and students. Another goal is to maximize the utilization of network resources by optimizing the distribution and access to resources such as servers, printers, and the internet, making them easily accessible to all users. Additionally, the project aims to create a modern, technology-integrated learning environment by supporting various technology-based learning activities with fast and reliable internet connectivity across the school. The project at SMKS XYZ Depok not only addresses the immediate necessity for a dependable and efficient network but also lays the groundwork for future technological advancements. By leveraging Cisco Packet Tracer, the school can proactively identify and address potential issues during the simulation phase, ensuring a smoother implementation and operation of the network. This forward-thinking approach is anticipated to significantly enhance the overall quality of education at SMKS XYZ Depok by providing a robust IT infrastructure that aligns with the demands of modern educational practices.

A computer network refers to a collection of interconnected computing devices that enable the exchange of data and sharing of resources. These networked devices operate based on system rules known as communication protocols, which facilitate the transmission of information through physical or wireless technologies, and implement specific network topologies. A network topology is the method or structure used to connect one computer to another. By utilizing Cisco Packet Tracer, we can design, simulate, and test various network configurations to ensure the school's IT infrastructure functions optimally. The steps involved in designing and implementing the LAN network at SMKS XYZ Depok are intended to strengthen the school's ability to manage its information technology resources and facilitate modern and efficient teaching and learning activities.

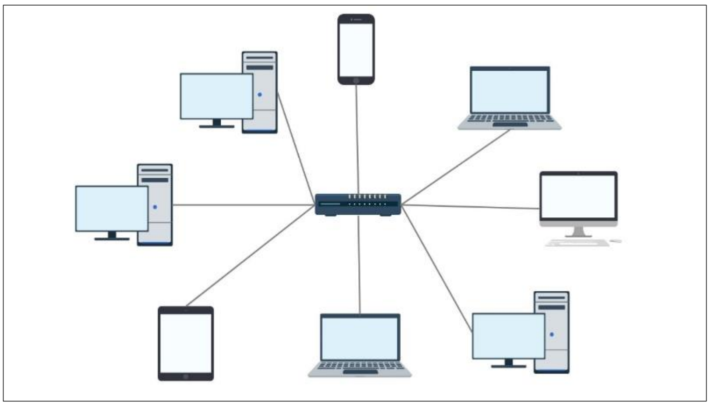


Figure 1. Star Network Topology

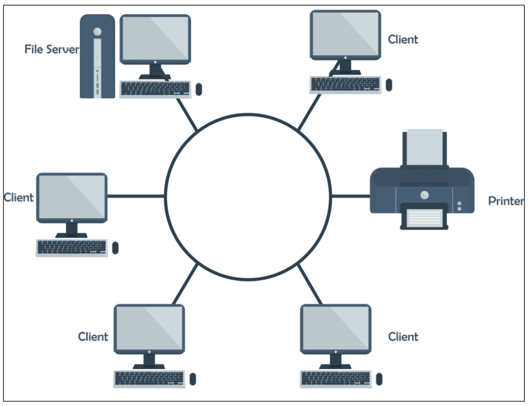


Figure 2. Ring Network Topology

Star topology (Figure 1), often referred to simply as a star network, is a network configuration in which all nodes or users converge at a central point. This topology is categorized as a medium-cost network structure. The main advantages of star topology include its ease of installation and configuration. Each device is connected to a central device (distributor or switch) via individual cables, making the setup straightforward and organized. The simplicity in setup stems from the fact that each device only needs to connect to a hub or switch [8]. Ring topology (Figure 2), also known as a ring network, consists of a series of points where each is connected to two others, forming a circular pathway. In a ring topology, communication can be interrupted if there is a disruption at any single point. The major drawback of this topology is that if one node fails, the entire network may cease to function [9]. Bus topology is one of the earliest forms of network topologies used to connect computers (Figure 3). In this setup, both ends of the network must be terminated with a terminator. The primary disadvantage of this topology is that if the main cable (backbone) experiences a fault, the entire network will be compromised. This is because all devices are connected to the main cable, and if it is severed, there is no alternate path for data to flow [10].

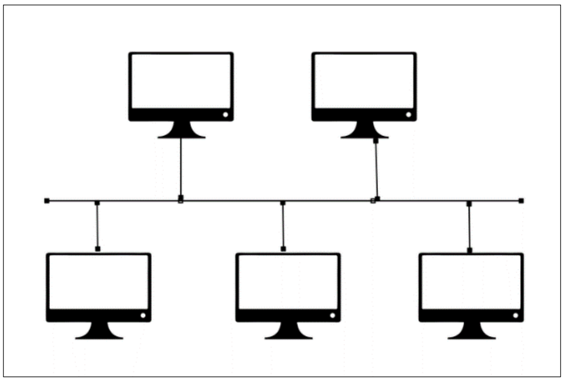


Figure 3. Bus Network Topology

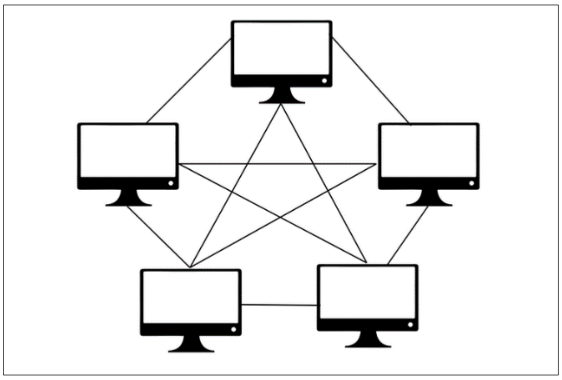


Figure 4. Mesh Network Topology

Mesh topology (Figure 4), or mesh network, involves the interconnection of devices where each device is directly connected to every other device in the network. Consequently, each device in the network can communicate directly with the target device through a dedicated link. The maximum number of connections in a mesh network can be calculated using the formula $\frac{n(n-1)}{2}$, where n represents the number of devices [11]. Tree topology (Figure 4), also known as hierarchical topology, is typically used for interconnecting central systems with different hierarchical levels. Lower levels are represented at lower positions, while higher levels occupy higher positions in the structure. This type of network topology is well-suited for computer network systems requiring multiple levels of nodes. In a tree network, various levels of nodes are connected, forming a hierarchical structure [11].

2. Research Method

This study employs a qualitative research method that focuses on in-depth observation to examine the internet network at SMKS XYZ Depok. This approach allows researchers to engage directly with the research subjects to gain a comprehensive understanding of the social, cultural, and environmental aspects associated with the network. Data was collected through observation, interviews, and literature review. Direct observations were conducted at SMKS XYZ Depok to gather accurate information, while interviews were held with the staff of SMKS XYZ Depok, despite some limitations regarding network confidentiality. Additional data was obtained from books, journals, and related studies. This method is expected to provide a profound understanding of the phenomena being studied.

The research is structured around the Network Development Life Cycle (NDLC) methodology, which includes analysis, design, prototype simulation using Cisco Packet Tracer software, and implementation. In the current digital era, efficient and reliable information technology (IT) infrastructure is crucial for educational institutions, including vocational schools (SMKs). A fundamental aspect of IT infrastructure is the local area network (LAN), which serves as the backbone for communication and data exchange among devices within the school. To achieve this, a systematic and structured approach to network design and implementation is required. The NDLC methodology, encompassing analysis, design, prototype simulation, and implementation, is one such approach that has proven effective in similar settings [1][2].

Cisco Packet Tracer is an advanced simulation tool that plays a pivotal role in supporting the design and testing of network topologies virtually before actual implementation. By using Cisco Packet Tracer, network engineers and IT professionals can design, configure, and test various network designs within a controlled environment, enabling the identification and resolution of potential issues before the actual implementation [3][4]. This tool not only aids in understanding networking concepts but also provides students with the opportunity to practice and develop practical skills required in the workforce [5]. The application of the NDLC methodology in the design and simulation of a LAN using Cisco Packet Tracer aims to create a network infrastructure that not only meets current needs but is also scalable to support future growth and development. Through detailed analysis, careful design, and realistic simulation, the resulting network infrastructure is expected to support more effective and efficient learning processes and improve operational efficiency within the school [6]0. Thus, this research aims to explore and document the process of designing and simulating a LAN at SMKS XYZ using Cisco Packet Tracer, as well as evaluate its impact on optimizing the school's IT infrastructure. The study is expected to make a significant contribution to the development of IT infrastructure in educational institutions and serve as a reference for other schools seeking to enhance their network quality.

2.1. Analysis

The analysis phase is the initial stage in the NDLC methodology, aiming to understand the needs and issues related to the internet network at SMKS XYZ Depok. This phase involves several steps:

1) Data Collection
   Gathering data on user needs, existing network topology, and available network infrastructure. This data can be collected through various methods, such as:
   a. Interviews
      Conducting interviews with the staff of SMKS XYZ Depok, including teachers and administrative staff, to understand their needs and the challenges they face concerning the internet network.
   b. Observation
      Directly observing the usage patterns of the internet network at SMKS XYZ Depok to identify common issues and usage patterns.
   c. Literature Review
      Reviewing relevant literature on computer networks and NDLC methodology to inform the analysis and design process.
2) Data Analysis
   Analyzing the collected data to identify the existing needs and issues. This analysis can be conducted using various methods, such as:
   a. SWOT Analysis
      Identifying the strengths, weaknesses, opportunities, and threats related to the internet network at SMKS XYZ Depok.
   b. Needs Analysis
      Determining user needs related to the internet network, such as internet access, bandwidth, and security requirements.
   c. Gap Analysis
      Identifying gaps between user needs and the current network capabilities to guide the design of improvements.

2.2. Design

The design phase in the NDLC methodology focuses on creating an optimal network architecture that meets the internet needs of SMKS XYZ Depok. This design must consider various factors, including:

1) User Requirements
   The number of users, the types of devices used, and internet usage patterns must all be taken into account.
2) Network Topology
   The physical structure of the network, such as the types of cables, routers, and switches used, needs to be carefully designed.
3) Network Protocols
   The protocols used for communication between devices within the network should be selected to ensure efficient and secure communication.
4) Network Security
   Security mechanisms must be implemented to protect the network from unauthorized access.
5) Network Availability
   Solutions must be devised to ensure the network is always available and accessible to users.

The design phase involves several steps:

1) Data Collection
   Gathering data on user requirements, existing network topology, and available infrastructure.
2) Data Analysis
   Analyzing the collected data to identify needs and problems.
3) Design Creation
   Developing a new network architecture or updating the existing one to meet identified needs.
4) Design Evaluation
   Evaluating the design to ensure it meets the requirements and can be easily implemented.

2.3. Simulation

The simulation phase aims to test the network design before it is implemented in reality. Simulation is conducted using Cisco Packet Tracer software, which allows researchers to create a virtual network model and test its performance. Simulation can assist in:

1) Identifying Problems
   Detecting issues in the network design before it is implemented.
2) Improving the Design
   Refining the network design based on simulation results.
3) Estimating Network Performance
   Predicting the performance of the network once implemented.

2.4. Implementation

The implementation phase is where the network design is translated into a real-world network. This phase involves several steps:

1) Device Installation
   Installing network devices such as routers, switches, and cables.
2) Device Configuration
   Configuring network devices according to the design specifications.
3) Network Testing
   Testing the network to ensure it functions as intended.
4) Network Documentation
   Documenting the network configuration and operational procedures. However, to maintain integrity, security, and confidentiality, all documentation is not included in this research.

2.5. Monitoring

The monitoring phase is aimed at continuously tracking the network’s performance and ensuring that it remains available and accessible to users. Monitoring is conducted using various tools and techniques, such as:

1) Network Management System (NMS)
   Tools used to collect data on network performance.
2) Sniffer Tools
   Tools used to capture and analyze network traffic.
3) Logs
   Logs containing information about network activities.

Through these detailed stages of the NDLC methodology, this research aims to develop a robust and scalable network infrastructure that not only addresses current needs but also anticipates future requirements. By employing Cisco Packet Tracer, potential issues can be identified and resolved during the simulation phase, ensuring a smoother implementation and operation. The ultimate goal is to enhance the educational environment at SMKS XYZ Depok by providing a stable, secure, and efficient network that supports modern learning and administrative functions.

3. Result and Discussion

3.1 Results

3.1.1 Implementation

The implementation of the network topology at SMKS XYZ Depok utilized a star topology, which was simulated using Cisco Packet Tracer to ensure the network's effectiveness and reliability before its actual deployment. The star topology was selected due to its simplicity, ease of troubleshooting, and centralization of network management, which aligns well with the requirements of the school. Based on the information gathered during the planning phase, it was determined that the network would cover ten key areas within the school, each with specific network configurations to support the educational and administrative activities effectively. In the Principal's office, the network setup includes one personal computer (PC) and one wireless router. The wireless router is assigned the IP address 192.168.1.10, while the PC is configured with the IP address 192.168.1.11. This configuration ensures that the Principal's office has a dedicated and secure connection to the school's network, allowing the principal to manage administrative tasks efficiently.

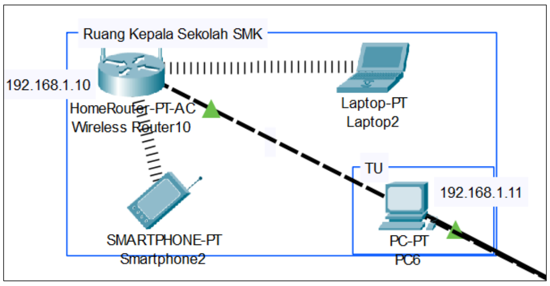


Figure 5. Principal's office network

Table 1. Devices and IP Addresses in the Principal's Office

No	Device	IP Address
1	HomeRouter PT-AC Wireless	192.168.1.10
2	PC	192.168.1.11

Auditorium 1 is equipped with a HomeRouter PT-AC Wireless to provide Wi-Fi access for students during events or gatherings. The router for this area is assigned the IP address 192.168.1.30, ensuring consistent network availability during use.

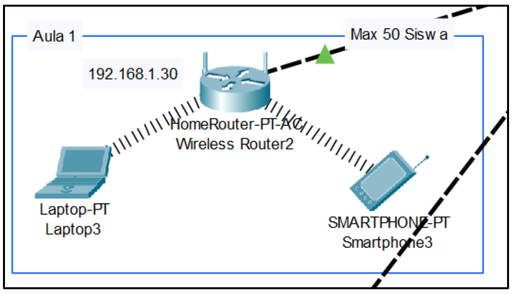


Figure 6. Hall Network 1

Table 2. Devices and IP Addresses in Auditorium 1

No	Device	IP Address
1	HomeRouter PT-AC Wireless	192.168.1.30

Similar to Auditorium 1, Auditorium 2 is also equipped with a HomeRouter PT-AC Wireless to provide Wi-Fi connectivity. The router here is assigned the IP address 192.168.1.40, offering a stable and managed network environment for various school activities.

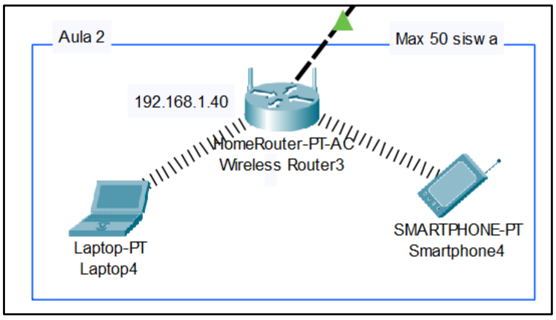
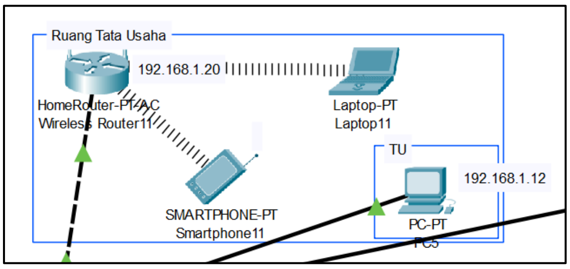


Figure 7. Hall Network 2

Table 3. Devices and IP Addresses in Auditorium 2

No	Device	IP Address
1	HomeRouter PT-AC Wireless	192.168.1.40

The Administrative Office is outfitted with one HomeRouter PT-AC Wireless and a personal computer. The router has the IP address 192.168.1.20, and the PC is configured with the IP address 192.168.1.12. This setup ensures that the administrative staff can perform their tasks with reliable internet access.



Gambar 8. Jaringan untuk Ruangan Tata Usaha

Table 4. Devices and IP Addresses in Administrative Office

No	Device	IP Address
1	HomeRouter PT-AC Wireless	192.168.1.20
2	PC	192.168.1.12

Laboratory 3 is equipped with two HomeRouter PT-AC Wireless routers, both connected to a central switch to manage multiple connections efficiently. The routers are assigned the IP addresses 192.168.3.3 and 192.168.3.4, ensuring stable connectivity for lab activities that require internet access.

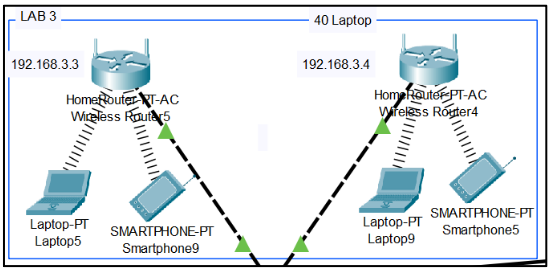


Figure 9. Lab Room Network 3

Table 5. Devices and IP Addresses in Laboratory 3

No	Device	IP Address
1	HomeRouter PT-AC Wireless	192.168.3.3
2	HomeRouter PT-AC Wireless	192.168.3.4

In the classrooms, three HomeRouter PT-AC Wireless routers are connected to two switches, ensuring broad coverage and consistent connectivity across multiple classrooms. The routers are assigned IP addresses 192.168.6.2, 192.168.5.3, and 192.168.5.2, providing uninterrupted internet access for educational activities.

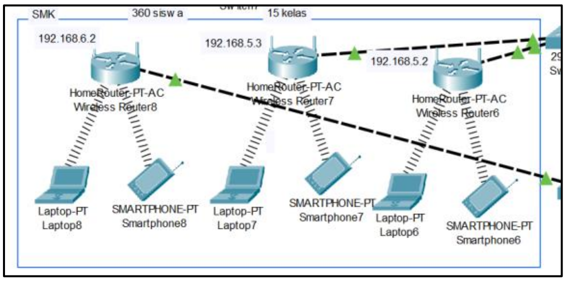


Figure 10. Student Study Room

Table 6. Devices and IP Addresses in Classrooms

No	Device	IP Address
1	HomeRouter PT-AC Wireless	192.168.6.2
2	HomeRouter PT-AC Wireless	192.168.5.3
3	HomeRouter PT-AC Wireless	192.168.5.2

The IT Room houses a server connected to the public network, with the IP address 192.168.1.10. This server serves as a central hub for managing the school's IT resources, ensuring that all networked devices are properly maintained and monitored.

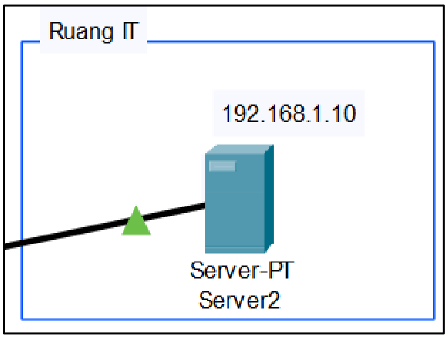


Figure 11. Network in IT Room

Table 7. Devices and IP Addresses in IT Room

No	Device	IP Address
1	Server	192.168.1.10

The Library is equipped with one HomeRouter PT-AC Wireless, which is connected to a switch. The router is assigned the IP address 192.168.7.2, providing stable internet access for students and staff accessing digital resources in the library.

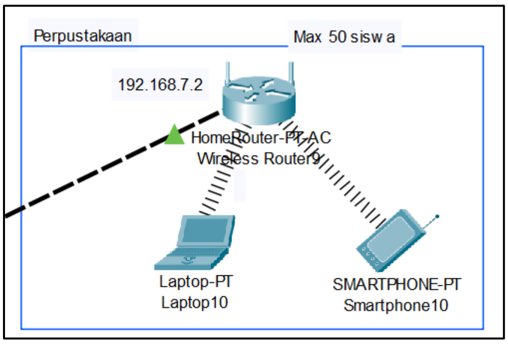


Figure 12. Network in the Library

Table 8. Devices and IP Addresses in Library

No	Device	IP Address
1	HomeRouter PT-AC Wireless	192.168.7.2

Laboratory 1 contains 40 personal computers connected to a switch. Each computer is assigned a unique IP address ranging from 192.168.7.13 to 192.168.7.53. This configuration allows efficient network communication and access to shared resources within the lab.

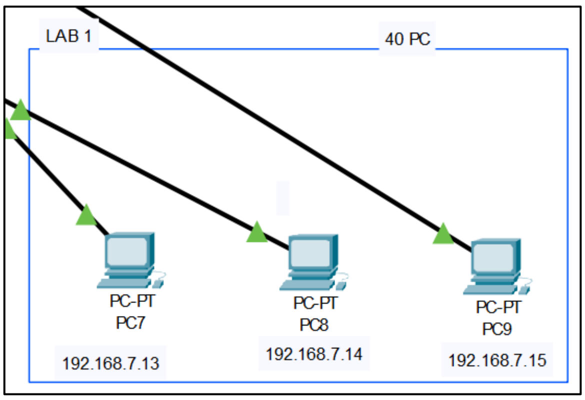


Figure 13. Laboratory Network 1

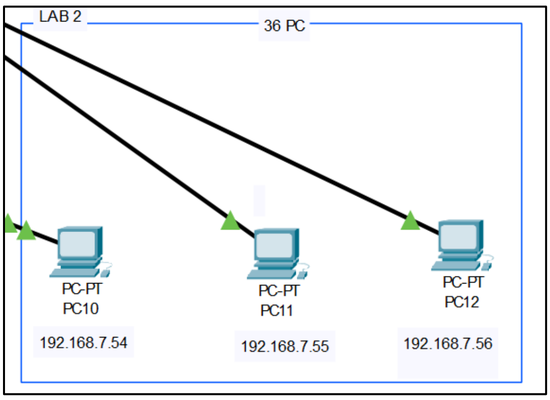


Figure 14. Laboratory Network 2

Table 9. Devices and IP Addresses in Laboratory 1

No	Device	IP Address
1	PC 1	192.168.7.13
2	PC 2	192.168.7.14
3	PC 3	192.168.7.15
..	..	..
40	PC 40	192.168.7.53

Similarly, Laboratory 2 contains 36 personal computers, each connected to a switch. The IP addresses for these computers range from 192.168.7.54 to 192.168.7.90, ensuring efficient network communication and data exchange within the laboratory.

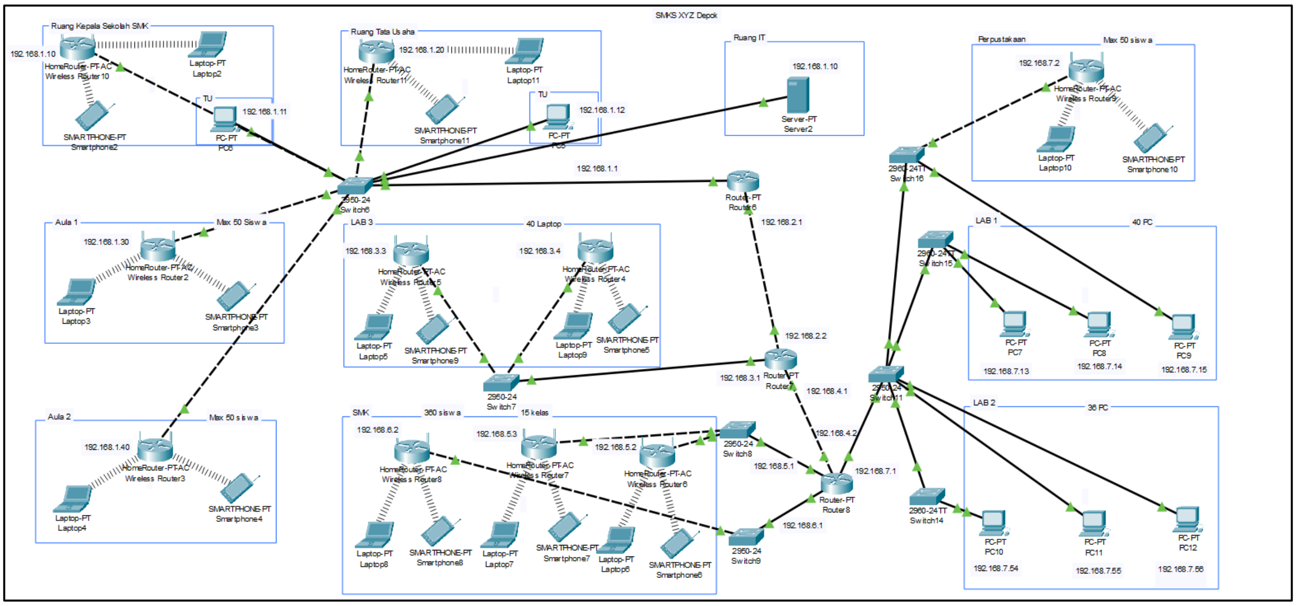


Figure 15. Full network for SMKS XYZ Depok

Table 10. Devices and IP Addresses in Laboratory 2

No	Device	IP Address
1	PC 41	192.168.7.54
2	PC 42	192.168.7.55
3	PC 43	192.168.7.56
..	..	..
36	PC 77	192.168.7.90

The network implemented across these ten areas follows the star topology, where all devices are connected to a central switch or hub, providing a stable and efficient network infrastructure. This topology is advantageous for SMKS XYZ Depok as it simplifies network management and enhances troubleshooting processes. The overall network configuration is shown below.

3.1.2 Testing Results

Following the implementation, the network was rigorously tested using Cisco Packet Tracer. This involved sending packets between various devices within the network to verify connectivity and functionality. For example, a successful message transmission from PC9 to PC7 was recorded, indicating that the network is functioning as intended.

Table 11. Packet Transmission Test Results

No	Source	Destination	Result
1	PC9	PC7	Success
2	PC7	PC9	Success
3	PC10	PC9	Success

These tests confirm that the network is ready to support the daily operations at SMKS XYZ Depok, providing reliable and efficient connectivity across all key areas. The successful implementation and testing of the network demonstrate its robustness, ensuring that the school can deliver educational and administrative services effectively. The use of a star topology has proven beneficial in achieving these objectives, making the network easier to manage and maintain over time.

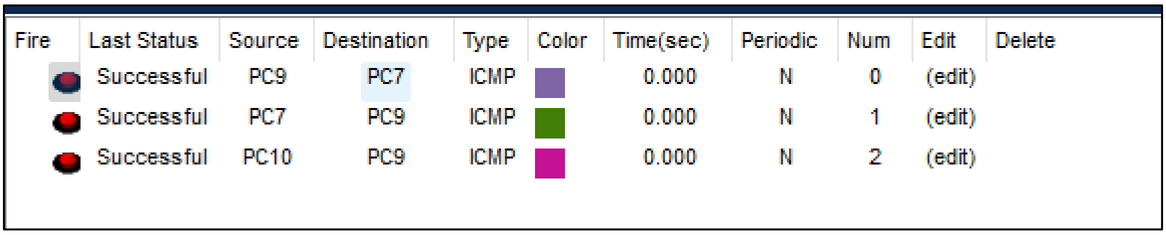


Figure 16. Packet Delivery Status

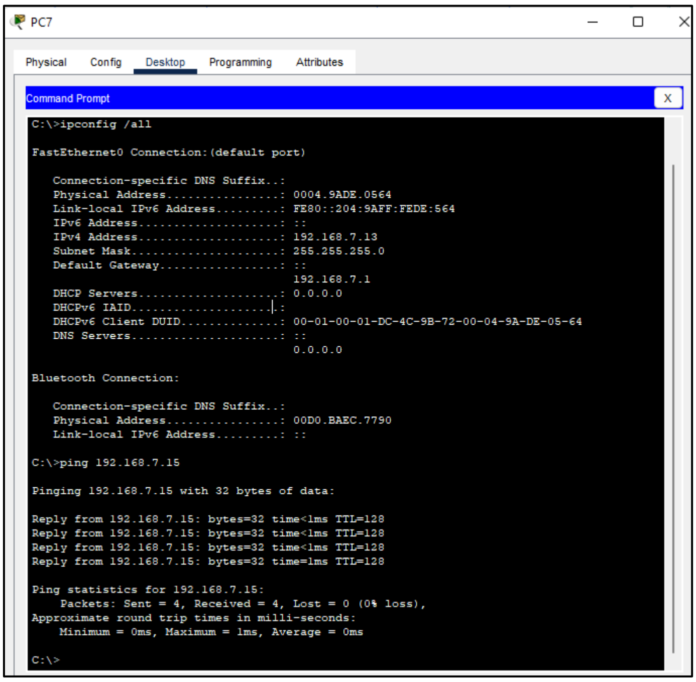


Figure 17. Test using terminal (console) from PC7 to PC9

3.2 Discussion

The implementation of the star topology network at SMKS XYZ Depok presents several significant advantages and considerations that are crucial for the institution's IT infrastructure. The decision to use a star topology was driven by its inherent benefits, such as ease of management, centralized control, and fault isolation, which are essential in an educational environment where reliable and efficient connectivity is paramount. One of the most notable advantages of the star topology is its centralized structure. In this configuration, all devices are connected to a central hub or switch, making network management more straightforward. This centralization allows for easier monitoring and control of the network, as any changes or issues can be addressed at a single point, reducing the complexity of network management. For instance, if a single device or connection fails, it does not affect the rest of the network, as the other devices can continue to communicate through the central hub. This feature is particularly beneficial in a school setting where minimizing downtime is critical for maintaining the continuity of educational activities.

Moreover, the star topology enhances network performance by reducing data collisions. Since each device is independently connected to the central switch, data packets do not compete for a shared communication line, which is a common issue in bus or ring topologies. This reduction in data collisions results in faster data transfer rates and more reliable communication, which is essential for supporting the various academic and administrative tasks at SMKS XYZ Depok. The ability to add new devices without disrupting the network also provides scalability, allowing the school to expand its network infrastructure as needed without significant reconfiguration.

However, the implementation of a star topology is not without its challenges. The reliance on a central hub or switch means that the entire network's functionality depends on this critical component. If the central hub fails, the entire network could be brought down, leading to significant disruptions. Therefore, it is essential to ensure that the central hub or switch is robust, with redundancy measures in place, such as backup power supplies or a secondary hub, to mitigate the risk of network failure. Another consideration is the cost associated with cabling and installation. Star topology requires more cabling than other topologies, as each device needs its own cable to connect to the central hub. This can increase the overall cost of network deployment, especially in a large environment like SMKS XYZ Depok, where multiple rooms and devices are connected. However, the benefits of improved performance and ease of management often justify these initial costs.

The testing phase of the network implementation provided valuable insights into the network's performance. The use of Cisco Packet Tracer to simulate and test the network ensured that potential issues were identified and addressed before the actual deployment. The successful transmission of data packets between various devices, as demonstrated in the test results, indicates that the network is functioning as expected, with no significant delays or data loss. The detailed results from the packet transmission tests, such as the successful communication between PC9 and PC7, confirm that the network infrastructure supports reliable data exchange across the school. This reliability is crucial in an educational setting, where timely access to digital resources and communication tools can significantly impact the learning experience. Furthermore, the successful test results validate the design and implementation process, providing confidence that the network will continue to perform well under the school's operational demands.

The successful implementation of the star topology at SMKS XYZ Depok has several positive implications for the school's future IT infrastructure. The network's robustness and reliability ensure that the school can support current and future digital learning initiatives, such as online learning platforms, digital libraries, and administrative automation. The network's scalability also means that the school can easily integrate new technologies or expand its facilities without significant rework, ensuring that the infrastructure remains future-proof. Additionally, the ease of network management and troubleshooting will reduce the workload on IT staff, allowing them to focus on more strategic tasks, such as further improving the school's digital capabilities or supporting innovative teaching methods that rely on technology. The implementation of a star topology at SMKS XYZ Depok has successfully met the school's needs for a reliable, efficient, and manageable network infrastructure. While there are challenges associated with the initial setup and the potential risks related to central hub dependency, the benefits of improved performance, scalability, and ease of management outweigh these concerns. The successful testing phase further demonstrates the network's readiness to support the school's educational and administrative functions, providing a solid foundation for future technological advancements at SMKS XYZ Depok.

4. Related Work

Research on internet networks in educational institutions, particularly at SMKS XYZ Depok, reveals that while the current network infrastructure successfully connects various devices, there are challenges in publicly testing the network due to confidentiality concerns. This aligns with findings by Zhan et al. (2022), which emphasize that quality internet access can significantly enhance the quality of life and education [12]. However, they also underscore the importance of proper testing and evaluation to ensure network effectiveness. In this context, the use of simulation tools like Cisco Packet Tracer becomes highly relevant. Herawati and Adelia (2019) explain that Cisco Packet Tracer can be used to simulate various network configurations, including the setup of Virtual Local Area Networks (VLANs), which aid in managing and testing networks without compromising data confidentiality [13].

Further supporting this, research by Rashid et al. (2019) highlights that network simulation using Cisco Packet Tracer can significantly enhance students' understanding of networking concepts. This improvement in comprehension directly contributes to better educational outcomes in schools. Rashid and colleagues argue that simulations provide a safe environment for students to experiment with and explore different network setups, allowing them to gain practical experience that is essential for mastering complex concepts [14]. This pedagogical advantage is crucial in vocational settings, such as SMKS XYZ Depok, where hands-on learning is a key component of the curriculum. Allison (2022) extends this argument by emphasizing that the use of Cisco Packet Tracer in education not only aids in teaching networking concepts but also provides students with opportunities to conduct in-depth experiments and simulations [15]. This experiential learning is vital in practice-based education, enabling students to bridge the gap between theoretical knowledge and practical application. Allison’s research suggests that such tools are indispensable in preparing students for real-world IT challenges, thereby aligning well with the educational goals of SMKS XYZ Depok.

Moreover, Kumar et al. (2023) argue that educational institutions can design and implement more efficient network systems by using simulation tools. These tools enable institutions to optimize their network infrastructure, leading to improved information access and communication within the school environment [16]. The research highlights the potential for simulation tools to enhance not just the technical aspects of network management but also the overall educational experience by ensuring that students and staff have reliable access to digital resources. A well-implemented network supports better access to information, communication, and educational resources, which in turn, improves the overall quality of education. Their findings are in line with the objectives of the research conducted at SMKS XYZ Depok, which aims to improve the quality of its internet network to better support the school's educational process. The related research highlights the critical role that simulation tools like Cisco Packet Tracer play in both educational and technical contexts. By enabling detailed network design, testing, and evaluation, these tools help educational institutions like SMKS XYZ Depok improve their network infrastructures while simultaneously enhancing the learning experience. The integration of such tools into the school’s IT strategy not only addresses current networking challenges but also prepares the institution for future technological advancements, thereby supporting its mission to deliver high-quality education.

5. Conclusion

The findings of this study indicate that the current internet network at SMKS XYZ Depok is effectively connected across various devices. However, due to confidentiality concerns, public testing of the network is not permitted, which limits the ability to conduct comprehensive testing. This suggests that while the network infrastructure is in place, there are challenges in ensuring that it has been optimally tested under various potential scenarios. This research is expected to significantly contribute to SMKS XYZ Depok’s efforts to improve the quality of its internet network. By enhancing and thoroughly testing the network, it is anticipated that access to information, communication, and educational resources within the school will become more efficient and effective. These improvements will not only support the smooth daily operations of the school but also directly contribute to the enhancement of the educational quality provided to students. Therefore, a high-quality network at SMKS XYZ Depok will serve as a crucial foundation in supporting a more effective and relevant teaching and learning process, aligned with the demands of the modern era.

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