



## Analysis and Implementation of Computer Network at PT XYZ to Improve the Efficiency of Interdepartmental Communication

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### ARTICLE INFO

*Keywords:* Computer Networking, Data Communication, Cisco Packet Tracer, Network Efficiency, Topology Design

*Received :* 3, January

*Revised :* 17, January

*Accepted:* 31, January

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### ABSTRACT

In the era of modern technology, the development of communication and computer networks plays an important role in supporting the efficiency and productivity of the company. This research was conducted at PT XYZ, which currently faces several obstacles in the available communication network. This research aims to design and analyze a more effective and efficient communication system and computer network to increase company productivity. The research method used is descriptive qualitative, with systematic steps in understanding empirical phenomena related to computer networks. The network design process is done through simulation using Cisco Packet Tracer, which allows testing the network topology before real implementation, thus reducing costs and risk of damage. The results show that the designed network design can overcome the existing communication constraints at PT XYZ. The simulation ensures that the network device configuration is running optimally, characterized by successful ping results and satisfactory connectivity testing. The use of Cisco Packet Tracer in this research helps in visualizing the network topology, simplifying analysis, and ensuring configuration according to company needs.

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## INTRODUCTION

Communication technology is currently developing rapidly along with the development of modern society which has high mobility, flexibility, ease, and efficiency in various fields so that the need for information and communication increases. The role of all parties is a driving force for the growth and development of information technology that is utilized. designed in a network and data communication system to support the exchange of information quickly, precisely, and safely. (Handika and Riadi 2014) The merging of computer systems using information technology and telecommunications greatly affects computing tasks. The merger affects the computing task of each computer into a computer network to communicate in carrying out tasks. The research conducted took place at PT XYZ, where the communication network currently available still has some shortcomings. The research conducted is expected to facilitate communication between departments at work so as to increase company productivity.

## THEORETICAL REVIEW

The objectives in this study are as follows:

1. Design the network and data communication system at XYZ.
2. Analyze the design of the proposed network and communication system by concluding a comparison of the results.

### *Data Communication*

Data communication is an important part of an information system because it supports the provision of infrastructure that allows computers to communicate with each other (Nencioni and Karstad 2020) Data communication can run well if it refers to the rules or standards recommended by the main international body that regulates it. Data communication is a fairly important element because data communication provides an infrastructure that allows communication between devices or tools. The data in question are electromagnetic signals generated by the data source which are then received and sent to the receiving device. In order for data to be communicated properly, the communication model must be fulfilled. The communication model in communication consists of the following things, namely

1. Source, generating data to be transmitted.
2. Transmitter, functions to convert data into signals that can be transmitted.
3. Transmission System, in charge of carrying data
4. Receiver, functions to convert received signals into data.

5. Destination, the final data destination or data retrieval.

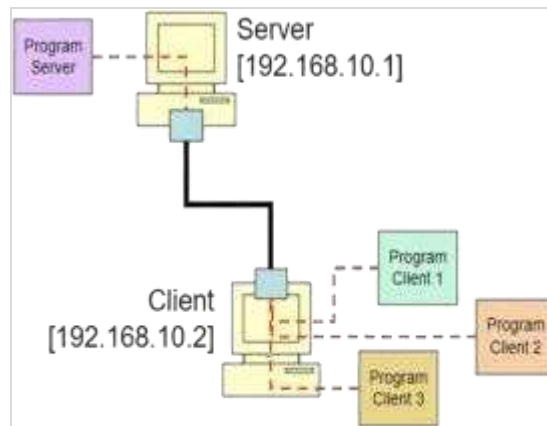


Fig.1 data communication

A computer network is a collection of computers, printers, and other equipment that are connected and interconnected so that they can communicate information using various transmission media (Binanto, 2007).. A form of network model that provides a framework for network communication. TCP/IP is a combination of two terms, TCP stands for Transmission Control Protocol and IP stands for Internet Protocol. The use of the term TCP/IP is often interpreted as a communication protocol for data transmission (data transport). So TCP/IP is a collection of protocols built so that all computers of various sizes, from different computer vendors and running with different operating Sistem dapat berkomunikasi satu sama lain (Widodo 2015). TCP/IP adalah bahasa Internet, tetapi sebenarnya hanya dua protocol. Tidak seperti yang dipikirkan sebagian besar orang, TCP/IP mengacu pada sekumpulan protokol yang dirancang untuk mengirimkan data melalui jaringan. But in everyday life TCP/IP is combined as such, because TCP/IP work closely with each other (Harahap, Badruzzaman, and Fajar 2007)). While the reference OSI model consists of seven layers, the reference TCP/IP model consists of only four layers, which can be compared to the OSI model. There are similarities and differences in functions.

Table 1. TCP IP Model Layer

TCP/IP Model	OSI Model	Protocol
Process / Application	Application / Presentation / Session	Telnet, FTP, SMTP, Karberos, DNS, TFTP, SNMP, NFS, X Windows
Host to Host	Transport	UDP, TCP
Internet	Network	IP, ARP, RARP, ICMP, BootP
Network Access	Physical Data Link	Ethernet, Token Ring, FDDI

**Concentrator (Swicth)**

A switch or concentrator is a hardware device with many ports that will connect several points (nodes) in a computer network (Soewito and Santoso 2012). A hub has a few shortcomings in terms of transmission technology, which

is that it will broadcast all packets to be sent to one destination IP. These words are often heard on computer networks, and the shape of these two tools is similar to each other. Salah satu kendala non-switched Ethernet adalah bahwa hanya satu device dapat mengirimkan data ke sebuah segmen pada waktu tertentu.

### ***Router***

A router is a device that uses a process called routing to rout data packets through a network or the Internet to their destination. This process takes place at layer 3 of the open system interconnection. Routers berfungsi sebagai penghubung antara dua atau lebih jaringan, memungkinkan pengiriman data dari satu jaringan ke jaringan lainnya. Routers differ from switches in that they connect multiple devices to form a Local Area Network (LAN). A road is the link between roads, which is how routers and switches differ (Noor Asyikin et al., 2013). Each house on the street has an address in a certain order, just like switches connect various devices, where each device has an address its own IP address on a LAN. Routers based on TCP/IP protocol technology are very common in networks, and that type of router is also called an IP Router. Beyond the IP Router, there are also AppleTalk Routers, and many other types of routers. Routers juga dapat digunakan untuk menghubungkan LAN ke telecommunications services seperti leased line telecommunications atau Digital Subscriber Line (DSL). Mereka juga dapat digunakan untuk menghubungkan banyak small networks ke a larger network, yang disebut internetwork, atau untuk membagi a large network menjadi beberapa subnetworks untuk meningkatkan kinerja dan memudahkan manajemen.

### ***Subnetting***

Subnetmask is an English information technology term that refers to a 32-bit binary number used to distinguish the network ID from the host ID and indicate the location of a host, whether it is on a local network or an outside network (Noor Asyikin et al. 2013)The use of a subnetmask is also referred to as an address mask as a 32-bit value used to distinguish the network identifier from the host identifier in an IP address. A subnetmask is usually expressed in dotted decimal notation, just like an IP address(Sinuraya and Sembiring 2014). After all bits are set as part of the network identifier and host identifier, the resulting 32-bit value is converted to dotted decimal notation. It should be noted that although represented as dotted decimal notation, a subnetmask is not an IP address. The default subnetmask is based on IP address classes and is used in TCP/IP networks that are not divided into subnets.

## **METHODOLOGY**

Based on the background that has been stated, the problem formulation is How to design and implement a computer network in accordance with network criteria and network efficiency at PT XYZ. The research method used in this research is descriptive qualitative where qualitative data is descriptive data in the form of numerical symbols(Siahaan et al. 2023). Qualitative data is carried out to understand empirical phenomena that are focused on finding as many descriptions as possible

without detailing the relationship between variables carried out in several stages.

## RESULTS AND DISCUSSION

Packet Tracer is a Cisco network equipment simulator that is often used as a medium of learning and training, and also in the field of computer network simulation research (Siahaan et al. 2023) Advantages and Capabilities of Cisco Packet Tracer. The function of Cisco Packet Tracer is to design a system or network topology that will be applied in the real world, if we create a computer network topology without the help of this application it usually costs a very expensive fee

*Advantages of Cisco Packet Tracer:* - Can increase individual creativity because learning is done alone, - Allows students to express ideas or ideas well and systematically, - Can reduce the large costs of doing network creation activities, - Learning will be more interesting because the media used is visual or image, - Can design a network topology easily and the placement of network devices can be arranged and determined properly.

*Disadvantages of Cisco Packet Tracer:* - To train the flow of students' ability to learn through media is very difficult, - The media displayed is sometimes difficult for students to understand, - The media displayed has limited physical components, - The problems posed are sometimes not in accordance with the students' reasoning power, - Must require high concentration, while students are invited to full concentration or totality.

Each device is connected using the appropriate type of cable. To create a network configuration, you should first determine the types of devices used, how many there are and what the network configuration looks like. The types of connecting cables are determined based on the following rules: - To connect different devices, use straight-through UTP cables, such as the connection between: Router-Switch, Router-Hub, PC-Switch, PC-Hub. - To connect the same device, use a cross-over UTP cable, such as: Router-PC, Router-PC, Switch-Switch, Switch-Hub. - To configure a Router through a PC, use a roll-over cable. Figure 2 illustrates the connection between devices with different cable types:

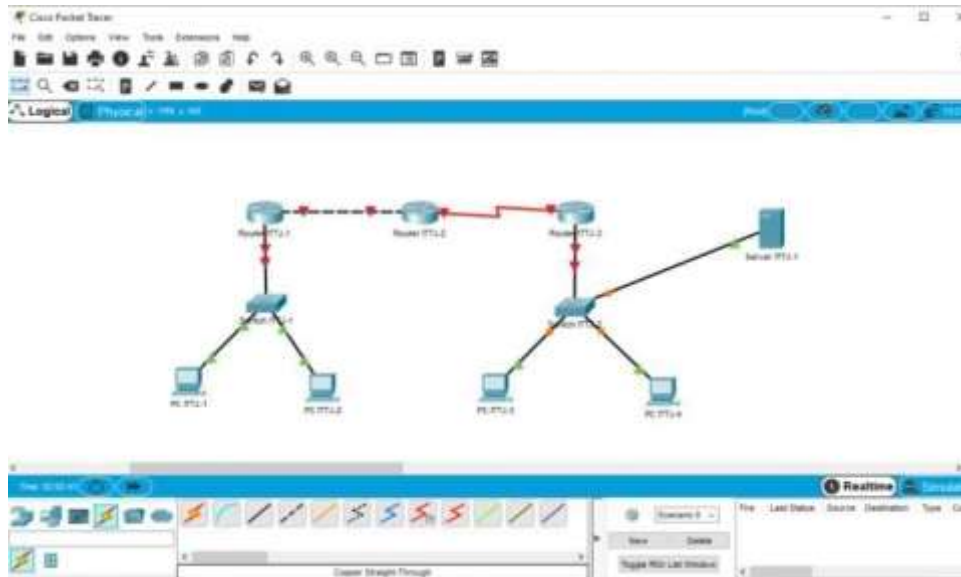


Figure.2 Network Simulation

The next step is to configure each device. The configuration process on each device is required to enable the function of the device. The configuration process includes giving the IP Address and subset mask on the interface of the device (on the Router, PC or Server), giving the Routing Table (on the Router), giving name labels and so on. After the configuration process is carried out, the red circle on the cable connected to the device turns green. There are 2 configuration modes that can be done: GUI mode (Config mode) and CLI mode (Command Line Interface). An example of configuration with GUI mode is shown in Figure 3.

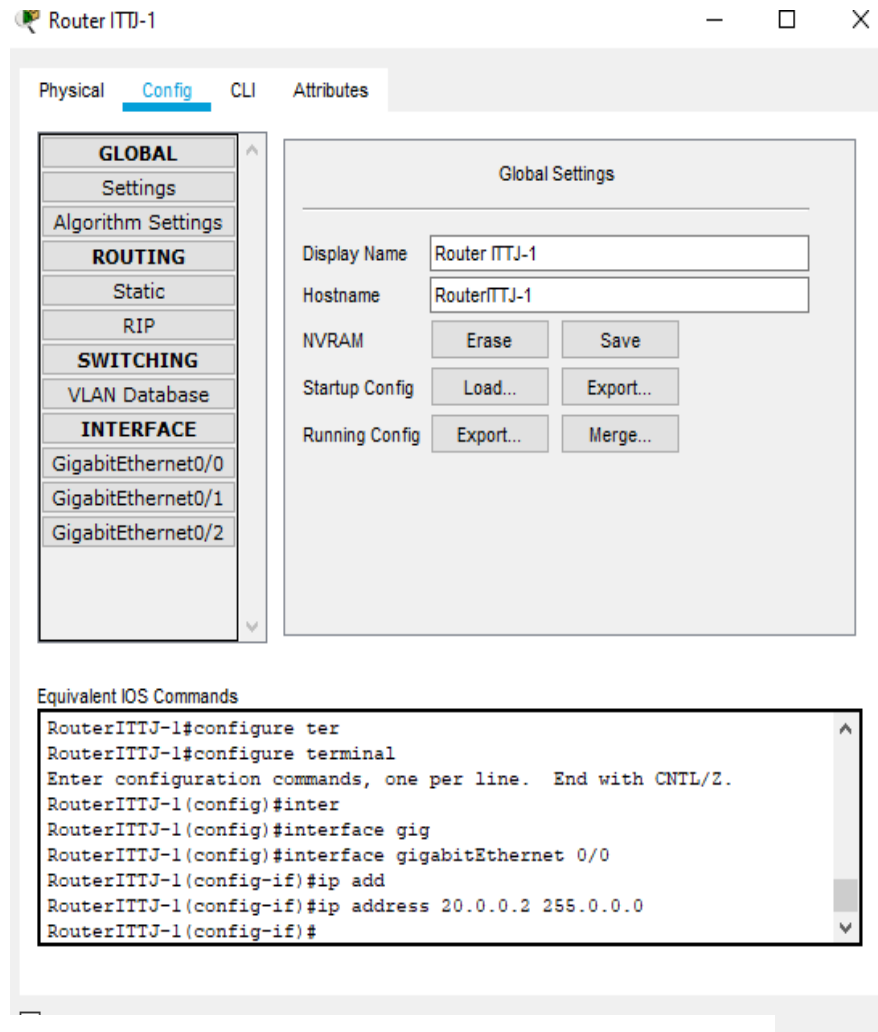


Fig.3 GUI Mode Configuration

Simulation is used to determine whether the network that has been created can run well or not. Before running this process, make sure that the devices are connected correctly, namely with the ping command to the destination device.

Example: from a device with IP address 20.0.0.2 ping the destination device 20.0.0.3. Ping 20.0.0.3

If the connection is good, the following reply will appear:

```
RouterITTJ-1#ping 20.0.0.3 Type escape sequence to
abort. Sending 5, 100-byte ICMP Echos to 20.0.0.3,
timeout is 2 seconds:
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max= 0/0/1 ms
```

## CONCLUSIONS

The need for computer network information is so important, especially network administrators need a Network Monitoring System application for simulations that can reflect the architecture of computer networks on the network system used. By using the Cisco Packet Tracer software application, simulated data about the network can be utilized into information about the

connection state of a computer in network, so that it can be used to detect computer network damage quickly, easily, and cheaply. The application of the socket programming concept in a network is able to limit the client to the server which aims to prevent data communication to clients that are not verified by the server so that data communication security occurs only with clients that have been verified by the server.

## RECOMMENDATIONS

### 1. Applying the Socket Programming Concept for Security

Socket programming allows restricting client access to the server, so that only verified clients can communicate with the server.

This concept is essential to prevent unauthorized access and protect data from potential security threats.

### 2. Develop an Integrated Network Monitoring System

Network administrators can consider developing a network monitoring system that is integrated with Cisco Packet Tracer and implements the concept of socket programming. This system will provide better visibility into network performance and improve the security of data communications.

### 3. Training and Documentation

Ensure that network administrators are well trained in using Cisco Packet Tracer and understand socket programming concepts.

Complete documentation of network configuration and monitoring procedures is also important to facilitate maintenance and troubleshooting.

## FURTHER STUDY

### a. Network Performance Evaluation with Different Parameters

Study: Conducting network simulations with various parameters such as bandwidth, latency, and different types of data traffic to evaluate network performance under different conditions.

Objective: Understand how these factors affect network performance and identify potential bottlenecks or other issues.

### b. Development of a More Advanced Network Monitoring System

Study: Develop a network monitoring system that not only monitors connectivity, but also other performance metrics such as CPU, memory, and disk usage on network devices.

Objective: Provide more comprehensive visibility into network health and performance.

### c. Integration with Other Network Monitoring Technologies

Study: Investigate how Cisco Packet Tracer can be integrated with other network monitoring technologies such as SNMP (Simple Network Management Protocol) or NetFlow.

Objective: Enable greater information exchange between various network monitoring tools.

### d. Further Application of Network Security

Study: Learn more advanced network security techniques such as firewall, intrusion detection system (IDS), and VPN (Virtual Private Network) to be implemented in network simulations.

Objective: Improve understanding of how to protect the network from various security threats.

e. Implementation Case Study in Real Environment

Study: Conduct a case study on the application of socket programming concepts and network monitoring systems in a real network environment.

Objective: To gain practical insight into the challenges and benefits of implementing these technologies in a real-world scenario.

f. Comparison with Other Network Simulation Tools

Study: Comparing Cisco Packet Tracer with other network simulation tools such as GNS3 or Mininet.

Objective: Understand the advantages and disadvantages of each tool to choose the one that best suits the needs.

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