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Analysis and Design of Cisco Packet Tracer Interconnections Between Autonomous Systems (AS) Using the Border Gateway Protocol at Campus 3 Khairun University

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Abstract. The purpose of the research is to analyze and design Autonomous System (AS) Interconnection using Border Gateway Protocol (BGP) at Campus 3, Khairun University. AS itself is an entity that plays an important role in a computer network consisting of several interconnected networks. BGP is a routing protocol used to exchange routing information between different ASes. The research methodology used includes a literature review to understand the concepts and basic principles of BGP and the relationship between ASes. Cisco Packet Tracer was later used as a simulation tool to design and implement interconnection scenarios between ASes at Campus 3, Khairun University. Analysis was conducted on network performance related to inter-AS connectivity, including latency, data transfer rate, and reliability. In addition, security aspects are also assessed to ensure the inter-AS connection at Campus 3, Khairun University is secure against cybersecurity attacks and threats. The results of this research will provide a better understanding of the relationship between AS and BGP implementation in a campus context. In addition, this research can also provide recommendations for improvements or enhancements to improve the performance and security of inter-AS connections at Campus 3 of Khairun University.

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1 Introduction

In today's digital era, computer networks are an important aspect of running a business and daily activities. The rapid development of computer networks today must be balanced with good data communication mechanisms. As a basic principle in data communication that the data sent must be received by the destination computer in the shortest time possible.[1] One of the most commonly used types of computer networks is a wide area network (WAN) which connects several different areas using interconnection technology between Autonomous Systems (AS).[1]

Border Gateway Protocol is a protocol that is responsible for managing Network Reachability (NRI) between autonomous systems with the guarantee of avoiding routing loops.[2] BGP has the ability to determine the best path for sending data between ASs which can optimize network performance and is used to manage data transmission in WAN networks.

Some research related to bgp routing has been done before, in research [1] discussing the simulation of interconnection between autonomous systems (AS) using the border gateway protocol (BGP) with the aim of discussing the application of the BGP routing protocol in networks that have different ASes so that they can interconnect. The application uses Packet Tracer 7.0 software to create a network prototype and simulate it. So that later it can be applied to the actual network, In research [3] discussing the Analysis and Simulation of Routing Border Gateway Protocol (BGP) Between Autonomous Systems Using Free Range Routing (FRR) With the aim of testing Quality of Service (QoS) performance on topology 1 and 2 using scenarios without failover (main route) and failover (backup route). The QoS parameters tested are throughput, delay, jitter, and packet loss, and the research [4] discusses the Analysis and Design of Computer Network Performance Comparison Simulations Using Static Routing Protocol Methods, Open Shortest Path First (OSPF) and Border Gateway Protocol (BGP) (Case Study Tanri Abeng University) with the aim of comparing the performance of computer networks in sending data packets using static routing protocols, OSPF, and BGP based on the parameters used.

At Khairun University, there is a need to build a computer network that can connect several areas on campus and the city by using interconnection technology between AS. The use of interconnection technology between AS at Khairun University will enable faster and more efficient transmission of data between different areas in the network.

The use of the Cisco Packet Tracer application is felt to be able to simulate data about networks that can be used to obtain information about the state of a network connection, whether the network has problems or not.[5] In its use, Packet Tracer can implement various types of network technology, including interconnection technology between AS using BGP. Therefore, the analysis and design of interconnection

networks between AS at Khairun University using Packet Tracer and BGP is an important thing to do.

By analyzing and designing interconnection networks between AS at Khairun University, it is expected to improve network performance and make it easier to send data between different areas. In addition, a better understanding of the interconnection technology between AS using Packet Tracer and BGP will also be gained through this analysis and design process.

2 Material and Method

2.1 Analysis and Design

The definition of analysis is the translation of a complete information system into its various component parts with the intention that we can identify or evaluate various kinds of problems that will arise in the system, so that these problems can be overcome, repaired or also developed. [6]

2.2 Autonomous System (AS)

Autonomous system (AS) is a network or a group of networks under the control of a single administration. The example of AS is a set of computers in a company or in a college that share administrator control. [1]

2.3 Border Gateway Protocol (BGP)

Border Gateway Protocol (BGP) is a type of routing protocol used for connections between autonomous systems (AS), and a type of routing protocol that is widely used by large Internet Service Providers (ISPs) or for banking.[1]

2.4 Routing Protocol

Routing protocol is an algorithm used to manage the routing process. Routing is the process of choosing the route to be traveled by a data packet in a computer network and the device used to carry out routing, namely the router. [3]

2.5 Cisco Packet Tracer

Cisco Packet Tracer is a software for making computer network simulations, by using this application package network administrators can know for sure the existing network system. [7]

This application software is shown in Figure 1. Cisco Packet Tracer is also a network simulation application that is often used to design network topologies such as LAN, MAN, WAN or other networks which later the results of the design are implemented.

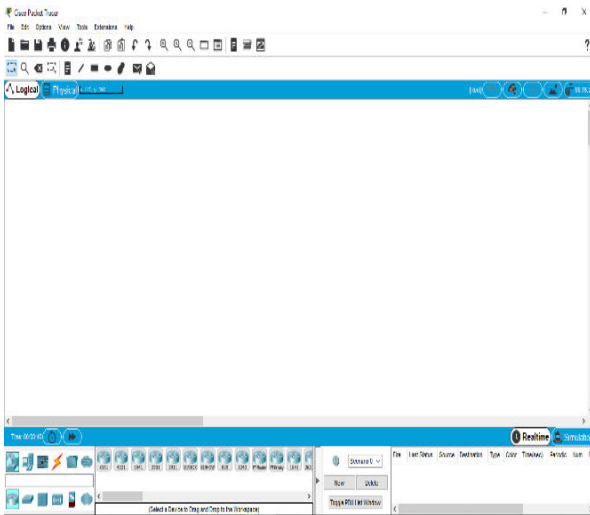


Fig. 1. Initial view of Cisco Packet Tracer

2.5.1 Router

This equipment makes it possible for computers or other devices operating with different physical media and different protocols to communicate through him. For this, when receiving a message from a computer, the router examines its contents and forwards it to the next rewriting device seeing the message so that the device according to understand.[8] The figure 2 below shows that a router can be seen as an exchange of data packets that operate at layer 3 of the OSI model.[8]

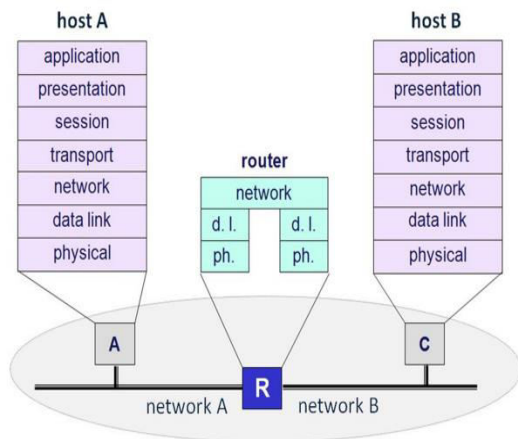


Fig 2. router exchange of data packets that operate at layer 3 of the OSI model

2.5.2 Switch

It has a table with all MAC addresses of the devices connected to it. Thus, upon receiving a message from a computer, it verifies the destination MAC address and forwards it to the port where this computer is connected.[8]

3 Simulation Result and Discussion

3.1 Network Schema

The network equipment used on Campus 3 is centered on routers and also several access points, and each lab is equipped with a switch which is useful as a connecting medium to the router.

The network scheme used on campus 3 at Khairun University can be seen in Figure 2.

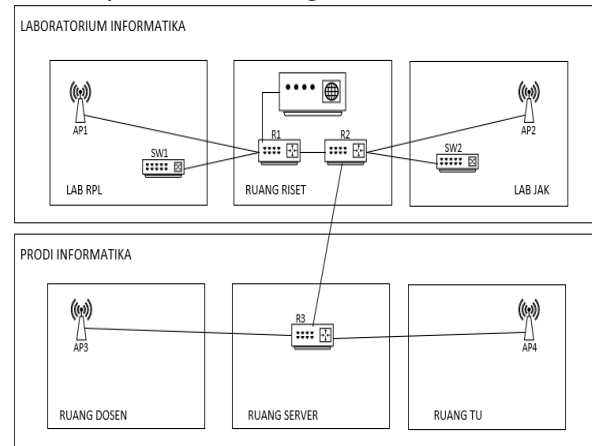


Fig 3. Network Schema

3.2 Network Simulation

The results of the BGP design on the Khairun University network campus 3 will be simulated later using the Cisco Packet Tracer application.

3.2.1 Border Gateway Protocol (BGP) Configuration

Configuring AS numbers on each router, as well as configuring neighbors or AS on other routers, and adding networks so that each client on the router can connect to each other. Look at Figure 3

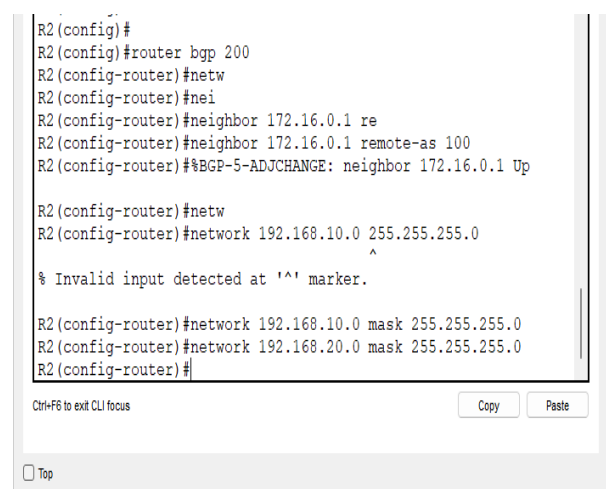


Fig 4. Border Gateway Protocol (BGP) Configuration

3.3 Examination

Doing the examination and analysis on the topology that has been designed and built to find out how the connection operates and works.

Figure 4 depicts the network topology that has been configured on the Cisco Packet Tracer

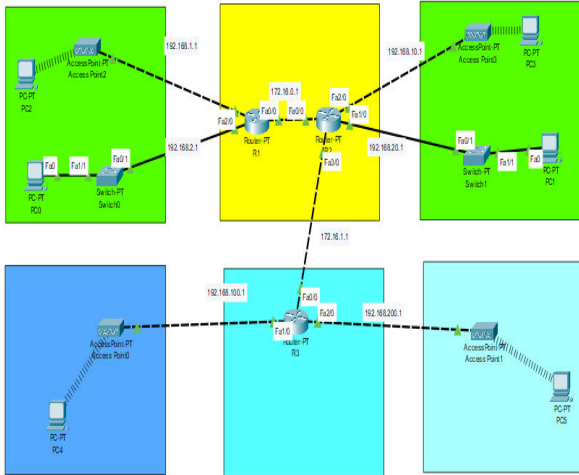


Fig 5. The results of the BGP configuration on the topology

3.3.1 Connection Test

Doing a connection test on each client on each router to find out whether the connection was successful or not.

Figure 5 shows the result of performing the connection test.

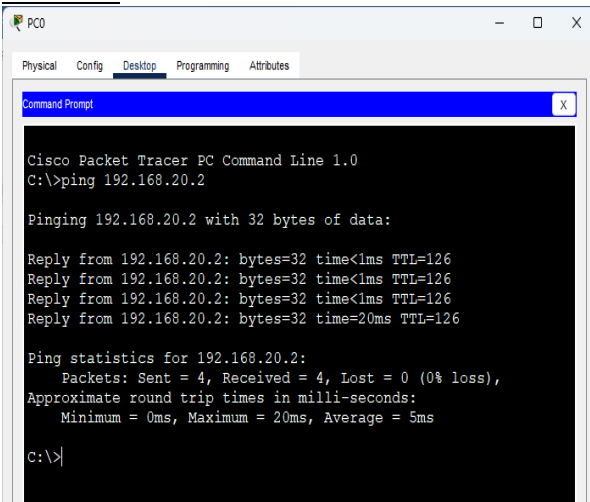


Fig 6. Results connection test

4 Conclusion

This study concludes that the implementation of BGP on the network at Khairun University Campus 3 improves network performance, reliability and security. BGP optimizes the exchange of routing information between AS, reduces latency, and increases data transfer rates. This research is an important contribution to the design of AS connectivity with BGP in the campus environment.

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