Simulation And Analysis of Mesh Topology Using Ns2 And Cisco Packet Tracer

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Abstract- *Mesh topology is a robust and reli- able network design commonly utilized in scenarios requiring high fault tolerance and consistent data flow. Packet Tracer, a versatile network simulation tool developed by Cisco, provides an ideal environment for implementing and studying the be- haviour of mesh networks. This abstract highlights the process and benefits of implementing mesh topology in Packet Tracer for educational and practical purposes. In a mesh topology, every node is interconnected, either fully or partially, ensuring multiple communication paths. This redundancy minimizes the risk of network failure, making it a popular choice for mission- critical networks. The implementation in Packet Tracer involves creating and connecting nodes, such as routers, switches, and PCs, using appropriate cables and configurations to simulate full or partial mesh networks. Protocols such as OSPF or EIGRP are configured to optimize routing and demonstrate self- healing capabilities. Simulating mesh topology in Packet Tracer offers several advantages. It provides an interactive platform to visualize and analyse data flow, fault tolerance, and load balancing. Students and network professionals can experiment with different configurations, observe the effects of link failures, and understand how routing protocols adapt to maintain network connectivity. This abstract underscores the value of Packet Tracer as a tool for learning and experimenting with mesh topology, helping users gain a deeper understanding of real-world network design principles and their practical applications*

I. INTRODUCTION

Mesh topology is a type of network topology where each device is connected to every other device. This type of topology provides a high degree of redundancy and reliability, making it suitable for applications that require high availability and fault tolerance. In a mesh topology, multiple paths exist between devices, allowing data to be transmitted through different routes in case of a failure. This topology is further divided into two types: full mesh topology, where each device is connected to every other device, and partial mesh topology, where only some devices are connected to each other. The mesh topology offers several advantages, including high reliability and fault tolerance, as the failure of one device or connection does not affect the entire network. Additionally, multiple paths for data transmission enable faster data transfer rates and improved network performance. The mesh topology also allows for easy maintenance and troubleshooting, as each device can be isolated and diagnosed independently. However, the mesh topology also has some disadvantages. One major drawback is the high cost and complexity of implementing and maintaining a mesh network. The requirement for each device to be connected to every other device results in a large number of connections, which can be difficult to manage and maintain. Furthermore, the mesh topology can be difficult to scale, as adding new devices to the network can result in a significant increase in the number of connections required. Despite these limitations, the mesh topology has several real- world applications. Wireless mesh networks, for example, use mesh topology to provide reliable and scalable wireless connectivity. Sensor networks, which are used in applications such as environmental monitoring and industrial automation, also often employ mesh topology. Additionally, distributed computing systems, which are used in applications such as scientific simulations and data analytics, can benefit from the reliability and scalability of mesh topology.

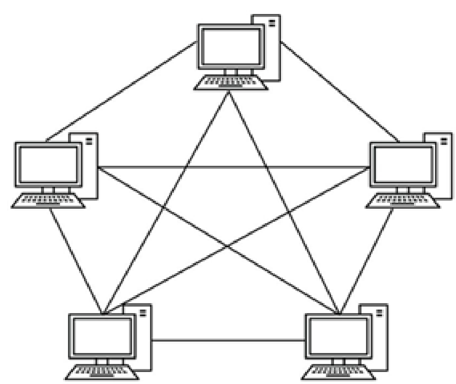

Fig. 1. Full mesh topology

II. IMPLEMENTATION OF MESH TOPOLOGY

A. NS2

NS2,or Network Simulator 2, is an open-source, event- driven simulator designed specifically for research in computer communication networks. It is widely used for simulating the behavior of networks and is built using C++ and OTcl (Object Tool Command Language) Additionally, forgeries often introduce artifacts like noise or unnatural gradients that can be detected through statistical analysis and image pro- cessing techniques. By leveraging the CASIA V2.0 Dataset, researchers can develop machine learning algorithms capable of identifying these discrepancies, ultimately improving the accuracy and reliability of image forensics systems for detect- ing tampered content.To implement mesh topology in NS2, First need to set up the mesh network topology by defining the nodes in the network. Next, create duplex links among the nodes, ensuring that each node is connected to at least two or more nodes to form a web of connections. This interconnected structure guarantees redundancy and reliability in the network. After setting up the topology, simulate the traffic flow between any pair of nodes. The routing mechanism within NS2 will determine the path that the data takes, facilitating seamless communication across the network. This process allows for an efficient and robust network simulation in NS2.

The simulation and implementation of a mesh topology using NS2 are illustrated in Figure 4. In this setup, five nodes are interconnected using dedicated point-to-point links. Each node is directly connected to every other node in the network. Specifically, Node 1 connects to all other n-1 nodes.Node 2 also connects to n-1 nodes.and this pattern continues until the last node.For a fully connected mesh topology, the number of duplex links required is calculated using the formula:- n(n-1)/2.Since five nodes are used in this simulation, a total of 10 duplex links are necessary. Here, Node 1 acts as the source, while Node 4 is the destination. An FTP connection is established between these two nodes, represented by a blue link[1]. Due to the use of dedicated links, this topology ensures enhanced security and privacy. 1

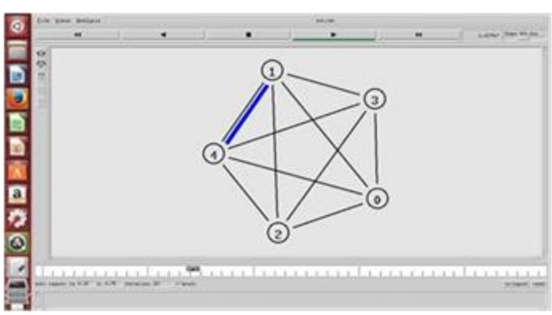

Fig. 2. Mesh Topology Implementation in NS2

B. CISCO-PACKET TRACER

Step 1: Open Cisco Packet Tracer

1. Launch Cisco Packet Tracer on your system.
2. Open a new workspace to begin designing the network. Step 2: Add Four Devices to the Workspace

1. From the Devices Toolbar, drag and drop four PCs (e.g., PC0, PC1, PC2, PC3) onto the workspace.
2. Alternatively, you can use other network devices like routers or switches, depending on the simulation goal

. Step 3: Add Connections

1. Select the Connection Tool (the lightning bolt icon in the toolbar).
2. Connect each device to every other device using Copper Straight-Through Cables: o Connect PC0 to PC1, PC2, and PC3. o Connect PC1 to PC2 and PC3. o Connect PC2 to PC3. This ensures that all devices have direct links, forming a full mesh topology.

Step 4: Configure IP Addresses 1. Click on each PC and open the Desktop Tab. 2. Select IP Configuration and assign a unique IP address to each PC.

For example:

o PC0: 192.168.1.1 / 255.255.255.0
o PC1: 192.168.1.2 / 255.255.255.0
o PC2: 192.168.1.3 / 255.255.255.0
o PC3: 192.168.1.4 / 255.255.255.0

Step 5: Verify Connectivity

1. Use the Command Prompt in each PC to test connectivity.
2. Type ping ¡IP Address¿ to test the connection between devices.

example: o From PC0, execute ping 192.168.1.2, ping 192.168.1.3, and ping 192.168.1.4.

3. Ensure that all ping requests are successful, confirming that the mesh topology is functioning correctly.

Step 6: Save the Project 1. Save project by clicking File ¿ Save As and naming the file appropriately.

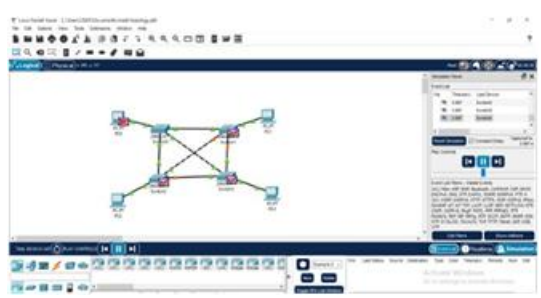

Fig. 3. Setting Up a Mesh Topology by Connecting four nodes and Assigning IP Addresses.

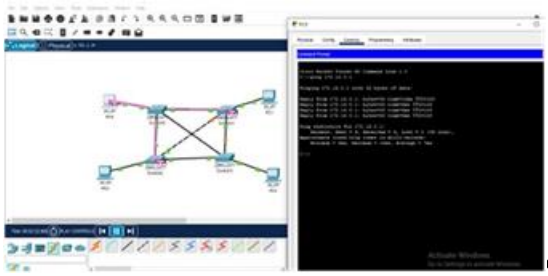
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Fig. 4. Validating Connections in Mesh Topology by transferring messages and using the Ping Command..

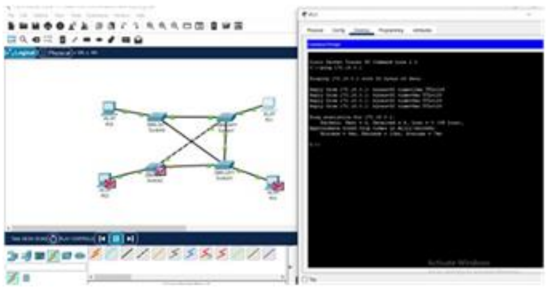

Fig. 5. Validating Connections in Mesh Topology by transferring messages and using the Ping Command by failing a link between switches. .

III. CONCLUSION

The simulation of Mesh Topology in NS2 and Cisco Packet Tracer provides valuable insights into network performance, efficiency, and scalability. Each tool has its own merits and demerits, making them suitable for different aspects of mesh topology analysis.

In comparing the simulation of Mesh Topology using NS2 and Cisco Packet Tracer, both tools offer distinct advantages and limitations, making them suitable for different use cases.

NS2 excels in providing high flexibility for custom network protocols and detailed packet-level analysis, making it an ideal choice for academic research and performance evaluation. It allows for in-depth monitoring of key parameters such as delay, throughput, and packet loss. However, it has a steep learning curve, requiring users to work with TCL scripting and extensive manual configurations. Additionally, debugging can be complex, and real-time visualization tools are limited. On the other hand, Cisco Packet Tracer offers a user-friendly graphical interface, making it an excellent choice for begin- ners and those focusing on network topology visualization. With drag-and-drop functionality and predefined networking devices, it simplifies the process of setting up a mesh topology. However, it lacks the depth of customization and advanced simulation features available in NS2. It is primarily useful for basic network design rather than in-depth performance analysis.

In conclusion, NS2 is better suited for researchers and advanced users looking to analyze network behavior at a granular level, while Cisco Packet Tracer is more practical for learners and professionals who need a quick and intuitive way to design and visualize network topologies. A combined approach—using Cisco Packet Tracer for initial design and NS2 for detailed performance evaluation—can provide a more comprehensive understanding of mesh topology behavior.

REFERENCES

[1] Mr.Ranjeet Ramesh Suryawanshi(Eletronics and Telecommunication Department, Bharati Vidyapeeth's College Of Engineering Kolhapur, India) "SIMULATION AND IMPLEMENTATION OF NETWORK TOPOLOGY USING NS2"INTERNATIONAL JOURNAL OF ENGI-NEERING SCIENCES RESEARCH TECHNOLOGY,[Suryawanshi*etal., 5(12): December, 2016,ISSN: 2277-9655 Impact Factor: 4.116] IC™ Value: 3.00

[2] Garima Jain1, Nasreen noorani2, Nisha kiran3, Sourabh sharma (As- sistant professor, Electronics communication dept., Acropolis technical campus, Indore, M.P. ,India) "Designing Simulation of Topology Net- work using Packet Tracer"International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 02 Issue: 02 —May-2015 www.irjet.net p-ISSN: 2395-0072

[3] SIRWAN A. MOHAMMED.(MSc Student, Faculty of Electrical Engi- neering University of Babylon, University of Sulaimani, Iraq) " DESIGN AND SIMULATION OF NETWORK USING NS2 " International Journal of Electronics, Communication Instrumentation Engineering Research and Development (IJECIERD) ISSN 2249-684X Vol.3, Issue 1, Mar 2013, 237-248 © TJPRC Pvt. Ltd.