Design and Evaluation of TCP/IP Network Models Using NS2

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ABSTRACT

A network is basically the interconnection of two or more devices. The study of arrangement or mapping of elements such as links and nodes of a network is called as network topology. Data communication and networking are changing in the way we do business and the way we live. Advances in Technology are making it possible for communication links to carry more and faster signals as well as data. Research in data communication and networking has resulted in number of new technologies. Popular technology of computer network is internet. For interconnectivity between end users, network topology describe the physical appearance and interconnection between arrangement of computers, cables and other component. So we can say network topology is the backbone of any computer network. In this paper, computer networks with different types of topology is implemented and simulated using network simulator NS2 for TCP-IP Protocol

Keywords: Computer Network, Topologies,TCP, Network Simulator NS2

I. INTRODUCTION

In computer network we have two or more computers which are linked together with a medium and data communication devices so that we can communicate and we can share data with the help of resources. Topology in computer network defined as way the computers or workstations which are linked together in the network. The 5 basic types of network topologies in computer network are: 1) Bus Topology 2) Star Topology 3)Ring Topology 4)Mesh Topology 5) Hybrid Topology.

These Network topologies [1-2, 8-9]are the technology which are used for arrangement of various computer elements like different links and nodes etc.

Network topology is the topological structure as well graphical representation [5] of a computer network. In mathematics topology is concerned with the connections of objects. Each type of topology is suited for specific tasks and each has its own advantages and disadvantages acoording to rquirement. A commonly used example of network topology is LAN [3-4]. LAN which has one or more physical links to one or more deviceslike computer in the network. Now a days there are two basic categories of network topologies:1) Physical topologies [9]
2) Logical topologies [8]. Physical Network Topology Consist different workstations, remote terminals, servers, and also associated wiring between assets. Logical Network Topology consist the graphical representation of data flow between nodes as well as links.

II. LITERATURE REVIEW OF TOPOLOGIES

It emphasizes with the system which includes workstations, remote terminals, servers, and the associated wiring between assets. It defines how the systems are physically connected to each other. The arrangement of devices in a computer network through the actual cables that transmit data.

A. Point to point

In this topology there is a direct connection between two devices (nodes).One example of this is a PC connected to a printer. A more common example is a mainframe terminal connected to a mainframe front-end processor.

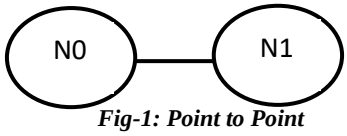

Fig-1: Point to Point

B. Bus Topology

In this topology a set of computers which are connected through single network cable which is known as bus. It acts as a backbone of this topology. It is the easiest way to connect multiple computers for this topology. Disadvantages of this topology is that problem occur at that time when two clients those are wanted to transmit at the same time on the same bus.

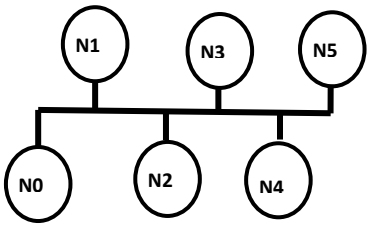

Fig. 2. Bus Topology

1) Advantages:

- Easy to implement and extend.
- Less expensive because it require least amount of Cable to connect the computers together.
- Suitable and easy to use for small or temporary Networks.
- A repeater can also be used.

2) Disadvantages:

- Heavy network traffic can slow a bus.
- Proper termination is required.
- Fault in the bus cable stops all transmission.
- Difficult to administer.

C. Star Topology

In star topology, all the components are connected to central hub or switch. The devices or users are not linked to each other and it does allow direct traffic between devices. The star network has a central node or hub that usually has the means to prevent echo related problems.

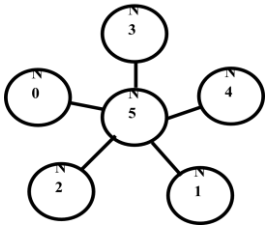

Fig. 3. Star Topology

1) Advantages:

- Easy to diagnose network fault.
- Good performance.
- Very easy to set up and to extend.
- Uses multiple cable types in the same network with a hub.

2) Disadvantages:

- Totally depend on a single hub.
- Expensive to install.

D. Ring topology

In this ring topology all of the nodes or devices are connected to one another in a circle. The data will go from from one device to the next one and all the way around the ring layout until it reaches the destination node. A major disadvantage is that if a single device is switched off, the network does not work

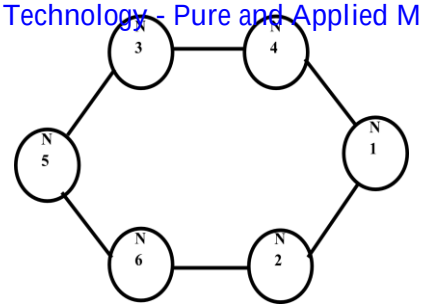

Fig. 4. Ring Topology

1) Advantages:
   - It gives very high performance for a small number of workstations or for large networks where each station has a similar workload.
   - Easy to extend.
2) Disadvantage:
   - Adding and removing disrupt the network.
   - Troubleshooting is difficult.

E. Mesh Topology

In this topology is nodes are connected to other nodes or instruction which allows them for continuous connections and reconfiguration around broken and also blocked paths by hopping from node to node until reached to destination.

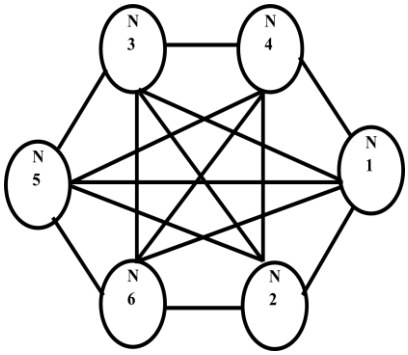

Fig. 5. Mesh Topology

1) Advantage:
   - Robust.
   - Fault diagnosis is easy.
   - Provide security and privacy
   - ***Each connection can carry its own load***

3) Advantages:
- Easy to implement and extend.
- Less expensive because it require least amount of Cable to connect the computers together.
- Suitable and easy to use for small or temporary Networks.
- A repeater can also be used.

4) Disadvantages:
- Heavy network traffic can slow a bus.
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- Fault in the bus cable stops all transmission.
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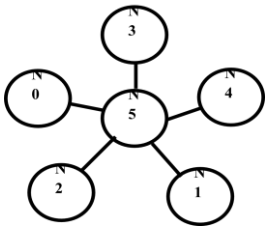

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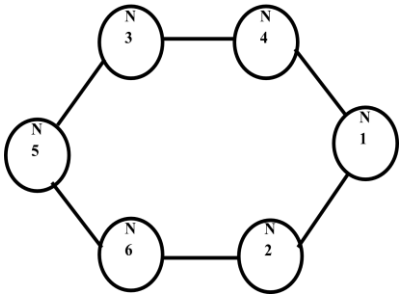

Fig. 4. Ring Topology

3) Advantages:

- It gives very high performance for a small number of workstations or for large networks where each station has a similar workload.
- Easy to extend.

4) Disadvantage:

- Adding and removing disrupt the network.
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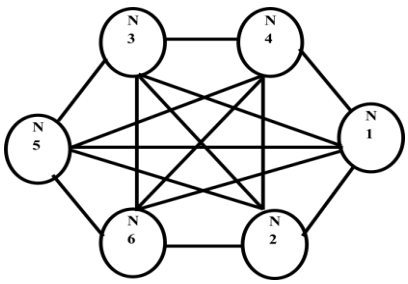

Fig. 5. Mesh Topology

2) Advantage:
   - Robust.
   - Fault diagnosis is easy.
   - Provide security and privacy.

Each connection can carry its own load

Here FTP traffic is assigned between node1,2,3,4 shown by different colors. As dedicated link are used this topology provides better security and privacy.

A. Star topology

From figure 9, here 4 nodes are connected to central hub. Four nodes are connected to hub with duplex links. Node 0 is the source node and node 1,2,3 are the destination. Node 0 will forward the data to node 1,2,3. Here FTP traffic is assigned between node 1,2,3,4 shown by different colors.

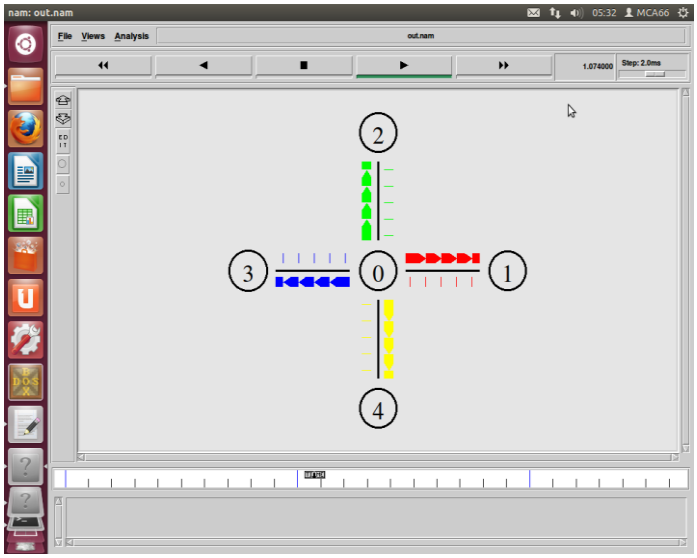

Fig. 9. Simulation output for STAR Topology using NS2

B. Ring topology

From figure 10, here 6 nodes are connected to each other in ring manner. Six nodes are connected to hub with duplex links with Bandwidth of 10Mbps and propogation delay of 20ms. Here FTP traffic is assigned between all the nodes shown by different colors.

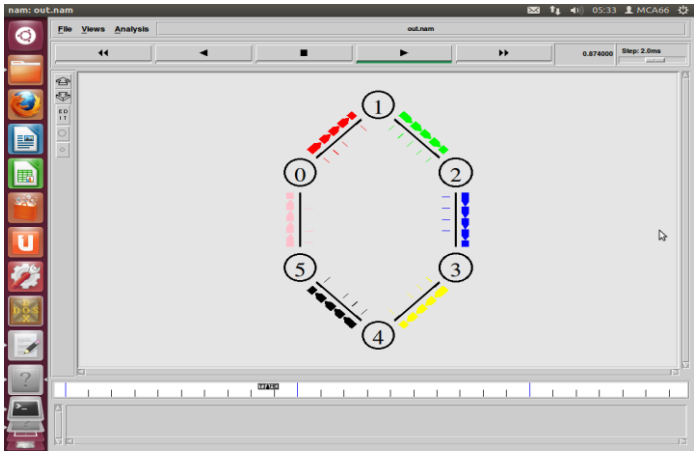

Fig. 10. Simulation output for RING Topology using NS2

III. CONCLUSION

In this paper, we have done analytical study of different basic topologies which provide us a brief idea about each topology and their features. Each topology have some advantages and disadvantages. we have simulated the different types of network topology by configuring the number of nodes and network devices to it and shown how packets can be transmitted from node to node based on type of topology.
Here we have used network simulator NS2 to simulate the different network topology and understand the practical concept of data communication over different network topology

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