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Title

ANALYZED TRAFFIC THROUGH SWITCHES IN THE DESIGN OF LANS USING OPNET MODELER

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Abstract:

The corporate LAN has evolved from a passive background business component to a highly active, highly visible core asset that enterprises rely on to support day-to-day operations critical to their market success. Today's network is a strategic instrument that must be accessible anytime from anywhere—simultaneously offering fast, secure, reliable services at scale regardless of location. It has also evolved from traditional client/server data flow support to peer-to-peer flow support, and it must also accommodate an increasing number of devices and services. The main aim of this research paper is to demonstrate the need for implementation of switches in the design of LANs using OPNET-MODELER. The performance of a 16-station LAN using first a simple hub, and then a switch and two hubs is compared. By analyzing the graphs, it is concluded that traffic performance of a network after deploying switches is better.

Keywords: OPNET-MODELER, Traffic analysis, Switches over Hub, Design of LANs, Performance of Switches.

INTRODUCTION:

A local area network (LAN) is a group of computers and associated devices that share a common communications line or wireless link [5, 7]. Typically, connected devices share the resources of a single processor or server within a small geographic area, for example, within an office building. Usually, the server has applications and data storage that are shared in common by multiple computer users. A local area network may serve as few as two or three users or as many as thousands of users [1].

Utilization of Hub in LAN:

Networking hubs are central components of local area networks (LANs) [2, 4]. To understand the role of networking hubs, a basic understanding of LANs is required. Whenever one or more computers are networked together, a LAN is created. The purpose of joining computers together in a LAN is to share resources like files, a printer, a scanner, or. There are four components in a basic wired Hub network [3].

1. Ethernet wire: This is the physical cable that links the computers together, enabling them to talk to each other. The Ethernet cable, also called twisted pair, or 10-Base T, plugs into a network card located in each computer on the LAN.
2. Network Interface Cards (NICs) : One of these cards goes into a vacant slot inside each computer. The back of the card features a port for one end of an Ethernet cable. Newer computers normally have a networking card built-in.
3. Networking Hubs: The networking hub is a junction box with several ports in the back for receiving the Ethernet cables that are plugged into each computer on the LAN. With Ethernet cables going from each NIC to the hub, all computers are connected to the hub.
4. Networking Software: Most operating systems today come with networking software built-in, but the software is also available from third parties. The software works with the hardware to create a networking environment on each computer, allowing the user to see shared files and recourses. It also allows for administration of the network.

Utilization of Hub in LAN:

A network switch is a device that provides a switching function in a data communications network. Data communication in a computer network involves the exchange of data between two or more entities interconnected by communication links and sub networks. A network switch is an intermediate station which interconnects the communication links and sub networks to enable transmission of data between the end stations. Switching involves transferring information, such as digital data packets or frames, among entities of the network. A switch functions as an interchange and provides path switching for data being transported over a network [6, 8].

PERFORMANCE EVALUATION:

Procedure

- In this first phase open and name the project and first simulation scenario. The first simulation scenario will consist of 16 networked stations (PCs) and one hub. In this first phase specify the geographic size of the network.

- To create our switched LAN:

Select Topology → Rapid Configuration. From the drop-down menu choose Star .Click the Select Models button in the Rapid Configuration dialog box. From the Model List drop-down menu choose ethernet . In the Rapid Configuration dialog box, set the following six values:

Center Node Model= ethernet16_hub,
Periphery Node Model = ethernet_station,
Link Model =10BaseT, Number =16, Y=50, and Radius = 42
After creating the network, it should look like the network on Figure 1.

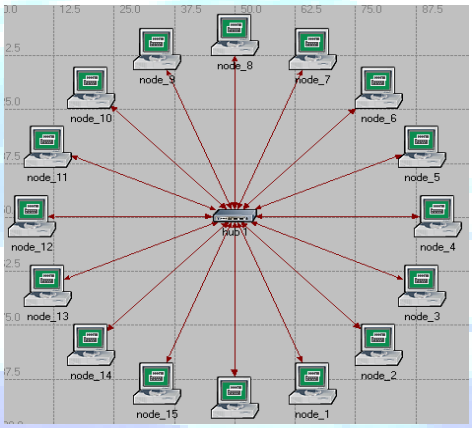


Figure 1: Scenario 1 of Ethernet network for 16 stations employing Hub

- Configure the network nodes:

Right-click on any of the 16 stations (node_0 to node_15) →Select Similar Nodes.
Right-click on any of the 16 stations → Edit Attributes.
Check the Apply Changes to Selected Objects check box. Expand the hierarchies of the Traffic Generation Parameters attribute and the Packet Generation Arguments attribute → Set the following four values as shown in Figure 2.

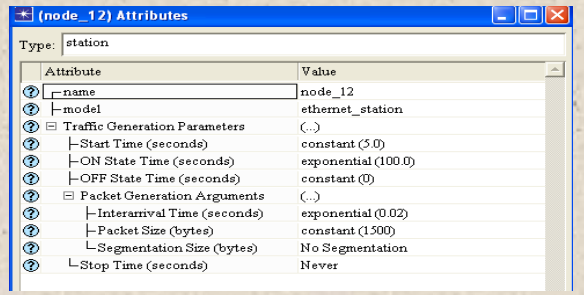


Figure 2: Packet Generation Arguments attribute

- Choose Statistics

  Right-click anywhere in the project workspace and select Choose Individual Statistics DES from the pop-up menu. In the Choose Results dialog box, choose the statistics:

  a. Traffic Received (in packets/sec) by the traffic sinks across all nodes.

  b. Traffic Sent (in packets/sec) by the traffic sources across all nodes.

- Duplicate the Scenario

  To create another network that utilizes a switch and sees how it will affect the network performance. To do that create a Duplicate of the current network. Place a hub and a switch in the new scenario and Reconfigure the network of the Hub And Switch scenario so that it looks like as shown in Figure 3.

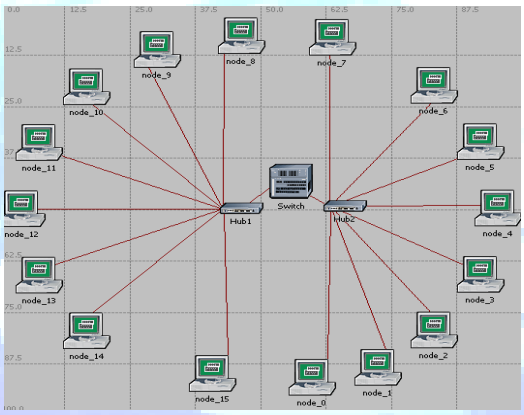


Figure 3: Scenario 2 of Ethernet network employing Hub and Switch

- Run the Simulation

  To run the simulation for both scenarios simultaneously:

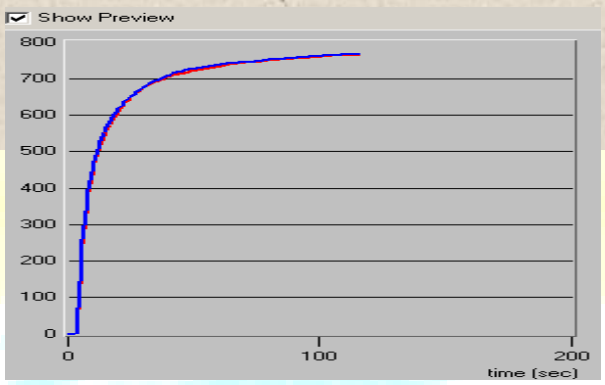
  Select Manage Scenarios from the Scenarios menu. Change the values under the Results column to <collect>for both scenarios and set the duration to 2 minutes.

PERFORMANCE ANALYSIS:

View the Results

Select Compare Results from the Results menu. Change the drop-down menu in the lower-right part of the Compare Results dialog box from As Is to time average.

Select the Traffic Sent (packets/sec) statistics of both the scenarios and click Show. The graph is as shown in Figure 4. By analyzing the graph, it is cleared that traffic sent in form of packets/sec in both the scenarios 1 and 2 is same i.e. 750 packets/sec.

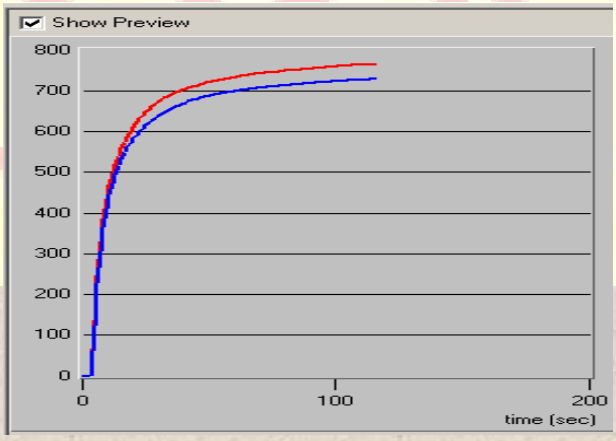


Ethernet network _Hub

Ethernet network _Hub & Switch

Figure 4: Graph comparing Traffic sent (Packets/sec) of both the scenarios

Now, Select the Traffic Received (packets/sec) statistics and the graph is as shown in Figure 5. From the graph, it is cleared that in scenario 1 of Ethernet network employing only Hub, the traffic received (packets/sec) is less as compared to traffic sent. There is some loss of packets. But in Scenario 2 of Ethernet network employing Hub and Switch, the traffic received is same as it is sent which means there is no packet loss.



Ethernet network _Hub

Ethernet network _Hub & Switch

Figure 5: Graph comparing Traffic received (Packets/sec) of both the scenarios

RESULTS AND CONCLUSIONS:

By analyzing the graphs, it is observed that in Ethernet network employing only Hub, the traffic received (packets/sec) is less as compared to traffic sent. There is some loss of packets. This is because when a hub receives a packet of data at one of its ports from a PC on the network, it transmits the packet to all of its ports and, thus, to all of the other PCs on the network. If two or more PCs on the network try to send packets at the same time a collision is said to occur which leads to packet loss.

But in Scenario 2 of Ethernet network employing Hub and Switch, the traffic received is same as it is sent which means there is no packet loss. This demonstrates the need for implementation of switches in the design of local area networks.

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