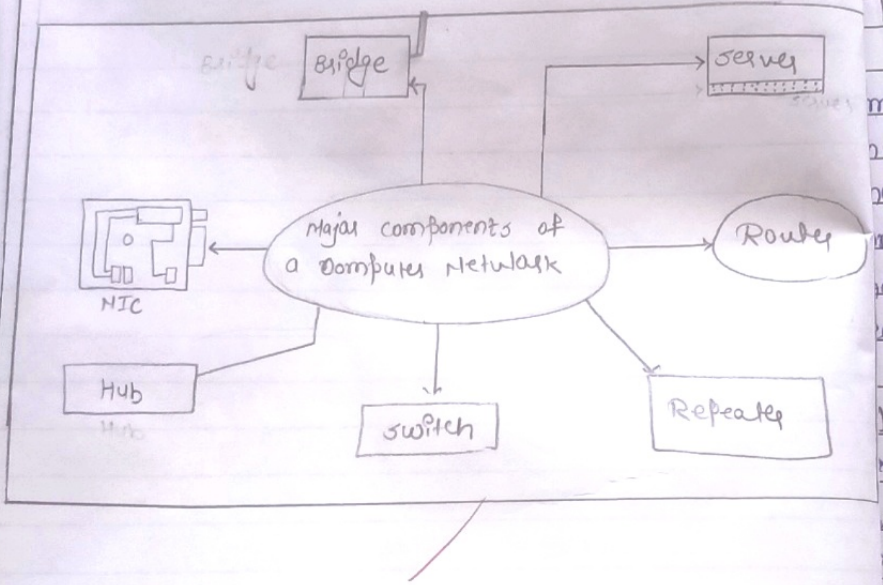
Date :- 16/02/23

Experiment NO. 1

Aim :- To study the network hardware components for Cable, NIC, Repeaters, Hubs, bridges, switch & Router.

Component :- NIC, Repeaters, HUBS, Bridges, Switches, Router,



Date : 16/02/23

Experiment NO. 1

Aim :- To study the network hardware components for cable, NIC, Repeaters, Hub, Bridges, Switch and Router

Theory :- Computer network components are the major parts which are needed to install the software. Some important network components are NIC, switch, cable, hub, router and modem. Depending on the type of network that we need to install, some network components can also be removed. For example, the wireless network does not require a cable. Following are the major components required to install a network:

1) NIC (Network Interface Card)

→ NIC is a hardware component used to connect a computer with another computer onto a n/w.

→ It can support a transfer rate of 10, 100 to 1000 Mb/s.

→ The MAC address as physical address is encoded on the network card chip which is assigned by the IEEE to identify a network card uniquely.

→ There are two types of NIC :

a) Wired NIC

b) Wireless NIC

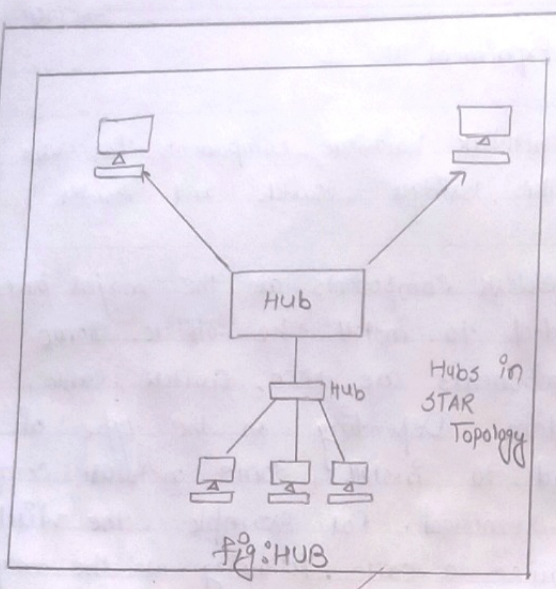
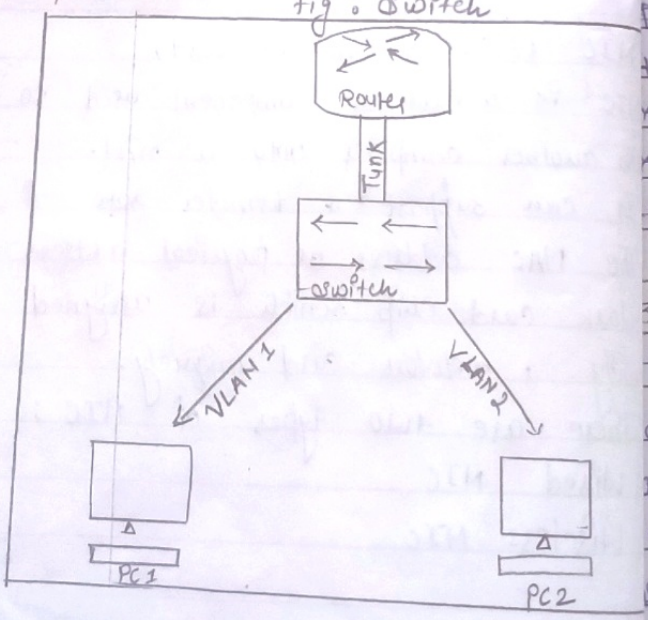


fig: HUB

fig : Switch



a) Wired NIC :- The Wired NIC is present inside the motherboard. Cables and connectors are used with wired NIC to transfer data.

b) Wireless NIC :- The Wireless NIC contains the antenna to obtain the connection over the Wireless network. For example, laptop computer contains the Wireless NIC.

2) HUB

- A hub is a hardware device that divides the network connecting among multiple devices. When computer requests for some information from a Network, it first sends the request to the Hub through cable.
- Hub will broadcast this request to the entire network.
- All the devices will check whether the request belongs to them or not. If not, the request will be dropped.

3) Switch

- A switch is a hardware device that connects multiple devices on a computer n/w. A switch contains more advanced features than Hub. The switch contains updated table that decides where the data is transmitted or not. Switch delivers the message to the correct destination based

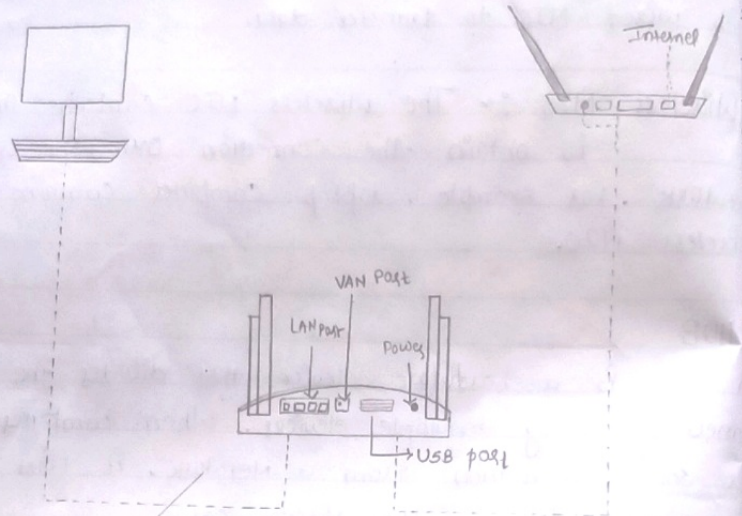


Fig : Router

on the physical address present in the incoming messages. A switch does not broadcast the message to the entire network like the Hub. It determines the device to whom the message is to be transmitted.

4) Router

→ A Router is a hardware device which is used to connect a LAN with an internet connection. It is used to receive, analyze and forward the incoming packets to another network.

→ A router works in a layer 3 (Network layer) of the OSI Reference model.

→ A Router forwards the packet based on the information available in the routing table.

→ It determines the best path from the available paths for the transmission of the packet.

5) Cables :-

→ Cable is a transmission media used for transmitting a signal.

→ There are three types of cables used in transmission
  i) Twisted pair cable
  ii) Coaxial cable
  iii) Fiber-optic cable.

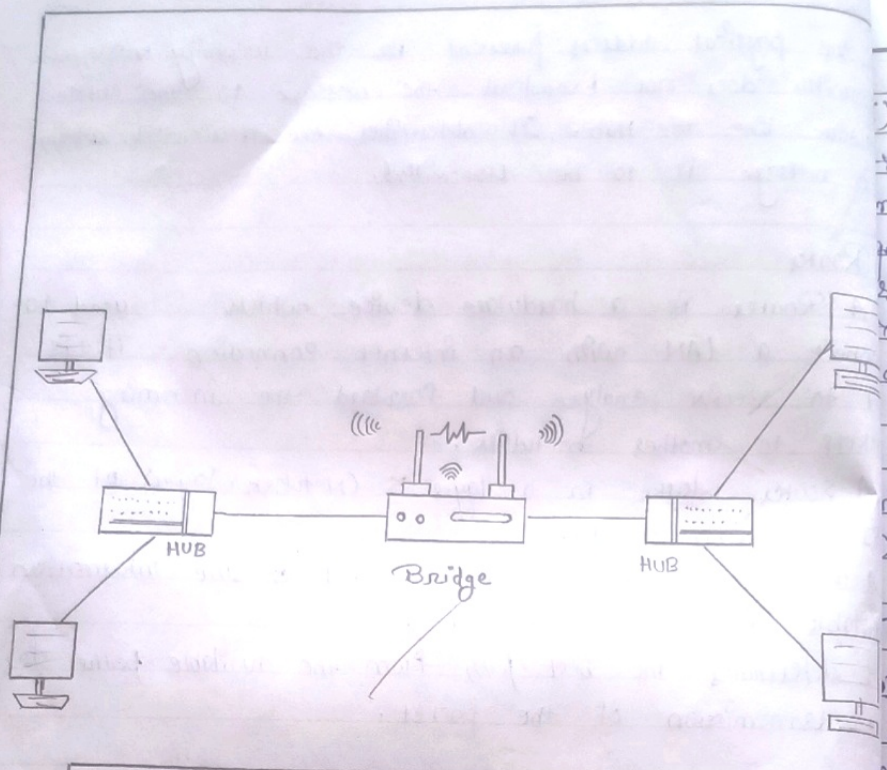


fig: Bridge

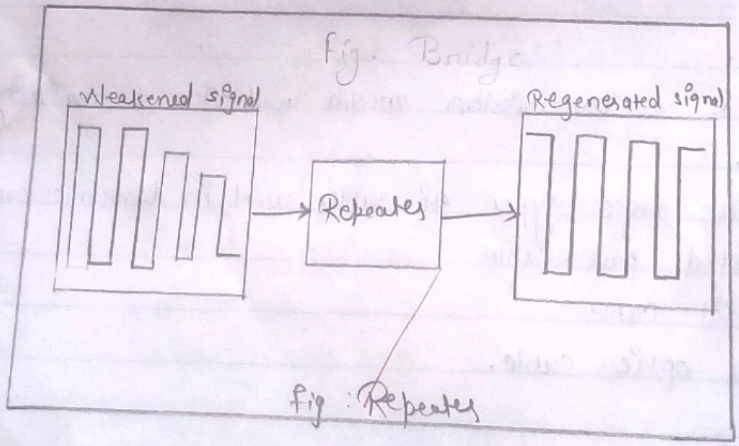


fig: Repeater

6) Repeater

→ The repeater is a physical layer device. As the name suggests, the repeater is mainly used to re-generate the signal over the same n/w and it mainly regenerates before the signal gets corrupted or weak.

→ Repeaters can connect signals by making the use of different types of cables.

a) Repeaters are cost-effective.

b) Repeaters are very easy to install and after their installation, they can easily extend the coverage area of n/w

c) Repeaters do not help to reduce the traffic in the n/w.

Types of repeaters:

1) Analog Repeaters these are only used to amplify the analog signal.

2) Digital repeaters these are only used to amplify digital signal.

3) Local Repeaters.

4) Remote Repeaters.

7) Bridge

It is another important component of the comp n/w. The bridge is also a layer-2 (that is data link layer device)

A bridge is mainly used to connect two or more local

area networks together. These are mainly used as they help in the fast transferring of the data.

→ But these are not versatile like routers.

→ Thus bridge can mainly transfer the data between different protocols (i.e a Token Ring and Ethernet network) and operates at the data link layer or level 2 of the OSI (Open Systems Interconnection) N/W reference model as told above.

Bridges are further divided into two:

→ Local bridges: These are ordinary bridges.

→ Remote bridges: These are mainly used to connect N/W that are at a distance from each other. Generally Wide Area Network is provided between two bridges.

Some Bridge protocols are spanning tree protocol, source routing protocol and source routing transparent protocol.

Result :→ Thus we successfully studied all the computer network hardware component.

Date: 02/03/23

Experiment No. 2

Aim :- To demonstrate data transmission using ping protocol tracert and Ip configuration.

Theory :

Ping Protocol : ping works by sending an Internet protocol control message protocol (Icmp) Echo Request to a specified interface on the network and waiting for a reply. when a ping command is issued a ping signal is sent to a specified address. When the target host receives the echo request, it response by sending an echo reply packet. with the ping command you can quickly determine whether a machine has internet access and can communicate with other computer or network devices ping also has additional features such as

- Network Connectivity testing
- Network interface card troubleshooting
- Putting DNS name resolution issues to the test.

* How does the ping work?

Ping uses the computers Echo request and operates within the Internet control message protocol (Icmp) which is a Fundamental component of any Ip networks when the ping command is issued an echo request packet is sent to

Specified address. Once the remote ~~host~~ host gets the Echo request, it responds with an Echo reply packet. Each Echo request outcome is displayed.

* Why use the ping command?

(1) Troubleshooting

You can use the ping command to confirm whether or not your computer have an Internet connection or whether connection is broken.

(2) Exploration

You can quickly use the ping cmd to discover all network connected devices.

(3) Observing

You can also routinely verify the availability of devices on a network.

(4) Security

Nowdays many hackers are use ping cmd to collect crucial information. such as determining which system are connected to a network where they are? Is the system running? To prevent this you can set firewalls to block pings from untrusted networks.

* Tracert

The tracert command or trace route command is a network analysis tool that can be used to know the path a packet goes through or follows from the source to destination. The time duration for this transfer to happen is also recorded with the IP addresses of all routers encountered during its movement returned Hop is the movement of the packet from one router to another.

* Advantages of Tracert

- It can determine the cause of a response delay in a network.
- It determines the routing loops present in the N/w path way across nodes that send & receive packets.

* IP configuration

IP config is a window command line utility used often to troubleshooting computer network issues. This is often used to determines the local IP address, Subnet mask the gateway address and other network config of a computer. Additionally this tool is used to refresh DHCP (Dynamic host config protocol) and DNS (Domain Name system) settings.

Result :→ Hence we successfully demonstrate and study data transmission using ping protocol, tracert and IP configuration.

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Date: 09/03/23

Practical No. 3

Aim :- To study the network Simulator.

Theory :- About NS2 :-

NS2 stands for Network Simulator version 2. It is an open-source event-driven simulator designed specifically for research in computer communication network. Since Comm^{n} networks have become too complex for traditional analytical methods to provide an accurate understanding of system behavior, network simulators are used. In simulators, the computer network is modeled with devices, links, application etc..., and the network performance is reported.

* Features of NS2

1) It is discrete event simulator for networking research.
2) It provides substantial support to simulate bunch of protocol like TCP, FTP, UTP and DSR.
3) It simulates wired and wireless n/w.
4) It is primarily Unix based.
5) Uses TCL as its scripting language.
6) Object oriented support : [Otcl].
7) Tclcl : C++ & Otcl linkage.
8) Discrete event scheduler.

Basic Architecture of NS-2

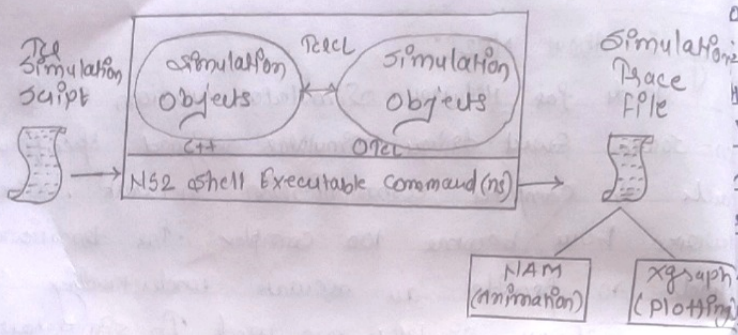

fig: Basic Architecture of NS-2

Basic Architecture

NS2 consist of two key language : C++ and object-oriented Tool Command Language (OTCL). While the C++ defines of internal mechanism (i.e. backend) of the simulation objects, the OTCL sets up simulation by assembling and configuring the objects as well as scheduling discrete events. The C++ and the OTcl are linked together using TclCL. NS2 uses OTcl to create and configure a network, and uses C++ to run simulation. All C++ codes need to be compiled and linked to create an executable file.

1) Use OTcL

For configuration, setup, as one time simulation or to run simulation with existing NS2 modules.
This option is preferable for most beginners, since it does not involve complicated internal mechanism of NS2.
Unfortunately, existing NS2 modules are fairly limited.
This option is perhaps not sufficient for most researchers.

2) Use C++

When you are dealing with a packet, as when you need to modify existing NS2 modules.
This option perhaps discourages most of the beginners from using NS2. This book particularly aims at

helping the readers understand the structure of NS2 and feel more comfortable in modifying NS2 modules.

3) Node

A node is a point of intersection / connection within a data comm^{n} network. In an environment where all devices are accessible through the network, these devices are all considered nodes. The individual definition of each node depends on the type of network it refers to. For example, within the physical network of a smart home domotics system, each home appliance capable of transmitting or receiving information over the network constitutes a node. However a passive distribution point such as a patch panel would not be considered a node.

4) Agent

Agent are used to separate protocol states from nodes. They are always associated with nodes. An agent has a name, which is unique identifier of the agent. It is shown as a square with its name inside and a link the line link the square to its associated node.

5] NAM

NAM is a Network animator tool used in NS_2 to visualize the network graphically. It is the first tool design to provide general purpose packet level network animation in NS2. It is use to provide protocol specific graphs for the designing and debugging of new network protocol.

* Application of NS2

- N/W simulator 2 (NS-2) provides substantial support for simulation of different protocol over wired and wireless networks.
- It provides a highly modular platform for wired and wireless simulations supporting different n/w elements, protocols, traffic and routing types.

Result :- Hence we successfully study network simulator 2 "NS-2".

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Date: 23/03/23

Practical NO. 4

Aim :- To connect the ~~computers~~ in or demonstrate the formation of local Area Network.

Components : 1) Cable - CAT5
2) 4 - 5 Computers
3) Switch

Theory : Local Area Network (LAN) is a group of computers and associated devices that share a common communication line or wireless link to a server. Typically, a LAN encompasses computers and peripherals connected to a server with a small geographic area such as an office building or home. Computers and others mobile devices can share resources such as a printer or network storage. The IEEE 802 LAN is a shared medium peer-to-peer Comm^{n} n/w that broadcast Infos^{n} for all stations to receive. The LAN enables stations to communication directly using a common physical medium on a point-to-point basis. A LAN is a system composed of network hardware and transmission medium and systems.

Procedure :

On the host computer :

on the host computer, follow these steps to share the Internet connection.

1) Log on to the host comp as administrator or as owner.
2) Click start, and then click on control panel.
3) Click N/w and Internet connection.
4) Click N/w connection.
5) Right click the connection that you use to connect to the Internet. For example, if you connect to the Internet by using a modem, right-click the connection that you want under dial-up / other network available.
6) Click properties.
7) Click the advanced tab.
8) Under Internet connection sharing, select the allow other network users to connect through this computer's Internet connection check box.
9) If you are sharing a dial-up Internet connection, select the Establish a dial-up connection whenever a computer on my n/w attempts to access the Internet check box if you want to permit your computer to automatically connect to the Internet.
10) Click OK you receive the following message: When Internet conn^n Sharing is enabled, your LAN adapter will be set to use IP address 192.168.0.1. Your comp may lose connectivity with other computers on your n/w. If these other computers have static IP addresses, it is a good idea to set them to obtain their IP addresses automatically. Are you sure you want to enable Internet connection sharing.

11) Click Yes

The connection to the Internet is shared to other computers on the local area network (LAN). The N/W adapter that is connected to the LAN is configured with a static IP address of 192.168.0.1 & a subnet mask of 255.255.255.0.

On the client computers:

To connect to the Internet by using the shared connection you must confirm the LAN adapter IP configuration and then configure the client computer. To confirm the LAN adapter IP configuration follow these steps:

1) log on to the client computers as Administrator or owner
2) Click start, and then click control Panel.
3) Click N/W & Internet connection.
4) Click N/W connections.
5) Right-click local area conn^n & then click properties.
6) Click the General tab, click internet protocol (TCP/IP) in the connection uses the following items list, & then click properties.
7) In the internet protocol (TCP/IP) properties dialog box click obtain an IP address Automatically (if it is not already selected), & then click OK.
8) Note: you can also assign a unique static IP address in the range of 192.168.0.2 to 192.188.0.0254. for Ex you can assign the following static IP address, subnet mask and default gateway:

IP Address 192.168.31.2029

Subnet mask 255.255.255.0.10.

Default gateway 192.168.31.1

8) In the Local & Area connection properties dialog box, click ok.

9) Quit control panel.

Result : Thus we have studied how to ~~check~~ connect the computers in LAN.

Conclusion : From the experiments we come to understand of different computers can be group together to form a computer N/w (LAN). which can be used for sharing the information as well as resources attached in the network.

6/4/22 15

Date: 06/04/23

Practical No. 5

Aim :- To perform simulation of two nodes in NS2.

Objective :- To understand the process of ~~processing~~ creating nodes and connecting link.

Theory :- Network simulation is an important tool in developing, testing and evaluating network protocols. Simulations can be used without the target physical hardware, making it economical and practical for almost any scale of network topology and setup. It is possible to simulate a link of any bandwidth and delay, even if such a link is currently impossible in the real world.

1] Set ns [new simulator] :- Generates an NS simulator object instance, and assigns it to variable ns.
1] Initializes the packet format.
2] Creates a scheduler.
3] Selects the default address format.

2] $ns color fid color :- for eg : $ns color 1 Blue.
It is to set colour of the packets for a flow specified by the flow id (fid). This member function of "Simulator" objects is for the NAM displays, and has no effect on the actual simulation.

4] $ns namtrace-all file-descriptor :- This member function tells the simulator to record simulation traces in NAM input format. It also gives the file name that the trace will be written to later by the command $ns flush-trace. Similarly, the member function trace-all is for recording the simulation trace in a general format.

4] proc finish {} {} :- It is called after the simulation is over by the command $ns at 5.0 "finish". In this function, post-simulation procedures are specified.

5) Set n0 [$ns node] :- for eg: set n1 [$ns node] The member function node. Create a node. A node in NS is compound object made of address and port classifiers.

6] $ns duplex-link node1 node2 bandwidth delay queue-type :- For eg: $ns duplex-link $n1 $n2 2Mb 10ms DropTail. It creates two simplex links of specified bandwidth and delay and connects the two specified nodes. In NS, the output queue of a node is implemented as a part of a link, therefore user should specify the queue-type when creating links. In the above simulation script, DropTail queue is used. If the reader wants to use a RED queue,

7] $ns queue-limit node1 node2 number ;# Eg. $ns queue-limit $n1 $n2 20. This line sets the queue limit of the two simplex links that connect node 1 & node 2 to the number specified.

8] $ns duplex-link-op node1 node2 ... ;# The next couple of lines are used for the NAM display. To see the effects of these lines, users can comment these lines out and try the simulation. Eg: $ns duplex-link-op $n1 $n2 orient right-up.

* CODE

```
set ns [new Simulator]
set nf [open out.nam w]
$ns namtrace-all $nf

proc finish {} {
global ns nf
$ns flush-trace
close $nf
Exec nam out.nam &
exit 0
}
set n1 [$ns node]
set n2 [$ns node]
```

```
$ns duplex-link $n1 $n2 10Mb 10ms DropTail
$ns queue-limit $n1 $n2 20

set tcp0 [new Agent/TCP]
set sink [new Agent/TCPsink]

$ns attach-agent $n1 $tcp0
$ns attach-agent $n2 $sink1

$ns connect $tcp0 $sink1
set ftp [new Application/FTP]
$ftp attach-agent $tcp0

$ns at 0.2 "$ftp start"
$ns at 4.5 "$ftp stop"
$ns at 5.0 "finish"
$ns run.
```

Result :- Transmission between mobile nodes using TCP connection studied.

13/4/23

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Date : 13/09/23

Practical No. 6

Aim : To create a simple Network Topology in NS2.

Theory :

A network topology is the physical and logical arrangement of nodes and connection in a network. Nodes usually include devices such as switches, routers and software with switch and router features. Network topologies are often represented as a graph. Physical topology describes the layout of devices and cables, and logical topology describes the way in which data is transmitted within the network - regardless of the physical layout.

Types of Network topologies are :

1) Mesh topology
2) Ring topology
3) Star topology
4) Tree topology
5) Bus topology
6) Hybrid topology

Algorithm :-

1) First we initialize the network simulator by creating a network simulator object.
2) Then we create a trace file and nam file where nam file used to view simulator output and trace file used to traces all the routing information.
3) Then we add finish procedure to flush all data into trace file and then run the nam file.
4) Then we create a number of nodes to create topology.
5) Then we create duplex-links between nodes forming a star. In the end by specifying three parameters (data rate, delay and type of Queue).
6) At the end we give time interval and run command.

Code :-

```
set ns [new Simulator]
set nf [open out.nam w]
$ns namtrace-all $nf

proc finish {} {
global ns nf
$ns flush-trace
close $nf
```

```
        exec nam out.nam &
        exit 0
}

set n0 [$ns node]
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]
set n4 [$ns node]
set n5 [$ns node]

$n0 shape square

$ns duplex-link $n0 $n1 1Mb 10ms DropTail
$ns duplex-link $n0 $n2 1Mb 10ms DropTail
$ns duplex-link $n0 $n3 1Mb 10ms DropTail
$ns duplex-link $n0 $n4 1Mb 10ms DropTail
$ns duplex-link $n0 $n5 1Mb 10ms DropTail

$tcp0 [new Agent / TCP]
$tcp0 set class_ 1
$ns attach-agent $n1 $tcp0

set sink0 [new Agent / TCPSink]
$ns attach-agent $n3 $sink0
```

$ns connect $tcp0 $sink0

set cbr0 [new Application/Traffic/CBR]
$cbr0 set packetSize_500
$cbr0 set interval_0.01
$cbr0 attach-agent $tcp0.

$ns at 0.5 "$cbr0 start"
$ns at 4.5 "$cbr0 stop"
$ns at 5.0 "finish"
$ns run

Result :- Hence we successfully create a star topology.

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8/2014

Date :- 20/1/23

Experiment No. 7

Aim :- To write TCL script for transmission between two nodes using TCP / FTP.

Objective :- To understand the process of generating a wireless system using TCL script for wireless transmission.

Theory :- Once the basic n/w setup is done, the next thing to do is to setup traffic agents such as TCP and UDP, traffic sources such as FTP and CBR, & attach them to nodes and agents respectively.

Algorithm :-

1) First we initialize the network simulator by creating a network simulator object.
2) Then we create a trace file and nam file where nam file used to view simulation output and trace file used to trace all the routing information.
3) Then we add finish procedure to flush all data the trace file and then run the nam file.

4) Now we create a number of nodes as two nodes for community with each other.
5) Then we create duplex - links between nodes forming a connection. In the end by specifying three parameter (data rate, delay and kind of Queue).
6) Now set the TCP and create the agent as TCP.
7) Then attach - agent the node with the TCP. create the new SINK and attach the second node with SINK.
8) Now create the FTP with and attach - agent with TCP.
9) At the End we give time interval and run command.

Code :-

```
set ns [new Simulator]
set nf [open out.nam w]
$ns namtrace-all $nf

proc finish {} {
global ns nf
$ns flush-trace
close $nf
Exec nam out.nam &
Exit 0
}
```

set n1 [$ns node]
set n2 [$ns node]
$ns duplex-link $n1 $n2 10mb 10ms DropTail
$ns queue-limit $n1 $n2 20

set tcp0 [new Agent/TCP]
set sink [new Agent/TCPSink]

$ns attach-agent $n1 $tcp0
$ns attach-agent $n2 $sink

$ns connect $tcp0 $sink
set ftp [new Application/FTP]
$ftp attach-agent $tcp0.

$ns at 0.2 "$ftp start"
$ns at 4.5 "$ftp stop"
$ns at 5.0 "finish"
$ns run.

Result : Transmission between two nodes using TCP/FTP connection studied.

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Date :- 20/1/23

Experiment No. 8

Aim :- To write TCL script for transmission between nodes UDP transmission.

Objective :- To understand the process of generating a wireless system using TCL script for wireless transmission.

Theory :- Once the basic network setup is done, the next thing to do is to setup traffic agents such as TCP and UDP, traffic sources such as FTP and CBR and attach them to nodes and agents respectively.

Algorithm :-

1) Initialize the network simulator by creating a network simulator object.
2) Then we create a trace file and nam file where nam file used to view simulator output and trace file used to trace all the routing information.
3) Then we add finish procedure to flush all data into trace file and then run the nam file.

Exec.

4) How we create a number of nodes as two nodes for community with each other.

5) Then we create duplex-links between nodes forming a connection to the end by specifying three parameters (data rate, delay and kind of queue).

6) Now set the UDP and create the agent as TCP.

7) Then attach-agent the node with the udp. Create the new ~~int~~ null & attach the second node with ~~sink~~ null

8) Now create the CBR and attach-agent with udp.

9) At the end we give time interval and run command.

Code :->

set ns [new Simulator]
set nf [open out.nam w]
$ns namtrace-all $nf

proc finish {} {
global ns nf
$ns flush-trace
close $nf

```
exec nam out.nam &
exit 0
}
set n1 [$ns node]
set n2 [$ns node]
set n3 [$ns node]

$ns duplex-link $n1 $n2 10Mb 10ms DropTail
$ns queue-limit $n1 $n2 20
$ns duplex-link $n1 $n3 10Mb 10ms DropTail
$ns queue-limit $n1 $n3 20

set udp0 [new Agent/UDP]
set attack-agent [new
set sink1 [new Agent/Null]
set sink2 [new Agent/Null]

$ns attach-agent $n1 $udp0
$ns attach-agent $n2 $sink1
$ns attach-agent $n3 $sink2

$ns connect $udp0 $sink1
$ns connect $udp0 $sink2
set [new set cbr0 [new Application/Traffic/CBR]
$cbr0 attach-agent $udp0
$cbr0 set packetSize_ 500
```

$cbr0 set interval_ 0.005

$ns at 0.2 "$cbr0 start"
$ns at 4.5 "$cbr0 stop"
$ns at 5.0 "finish"

Result :- Transmission between mobile nodes using UDP / CBR connection studied.