SRM
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)
DELHI-NCR CAMPUS, GHAZIABAD (U.P.)

COMPUTER COMMUNICATIONS LAB

(Subject Code: 18CSS202J)

B.TECH. (CoMpUTEr sCiENCE ANd ENGiNEEriNG) - i

ii YEAr / iV sEMEsTEr

Name - Ananya Gupta

Registration Number - RA1911003030265

Experiment-6 Create a network for data transfer through Open Shortest Path First (OSPF) protocol.

Theory: In OSPF, the Packets are transmitted through the shortest path between the source and destination

Shortest path: OSPF allows administrator to assign a cost for passing through a link. The total cost of a particular route is equal to the sum of the costs of all links that comprise the route. A router chooses the route with the shortest (smallest) cost.

In OSPF, each router has a link state database which is tabular representation of the topology of the network (including cost). Using dijkstra algorithm each router finds the shortest path between source and destination.

Formation of OSPF Routing Table

- OSPF-speaking routers send Hello packets out all OSPF-enabled interfaces. If two routers sharing a common data link agree on certain parameters specified in their respective Hello packets, they will become neighbors.
- Adjacencies, which can be thought of as virtual point-to-point links, are formed between some neighbors. OSPF defines several network types and several router

types. The establishment of an adjacency is determined by the types of routers exchanging Hellos and the type of network over which the Hellos are exchanged.

- Each router sends link-state advertisements (LSAs) over all adjacencies. The LSAs describe all of the router's links, or interfaces, the router's neighbors, and the state of the links. These links might be to stub networks (networks with no other router attached), to other OSPF routers, or to external networks (networks learned from another routing process). Because of the varying types of link-state information, OSPF defines multiple LSA types.
- Each router receiving an LSA from a neighbor records the LSA in its link-state database and sends a copy of the LSA to all of its other neighbors.
- By flooding LSAs throughout an area, all routers will build identical link-state databases. 6. When the databases are complete, each router uses the SPF algorithm to calculate a loop-free graph describing the shortest (lowest cost) path to every known destination, with itself as the root.

This graph is the SPF tree.

7. Each router builds its route table from its SPF tree

OSPF

The main operation of the OSPF protocol occurs in the following consecutive stages and leads to the convergence of the internetworks:

- Compiling the LSDB
- Calculating the Shortest Path First (SPF) Tree.
- Creating the routing table entries.

Compiling the LSDB

The LSDB is a database of all OSPF router LSAs. The LSDB is compiled by an ongoing exchange of LSAs between neighbouring routers so that each router is synchronized with its neighbour. When the Network converged, all routers have the appropriate entries in their LSDB.

Calculating the SPF Tree Using Dijkstra's Algorithm

Once the LSDB is compiled, each OSPF router performs a least cost path calculation called the Dijkstra algorithm on the information in the LSDB and creates a tree of shortest paths to each other router and network with themselves as the root. This tree is known as the SPF Tree and contains a single, least cost path to each router and in the Network. The least cost path calculation is performed by each router with itself as the root of the tree

Calculating the Routing Table Entries from the SPF Tree

The OSPF routing table entries are created from the SPF

tree and a single entry for each network in the AS is produced. The metric for the routing table entry is the OSPF-calculated cost, not a hop count.

Link Properties:

Link Properties	Link 1	Link 2	Link 3	Link 4	Link 5	Link 6	Link 7
Uplink Speed	100	100	100	100	100	10	10
Downlink Speed	100	100	100	100	100	10	10

The OSPF table in NetSim

• After running Sample 2, click IP Forwarding table in Simulation Analysis screen. Then click the router to view the Routing table

We have shown the routing table for Router A, B, C, D and E which take part in routing the data packets from source to destination.

From the IP Forwarding table of Router A it is evident that all packets destined to the network 11.9.0.0 are forwarded to the Router B with interface IP 11.2.1.1

From the IP Forwarding table of Router C it is evident that all packets destined to the network 11.9.0.0 are forwarded to the Router D with interface IP 11.4.1.1

From the IP Forwarding table of Router D it is evident that all packets destined to the network 11.9.0.0 are

forwarded to the Router E with interface IP 11.5.1.1

From the IP Forwarding table of Router E it is evident that all packets destined to the network 11.9.0.0 are forwarded to the Router F with interface IP 11.6.1.1

Shortest Path from Wired Node H to Wired Node I in OSPF (Use Packet Animation to view)

Wired Node J->L2 Switch H->Router A->Router B ->Router C->Router D->Router E- >Router F->L2 Switch I ->Wired Node K. OSPF chooses the upper path (cost is less-5) since OSPF is based on cost.

Note: The Cost is calculated by using the following formula

$$Cost = \frac{ReferenceBandwidth}{LinkSpeedUp}$$

Reference Bandwidth = 100 Mbps

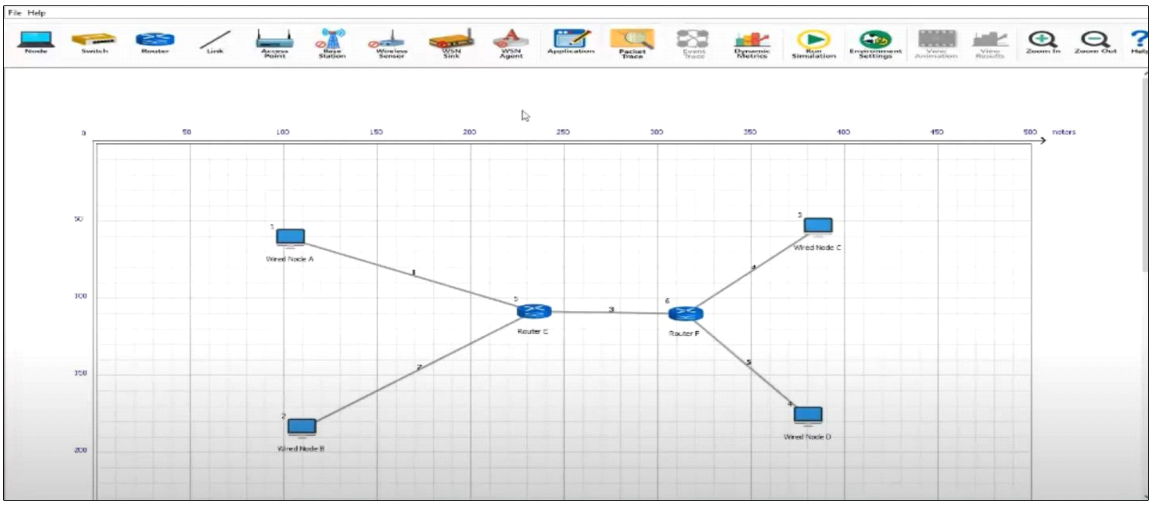
For Example,

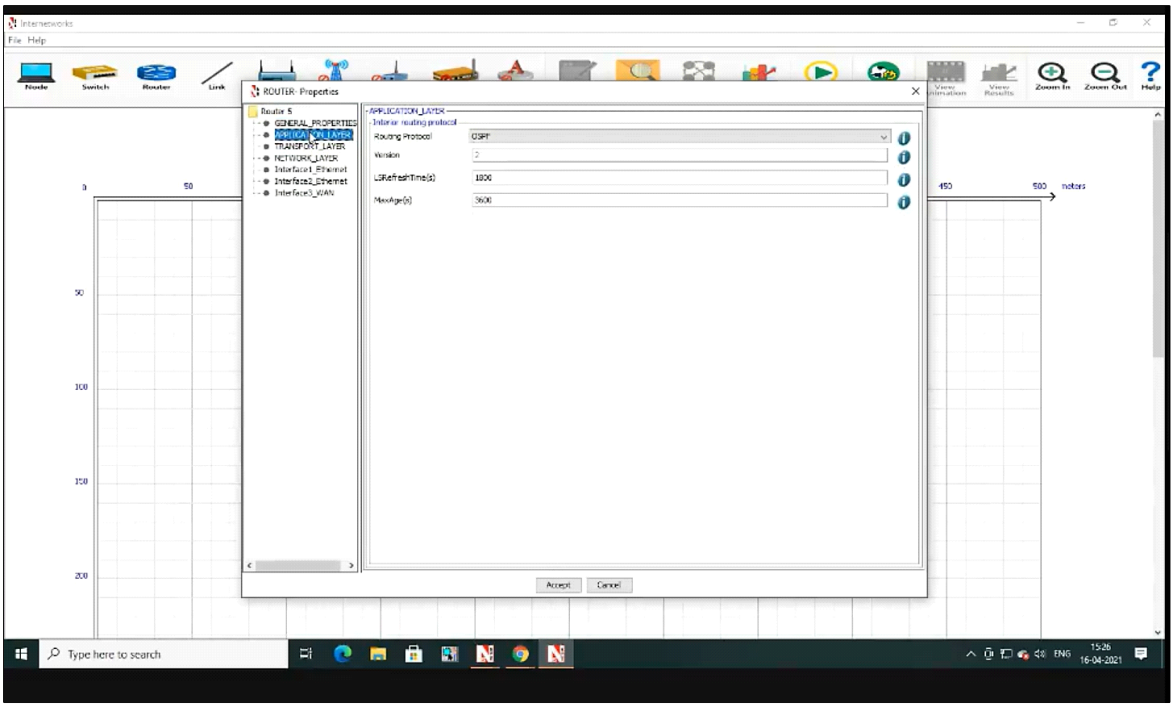
Let us take, Link Speed UP = 100 Mbps

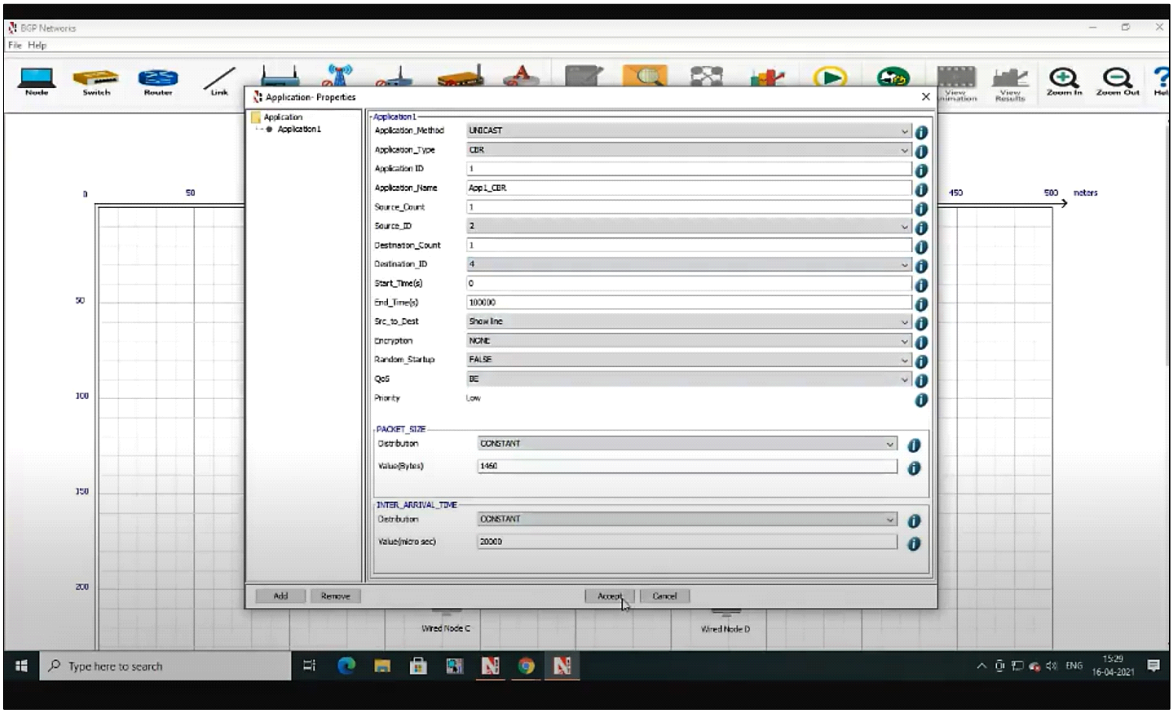
$$Cost = \frac{100\ (ReferenceBandwidth)}{100\ (LinkSpeedUP)} = 1$$

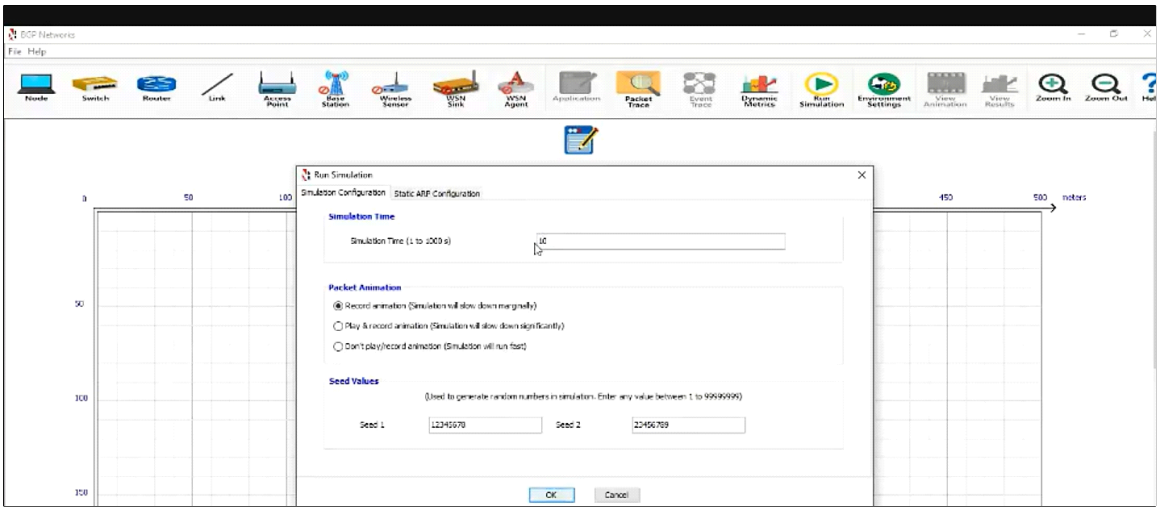
Note: The device / link numbering and IP Address setting in NetSim is based on order in which in the devices are dragged & dropped, and the order in which links are connected. Hence if the order in which a user executes

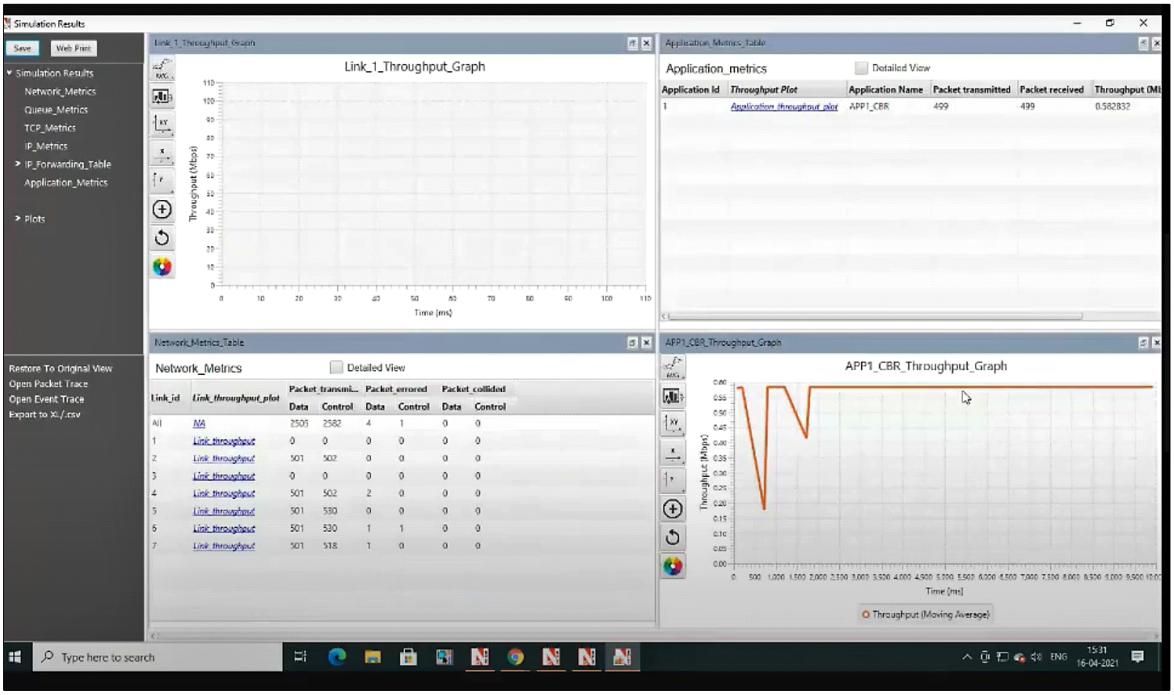
these tasks is different from what is shown in the screen shots, users would notice different tables from what is shown in the screen shots.











Result: Network created and the data transferred through Open Shortest Path First (OSPF)