Data structure

Weighted Graph is used in this assignment. Every node in this graph is a router in the topology and every edge is a path which is constructed by two nodes. Every edge has a weight which is a list and the first value in this list is delay, the second argument is capacity and the third argument is a time list that stores the finishing time of every request which has used this current path.

When doing the loop to send a request, first of all, the time list (third argument of edge) of every edge in the graph will be iterated once to remove the times which is smaller than the start time of the current request. It is called releasing resources. Then the Dijkstra algorithm will be used to find a best path depend on the chosen routing scheme. Then the path will be tested to check if it has been blocked or not (Whether the length of time list is equal to the capacity). If it has been blocked, then do nothing and jump to the next request. Otherwise, connection will be established and the finishing time should be appended into time list. It is called occupying resources.

Comparison

8 columns represent the following meanings: 1. Total number of virtual connection requests 2. Total number of packets 3. Number of successfully routed packets 4. Percentage of successfully routed packets 5. Number of blocked packets 6. Percentage of blocked packets 7. Average number of hops per circuit 8. Average cumulative propagation delay per circuit

Both packets rate of this two tables are 2.

Virtual Circuit Network (SHP, SDP, LLP)							
5884	355091	323558	91.12	31533	8.88	3.65	166.82
5884	355091	334409	94.18	20682	5.82	3.89	154.18
5884	355091	350527	98.71	4564	1.29	4.02	187.03

| Virtual Packet Network (SHP, SDP, LLP)							
5884	360975	340133	94.23	20842	5.77	3.63	164.35
5884	360975	349378	96.79	11597	3.21	3.88	153.99
5884	360975	360704	99.92	271	0.08	4.00	184.96

Analysis

Shortest hops protocol(SHP) always chooses the path which has the least sum of hops so average number of hops per circuit is the smallest among three protocols. Shortest delay protocol(SDP) always chooses the path which has the least sum of delays. That's why SDP has the least average cumulative propagation delay per circuit. However, it is very difficult to tell which scheme should have a higher percentage of successfully routed packets between SHP and SDP because the ways they choose paths are not depend on capacity or used capacity. Least Loaded Path (LLP) always finds the least loaded path currently available from the source to the destination. This algorithm may have the biggest average number of hops and average cumulative propagation delay per circuit, however, it should have the highest percentage of successfully routed packets.

Totally, virtual packet network performs better than virtual circuit network, according to the percentage of successfully routed packets. Because the packets of virtual circuit network follow the same path for transmitting once the connection has been established. If the chosen has been blocked, then all packets will be blocked. However, the packets in virtual
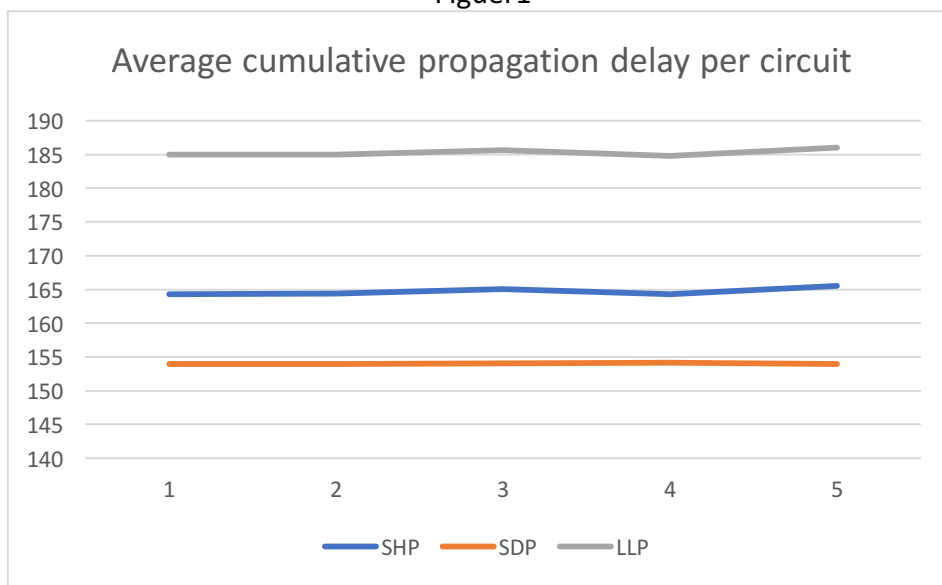
packet network choose paths independently and they don't affect each other. That's why percentage of successfully routed packets of virtual packet network is higher than the other.
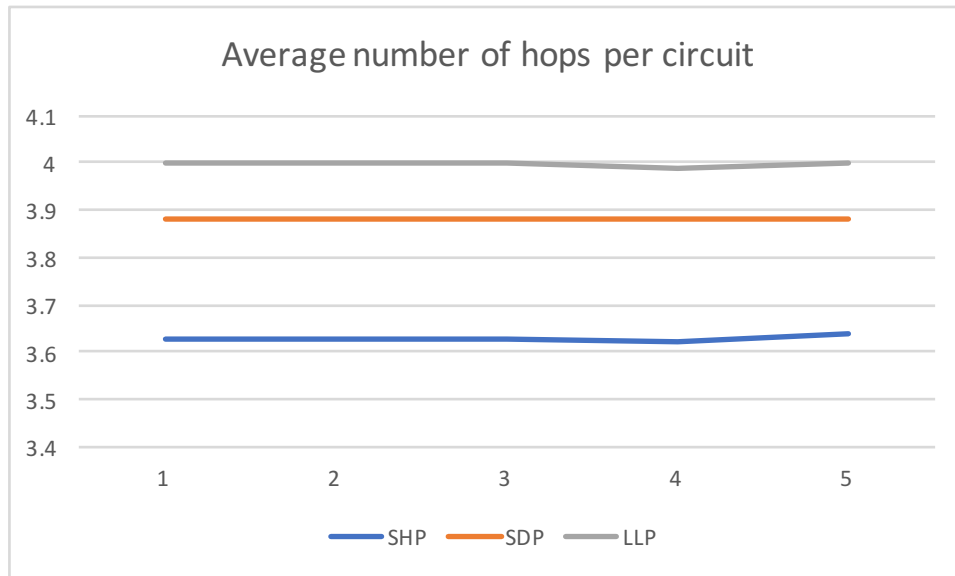
Virtual packet network

If the packet rate is larger than 3, it will take more than 5 minutes to get the result!
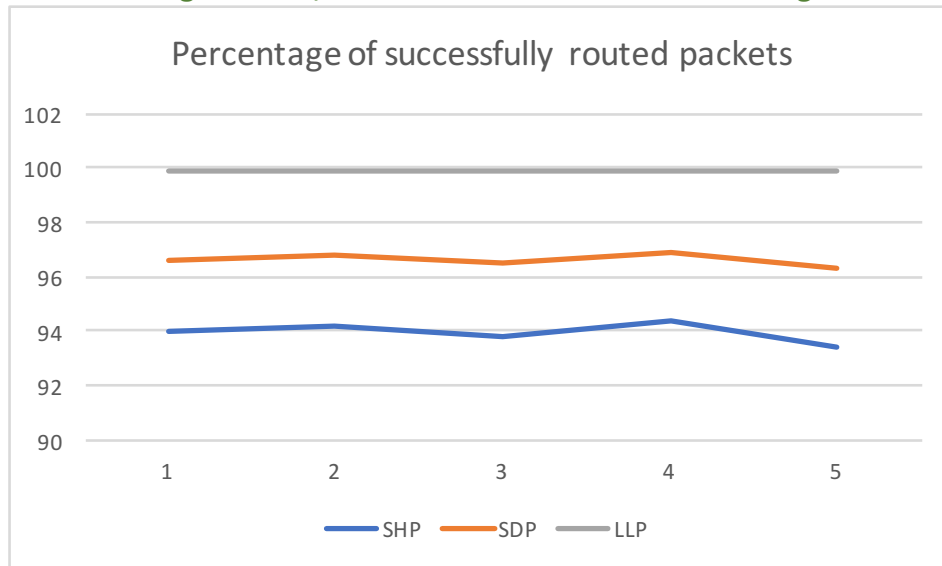
Figuer1

Figuer2

Figuer3

Figuer1: Least Loaded Path (LLP) always finds the least loaded path currently available from the source to the destination. So the path it chooses has the lowest possibility to be blocked.

Figuer2: Shortest delay protocol(SDP) always chooses the path which has the least sum of delays. That's why SDP has the least average cumulative propagation delay per circuit.

Figuer3: Shortest hops protocol(SHP) always chooses the path which has the least sum of hops so average number of hops per circuit is the smallest among three protocols.

https://youtu.be/rQ8VZULn0WE