TCP-IP Research Exercice
Lab 1

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1 Analyzed scenarios

1.1 Star Topology

First, we decided to analyze the communication latency of the star topology with 2,5,50 and 100 hosts. The star topology is a network architecture where all hosts are connected to one router. Therefor, it is the only device managing all the traffic between all the hosts. We implemented the star topology for N hosts from the code snippet given previously in the Lab.

1.2 Tree Topology

The second topology we decided to analyze is the tree topology. This network architecture is made of one root router which is connect to F outer routers which are then connect to F hosts each. To analyse this architecture we choose the depth of the tree to be equal to 2. We also adapted the fanout F to increase the number of hosts. We used the built in tree topology from MiniNet to evaluate the average latency

2 Latency analysis

To evaluate the average latency for both topologies we used the pingallfull command which provides detailed feedback about the average latency of a ping between two hosts. We then computed the total average latency by averaging all the average latencies between two hosts.

2.1 Star Topology

The star topology posses no shared links. Therefor the only expected increase in latency is the growing congestion at the middle router. We can see that for a few number of hosts that the latency goes from 10 ms to 17ms for 2 to 5 hosts.

This increase is not significant has the experiment result can vary from 3-4 ms due to the environment where the experiment is conducted (VM). After that we can observe a stabilization around 17 ms with 5 to 50 hosts and finally a linear growth from 50 hosts and more. This is because in the star topology each host is connect to the middle router with an unique link i.e this link is only used to communicate with the host on it. Once the number of hosts increases above 40 the average latency starts to increase too. This gain in latency is not that significant (around 10 ms) but is still representative of the queuing delay increasing at the middle router as the traffic grow. The more hosts the more there is traffic at the middle router.

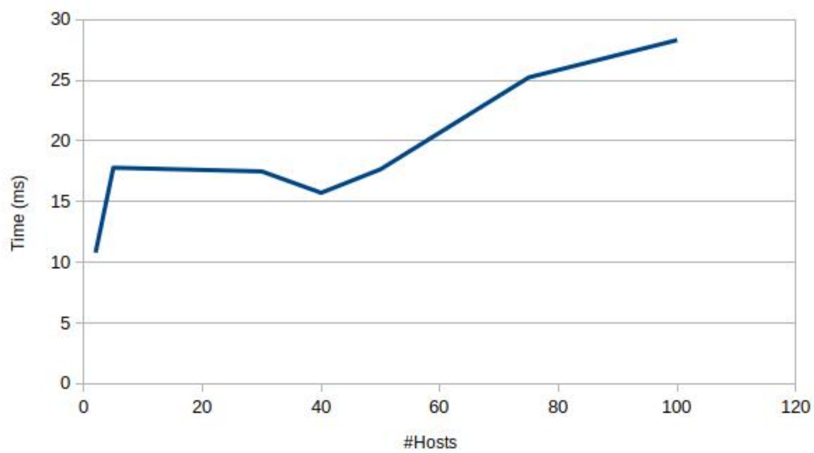

Figure 1: Average latency in a star topology network by the number of hosts

Hosts	Average latency (ms)
2	10.7
5	17.7
30	17.48
40	15.8
50	25.23
40	25.23
100	28.3

2.2 Tree Topology

In the tree topology we observe a higher latency at the start, this is because of the fact that when a host which is on the right of the tree wants to communicate with a host at the far left the number of crossed links is :

$$MaxCrossedLinks = 2 * depth$$

In our case we choose the make the depth of the tree a constant equal to 2. When the number of hosts increases we instantly begin to see a huge increase in latency. This can be explained from the fact that in a tree topology the number of shared links is :

$$SharedLinks = (depth - 1) * fanout$$

We observe a linear grow of the average latency if we increase the number of hosts, this is as expected as the traffic reaching the root router is increasing with the number of hosts growing of both sides of the tree as they have to ping each other to compute the average latency. But, it is important to notice that only half of the traffic reaches the root router whereas in the start topology all the traffic was passing through the middle one. This can explain the fact that we do not have any sign of congestion in the tree topology Figure 2

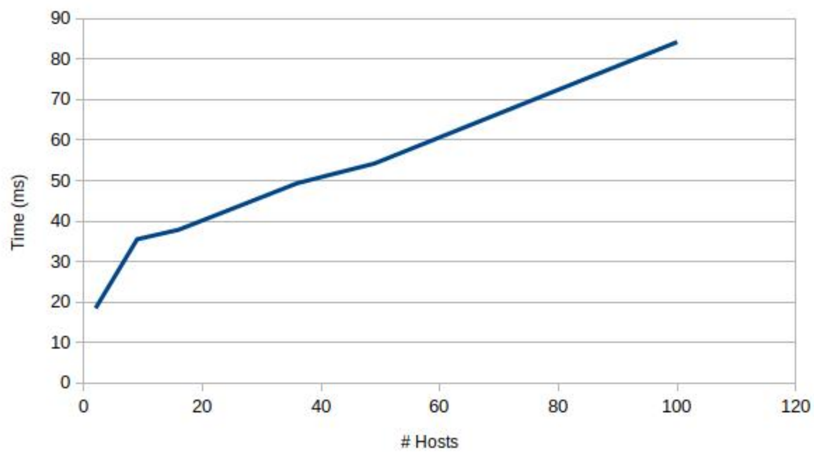

Figure 2: Average latency in a tree topology network by the number of hosts

Hosts	Average latency (ms)
2	18.4
9	35.4
16	37.4
49	54.23
100	84.2