MOBILE COMPUTING

ASSIGNMENT 2

SIMULATION OF THE DSR AD-HOC ROUTING PROTOCOL

BY

MANAN SHAH ROLL NO: 08305004
VISHAL PRAJAPATI ROLL NO: 08305030

STEPS CARRIED OUT TO PERFORM THE EXPERIMENT

This simulation has been carried out using the Qualnet 4.5 simulator.

1. In order to place 15 nodes in a chain topology, we need to change the default values of the co-ordinate system provided for the canvas. For that, we go to the Inspector -> Config Settings -> General -> Terrain -> Co-ordinate System - > Dimension -> 4000 x 4000.

2. All the nodes are placed at a distance of 200 meters from each other. A snapshot of the scenario is given:

3. After placing the 15 nodes in chain topology, we set the parameters for the nodes in the following way:

   Node Configuration -> MAC protocol -> 802.11
   Node Configuration -> Radio/Physical Layer -> Radio type ->
   Auto rate fallback -> No
   Node Configuration -> Radio/Physical Layer -> Radio type -> Data Rate->11 Mbps

   - In the Node Configuration -> Radio/Physical Layer -> Radio type, We change the parameter of Transmission Power from 15 to 6 dbm. This change is required to ensure that the packets from one node are able to reach only the adjacent nodes. The value was derived through the method of observation of the simulation.

4. Now, in order to change the routing protocol to DSR, we change the following parameters:

   Node Configuration -> Routing protocol -> Routing policy -> Routing protocol for IPV4 -> DSR

   In order to ensure that there is no loss of packets due to packets being dropped, we set the Buffer Packets parameter to an arbitrary value say, 5000 and accordingly also set the Buffer size. (e.g. 5000 x 4096 (pkt size).

5. For the CBR UDP link which goes from node 1 to node 2 (and eventually till node 15 as we go on increasing the hop counts), we set the following parameters:

   - Now, here we need to ensure a data rate of 10 Mbps. Our calculation is as follows:

     A data rate of 10 Mbps for 200 seconds = 10 x 10E6 x 200 bits …A

     Now, each packet is of 512 bytes = 512 x 8 = 4096 bits …B

     So, therefore dividing A/B, we get 4,88,282 packets to be sent in all

     Therefore, no. of packets sent in one second = 4,88,282/200 = 2442

     Hence, the inter-packet interval is 1/2442 = 4.095 x 10E-4 ~ 4 msec.

     Thus we set the no. of Items to be sent as 4,88,282

     The Item Size is set as 512 bytes

     The Inter-Packet interval is set at 0.0004.

     The End Time is set at 200 sec.

6. We make some more changes to the Config settings as follows:-

   Config Settings -> Wireless Settings -> Channel -> Path loss model -> Free Space

   Config Settings -> Wireless Settings -> Radio Physical Layer -> Noise Factor-> 0

   Config Settings -> General -> General -> Simulation time -> 200 seconds

7. In order to set the mobility parameters for the second part of the experiment, we set the following parameters:

   Node Configuration -> Mobility -> Position Granularity -> 0.5

   Node Configuration -> Mobility -> Mobility Model -> Random Waypoint

   Node Configuration -> Mobility -> Pause -> 10 seconds

   Node Configuration -> Mobility -> Min. speed -> 1 meters/sec

   Node Configuration -> Mobility -> Max speed -> 10 meters/sec

8. The results of the simulation for the different hop counts measuring Initial delay, Average total delay and Throughput are as follows:

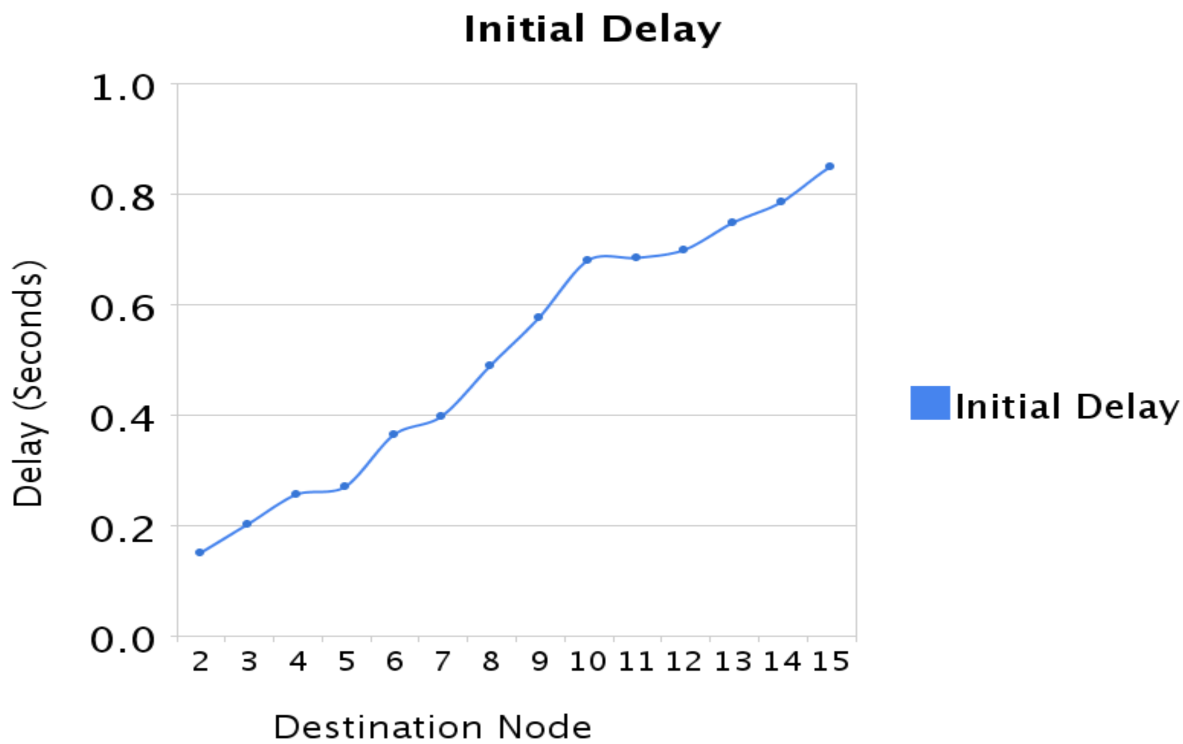
I. Initial Delay

No of hops	Initial delay (seconds)
1	0.15
2	0.20
3	0.26
4	0.27
5	0.36
6	0.40
7	0.49
8	0.58
9	0.68
10	0.68
11	0.70
12	0.75
13	0.79
14	0.85

The initial delay of the packet has been calculated using the tracer facility of the Qualnet simulator. A snapshot of the same for the hop count of 13 has been given below: (here we calculate the CBR (application layer) to CBR (application layer) delay from the source node to the destination node).

Serial	Type	Check	Tracing Node	Tracing Proto.	Sim. Time	Originating Node	Message Seq. ...	Originating Proto.	Action
1			1	CBR	1.0	1	0	CBR	SEND
2			1	UDP	1.0	1	0	CBR	SEND
634			14	UDP	1.78557777	1	0	CBR	RECV
635			14	CBR	1.78557877	1	0	CBR	RECV
4			1	CBR	1.0004	1	2	CBR	SEND
5			1	UDP	1.0004	1	2	CBR	SEND
761			14	UDP	1.826130477	1	2	CBR	RECV

The initial packet delay for a hop count of 13 (the message sequence number = 0 and source node = 1 (originating node) and destination node = 14 (tracing node)) is 1.78557877-1.0 ~ 0.79

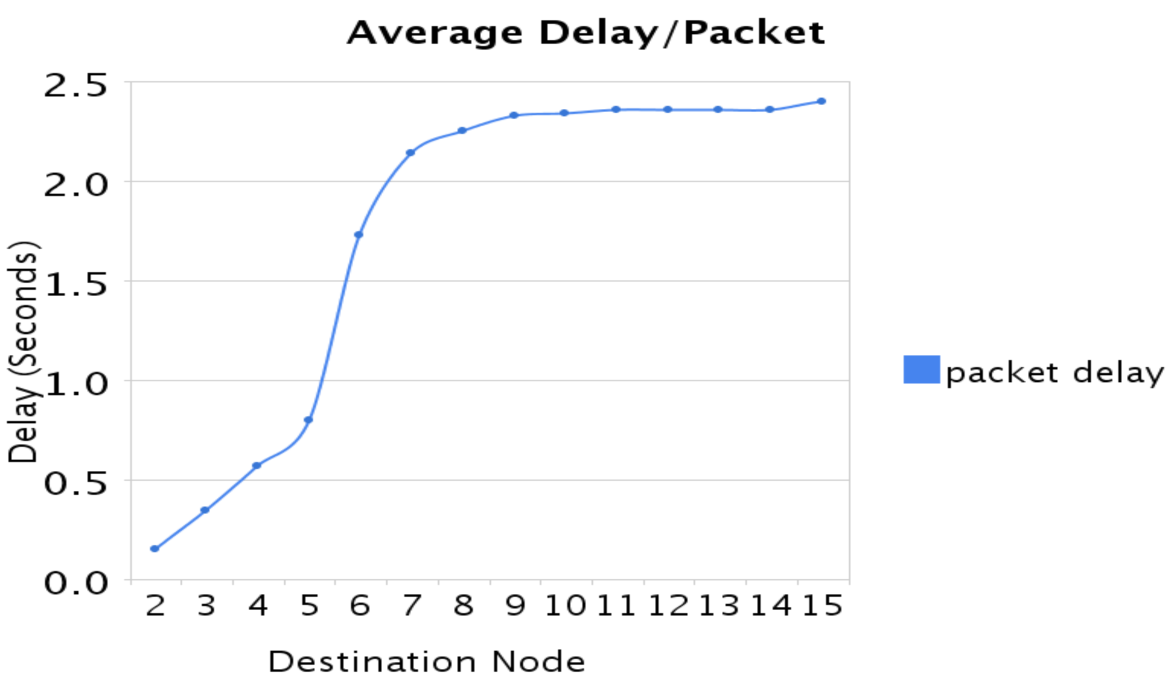


Initial Delay
1.0
0.8
0.6
0.4
0.2
0.0
Delay (Seconds)
2 3 4 5 6 7 8 9 10 11 12 13 14 15
Destination Node
Initial Delay

II. Average total delay

No of hops	Average total delay (seconds)
1	0.15
2	0.35
3	0.57
4	0.80
5	1.73
6	2.14
7	2.25
8	2.33
9	2.34
10	2.36
11	2.36
12	2.36
13	2.36
14	2.4

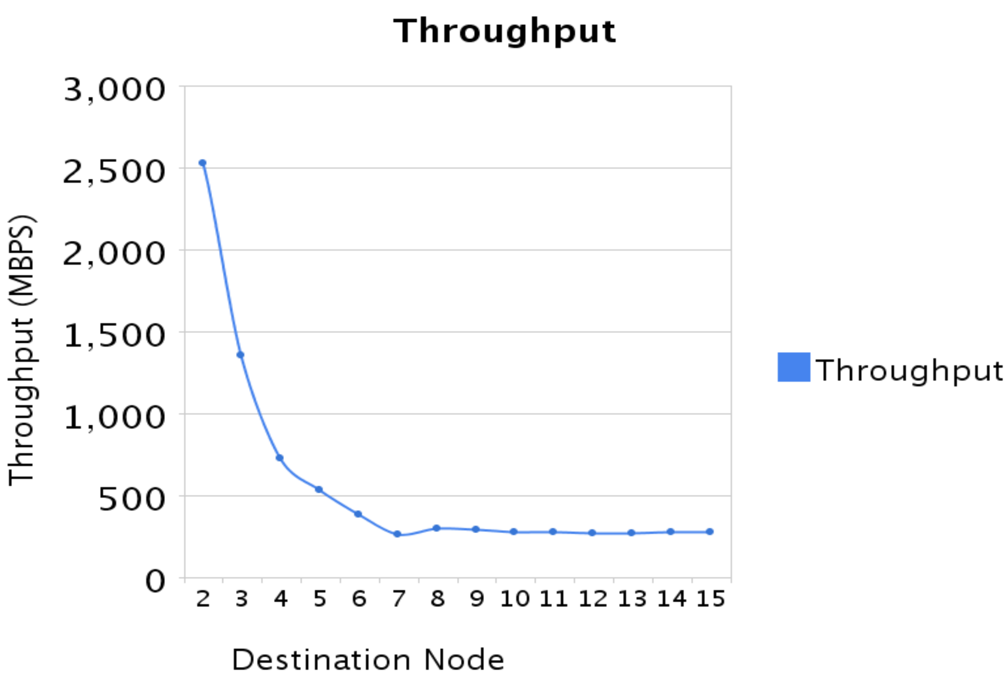
The Qualnet simulator provides the values for the Average end-to-end delay for the different hop counts through the means of graphs. So we have just exported the values for each of the hop counts into a text file and built a graph using the same.



III Throughput

No of hops	Average throughput (Kbits/sec)
1	2530
2	1360
3	729
4	539
5	385
6	263
7	301
8	291
9	279
10	275
11	268
12	270
13	275
14	270

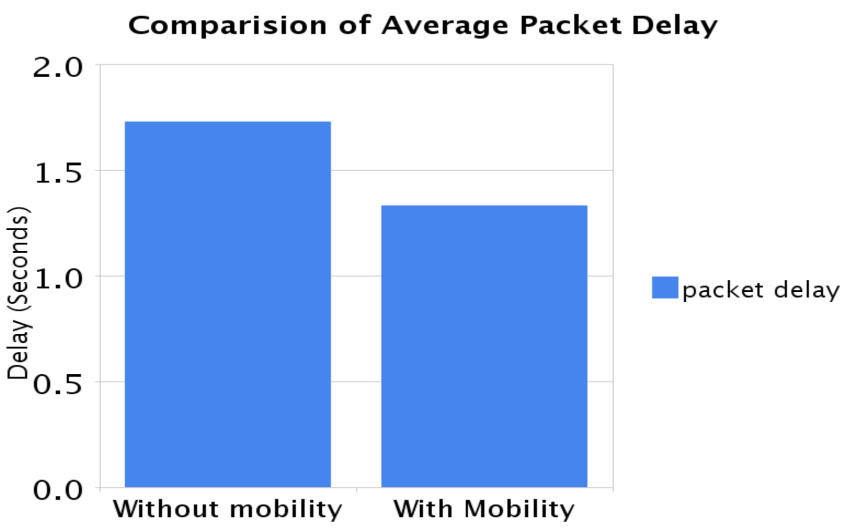
The graph is constructed using the same procedure as described in the above section

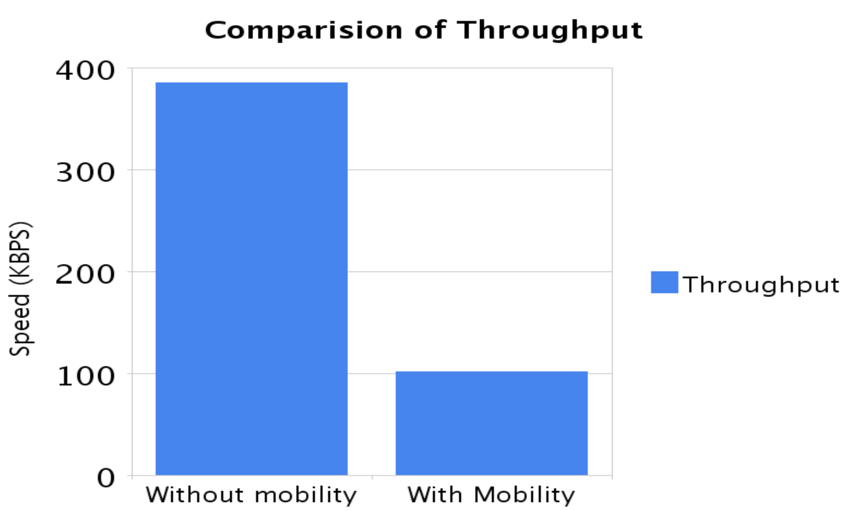


SIMULATION WITH MOBILITY ENABLED FOR A HOP COUNT OF FIVE

After setting the mobility parameters as described in the first section, we got the following results from the simulation.

	Without Mobility	With Mobility
Average total delay (seconds)	1.73	1.32
Throughput (Kbits/sec)	385	103





Impact of mobility on Throughput and Delay

From the above results, we can see that due to mobility, there has been a significant decrease in the Throughput of the data. But at the same time we also observe a decrease in the Average total delay of the packets.

The reason for this is that as the nodes start moving randomly, there occurs a change in the topology. Some nodes that were not within the radio range of each other previously, may come into contact now while some who were in touch with each other previously, may lose their radio contact.

As a consequence of this change in topology, it may happen that the sender and the receiver may come closer to each other during certain duration of time. During this period, the data transfer between the sender and the receiver will be much faster than when they were distant. Hence, there is drop in the average total delay.

But as soon as the sender and the receiver start moving away from each other, and the sender is also not able to find a route to the receiver via any of its adjacent nodes, the receiver is unable to receive packets from the sender. Hence, there is drop in the throughput.

Conclusion

Thus after performing the simulations for the objectives stated in the experiment, We come to the following conclusions:-

1) The initial packet delay increases almost linearly as the number of hops increases.

2) The average total packet delay initially increases very rapidly as the number of hops increases but then it stabilizes after a certain number of hops (in our example, it starts stabilizing after hop count 9).

3) Similarly, for Throughput, it first decreases very rapidly as the number of hops increase, but it starts to settle down at almost a constant value after a certain number of hops (e.g. It stabilizes at around 270 kbps after hop count 9).

4) Due to mobility, there is a decrease in the Average total delay of the packets but at the same time, there is a significant decrease in the throughput also.