



Emerging Network Technologies

NetSim Exercise 7

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7. Analyze the performance of a MANET, (running CSMA/CA (802.11b) in MAC) with increasing node mobility

7.1 Theory:

Mobile Ad-Hoc Network (MANET) is a self-configuring network of mobile nodes connected by wireless links to form an arbitrary topology without the use of existing infrastructure. The nodes are free to move randomly. Thus the network's wireless topology may be unpredictable and may change rapidly.

Mobility and node density are the two major factors which influences the performance of any routing protocol of mobile ad hoc network. The mobility of the nodes affects the number of connected paths, which in turn affect the performance of the routing algorithm.

7.2 Performance metrics:

The different parameters used to analyze the performance are explained as follows:

- **Throughput:** It is the rate of successfully transmitted data packets in unit time in the network during the simulation.

7.3 Procedure:

In NetSim, Select –Simulation → New → Advanced Wireless Networks →MANET.

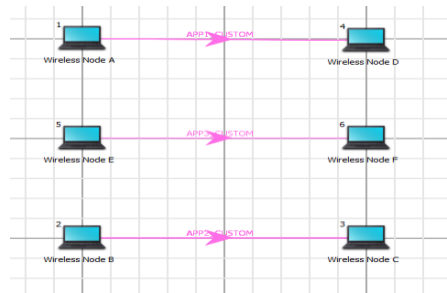
Step 1: Create /Design the Network

Devices Required: 6 Wireless Nodes

Step 2: Configure the Network (Sample 1)

Wireless Node Properties:

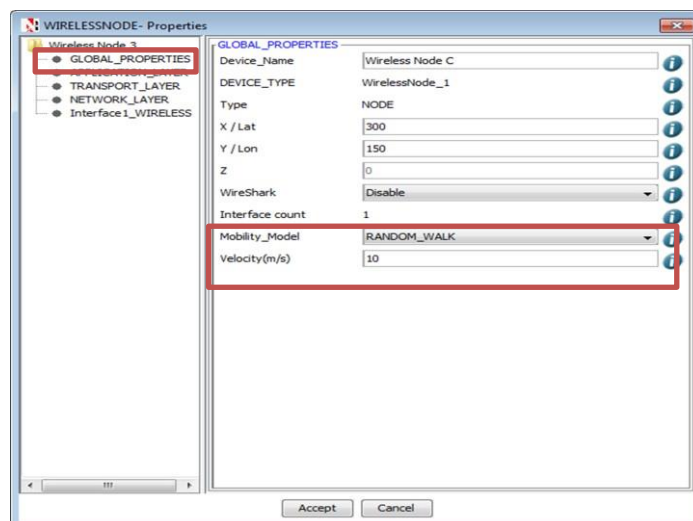
- Click & drop 6 Wireless Nodes onto the Simulation Environment.
- Arrange the positions of the nodes as per the following table:



Wireless Node	X-Coordinate	Y-Coordinate
1	100	50
2	100	150
3	200	150
4	200	50
5	100	100
6	200	100

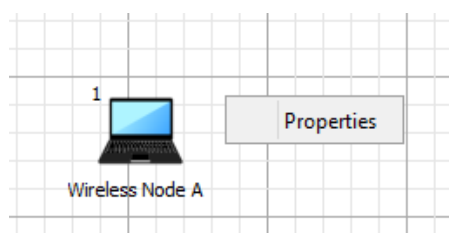
- Disable TCP in all Wireless Nodes.
- Change Mobility model to **RANDOM_WALK** and set velocity **10 m/s** for all nodes.

NOTE: To change Mobility Model, go to **Global Properties → Mobility Model**



Wireless Link Properties:

Right Click anywhere on the Grid Environment → Properties



Channel Characteristics	Line of Sight
Path Loss Exponent (n)	2

Path loss is the reduction in the power density of radio wave as it travels. The loss is proportional to (distance) to the power (n), where n is the path loss exponent. The general value of n is from 2 to 5. As the value of n is increased there will be more reduction in power and hence higher likelihood of error in the packet. In general, users would notice that as n increases the error increases, the data rate decreases and the throughput decreases.

NetSim provides various propagation models such as fading only, fading and shadowing and line of sight.

In Line of sight, sender and receiver have an unobstructed path between them. The reduction in signal power is only due to the path loss explained above.

In fading only, signal can take many different paths between sender and receiver due to reflection, scattering, diffraction and others.

In fading and shadowing, apart from fading then received signal is shadowed by obstructions such as hills and buildings.

Step 3: Model Traffic in the Network (Sample 1)

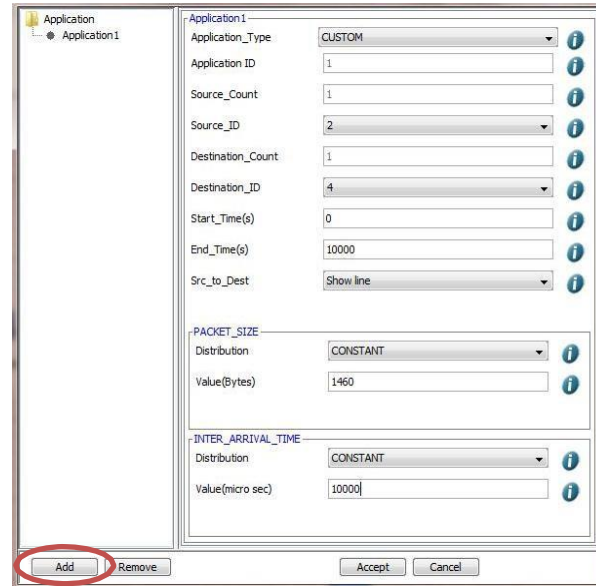
Select the Application Button and click on the gap between the Grid Environment and the ribbon. Now right click on Application and select Properties.

Application Properties:

Application Type	Custom	Custom	Custom
Source ID	1 (Wireless Node A)	2 (Wireless Node B)	5 (Wireless Node E)
Destination ID	4 (Wireless Node D)	3 (Wireless Node C)	6 (Wireless Node F)
Packet Size			
Distribution	Constant	Constant	Constant
Value(Bytes)	1460	1460	1460
Inter Arrival Time			
Distribution	Constant	Constant	Constant
Value(µs)	20000	20000	20000

NOTE: The procedure to create multiple applications are as follows:

Step 1: Click on the ADD button present in the bottom left corner to add a new application.



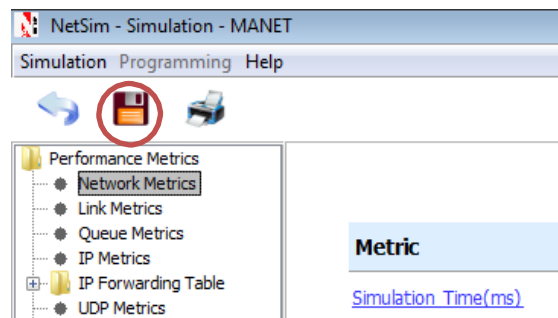
Step 4: Simulate

Simulation Time - 100 Sec

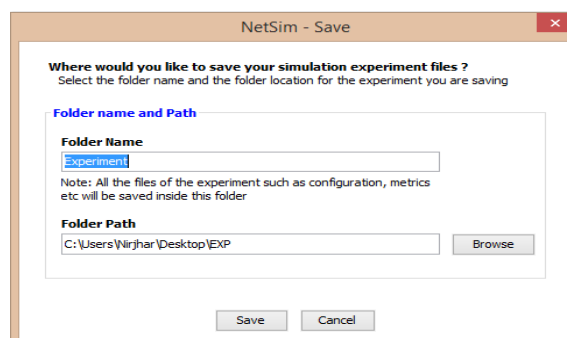
After completion of the experiment, —Save the experiment for future analysis of results.

Steps to save an experiment:

Step 1: After simulation of the network, on the top left corner of Performance metrics screen, click on the –Save Network and Metric as button



Step 2: Specify the **Experiment Name** and **Save Path** and click on **OK**



Step 5: Configure the Network (Sample 2)

Wireless Node Properties:

Change Mobility model to **RANDOM_WALK** and set velocity **30 m/s** for all nodes.

The remaining properties are same as Sample 1.

Step 6: Simulate

Simulation Time - 100 Sec

After completion of the experiment, —Save the experiment for future analysis of results.

Step 7: Configure the Network (Sample 3)

Wireless Node Properties:

Change Mobility model to **RANDOM_WALK** and set velocity **50 m/s** for all nodes.

The remaining properties are same as Sample 1.

7.4 Simulate

Simulation Time - 100 Sec

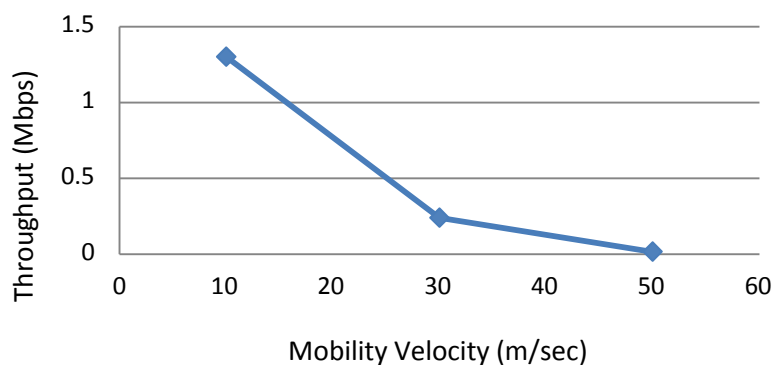
After completion of experiment, -Save the experiment, for future analysis of results. Users can view the mobility of the nodes and flow of packets clearly using packet animation.

7.5 Analysis of Result

Go to **Simulation** → **Open** → **Metrics** menu to open the results of saved experiments.

- Go to Application metrics and compute the sum of all column wise values of throughput.

Throughput = Sum of throughputs obtained from all Applications



7.6 Inference

As the mobility of nodes increases, the throughput decreases. This is because as the velocity increases, more packets get lost in lieu of ad hoc movement of the nodes. The packet delivery ratio decreases as the sum of total packets received decreases with increased mobility.

NOTE: The results are highly dependent on position/velocity/ traffic etc given the inherent characteristics of MANET protocols. Any modifications with the above mentioned input parameters will change the final output result.