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Scalability in QoS Analysis Of Mobile Ad-Hoc Network

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ABSTRACT

Wireless ad-hoc networking is core technology useed in modern communication system. Difference in terms of scalability by varying number of nodes and topology is studied by using Network Simulator-2 (NS-2) software for QoS service analysis of MANET. To analyze the effect of scalability in mobile ad-hoc network, we are using Xgraph to show difference graphs. The parameters taken for the comparison are number of packets transmitted during communication, number of packets lost, total bytes transferred, bit rate during signal transmission, bitrate with delay and packet loss rate during transmission.

Key words: MANET, QoS

1. QUALITY OF SERVICE (QOS) [1,2,3,4]

QoS is the guaranteed amount of data transfer. The QoS can be defined in terms of set of service requirements met by the network during packet transmission [5]. The collective effect of service performance determining degree of user satisfaction is QoS in mobile ad-hoc network. The following are some of the qos parameters [6] reflecting the service differentiation: throughput (the desired bite rate (bps) or bandwidth used in signal transmission), end-to-end (ete) delay (delay encountered by a packet, the sum of transmission delay, processing delays (includes router look-up), queuing delay etc.), delay jitter (variations in ete delay), packet loss rate (the percentage of lost packets due to channel error or queue overflow).

2. RANDOM TOPOLOGY

For different number of nodes keeping all other parameters constant and using random topology, the various QoS parameters i.e. number of packets transmitted, number of packets lost, total bytes transmitted, bit rate, bit rate with delay and packet lost rate are studied. The various parameters used during simulations are shown in table 1.

Table 1: Parameters used in simulation

Parameter	Value
Number of Nodes	25,15,50,75
Topography Dimension	50m*50m
Traffic Type	CBR
Radio Propagation Model	Two ray ground model
MAC Type	802.15.4.Mac Layer
Packet Size	70
Mobility Model	Random Way Point
Antenna Type	Omni directional
Protocol	AODV

Here the basic parameters of the proposed work are presented respective to the simulation environment. The system is implemented on Ubuntu Environment with NS2 simulator.

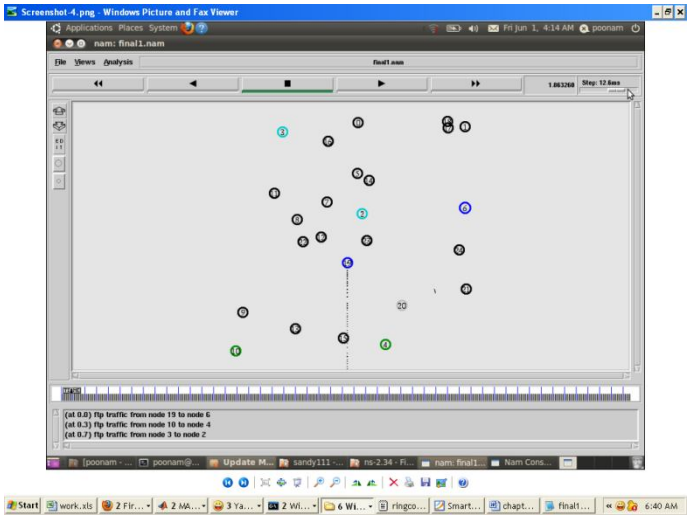

Figure 1: Simulation 1 (Random Topology/25 Nodes)

Figure 1 shows Network has about 25 nodes. The communication begins at 0 seconds. The circles represent the coverage area and the blue nodes are the source and destination nodes. in this figure communication is being performed in three different node pairs. The darkline coming downward is showing the packet loss during the communication over the network. The communication is being performed between node 10 and node 4, Node 15 is the intermediate node that gives the data loss because of heavy load on it.

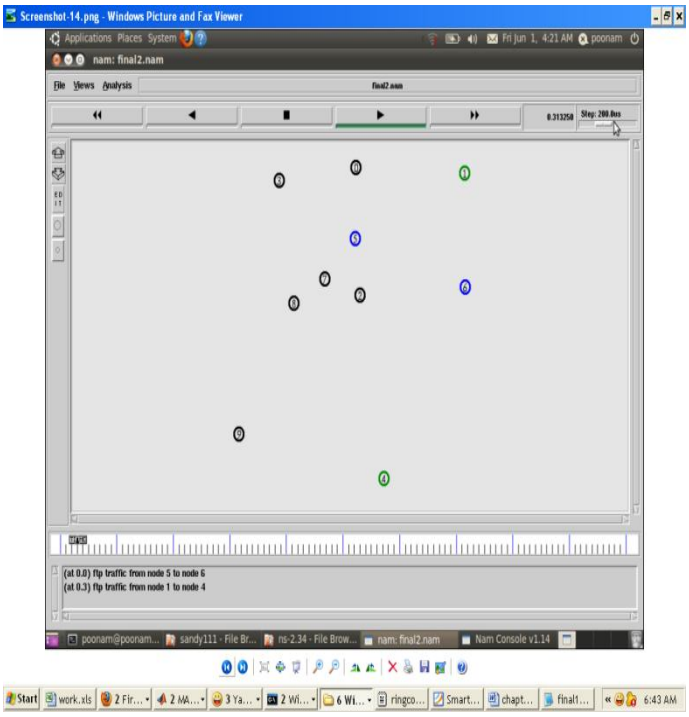

Figure 2: Simulation 2 (Random Topology/15 Nodes)

Figure 2 shows Network has about 15 nodes. The communication begins at 0 seconds. the blue nodes are the source and destination nodes. Communication is being performed in two different node pairs. At time 0 the communication is performed between node 5 and node 6 and at time 0.3 second another communication begin between node 1 and node 4.

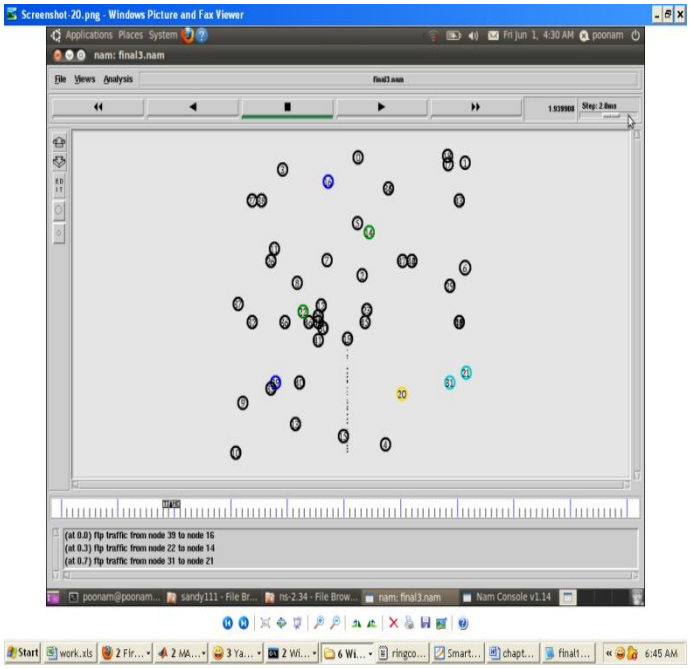

Figure 3: Simulation 3 (Random Topology/50 Nodes)

Figure 3 shows communication is being performed in three different node pairs i.e. between 39 and 16 at time 0, between 22 and 14 at time 0.3 and between 31 and 21 at time 0.7. The dark line coming downward is showing the packet loss at node 19 during the communication between node 39 and 16.

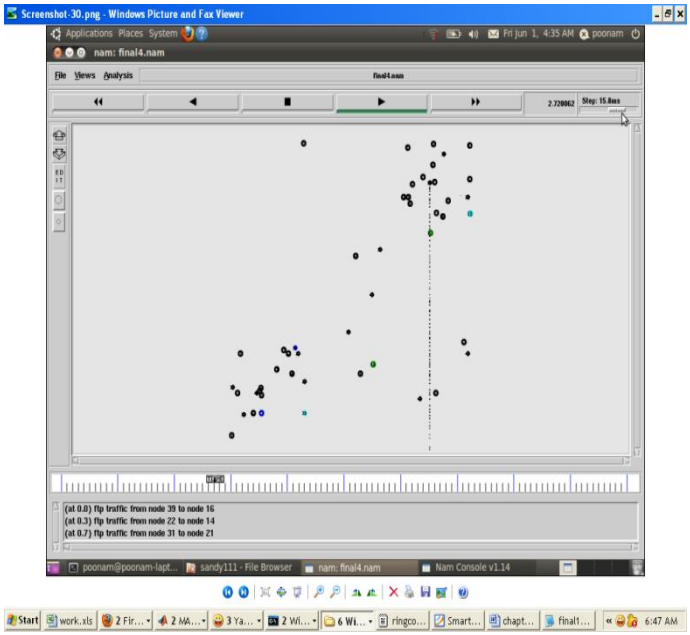

Figure 4: Simulation 4 (Random Topology/75 Nodes)

Figure 4 shows Network has about 75 nodes. The communication begins at 0 seconds. the blue nodes are the source and destination nodes. Communication is being performed in three different node pairs. i.e. node 39 and 16, node 22 and 14 and node 31 and node 23 The dark line coming downward is showing the packet loss during the communication between node 22 and node 14 because of heavy traffic over it.

3. COMPARATIVE ANALYSIS

We have taken 4 different Scenarios that are different in terms of Number of nodes, all other parameters are identical. The particular work is showing the difference in terms of scalability. As the PAN is small area network because of this more number of nodes reduces the gap between nodes. To analyze the effect of scalability we are using Xgraph to show the difference graph. The parameters taken for the comparison are number of packets transmitted, number of packets lost, total bytes transferred, bit rate, bit rate with delay and packet loss rate.

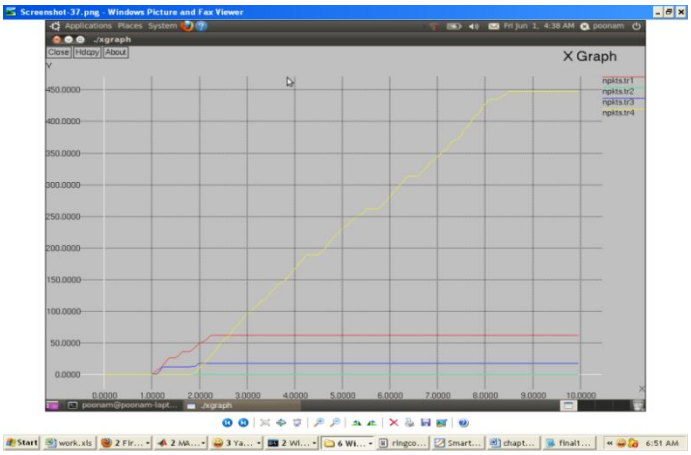

Figure 5: Comparison Packet Transmitted (Random Topology)

Figure 5 shows the simulation is been performed for 10 seconds. The x-axis here represents the time and y axis represents the packet transmitted over the network. The yellow line here represents the maximum number of nodes in network i.e. 75 nodes. And the green line shows the minimum number of nodes in the network. We can observe that as the number of nodes in the network increases the distance between the nodes decreases. As we know smart dust are the tiny particles that have very less energy to communicate. They can give better results if the distance between nodes is less. So we can conclude as the distance between nodes in a network decreases the success rate will be high.

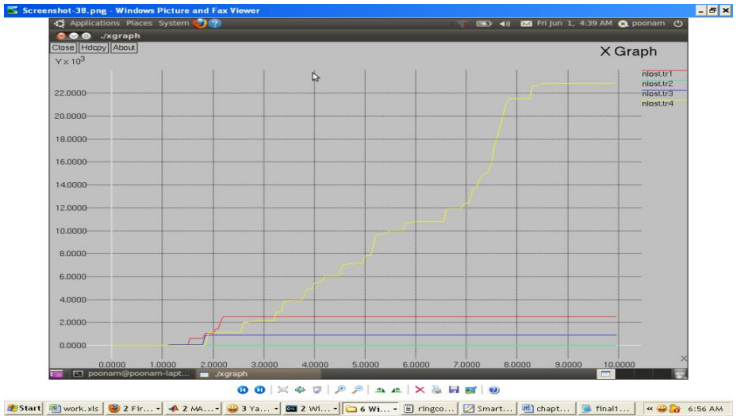

Figure 6: Comparison Packet loss (Random Topology)

From figure 6, we can observe that as the number of nodes in the network increases the distance between the nodes decreases. Because of this there are more chances of collision. As the collision rate will be increased the data loss is also increased. So we can conclude as the collision rate between nodes in a network increases the loss rate will also increase over the network.

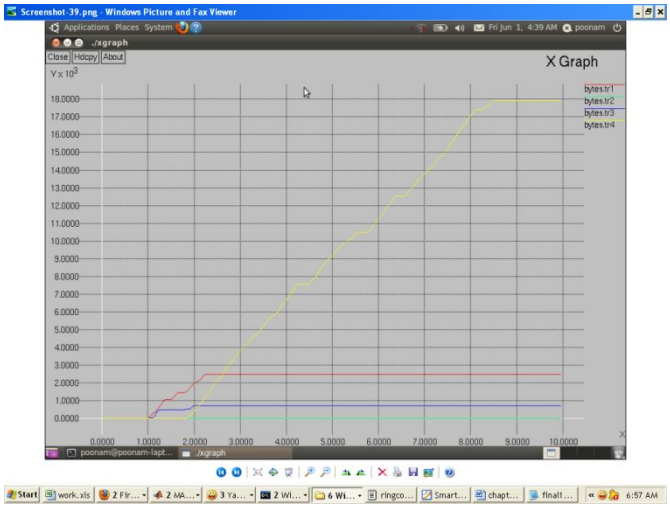

Figure 7: Comparison bytes Transmitted (Random Topology)

From figure 7, we can observe that as the number of nodes in the network increases the distance between the nodes decreases. Because of this there are more chances of collision. Because of this the communicating packets over the network will also increase. We can say that as the distance between nodes decrease the number of bytes communicated over the network will be increased.

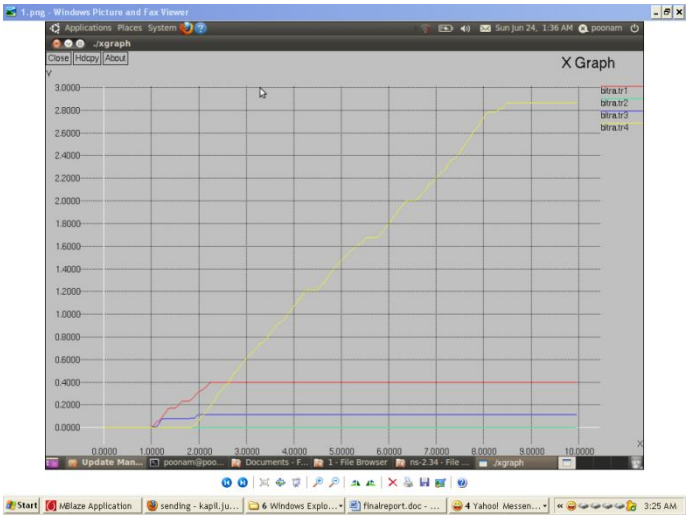

Figure 8: Comparison Bit rate (Random Topology)

From the figure8, we can conclude that as the distance between nodes decrease the Rate of data transmission over the network will be increased.

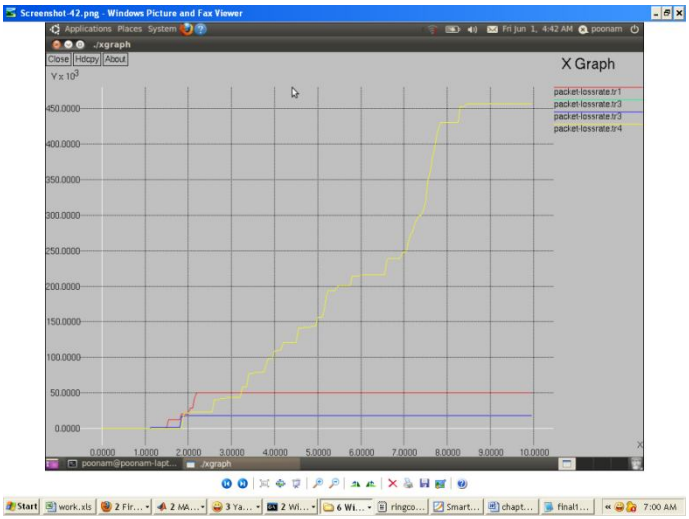

Figure 9: Comparison Packet loss rate (Random Topology)

From the figure 9, we can observe that as the number of nodes in the network increases the distance between the nodes decreases. Because of this there are more chances of collision. As the collision rate will be increased the data loss is also increased. Here we can conclude that as the number of ratio of area between node increases the packet loss will be increased very fast. It means the the loss rate will be increased.

4. CONCLUSION

We have performed the random topology on a WPAN network in same size area with different number of nodes. As we can see from above results as the number of nodes increases the packet loss is increased because of low distance between nodes. Low Distance between nodes increase the communicate rate and improve the packet transmitted. As the communication rate increased the chances of collision increased, It increase the packet loss.

Table 2: Concluded results of QoS parameters

	15	25	50	70
Number of Packet Transmitted	Less	Improved	High	Very High
Number of Packet Lost	Low	Low	High	High
Number of Bytes	Less	Improved	High	Very High
Packet Loss Rate	Low	Low	High	High

Number of bytes transmitted will be improved as the communication rate will be improved, The communication rate depends on distance between nodes. Distance decreases between nodes, improve the packet loss over the network.

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