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Management of Packet Queues in Buffer using Proactive Protocol

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Abstract-- Mobile Ad hoc Network is a self-configuring infrastructure less wireless network in which nodes are mobile in nature and they form a temporary network. Each mobile node is free to move anywhere independently in any direction. As the number of nodes in the network increases the transfer of packets also increases so it becomes necessary to give priority to the packets. When packets are processed according to their priority then more packet or same service may arrive at processing node and hence it becomes necessary to queue the incoming packets in the buffer. Thus the primary objective of the research work is on management of buffer space for queuing the packets. Active queue management scheme is used for queuing packet in which sending node is notified before the queue is about to filled completely so sender can stop sending data or lower the rate of data transmission. The MANET model which is considered is working on Optimized Link State routing protocol (OLSR). In this paper, the performance of the protocol is analyzed and compared with previous work on the basis of parameters Delay and Throughput. After the evaluation and comparison of results, it is concluded that the performance of OLSR is better than AODV protocol.

Keywords: ***AODV, OLSR, Manet, DSDV, GRP***

I. INTRODUCTION

Routing is one of the most central and important areas in the wireless multi hop ad hoc network architecture. Despite its importance, and the hundreds of different routing protocols proposed over the past decade, few real world experimental studies have investigated routing. Mobile Ad-hoc Network (MANET) is an especial kind of network where all the nodes configure themselves. Nodes themselves can act like a router. The topology may also change frequently. It is a network which has dynamic topology and mobile nodes. Due to the dynamic nature of network, there is no central control and nodes communicate with other nodes through intermediate nodes. Every node in the network acts as a router to forward data to the designated node[1]. In this network each node is free to move independently anywhere and hence change its links to other devices frequently [2].

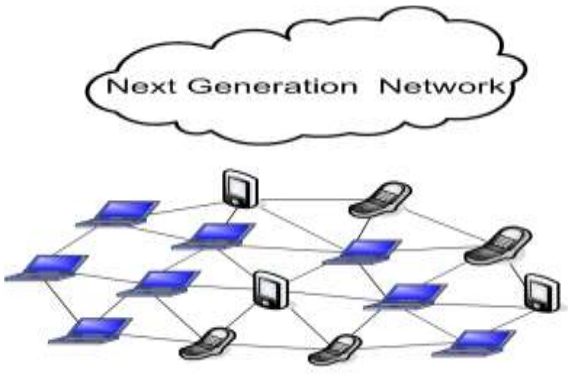

Fig. 1: Layout of MANET Network[3]

In MANET each nodes which are participating in the network acts both as host and a router and hence must be able to forward packets for other nodes. A routing protocol is needed for forwarding the packets from one node to another. The nodes can consist of mobile laptops and personal digital assistants and can facilitates users by providing many services such as file transferring, print sharing, video streaming and voice conferencing. Routing protocols specify how routers communicate with each other by disseminating information. The router always has a prior knowledge about the adjacent networks which can help in selecting the routes between two nodes.

A. Classifications of Routing protocols in MANETs

The MANET routing protocol are classified as:

1. Proactive or Table-Driven Routing Protocol(OLSR)
2. Reactive or On-Demand Routing Protocol(AODV)
3. Hybrid Routing Protocol(GRP)

1. Proactive Routing Protocols

Proactive protocols rely upon maintaining routing tables of known destinations, which reduces the amount of control traffic overhead that proactive routing generates because packets are forwarded immediately by using the known routes. Every node in the network knows about the other node in advance, in other words the whole network is known to all the nodes making that network. All the routing information is usually kept in tables. Whenever there is a change in the network topology, these tables are updated according to the change. The nodes exchange topology information with each other; they can have route

information any time when they needed. Some of the existing proactive routing protocols are OLSR, DSDV[5].

*2. **Reactive or On Demand Protocol***

Reactive protocols are also known as On-demand driven reactive protocols. These Protocols do not initiate route discovery by themselves, until or unless a source node request to find a route. That's why these protocols are called reactive protocols. These protocols setup routes when demanded. When a node wants to communicate with another node in the network, and the source node does not have a route to the node it wants to communicate with, reactive routing protocols will establish a route for the source to destination node[6].

3. Hybrid Protocol

Hybrid routing protocol combines feature from both reactive and proactive routing protocols. The routing is initially done with some proactively prospected routes and then it serves the demand from additionally activated nodes through reactive flooding [7]. It attempts to exploit the reduced control traffic overhead from proactive systems while reducing the route discovery delays of reactive systems by maintaining some form of routing table.

II. ACTIVE QUEUE MANAGEMENT

Active queue management (AQM) is a technique that consists in dropping packets before a router's queue is full. They operate by maintaining one or more drop/mark probabilities, and probabilistically dropping or marking packets even when the queue is short. In this scheme, the sending node is notified before the queue is near to be completely filled so that the sender can stop sending data or lower the rate of data transmission. Meanwhile, the current length of queue is shortened with the processing and de-queuing of buffered packets. After a sufficient space is again available in the queue, the source can be allowed to send more packets for en-queuing in the buffer and further processing [1].

III. LITERATURE REVIEW

In this paper, presented a comprehensive literature surveys on different perspectives of Mobile Ad hoc Networks, its Routing Protocols and different types of queue management techniques. Mobile Ad hoc Network consist of wireless nodes which form the network and moves anywhere in any direction independently. The literature has been discussed in various sections.

Chang Wook Ahn [15] discussed a Gathering based routing protocol (GRP) in mobile ad hoc networks. GRP collects all information at the source node at an expense of a small amount of overheads. It combines the features of both reactive and proactive protocol. PRP requires that every node maintain full information of routing hence it is suitable for delay sensitive data and consumes a great portion of capacity. While RRP is responsible for flooding of queries to search a destination hence it is not suitable for real time communication. RRP can reduce routing overhead of network when the active traffic is light and network is static. The main function of GRP is to gather network information at source node without spending a large amount of overheads.

Vilpav Yadav *et al.* [2] presented different types of routing protocols in MANET, its characteristics, challenges, application and security issues. A MANET is ad hoc network that change its location and configure itself on fly. Since MANET is mobile, they can connect to various networks by using wireless connections. Due to its dynamic topology and wireless medium MANET is vulnerable to various security attacks.

Sharma Shelja *et al* [10] presented performance improvement of OLSR protocol by modifying the Routing Table Construction Mechanism. They discussed the construction of routing table in OLSR protocol so that it become improved OLSR in comparison to existing one. OLSR is a proactive protocol in MANET. The route construction is complex and time consuming in OLSR as compare to other proactive protocols. After Analysis, it has been observed that the complexity in constructing routing table can be reduced by merging some tables.

P.T.Mahinda *et al.*[18] have done the analysis of queue management techniques using NS-2 simulator. Allocating resources to user in the network effectively is the main issue. Queue management enhances the efficiency of transferring the packet in the network by using Transmission control protocol (TCP). Too many packets in the queue are queued for transmission and as the queue overflow packets are dropped which results in congestion. So to overcome this queue management algorithms are applied to router to provide quality of service. Comparison of various queue management scheme is done on the basis of simulation and the results indicates that active queue management schemes (RED, REM) performed better in terms of packet drop rate and end to end delay.

Shubhangi Rastogi *et al.* [17]done the comparison of different queuing mechanism in Dumb-bell Technology. Congestion is the main problem in the networks so for managing traffic and keep network stable congestion control algorithms are required. Queuing is also important in traffic management system so various queuing mechanisms are analyzed on the basis of performance parameters. The simulation results show that Non Linear Random Early Detection has superior quality than others.

IV. RESEARCH METHODOLOGY

For analyzing the proposed problem, the adopted methodology has been carried out in various phases. In the initialization phase, an equal buffer space is allocated to each node in the MANET network. The allocation is dynamically adjusted according to the share of the node in the buffer. In second phase for the appearance of a new neighbor node the assigned buffer space is reconfigured in such a way that equal share is allocated to all the nodes in the network including the new neighboring node. A maximum and minimum limit is put on buffer space each single node can occupy so that each node has equal fair share in buffer. In the last phase we identify if any misbehaving node is present in network and if any

misbehaving node is present in network then its buffer packet are dropped and the buffer space assigned to this node becomes minimum and the freed available buffer space is again distributed among the remaining node. For the implementation of protocols three different scenarios are created with different number of nodes. Then the performance of the routing protocols is analyzed for some performance metrics like delay, throughput and network load and comparison is done on the basis of results.

V. STEPS TO DESIGN AND IMPLEMENTATION OF THE RESEARCH WORK

In this paper, we proposed the design and implementations steps of the research work. It focuses on Mobile ad hoc network and a scheme of buffer management to handle packet queues in MANETs for mobile nodes using proactive protocol. Different scenarios are created in order to evaluate the performance of these protocols. In order to achieve the desired results the NS2 simulator is used to implement the different scenarios.

A. Flow diagram for the proposed work

First of all a network [8] model must be created. The network model can be created by using the suitable tools in the NS2. For the creation of network model, various utilities provided in software can be used according to the requirements. To create a MANET network the initial specifications are setup such as number of nodes in the network, area under experimentation, defining the channel type, the type of propagation model to be used etc. and then the simulation scenarios are implemented.

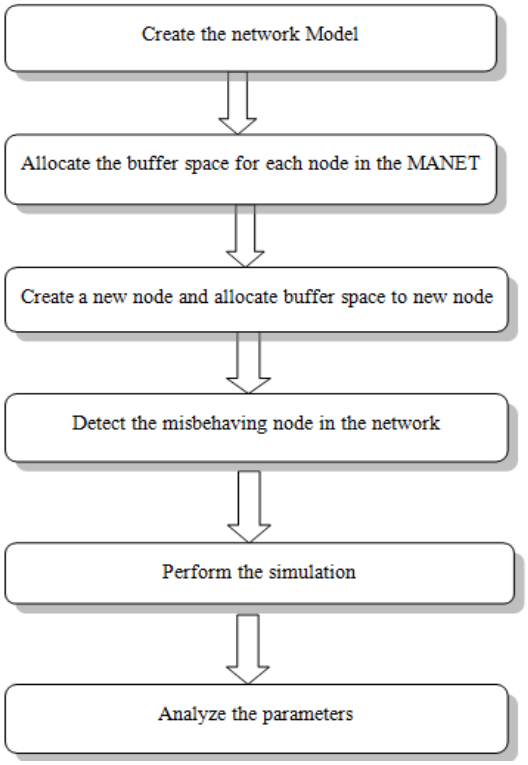

Fig. 2 Workflow Model

In the flow diagrams, first of all we create a network model and then different scenarios are created on the basis of number of nodes. After this buffer space is allocated to each node in the network in such a way that equal space is allocated to each node. For the appearance of new neighbor node the assigned buffer space is reconfigured and equal share is allocated to all nodes. Further if any misbehaving node is present in the network then its buffer packets are dropped and the freed available apace is again distributed among the remaining node. At last evaluate the parameters.

B. SIMULATION MODELING STEPS:

The objective of research work is the performance evaluation of two routing protocol for mobile ad hoc networks by using an open-source network simulation tool called NS-2. Two routing protocols: OLSR and AODV have been considered for performance evaluation in the work. The simulation environment has been conducted with the LINUX operating system, because NS-2 works with Linux platform only.

Fig. 3 Simulation Overview [11]

Whole simulation study is divided into two parts firstly creation of the node i.e. NS-2 output. It is called NAM (Network Animation) file, which shows the nodes movement and communication occurs between various nodes. Secondly, graphical analysis of trace file (.tr) file. Fig 4.1.5 shows the overall process of how simulation is conducted under NS-2. Output files such as trace files have to be parsed to extract the useful information [19].

C. PERFORMANCE METRICS

The performance of Buffer Management for packet queues using proactive protocols in MANETs can be evaluated along various dimensions like delay, throughput and network load. To evaluate the performance of proposed solution following measures have been considered.

1. **Delay**: The packet end-to-end delay [3] is the time of generation of a packet by the source up to the destination reception.
2. **Network Load –** Network load is the number of packets sent to the network greater than the capacity of the network. When the load is less than the capacity of the network, the delay in packets is minimum.
3. **Throughput:** Throughput [3] is the average rate of successful data packets received at the destination. It is the measure of how fast we can actually send the packets through the network.
4. **Jitter:** Jitter [4] is the ratio of transmission delay of the current packet and the transmission of the previous packet. It can be calculated only if at least two packets have been arrived.

D. Simulations strategy

For the simulation of the developed system, latest version 2.34 of NS-2 has been used in this paper. NS-2 is a discrete event simulator targeted at networking research.

1. Scenario

- Topology of 1000*1000 is taken for simulation.
- Nodes are being generated randomly at random position.
- Nodes are generated at random time as if few nodes are entering into the topology.
- Nodes are moving at constant random speed.
- Radio propagation model used is Two-Ray Ground.
- Antenna model used is Omni Antenna.
- Movement is linear and node speed is constant for a simulation.

2. Node Characteristics

- Link Layer Type: Logical Link (LL) type
- MAC type: 802_11
- Queue type: Active Queue
- Network Interface type: Wireless
- Channel type: Wireless

VI. RESULT AND DISCUSSION

After choosing the required statistics and the run of simulation scenario, the results can be obtained for the individual node or for the whole network. After configuring the simulation parameters and running, the simulations are analyzed xgraphs in the form of graphs. The output file is trace file which have to be parsed to extract useful information. Trace files contains the trace of all the events that can be managed further to understand the performance of the network. The NAM (Network Animation) file shows the movement of the node and how communication occurs between various nodes [18].The analysis tool of NS-2provides the capability to extract the simulation results and display them in the form of graphs.

A. Simulation Topology

The NAM file i.e. Network Animator file shows the movement of the node and how communication occurs between various nodes in different conditions. It allows the user to visualize the movement of the node and also the interaction of the mobile nodes.

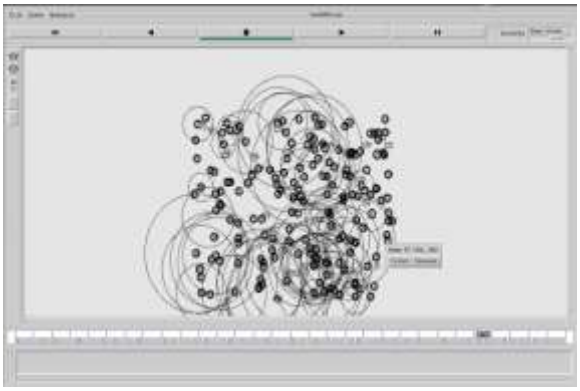

Fig.4 Simulation topology in NAM file

NAM is a TCL based animation tool used for viewing network simulation traces. A network animator provides packet level animation and protocol specific graphs that help to design and debug the network protocol. The trace file is generated by ns (network simulator). Once trace file is generated NAM is used to animate it. The simulation topology in NAM for 100 mobile nodes is shown in fig 5.2 which shows the communication or transfer of packets between mobile nodes.

B. Simulation Scenarios

For the evaluation of the proposed work we consider a MANET network in three different scenarios.

Table 5.2 Different simulation scenarios

Scenario Name	Number of Nodes
Scenario 1	20
Scenario 2	100

1. Simulation of Scenario 1

In this NAM file shows the movement of the nodes and communication between nodes in a network with 20 nodes**.**

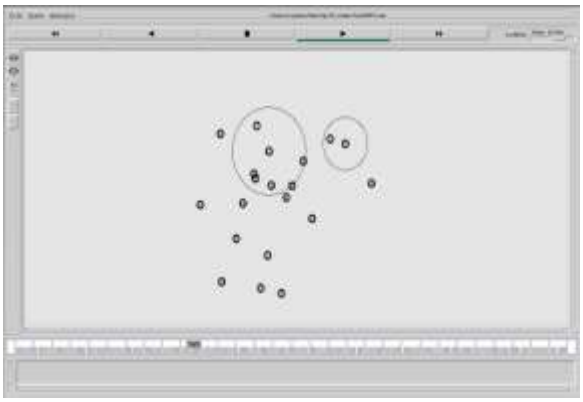

Fig. 5 Network Model designed with 20 nodes

In scenario 1 we carried out our simulation with 20 nodes. All the nodes are mobile in nature and hence they are free to move anywhere in the network. After initialization nodes

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start communication with each other by sending packets among them. The simulation time for which communication takes place is 30 sec.

2. Delay

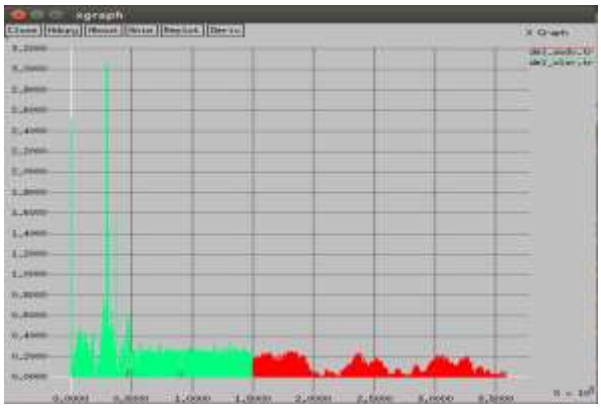

Fig. 6 Delay with 20 nodes

The above Figure shows the graph of delay for both AODV and OLSR routing protocol. It is then observed that the delay is highest in AODV as compare to OLSR. Initially there is no delay in case of AODV where in case of OLSR initially there is a large delay but after 0.5 sec the delay remains almost constant and after 1.5 sec there is no delay in OLSR. Delay in AODV starts after 1.5 sec and it goes up to 3.5 sec which is more as compare to OLSR.

3. Throughput

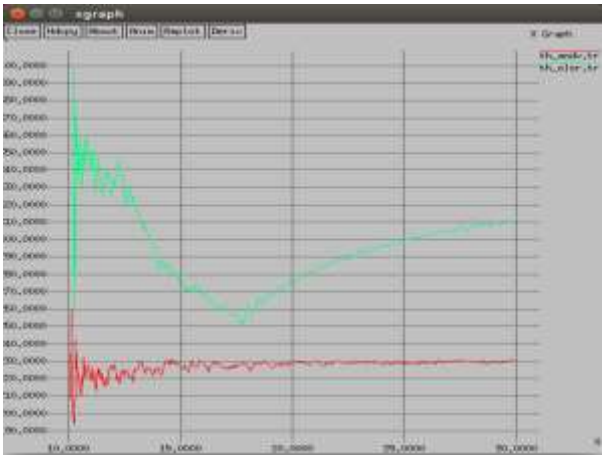

Fig.7 Throughput with 20 nodes

The above figure shows the graph of throughput with 20 nodes for both AODV and OLSR routing protocols. It is clear from the figure that the throughput of OLSR is better as compared to AODV. Throughput is defined as the ratio of the total data that reaches the destination from the source. At 10 sec the throughput of OLSR is maximum which then gradually decrease and after 18 sec it again starts increasing whereas in case of AODV at 10 sec it is maximum and after 20 sec there is very less variations and it is almost constant.

4. Packet Loss

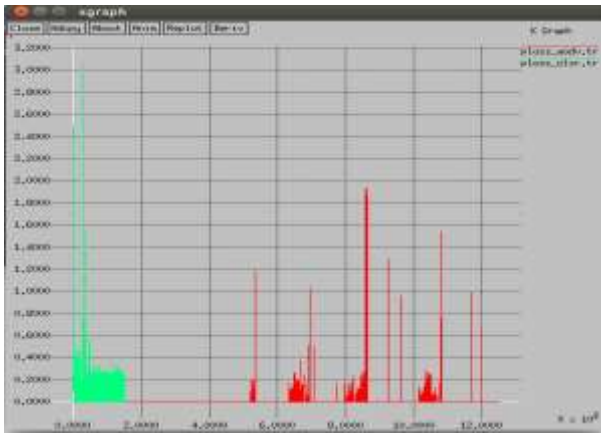

Fig. 8 Loss with 20 nodes

Above figure, indicates the loss of packets in both AODV and OLSR routing protocol. In this the number of nodes is less and the packet loss is always less. Initially no packet is lost in case of AODV but later on packet drop starts. In both the case small amount of packet are lost during the transmission.
very slightly in case of OLSR whereas in case of AODV delay starts at 0.3 sec and goes up to 2.0 sec. Delay is continuously varying in case of AODV. From the graph t is clear that in case of 30 nodes the delay in OLSR is less than that of AODV.

A. Simulation of Scenario 2

The network model with100 nodes communicating and sending data to each other.

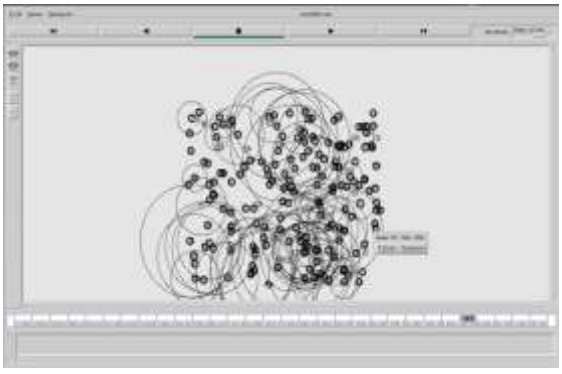

Fig. 9 Network Model designed with 100 nodes

Scenario 2 represents the network model with 100 nodes. After initialization nodes start communication with each other by sending packets among them. Initially no node is communicating and after 10 sec data starts transferring among all the nodes and communication between the nodes starts. Movement of the nodes and the packets starts in the network as it is a wireless network and nodes are mobile nodes. The data is continuously transferred from one node to

another in the network with large number of nodes. Since the number of nodes in the network is large so there is more chance of congestion in the network.

1. Delay

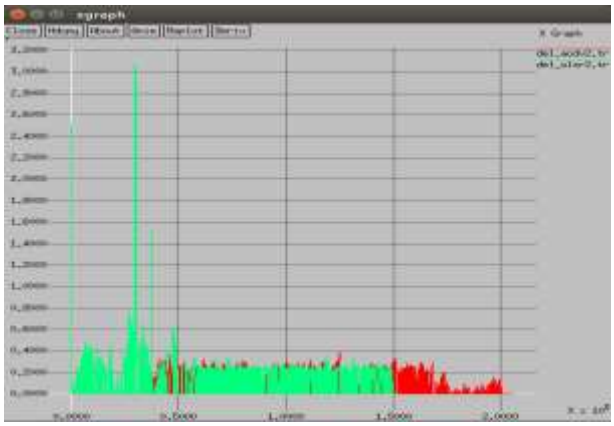

Fig. 10 Delay with 100 nodes

Above figure it is clear that the delay is more in case of AODV than OLSR in a network with 100 nodes. In OLSR the maximum delay is at 0.3 sec and then it is decreases. After 1.5 sec there is no delay in OLSR. After 0.6 sec the delay is varying very slightly in case of OLSR whereas in case of AODV delay starts at 0.3 sec and goes up to 2.0 sec. Delay is continuously varying in case of AODV. From the graphs is clear that in case of 30 and 100 nodes the delay in OLSR is less than that of AODV and is almost similar.

2. Throughput

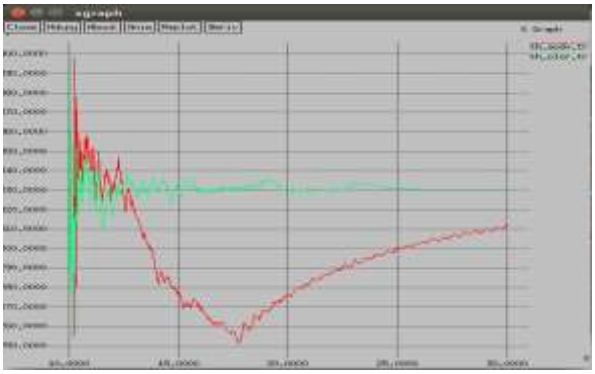

Fig. 11 Throughput with 100 nodes

Above figure shows the throughput of both OLSR and AODV routing protocol in case of 100 nodes. From the figure it is seen that the throughput of OLSR s better than that of AODV when the number of nodes is more. Throughput of OLSR after 16 sec varies slightly and after 25.5 sec it becomes constant whereas the throughput of AODV increases initially and then it is gradually decreases for some time period and after 18 sec it also starts increasing but it is less than OLSR.

3. Packet Loss

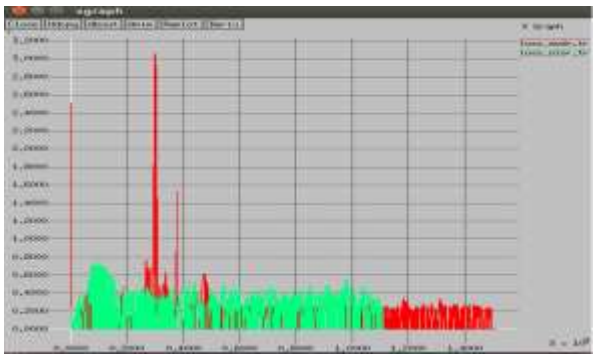

Fig. 12 Loss with 100 nodes

Above figure clearly shows that as the number of node increases the loss also increases because inference in the network increases. With large number of nodes traffic increases in the network which cause congestion in network which results in packet loss and hence less number of packets are successfully transferred from source to their destination. From the graph it is clear that OLSR show less loss than AODV.

VII. CONCLUSION

The paper has been described for the buffer management to handle packet queues in Mobile ad- hoc network for mobile nodes using proactive protocol OLSR. The packet queues needs to be maintained in such a way that equal buffer space is allocated to each node and extension is also available to each neighboring node to avoid underutilization of resources. According to the proposed algorithm for the occurrence of a selected incident, the allocation is adjusted dynamically according to the instantaneous share of neighbors in the nodes buffer and the gap between occupied and allocated buffer space. We can also put limits on maximum and minimum buffer space each single node can occupy in buffer.

Earlier this work is implemented using AODV protocol and now in our proposed work these Algorithms are implemented using OLSR protocol. The simulation study indicates the proposed work is a way to get improved buffer management for packet queue in mobile ad- hoc nodes. The proposed model is tested with different scenarios of 20 nodes, 100 nodes and then we compare the performance of existing work with earlier work. The proposed model has been found efficient than the existing one on the basis of result analysis.

VIII. FUTURE WORK

In the future, the proposed model can be evaluated with the properties of hybrid protocol as it contains advantages of both reactive and proactive protocol. Further the proposed model can also be tested for high mobility with more number of nodes and by running the simulation for longer period. The modification can also be done in the existing algorithms so as to reduce the processing overhead.

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