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Comparative Analysis of FIFO and RED QUEUE ALGORITHM for Congestion Control in MANET

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ABSTRACT : MANET is an area of researches, which deals with multiple packet transmission in available data node and furthers various routing protocol and algorithms used for communication. While dealing with the routing network, there are different approaches which deal with limitations. With the increase of traffic, congestion occurs. To reduce congestion different queue algorithms are available like FIFO, RED, SFQ etc. FIFO technique which also gets follow in ATM system is being performed in existing work. It waits for the first queue to finish and then get process to next step over. A Red queue work where number of data packet need to be hold and then process in the FIFO and required manner. Stochastic Fair Queuing (SFQ) ensures fair access to network resources and prevents a busty flow from consuming more than its fair share. In this paper we focussed on comparative analysis of FIFO and RED. Result establishes that the congestion occurs with increase of traffic.

KEYWORDS: MANET, AODV DSR, Congestion control, Network QoS, Qualnet

I.INTRODUCTION

Mobile ad hoc network (MANET) is a wireless network for mobile devices; it is a self-configurable network which does not use any infrastructure in that network devices are freely moves anywhere in the network. Topology frequently changes during the whole process. The major challenge in this network is to maintain links and provide information which is required to control the traffic in these networks. Routing is the biggest issue in the mobile ad hoc network because normal routing algorithms are not efficient to provide solution to transmit data in mobile ad hoc network. To obtain QoS in mobile ad hoc network normal routing algorithms are not efficient. Thus there is an enhanced functionality is required. Generally there are two type of mechanism called over provisioning and network traffic engineering are used to provide QoS in wired networks. But these techniques are not efficient to provide solution for the MANET.

AODV operation:
The AODV is a reactive protocol that establish the unidirectional routes to destination node when data is actually there to transmit between the nodes in an ad hoc network .The most unique factor of AODV is that it uses destination sequence numbers so that route discovery does not propagate back to the source and fall in loop . AODV guides the mobile nodes to adapt themselves to link failures and dynamism in topology quickly and seamlessly.
When the link breaks AODV informs all the related nodes to invalidate all the routes that were using broken link as a part of their routes.
Generally three types of control packets:
1) Route Requests (RREQs)
2) Route Replies (RREPs)
3) Route Errors (RERRs) are defined by AODV and are frequently generated during and as a part of Route discovery and Route maintenance phases. [1]

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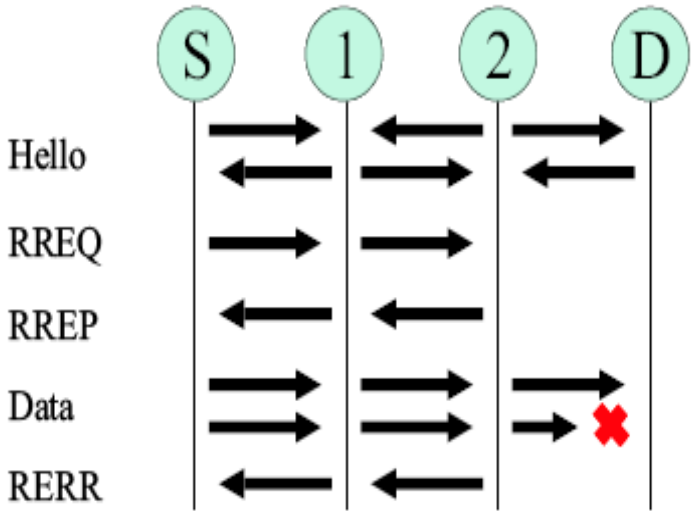

Figure 1– AODV protocol

Figure 1.shows the process of AODV protocol. In this fig. source send a data to destination by a different nodes. firstly source send the HELLO messages, this messages is used for broadcasting connectivity information. A node should use HELLO messages only if it is part of an active route. After that if route is active so node send the RREQ (Route Requests) to first node. A RREQ message is broadcast when a node needs to discover a route to a destination. After that when RREQ reaches a destination node ,the destination route is made available by unicasting a RREP(Route Replies) back to the source route. After a RREP message node send a data to another node if in during a sending process any link is break so RRER(Route Errors) message send to source node . this message is a broadcast for broken link.

Advantage of AODV

1. AODV can respond very quickly to the topological changes that affect the active routes because of its adaptability to highly dynamic network
2. AODV can support both unicast and multicast packet transmission, even for nodes in constant movement.
3. AODV has lower setup delay for connections and detection of the latest route to the destination.
4. AODV does not put any additional overheads on data packets as it does not make use of source routing.

Disadvantage of AODV:

1. A large no. of control packets are generated when a link breakage occurs . These control packets increase the congestion in the active route.
2. AODV has a high processing demand.
3. AODV consume a large share of the bandwidth.
4. AODV takes long time to build the routing table.
5. As the size of the network grows various performance metrics begin decreasing.

DSR Operation:

Further figure 2 demonstrate the working paradigm of DSR protocol for effective routing in below section. Dynamic source routing (DSR) is on demand source routed protocol which work with according to source given path and pre-defined routed path. Route discovery process, route determination and further be following that particular route is driven in DSR. One more concept is node stability over the network, which is driven using the queuing theory. It is like a node row and each node serves at a particular interval of time and provided equality in between the communication.

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Queuing theory gives it analysis of working in proper scheduling manner. At a situation where infinite packet arrive queuing model work fine with large process.

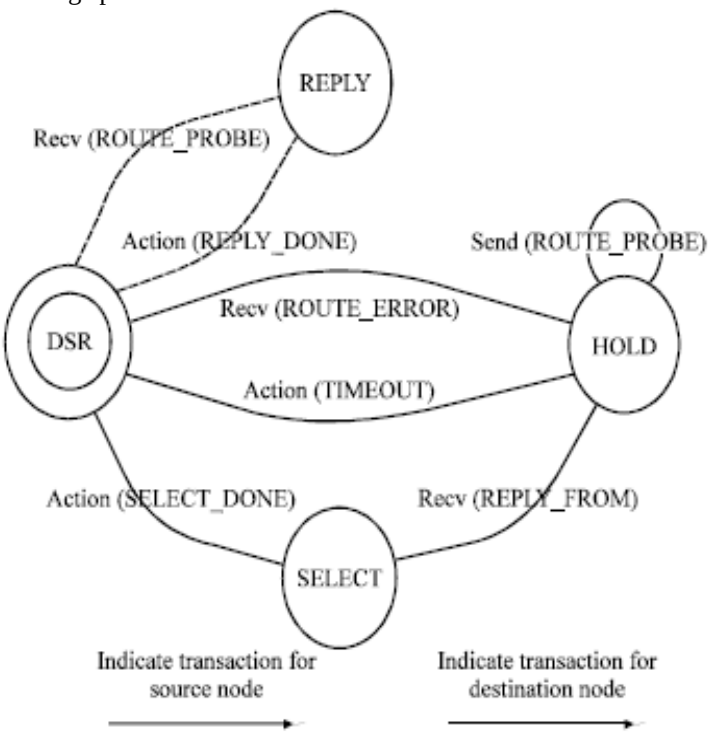

Figure 2: DSR routing protocol

Figure 2 shows the process of DSR protocol. In DSR route discovery cycle used for route finding .In this protocol not used of HELLO message like AODV protocol. And in DSR use of caches to store routes. When node 1 wants to send a packet to node 2, but does not know a route to node 2, node 1 initiate a route discovery. After that source floods RREQ (Route Requests), each RREQ has sender's address, destination's address and unique request id determined by the sender. Each node appends own identifier when forwarding RREQ.

Advantage of DSR

1. No need to keep a routing table inside each node because the entire route is contained in the packet header of each data packet sent from the source to the destination.
2. DSR allow multiple routes to any destination and allow each sender to select and control the routes used in routing its packets for example, for use in load balancing or for increased robustness.
3. DSR protocol includes easily guaranteed loop-free routing operation in network containing unidirectional link use of only "soft state "in routing and rapid recovery when route in the network change.
4. Route caching can further reduce route discovery.

Disadvantage of DSR

1. The disadvantage of this protocol is that the route maintenance mechanism does not locally repair a broken link
2. The connection setup delay is higher than in table-driven protocols.
3. Even though the protocol performs well in static and low-mobility environments, the performance degrades rapidly with increasing mobility.
4. This routing overhead is directly proportional to the path length.

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CONGESTION:
Congestion control is a major problem in MANET. Congestion means when transmit the number of packets across the network is larger than the capacity of the network then network becomes congested. Due to congestion the packets have to be deleted and also reduce the performance of the network. To finding the congestion free shortest path is a main issue in MANET. Congestion leads to packet losses and bandwidth degradation and waste time and energy on congestion recover. The particular dropped packets might already have travelled a long way in the network and thus consumed significant resources. When the routing protocols in MANET are not alert about the blocking, it results in the following issues.

A. Long delay
These holds up the procedure of detect the congestion. When the congestion is more exact, it is better to select an alternating new path. But the existing on- demand routing protocol delays the route searching process.

B. High overhead
More processing and communication at- tempts are required for new route detection. If the multi- path routing is utilized, it needs additional effort for upholding the multi-paths regardless of the existence of alternate route.

C. packet losses
The congestion control technique attempts to minimize the excess load in the network by either reducing the sending rate at the sender side or by drop- ping the packets at the intermediate nodes or by executing both the procedure. This cause improved packet loss rate or lowest throughput.

Congestion defines as when packets across the networks greater than the capacity of the networks and therefore, network become congested. Mainly congestion occurs when number of nodes shared same resources. Congestion is a reason of packet dropped, high end to end delay etc. So, congestion control is a difficult problem in mobile ad-hoc network. Many approaches or algorithms have been proposed for congestion control in MANET. Main function of any congestion control
Mechanism is to balance the traffic to increase throughput of the network. Also it is achievable to maximize nodes transmit, packets delivery ratio, less energy spending and decrease traffic congestion, decrease end to end delay and network performance can be improved[2]

RED QUEUE:
Random early Detection seeks to prevent the router's queue from becoming fully used by randomly dropping packets, and send signals to the sender to slow down before the queue is entirely full. RED also performs tail drop, but does so in a more gradual way. Once the queue hits a certain average length, packets en-queued have a configurable chance of being marked (which may mean dropped). This chance increases linearly up to a point called the max average queue length, although the queue might get bigger.

FIFO QUEUE:
FIFO is an acronym for first in, first out, a method for organizing and manipulating a data buffer, where the oldest (first) entry, or 'head' of the queue, is processed first. It is analogous to processing a queue with first-come, first-served (FCFS) behaviour: where the people leave the queue in the order in which they arrive. In this problem is when a queue is filled the router start to discard all extra packets thus dropping the tail of mechanism. The loss of packets (datagram's) causes the sender to enter slow start which decreases the throughput and thus increases its congestion window [3]

II. LITERATURE SURVEY

Shanti Rathore et.al[4], The routing in MANET is not easy to maintained strong link in between sender to receive. The availability bandwidth in MANET is fixed, that is creating the problem of link blockage and the load is enhancing rapidly on the link. In MANET if the congestion is occur then the performance of network is gradually decreased

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according to time In this research they proposed the ACO based multipath congestion control technique with varying the queue according to load in dynamic network. The AOMDV is also balance the load by providing alternative path but not proficient at every condition. The AOMDV is provides the multiple path for data sending.

S.B. Wankhade et.al [5], A Mobile Ad hoc Network (MANET) is based on a self-organizing and rapidly deployed network. Node can join and leave at any time and there is no fixed infrastructure. All the nodes are equal and there is no designated router nodes that may serve as routers for each other and data packets are forwarded from node to node in a multi-hop fashion. Many routing protocols have been proposed for MANETs in the recent past. Ant-based routing provides promising alternative to conventional approaches. These agents are autonomous entities, both proactive and reactive, and have the capability to adapt, cooperate and move intelligently from one location to the other in the communication network.

Bibhash Roy et.al [6], Mobile Ad Hoc Network (MANET) is a dynamic multi hop wireless network which is established by a set of mobile nodes on a shared wireless channel. One of the major issues in MANET is routing due to the mobility of the nodes. Routing means the moving information across an internet work from a source to a destination. QoS routing plays important role for providing QoS in wireless ad hoc network. The biggest challenge in this kind of networks is to find a path between the communication end points satisfying user's QoS requirement. A Nature-inspired algorithm such as ant colony optimization (ACO) algorithm has shown to be a good technique for developing routing algorithms for MANETs. In this paper, a new QoS algorithm for mobile ad hoc network had been proposed. The proposed algorithms combine the idea of Ant Colony Optimization (ACO) with Optimized Link State Routing (OLSR) protocol to identify multiple stable paths between source and destination node.

Pravin Ranj et.al [7], Mobile Ad hoc Network (MANET) is a collection of wireless mobile nodes which are autonomous, self organized and dynamic in nature. This topology change leads to frequent breakage of link. To repair the broken link AODV and DSR uses broadcasting mechanism. Broadcasting floods control packets. Flooding results in congestion due to limited buffer space, bandwidth, and battery power of mobile nodes. Congestion leads to dropping of packets resulting in decrease of network performance. Congestion can be avoided if the numbers of control packets are reduced. In this paper a new algorithm is proposed which avoid the congestion and repair the broken link by choosing a set of limited nodes for alternate route based on the quadrant position, battery status, queue length, and forwarding region To avoid above mentioned problems, a new route repair and congestion avoidance mechanism is proposed, termed as IOAS-AODV. This algorithm selects a limited set of nodes in order to find a new alternate route based on battery status, queue length, quadrant position, and forwarding region. The IOAS-AODV algorithm is tested using NS-2 simulator.

T. Senthil Kumaran et.al [8], This paper proposes an early congestion detection and adaptive routing in MANET called as EDAPR. Initially EDAPR constructs a NHN (non-congested neighbors) neighbors list and finds a route to a destination through an NHN node. All the primary path nodes periodically calculate its queue status at node level. EDAPR works with fewer packet losses than other techniques that are not adaptive to congestion. This is because EDAPR tries to prevent congestion from occurring in the first place, rather than dealing with it reactively. A key in EDAPR design is the NHN nodes selection. The NHN node is aware of a potential congestion ahead. It finds a non-congested route between source and destination, so that the congestion is controlled as a result.

III. MOTIVATION

Literature review motivates to work towards AODV DSR, QUEUE theory over the MANET. Bibash et. al. combined the idea of Ant Colony Optimization (ACO) with Optimized Link State Routing (OLSR) protocol to identify multiple stable paths between source and destination node. Flooding and route failure results in congestion [7]. Paper [8] discussed to find out the possibility of congestion before occurrence of congestion. Congestion results on packet loss and long delay, which cause the performance degradations of a network. Congestion control can be reduced by applying FIFIO and RED queue algorithm. For this, a comparative analysis and its impact is drawn.

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IV. PERFORMANCE METRICES

The following are the performance metrics used for the analysis:

a) Throughput.
b) Average End to End Delay
c) Total Packet Received
d) Avg. Queue Length

a) **Throughput**: For any network throughput is the average rate at which message is delivered from sender to receiver. It is also referred to as the ratio of the sum of data packet received from its sender to the time the last packet reaches its destination.

$$\text{Throughput} = \frac{\text{Total No. of Successful Packets Received in Bits}}{\text{Total Simulation Time in Sec}}$$

b) **Average End to End Delay**: This is the time taken for the delivery from source node to destination node. To calculate the average end-to-end delay, add delay of each successful data packet delivery and divide that sum by the number of successfully received data packets

$$\text{Average End to End Delay} = \frac{\sum(\text{Received Time} - \text{Sent Time})}{\text{Total Data Packet Received}}$$

c) **Total Packet Received**: It is the total number of packet which is received at receiver end. This is the difference between total packet send and packet dropped, abort by the network system.

$$\text{Total packet received} = \sum(\text{Packet total sent} - (\text{Packet dropped} + \text{Packet abort})$$

d) **Avg. Queue Length**: It is the total waiting time is performed at the time of packet or queue length transform. Average queue length is average number of node and delay in between delivering the packets in between source to destination [3].

$$\text{Average queue length} = \frac{\sum(\text{p state probability of packet})}{(1-p)}$$

V. EXPERIMENTAL SETUP & RESULT ANALYSIS

Simulator used or this research is QUALNET 5.0.2 .Performance analysis of two queue FIFO and RED Queue is evaluated basis on throughput ,avg. End to end delay, total packets received , Average queue length, total packets de-queued, drops packets. Six performance metrics by varying node 20,40,60,80,100

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Simulation Parameters:

The simulation configuration used for the current analysis summarized in below table:

Table no.1 configuration table for simulation

Parameter	Value
Number of NODES	20, 40, 60, 80, 100
Total Simulation Timing relevance parameter	600s
NETWORK Size	1500m x 1500 m
Movement Model	Random Movement
ma Buffer packets	100
Routing adapting communication Protocol	AODV, DSR
Packet Size	512Kb
Interface transmit Speed	10 Mbps
Interface Transmit Coverage	250 m
Number of traffic connection	5, 10, 15, 20, 25

VI. RESULT ANALYSIS

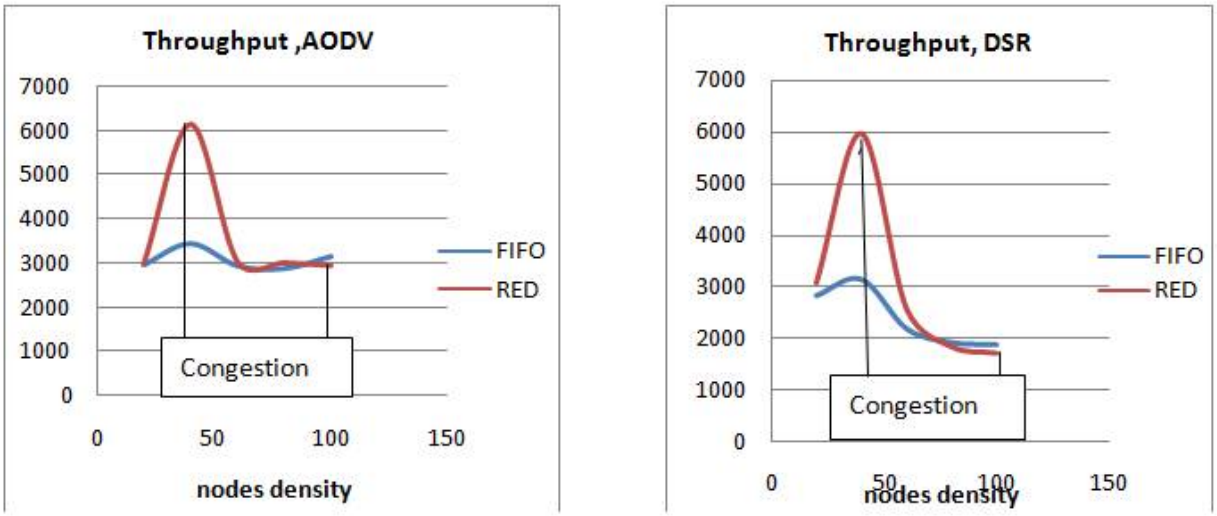

Figure 3 Analysis of Throughput Vs Node density

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Figure 3 shows throughput with number of nodes varying from 20 to 100 for AODV and DSR Routing protocols and comparison of RED and FIFO queues.. when number of nodes and links increased by 40 and 10, the throughput increases. .when link becomes more than 10 and node density more than 40 a traffic increase and throughput decrease drastically. Same as the result of DSR protocol. So RED queue is better than FIFO queue in throughput

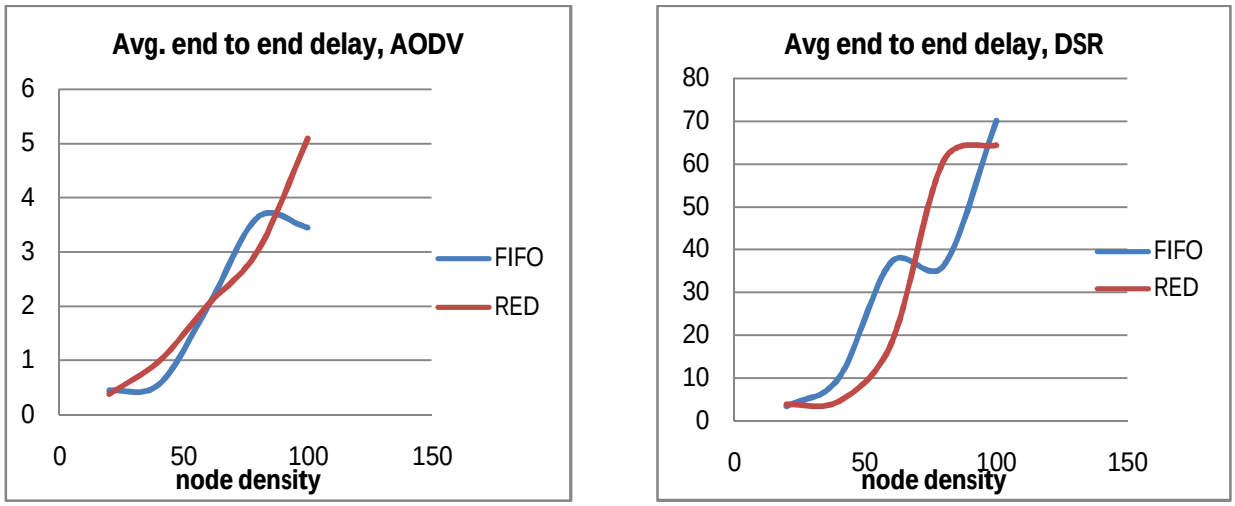

Figure 4 Analysis of Average end to end delay Vs Node density

Figure 4. Shows of average end to end delay with number of nodes varying from 20 to 100 for AODV and DSR protocol and also used the comparison of RED and FIFO queue. When the no. of nodes and links are increases so the delay is also increases . The basic difference between FIFO and RED queue in AODV protocol is less

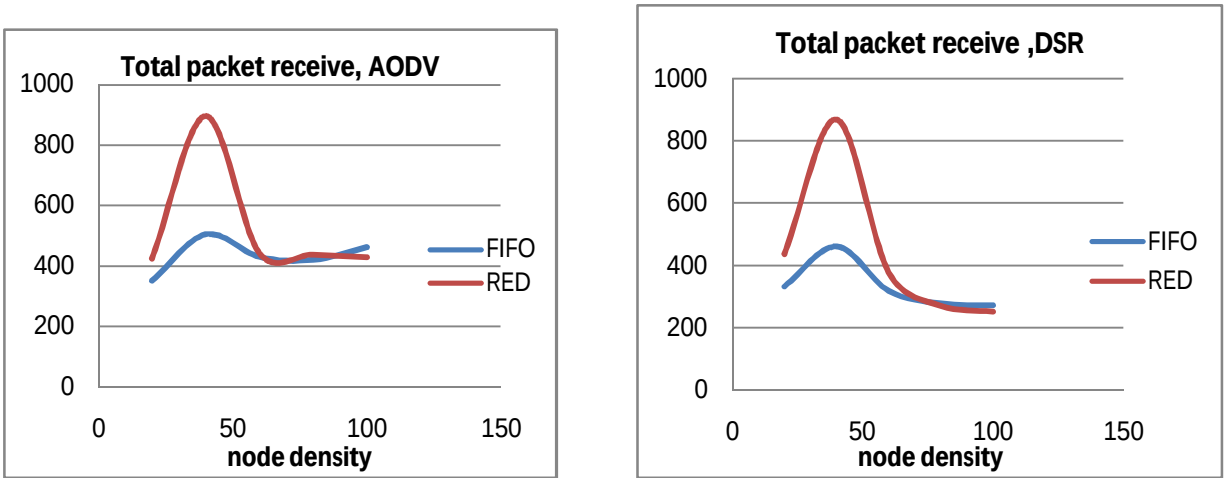

Figure 5 Analysis of Total packets receive Vs Node density

Figure 5 shows of packet delivery ratio with number of nodes varying from 20 to 100 for AODV and DSR routing protocol and also used the comparison of RED and FIFO queue. . The number of nodes and links increased by 40, the total packets receive increase. When the link becomes more than 10 and node density more than 40 a traffic increase and total packets receive decrease drastically.so in this performance matrices RED queue is better than FIFO queue.

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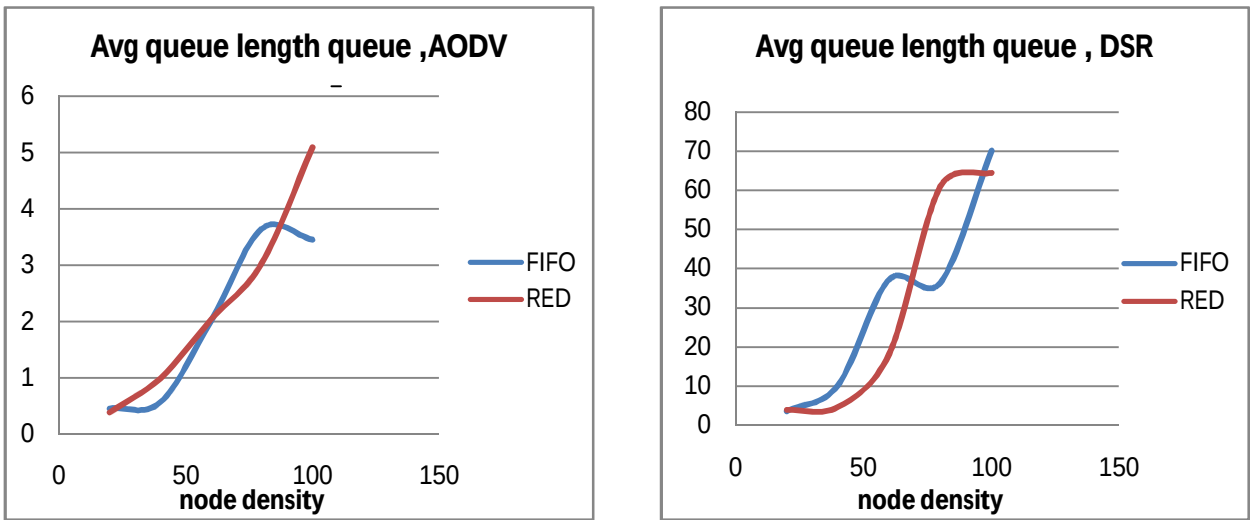

Figure 6 Analysis of Average length queue Vs Node density

Figure 6 shows of average queue length with number of nodes varying from 20 to 100 for AODV and DSR protocol and also used the comparison of RED and FIFO queue. When the no. of nodes and links are increases so the avg. queue length also increases . The basic difference between FIFO and RED queue in AODV protocol is less

Overall table

As per the experiment performed on Qualnet simulator with our proposed algorithm and previous system, further these are the following result observed by us. In the table below the complete scenario result is given. Our further parameter computation and simulation performed using Qualnet Simulator.

Table 2: Simulation parameter computed for AODV protocols

		AVG THROUGHOUT		AVG END TO END DELAY		TOTAL PACKET RECEIVED		AVG QUEUE LENGTH	
LINK	NODE	FIFO	RED	FIFO	RED	FIFO	RED	FIFO	RED
5	20	2964	2974.5	0.077	0.085	350.6	424	0.452	0.379
10	40	3461	6137.22	0.078	0.258	504.3	896	0.561	0.984
15	60	2943	3027.47	0.149	0.146	429.8	442.1	2.006	2.034
20	80	2876	3002.15	0.195	0.117	420	438.45	3.64	3.03
25	100	3162.1	2937.64	0.179	0.218	461.833	429.2	3.445	5.091

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Table 2 shows the result of FIFO queue and RED queue by using AODV protocol. In this table shows the throughput is very high of RED queue on the 40 node and 10 links but when links become more than 10 and node density more than 40 a traffic increase and throughput decrease drastically. Same as the process perform with total packet receive . so finally we conclude that the RED queue has given better performance with AODV protocol.

Table 3: Simulation parameter computed for DSR protocols

		AVG THROUGHOUT		AVG END TO END DELAY		TOTAL PACKET RECEIVED		AVG QUEUE LENGTH	
LINK	NODE	FIFO	RED	FIFO	RED	FIFO	RED	FIFO	RED
5	20	2828	3069.5	0.173	0.185	332.4	435	3.488	3.94
10	40	3149	5953.7	0.134	0.345	459.7	869.44	10.142	4.66
15	60	2178	2575.2	0.326	0.263	318.067	376.067	37.198	18.234
20	80	1904	1839.5	0.386	0.399	277.95	268.65	36364	61
25	100	1861	1713.2	0.405	0.456	271.708	250.2	70.127	64.47

Table 3 shows the result of FIFO queue and RED queue by using DSR protocol. In this table shows the throughput is very high of RED queue on the 40 node and 10 links but when links become more than 10 and node density more than 40 a traffic increase and throughput decrease drastically. Same as the process perform with total packet receive. So finally we have conclude that the RED queue has given better performance with DSR protocol.

VII. CONCLUSION AND FUTURE WORK

In this paper, we address the problems with existing congestion control algorithms and tried to show about various performance parameters of RED, FIFO for our considered network configuration. We have calculated the different performance parameters for each algorithm. We are sending the 1000 packets during the 600 sec simulation period so it has been observed that performance parameters are varying according to algorithms. RED achieved the better result in term of the throughput and total packets receive but in term of delay and queue length FIFO shows the better result. In this algorithm AODV protocols also shows the better performance with RED queue than DSR. Further enhancement will be worked on long size data and quality of services in between data sharing. And congestion can be decrease by varying different parameters.

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