A Congestion Control Multiple Route Establishments Routing in MANET

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***Abstract*—The congestion is occurring due to limited capacity of link between the nodes in mobile ad hoc network (MANET). The problem of congestion is resolve by proving the alternative path through AOMDV routing protocol in network. If one of the establish path is break due to congestion then instantly the other path is available for deliver data to destination. The AOMDV establish the minimum three paths in between sender and receiver. In this research we proposed the congestion control scheme that controls the rate of data sending by managing the queue level in network. The existing security scheme is handle also handle the congestion by transfer load to another link. The proposed scheme performance is compare with MEALBM scheme and performance of proposed scheme is better. The link failures in the primary path, through which data transmission is actually taking place, cause the source to switch to an alternate path in place of beginning another route discovery. The congestion control scheme is necessary to manages resources i.e. waste from dropping of packets and also the data is again retransmitted in between sender and receiver. The number of nodes processing capacity and the reliability of route is maintained in proposed scheme. The problem of congestion is only handled by reducing the data rate capacity or slows the transfer rate of sender to balance the data in network. The problem of congestion is also more occurring in dense network because each and every node are try to establish data to another nodes. The proposed scheme performance is providing the multiple links with queue management scheme in between source and destination. The proposed congestion control scheme is reduces the packet loss, reduce the overhead and improve the throughput performance. The performance metrics shows the less performance of MEALBM as compare to proposed congestion control scheme.**

***Keywords*— Queue, Load balancing, Routing, Multipath, MEALBM, Congestion, MANET.**

I. Introduction

A MANET (Mobile Ad hoc Network) consists of nodes acting as host and router in wireless infrastructure-less communicating network. The nodes communicate with one other over a wireless link with each node acting as host and router. Because of mobility of node the topology of the network changes, thus routing becomes crucial.The protocol ensures that the available bandwidth in the network is used expeditiously by distributing traffic equally that ensures higher load balancing and congestion management. The nodes in the network can communicate with every other without a physical infrastructure regardless of their physical location. So the MANETs are open, infrastructure less and decentralized. These features enable them to work anywhere without the help of centralized authority or base stations. MANET is a promising technology and has great strength to apply in critical situations like battle fields and commercial applications. Due to the dynamic topology and other great features MANET attracts to different real world applications. Ad-hoc networks are self-organizing and adaptive features make them a perfect choice for uses such as communication and data sharing. Because of openness and decentralization features, the members of the MANETs are not able to constrain the membership. MANETs are self-organizing networks [2]. They can move independently in the network that makes the frequent connection breakage between devices. Due to the absence of a central authority, the major challenge that the MANETs are facing is security. It is difficult to maintain an end-to-end route in an ad-hoc network because of its infrastructure less and dynamic topology features. Routing protocols [3] are responsible for efficiently establishing a reliable route between nodes so that data can be delivered between nodes in a timely manner. The efficiency of the routing protocols can dramatically affect the performance of the entire network in terms of bandwidth utilization, power consumption, and delay; therefore, the process of establishing a reliable and efficient route should be done with minimum complexity, delay, overhead, and bandwidth. Multipath routing methodology allows the establishment of multiple paths from a source node to the destination node. For stable transmission of data multiple path approach is proposed. load balancing is another advantage of it.

II. Congestion and Load Balancing Overview

It is essential to regulate the data rate utilized by each sender in order not to overload the network, wherever multiple senders compete for link bandwidth. Packets are loss when they reach the router and can't be forwarded. Several packets are dropped while excessive amount of packets make a network bottleneck. The packets loss would’ve cosmopolitan great distance and additionally the lost packets often trigger retransmissions. This intimates that even additional packets are sent into the network. And so, network throughput continues to be more worsened by the network congestion. There are probabilities of congestion collapse wherever nearly no data is delivered with success if no applicable congestion management is performed [4].

Shared broadcast medium is employed in mobile ad hoc networks. Medium capability that is extremely inadequate is shared within all the nodes in a collision domain. Whereas delivering data to multiple destinations, multicast communication is of nice concern in these networks, since it helps saving resources. Mobile nodes group communication that is an inherent feature of the many planned applications in MANETs is else to the current mass medium. So, it's necessary to avoid congestion collapse in wireless multi-hop networks so as to perform efficient congestion control [5, 6].

Load balancing is a communication methodology to distribute work across multiple mobile node, network links (wireless link), mobile node process units, memory space, or different resources, to attain optimum resource utilization like energy, link bandwidth, channel etc., to increase output, decreases latency, and avoid work..

A. Load Balancing Requirement

A vital a part of the optimal network is the load balancing. For instance, work completion becomes complicated, if heavy load is given to the nodes with less process capabilities and that don't have any means that to share the load [6]. There is a prospect of load imbalance due to that the computing processing power of the systems are non-uniform (i.e.) few nodes possibly idle and few can loaded. A node which has high processing power finishes its own work quickly and is calculable to own less or no load in the least maximize time. So, within the presence of under-loaded nodes, the necessity for over-loaded nodes is undesirable [6]. Multi-path routing will balance the load higher than the one path routing in ad hoc networks, wherever the primary selective shortest methods are used for direction-finding. This can be possible just for the networks having an enormous number of nodes (i.e., a large fraction of the total number of nodes in the network) between any source-destination couple of nodes. It’s impracticable to make such a system it's economical for locating and maintaining an alternative number of paths. Load balance isn't improved by exploit multiple shortest path routes rather than one path. So, for an improved load balanced network distributed multi-path load rending methods need to be rigorously designed [4]. The AOMDV [7] protocol has a capability to balance the load by providing the alternative path instantaneously in dynamic network and control the congestion. The load balancing techniques proposed by previous authors are mentioned in next section and these scheme are able to hanle the congestion problem but proposed queue management scheme is more reliable and better in tem of different parameters.

III. Literature Survey

Till now considerable work has been done in load balancing problem in MANETs. Several authors have done research in this domain.

This work [8] proposed a residual energy based algorithm to overcome the load traffic problem. The proposed solution will not only distribute complete transmission traffic to multiple routes but will also filter out inefficient routes according to energy status. This filtration will avoid undesirable link break because of node’s poor performance. First Discover all possible routes from source to destination. Second to Collect energy state of all intermediate nodes and calculated energy consumption of all possible routes using remaining battery charge value of each node involved into respected route. Third is Compare the route energy state with threshold value and filter out all energy efficient possible routes.

This paper [9], a technique for Multipath Load Balancing and Rate Based Congestion Control (MLBRBCC) is presented. In our technique, source node forwards the data packet to the destination node through the intermediate nodes. Upon reception of the data packet, the channel utilization percentage and queue length are estimated at each intermediate node along the destination. Based on these values congestion status and estimated rate are calculated and transmitted towards the destination. By checking the updated values from the intermediate nodes, the destination node determines the estimated rate and it is transmitted as a feedback to the sender. The source node forwards the data packet to the destination through the intermediate nodes. On reception of the data packet at the intermediate node, percentage of channel utilization and queue length are estimated and node is verified for congestion status.

In this paper [10] proposed technique of load balancing is Network Coding-based AOMDV routing algorithm in MANET (NC-AOMDV). It is typically proposed in order to increase the reliability of data transmission, and by applying network coding, which allows packet encoding at a relay node. Because the encoding packet is generated by a relay node, the source node does not need to encode the packets, and sends only data packets to each route. Thus, the packets transmitted by the source node are not increased. The multiple coded scheme is improves the performance in presence of receiving by removing multiple copies of data that is identified by the codes in network at destination.

In this paper [11] proposed Efficient Weighted innovative Routing Protocol (EWIRP) to Balance Load in Mobile Ad Hoc Networks (MANETs). The EWiRP proposed in this paper is a load balancing technique which can also be viewed as an efficient routing approach, improves delivery ratio, reduces end to end delay, efficiently exploits the resources like available bandwidth, node energy, queue space, without affecting the network's vital assets. The weight computation process considers not only the necessary parameters but also the service classes of the network.

In this paper [12] proposed Multipath Load Balancing & Rate Based Congestion Control for Mobile Ad Hoc Networks (MANET).This paper presents a new approach Multipath Load Balancing and Rate Based Congestion Control (MLBRBCC) based on rate control mechanism for avoiding congestion in network communication flows. In this technique the destination node copies the estimated rate from the intermediate nodes and the feedback is forwarded to the sender through an acknowledgement packet. Since the sending rate is adjusted based on the estimated rate, this technique is better than the traditional congestion control technique.

IV. Proposed Congestion Control Scheme for Balancing Load

Congestion control technique is necessary for control or reduces the packet loss in dynamic network. The number of nodes in MANET The proposed approach for balancing the network load which can tackle congestion and at identical time extend network life time is proposed. Multipath load balancing overcomes the capability limitation of single path routing by distributing data traffic on to multiple ways and reducing congestion by routing traffic through lightly loaded ways. However, the benefits of multipath routing come at a worth as synchronic data transmission on multiple methods interfere with one another. Further, once network traffic starts increasing, there'll be accumulated level of rivalry among nodes let alone higher collision level consequently leading to packet drops and network level congestion. In proposed approach the route selection is based shortest path route is selected but multipath is provides the next shortest path for communication. The data is only delivering through shortest path and these shortest paths are reliable and choose the nodes having sufficient energy for communication. Congestion control is associated to controlling traffic incoming in Mobile Ad hoc Network. To avoid congestive crumple or link capabilities of the intermediate nodes and networks and to reduce the rate of sending packets congestion control is used extensively. Congestion control and dependability mechanisms are combined with buffer enhancement and AOMDV to observe the congestion control without explicit feedback about the congestion status and without the intermediate nodes being directly intermittent. The congestion control status is required to identify the congested link and the number of relay nodes that deliver the data in same rate in network by that the congestion is heavily deployed. This proposed scheme the main point is to observe the load in each node. Here the multipath means to execute route meaning to select the multiple path in between sender to destination and how many number of nodes in them. The buffer capacity of each node is evaluated through queue length (the capacity of nodes in network to hold the data packets temporary) in a single path from multiple paths and how many numbers of nodes in single path and calculates the capacity of all nodes which are the part of multiple routes in network. The rate controlling is required to not enhance the buffer capacity to much. If the sender controls the data rate the in that case the stored packets in buffer easily leave buffer space and new arrival is too much reduced.

A. Proposed Algorithm

Step 1: Set Initial Paramete
Set node = m; // m number of mobile node
Set Sender = s; // s € m s sender that belong into m node
Set receiver = r; // r € m s receiver that belong into m node
Set protocol = AOMDV; // Routing protocol
Set rr = 550m // maximum radio range of node
Step 2: Broadcast Routing Packet for Searching Destination

```
Route_Rreq(s, r, rr)      // broadcast route request packet
{
If (rr<=550 && next_hop = =”true” && nex_hop != r)
      {
      Record incoming and outing connection in each node’s
      next hop find r-table = create route table
      Work until destination search
      }
Else if (nexthop = r)
      {
      If Find (number of paths from s to r) // all path are shortest base
      {
      Select more than two paths for communication
      sends data packets from one selected path
      Receive ACK of successful receiving
      }
      }
      Else
      {
      Receiver out of range;
      }
Step3: Check each path and node load
      If (any path or node drops the packets)
      {
      Set queue for minimizing drop;
      If (Queue = = full) &&(Data_rate = = full)
      {
      New_length = Queue++
      New_Load = Load/2
      }
      }
      Else
      {
      Normal flow of data through all paths
      }
      }
```

V. Simulation Parameters:

The simulation parameters are mentioned in table 1 is considered for simulation of existing AOMDV, network in Enhanced AODV for congestion and collision resolve. The parameters are considered similar for both routing cases because similar environment in both cases gives better justification for performance parameter. The work is done in NS-2 simulator version 2.31. The number of nodes is considered for simulation is 10,25,50,75 and 100 with random movement in a simulation area of 800m*800 m.

Table 1 Simulation Parameters

Parameters	**Type**
Physical Medium	Wireless Physical
Propagation Modes	Two Ray Ground
Antenna Type	Omni Directional Antenna
Number of Nodes	10, 20, 30
Simulation Area	800*800 m^2
Simulation Time	100 seconds
Frequency	914e+6 Mhz

MAC Layer	802.11
Routing Protocol	AOMDV
Queue Type	Drop tail/ Priority Queue
Traffic Type	CBR
Agent Type	TCP/UDP
Node Mobility	Random

A. Packets Sending Analysis

The number of packets sends in network is measures in three different node density scenarios. The number of packets sending in proposed load balancing algorithm is more as compare to MEALBM technique in MANET. The performance of both the modules is simulated in network simulator on same parameters. The chances of delay in communication in network are controlled by proposed congestion control scheme. The congestion in network is not possible to remove from network completely but possible to reduce the congestion to improve routing performance.

Fig.2 Number of Packets Sending Analysis

B. Packets Receiving Analysis

The number of packets receiving in network is actually decided the routing performance of multipath protocol in MANET. The number of senders is establishing the multiple paths and these paths are capable to handle the congestion in network. The performance of novel congestion control scheme is provides better data receiving in all three node density scenarios in network. The proposed scheme is able to handle congestion problem efficiently in dynamic network. The packet receiving in network is providing the better results in proposed scheme. The routing performance is improved and the congestion is controlled that improve bandwidth utilization.

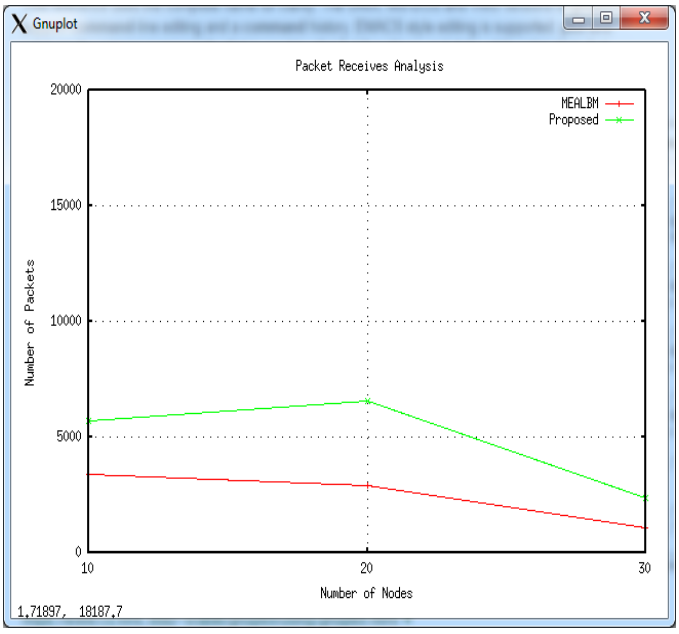

Fig. 1 Number of Packets Receiving Analysis

C. Packet Dropping Analysis

The number of packets drop performance in network is measures in three different node density scenarios. The number of packets dropping is less in proposed load balancing algorithm is more as compare to MEALBM technique in MANET. The performance of both the modules is simulated in network simulator on same parameters. The packet dropping are controlled by proposed congestion control scheme to manage queue status. The congestion in network is enhancing it means the congestion is consumes the limited bandwidth and processing capability of mobile nodes. The proposed congestion control scheme is improving routing performance.

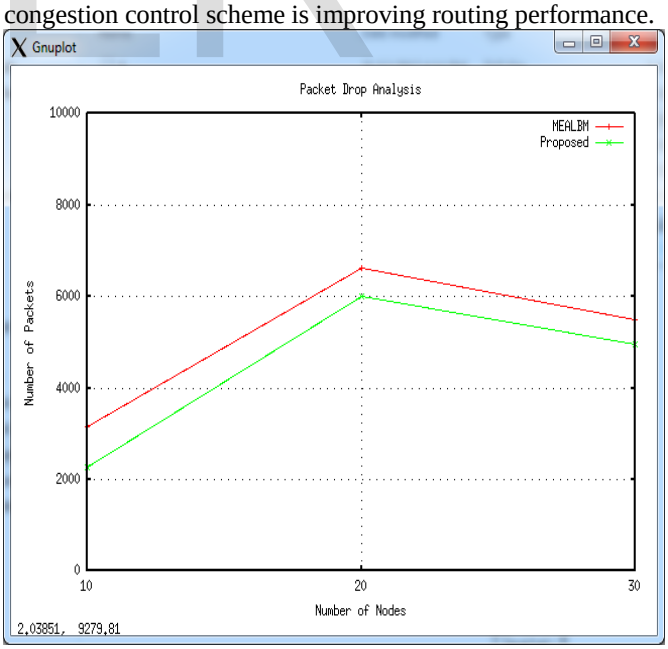

Fig.3 Packet Dropping Analysis

D. PDR Performance Analysis

Packet Delivery Ratio is the performance that provides result in the form of percentage of data receiving at destination. The congestion in network is controlled by selecting alternative path in network but this path is also not capable to handle congestion. The numbers of nodes are not able to forward data packets to next node or destination in network. The proposed queue management scheme is handle the problem of congestion and provides better results as compare as compare to MEALBM scheme. In MEALBM are also reduce the congestion but proposed scheme is better and improve multipath routing performance. The PDR performance in all node density scenarios is better than previous security scheme and about more than 10% performance is enhanced after applying proposed approach in MANET.

Fig.4 PDR Performance Analysis

E. Throughput Performance Analysis

The kilobytes of data per unit of time receiving at destination are measures by throughput performance metrics. The numbers of sender nodes are forming multiple links through AOMDV multipath protocol. The multiple paths are stronger or able to handle load in links are measure through MEALB existing scheme and proposed queue management based congestion control scheme in MANET. The proposed congestion control scheme is provides the better throughput performance in all node density scenarios. The better data receiving is provides better performance and improve the routing performance. The proposed congestion control scheme is control the problem of congestion and also not enhances the any overhead. The performance of proposed protocol is efficient and better as compare to MEALBM protocol in network.

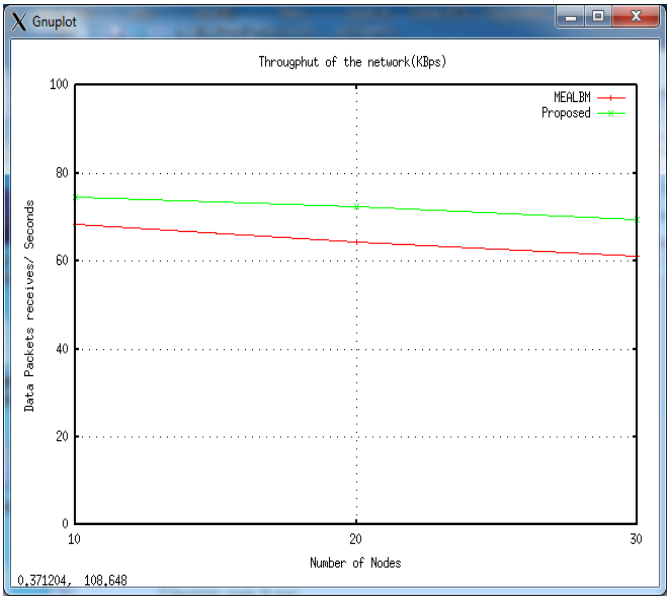

Fig.5 Throughput Analysis

F. Routing Overhead Analysis

The overhead in multipath routing is less as compare to unipath routing protocol in MANET. The flooding of packets in unipath and multipath is almost same but numbers of paths are established more or multiple paths are establish for sending data to destination. The more routing overhead is confirming the possibility of link breakage. In this graph the overhead in proposed congestion control scheme is less as compare to existing MEALBM. The packets loss in proposed scheme is reduced and the packet receiving is also more, which shows the strong link establishment. The multipath protocol is used in both the protocol for sending data but using different approach to handle congestion problem and the proposed scheme is handle more efficiently. The overhead in proposed scheme in all node density scenarios are less as compare to MEALBM protocol.

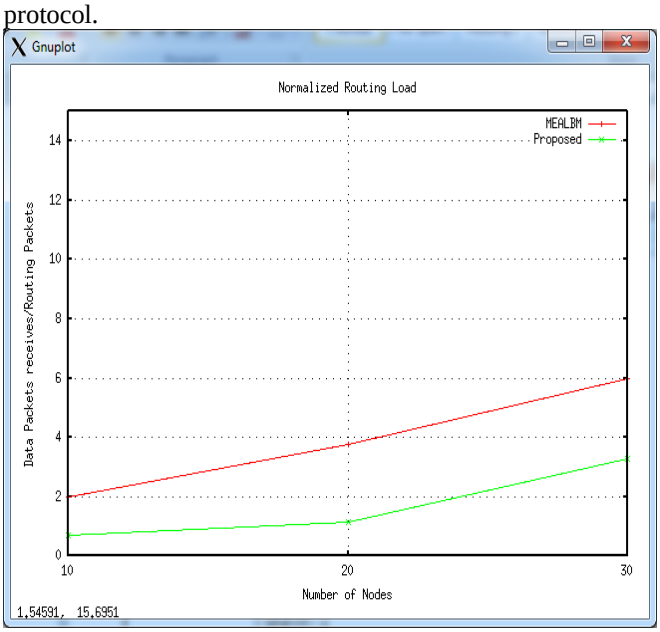

Fig.6 Overhead Performance Analysis

G. Average End to End Delay Performance Analysis

The delay problem in network is affected the packets receiving and due to that the overhead in network is also enhanced. The more packets loss due to problem of congestion is the main issue to enhance the congestion in dynamic network. The delay performance is measures in same 10, 20 and 30 node density scenarios in network. The delay is measured in milli- seconds. The number of senders are sends data to destination through multiple path and these paths are better or not based on the better packet delivery. The number of nodes are communicate with each other to in dynamic environment and the performance of proposed scheme is shows the less delay as compare to existing MEALBM scheme in MANET.

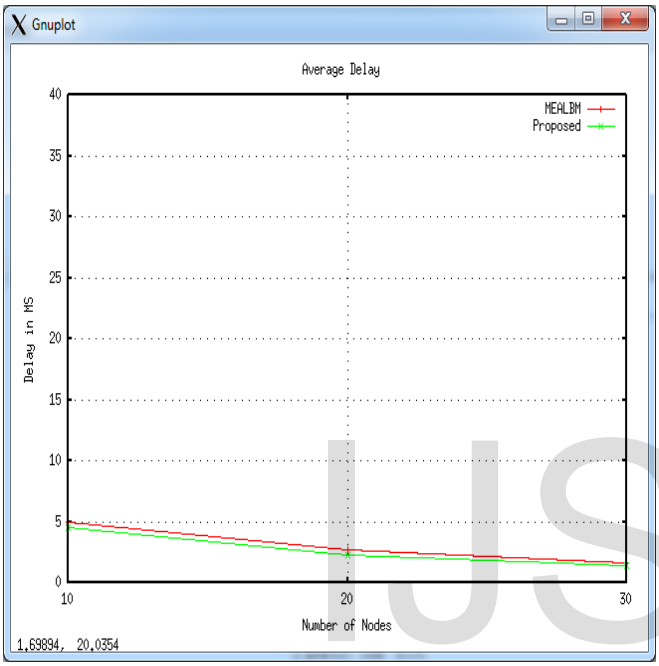

Fig.7 Average End to End delay Analysis

VI. Result Comparison

Packet dropping due to congestion in network is degrades the network performance. The congestion control scheme proposed in this research is reduces the packet loss and improves the packets receiving i.e. completely depends on the previous successful transmission. The better data receiving as compare to MEALBM is also enhance the through and PDR performances. The mobile node has restricted computational capacities like bandwidth and buffer suspect and also not possible to enhance the available bandwidth for efficient communication but possible to manage the higher data rates by managing queue capacity. The proposed research work is based on the queue management technique to handle the load in network and this queue management technique is provides the information of heavy load and after that the alternative path is choose for sending data in dynamic network. The previous MEALBM technique are provides information of recent good work that maintain the pair of source and destination nodes using intermediate nodes which are rich and utilizes resources like bandwidth and having a capability to handle the heavy load in network that also reduces the possibility of congestion but performance of proposed scheme is more better from it. The proposed approach for balancing the network load which can tackle congestion and maintain strong link in between sender and receiver. However, the benefits of proposed multipath routing come at a worth as managed data transmission on multiple methods interfere with one another. In dynamic network multipath route establishment is not easy to maintain strong link but proposed scheme able to provides the strong link and the link is not break due to congestion. The strong connection establishment is also reduces the possibility of link breakage and by that the overhead in network is also reduced as compare to existing MEALBM scheme in MANET.

The load balancing in the MANET is not easy but possible to modify the routing procedure. if the load in network is enhanced due to presence of attacker i.e. Resource Consumption Attack (RCA). In this attack the bandwidth and power of mobile nodes are consumed by attacker so, in future proposed the security scheme to detect and prevent the network from RCA and recover the performance of dynamic network.

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