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A Novel Technique to Control Congestion in MANET using Knowledge Base Learning

Archana Kumari[1], Dr. Shaveta Rani[2], Dr. Paramjeet Singh[3]
[1]*M.Tech Scholar,* [2]*Associate Professor,* [3]*Associate Professor*
[1, 2,3]*CSE Dept., GZS PTU Campus, Bathinda, India*

Abstract— MANET is mobile ad-hoc network in which mobile nodes can create the route from source to destination when they required. The path establishment from source to destination in mobile ad-hoc network is done on the basis of routing protocols. AODV is on-demand reactive routing protocol. In AODV routing protocol, during data transfer from source to destination a number of problem arises like congestion, packet loss and link failure. Due to congestion performance of the network degrades. Many algorithms had been proposed to overcome this problem. In this paper, we are proposing a novel technique for congestion control in MANET based on knowledge base learning.
Keywords— Mobile ad hoc network (MANET), Routing Protocol, AODV, Congestion Control

I. INTRODUCTION

A network is a group of two or more computer systems which linked together. It is the mode of exchange of information which is responsible for communication between the devices. When the number of devices are joined together to exchange information they form networks and share resources. A network is classified into wired network and wireless network. A wired network is one of the types of network that connects devices to the network or other network using cables. Wireless network is another type of network that does not require any cable for connecting devices to the network or other network. The communication between devices is usually managed and implemented via radio waves where the implementation takes place at physical level. The mobility is the main enhancement feature in wireless network unlike the wired connection. In wireless network communication between the devices occur with the help of Radio waves and microwaves. Both devices that are communicating to each other, these are lays within the radio range of each other. The IEEE standard for wireless network is defined as 802.11. Wireless networks further classified into two different categories that are infrastructure wireless network and infrastructure-less or Ad hoc wireless network. Infrastructure network is one of the types of wireless network that has centre controller or access point which helps in communication between the devices. In this type of network, all the wireless devices communicate to each other through Access point and Access point is responsible for data routing. Access point is a fixed base station. In infrastructure-less network, there is no central controller or access point. In ad-hoc network, every node forward the data to other node dynamically based on network connectivity in routing. A MANET (Mobile Ad hoc network) is a self-configuring infrastructure less network of mobile devices connected by wireless. Each mobile node in MANET is free to move in any direction independently and also will therefore change its link to other devices frequently. The mobile nodes that are in radio range of each other can directly communicate, but the mobile nodes that are not in range of radio waves it require intermediate nodes to route their packets. The primary objective of routing protocol is to discover the route. In MANET, constantly changing network topology causes link breakage and invalidation of end-to-end route. There is highly dynamic nature of wireless network imposes severe restrictions on routing protocols. One of the most important and a difficult mechanism to maintain in ad hoc networking is the routing mechanism.

II. LITERATURE REVIEW

Sreenivas B.C et al. [1], introduced about congestion control in mobile ad-hoc networks. Congestion on the network reduced the throughput and degrades performance of the network. Identifying the occurrence of congestion in a mobile ad hoc network (MANET) is more critical task. The congestion control techniques provided by Transmission Control Protocol (TCP) is specially designed for wired networks. There are several approaches designed for detecting and overcoming the congestion over TCP. This paper considers design of Link-Layer congestion control for ad hoc wireless networks, where the bandwidth and delay measured at each node along with the path. The receiver calculates the new window size and transmits this information to the sender as feedback based on their cumulated values. Sender behaviour altered accurately. In this proposed technique all the measurements of bandwidth and delay done at the link layer for congestion control.

P.K. Singh et al. [2], proposed a scheme that can be effective in dealing with the malicious nodes which act as black holes in MANET (Mobile Ad hoc Network). The proposed method uses promiscuous mode to detect malicious node and propagates the

information of malicious node to all other nodes in the network. The source node floods a Route Request packet or RREQ in the network and waits for Route Reply packet or for RREP to have a new route to the destination node. If the RREP (Route Reply) is received from the intermediate node, the node receiving RREP (Route Reply) packet then switches its promiscuous mode and sends a hello message to destination. If the intermediate node forwards the message to destination, the node is safe. Otherwise the node is a malicious one. This scheme does not require extra processing power and database.

S. A. Jain et al. [3] discuss about mobile ad hoc networks and their application. In ad hoc network nodes are free to move in any directions and there is no centralized management. Routing is an important factor in mobile ad hoc network not for small network, but it can also work well if network get expanded dynamically. Mobile nodes in MANET have limited transmission capacity; communication between the nodes is done by relay on multi-hop. Multi hop routing have many challenges such as limited wireless bandwidth, low device power, dynamic network topology and high vulnerability to Failure. For resolving challenges, many routing algorithms in MANETs were proposed. But one of the problems on them is congestion which decreases the overall performance of the network so in this paper authors are trying to identify the best routing algorithm which will improve the congestion control mechanism among all the multipath routing protocols. Multipath routing can improve network performance by reducing delay, increasing throughput and reliability of the network. Multi path routing protocols also improve load distribution and energy efficiency. AODVM-PSP (Ad hoc on demand distance vector routing with path selection probability) considers delays along the path while making routing decision. The ability to forward traffic on multiple paths would be useful for customizing paths for different application and for balancing load.

M.A.K. Fard [4], introduced Standard congestion control cannot detect link failure losses which occur due to mobility and power scarcity in multi-hop Ad-Hoc network (MANET). Moreover, successive executions of Back-off algorithm deficiently grow Retransmission Timeout (RTO) exponentially for the new route. The importance of detecting and responding link failure losses is to prevent sender from remaining idle unnecessarily and it also responsible for managing number of packet retransmission overhead. But in Cross-layer approach it requires feedback information from lower layers. This paper operates purely in Transport layer. This paper explores an end-to-end threshold-based algorithm which enhances congestion control to address link failure loss in MANET. There are two phases in this algorithm. First, threshold-based loss classification algorithm distinguishes losses due to link failure by estimating queue usage based on Relative One-way Trip Time (ROTT). Second phase adjusts RTO for new route by comparing capabilities of new route to the broken route using available information in Transport layer such as ROTT and number of hops**.**

S. Ahmed et al. [5], described Congestion in network occurs due to exceed in aggregate demand as compared to the accessible capacity of the resources. Congestion in the network will increase as network speed increases and new effective congestion control methods are needed, especially to handle "bursty" traffic of today's very high speed networks. Since late 90's numerous schemes etc. have been proposed. This paper concentrates on comparative study of the different congestion control schemes based on some key performance metrics. An effort has been made to judge the performance of Maximum Entropy (ME) based solution for a steady state GE/GE/1/N censored queues with partial buffer sharing scheme against these key performance metrics.

III.CONGESTION CONTROL IN MANET

Mobile Ad-hoc network is self configuring and infrastructure-less type of network. Due to its unique functionality like mobility, dynamic network topology, self configuring and decentralized administration a number of problems arises. Congestion is one from them. When too many packets are challenging for the similar link, the queue overflows and packets have to be dropped. When such drops become common events, the network is said to be congested. In Ad-hoc networks, there are no separate network elements called routers and hence the mobile nodes themselves act as the routers. In existing congestion control methods, the source informed about the congestion in the network so that either it may slow down the packet transmission rate or find an alternate route which may not necessarily be an optimal route. It must be pointed out that all the congestion control methods are able to inform the source about the congestion problem because they use Transmission Control Protocol. Congestion occurs in MANETs with limited resources. Due to freely movements of mobile nodes in any direction cause congestion problem in the network. Congestion leads to packet losses, bandwidth degradation and delay. It is also responsible for link failure problem and degrade transmission rate.

IV. PROPOSED METHODOLOGY

The MANET is the mobile ad hoc networks which are the self configuring and infrastructure-less type of network. The nodes are deployed in the network and path is established according to AODV protocol from source to destination. There are some nodes in the path having much movement than other nodes. Due to these nodes congestion problem occurs. So congestion is responsible for performance degradation and low reliability of the network. A novel technique is proposed to overcome

problem of congestion in AODV. In existing technique, path establishment on the basis of minimum hop count and fresh sequence number, and no knowledge of congestion in advance. In present work, to overcome congestion problem knowledge based learning will be used. To remove congestion problem a novel technique is proposed, in which path is established on the basis of minimum congestion counter, minimum hop cunt and fresh sequence number.

A. Proposed Technique

Steps of proposed technique:

1) The network is deployed with the finite number of mobile nodes.
2) The path between source and destination is selected using AODV protocol.
3) The adjacent node of every other node will give rating of chances of congestion on the node.
4) Rating will be given using knowledge base learning of neural networks
5) The path on which less chances of congestion is there is selected as best, second priority is given to hop count and last priority is given to sequence number.

Rate of chances of congestion on node is calculated by formula:

$$G_c = \frac{\sum_{c_o} \sum_{o} Cov(V_c, E)^p_{c_o,o}}{\sum_{o} \sum_{p} E^2_{o,p}}$$

Where o is the node id, p is semantic weight on the link; V_c is activation function has either value 0 or1. Value of V_c is 0 when there is congestion on the network and 1 when no congestion.

E is bias value has either value -1, 0, 1. In this proposed technique, E=1. When we calculate new values from old or existing values and give to the output in that case we use bias value 1. When there is no change any of the old or existing values and directly gave it to the output at that time we will use value for bias 0. Last and third bias value is -1 which is used when we want less change in the old values. For example when we had any old value and less congestion in the network at that time we will use -1 value for bias.

Cov is a co-efficient which is used for calculating the absolute value of the final value of the rate of congestion on the node, $_{Co}$=1,2,3 etc. Eo,p is old value of congestion at particular node have node id o and semantic weight p on link.

At the end source receive route reply message with congestion counter. The path which has minimum chances of congestion on the network will be selected as final path and second priority is given to hop count and last priority given to sequence number. In this way with the help of knowledge based technique Congestion problem resolve that means through this packet loss problem reduce, throughput of the network increase and delay reduce.

V. EXPERIMENTAL RESULTS

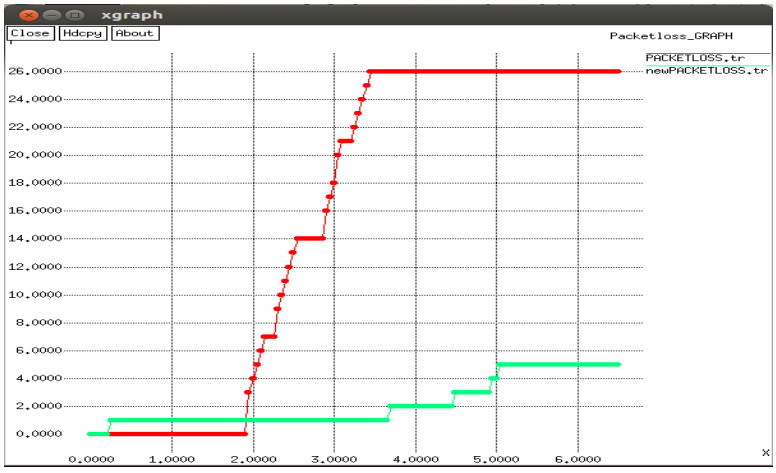

Fig 1: Packet Loss

Red lines shows old methodology packet loss and green line shows new methodology packet loss. It shows that proposed methodology is better than existing one.

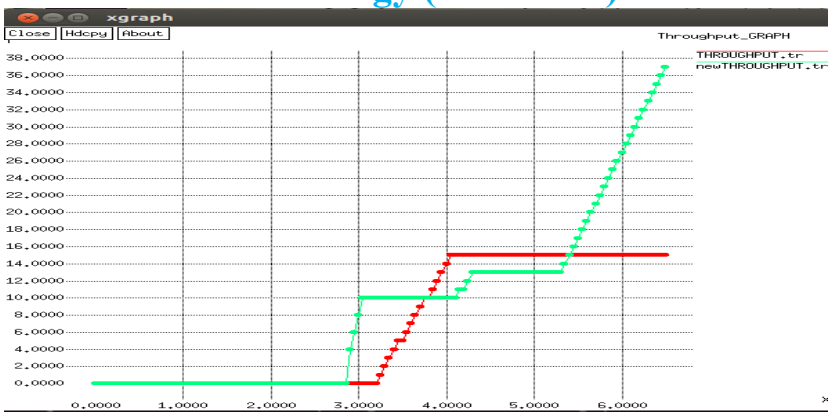

Fig. 2: Throughput

Red lines shows old throughput of the network and green line shows new methodology throughput. It shows that proposed methodology is better than existing one due to increase of the throughput of the network.

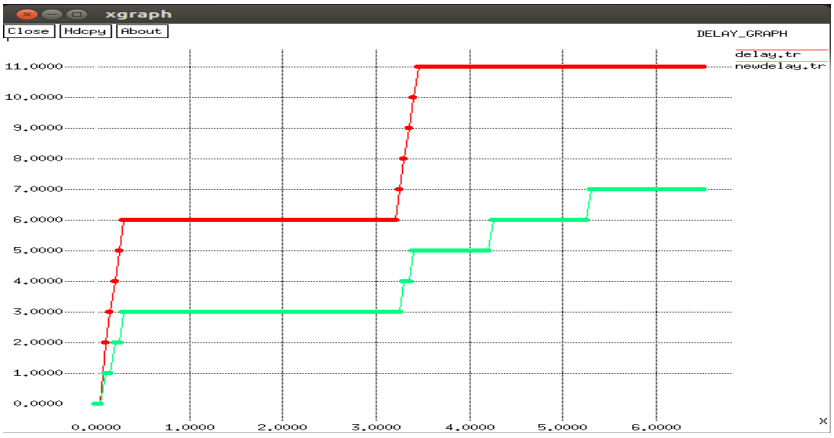

Fig 3: Delay

Green line shows news new methodology delay and red line shows old methodology delay. It shows that proposed methodology is better than existing one.

The comparison between the proposed technique and existing AODV is done by comparing the performance metrics as packet loss, throughput and delay.

Simulation Time	Packet-loss (byte/sec)		Throughput (byte/sec)		Delay(ms)	
	I	II	I	II	I	II
1	0	1	-	0	6	3
2	4	1	-	0	6	3
3	18	1	0	6	6	3
4	26	2	15	10	11	5
5	26	5	15	13	11	6
6	26	5	15	28	11	7

Table 1.1: Performance Analysis of Existing and Proposed Techniques

In the above table 1.1, I show results after the analysis of existing technique and II show results after the analysis of proposed technique. From the above comparison it is concluded that proposed technique is better than existing one.

VI. CONCLUSIONS

The MANET is the mobile ad hoc networks which is the self configuring type of network. The self configuring means that any mobile nodes can join or leave the network when they want. Mobile ad-hoc network is infrastructure less network means there is no any central controller. The nodes are deployed in the network and path is established according to AODV protocol from source to destination. AODV is on demand protocol. There are many types of issues that are arises during data transfer from source to destination. Congestion is also from one of them that are responsible for the degradation of the network. It concludes that congestion is dangerous for the packet loss. Due to this packet loss may occur and delay increase as well as throughput of the network decrease. The main objective of this proposed technique to control congestion so that packet loss decrease and throughput of the network increase using knowledge based learning. Source count the minimum congestion counter and select that path as a final path or best path which has minimum congestion counter measures. Experimental results show that proposed method is far better than existing method as it has less time delay and less packet loss as compare to the existing technique as well as throughput of the network in proposed technique is better than existing technique.

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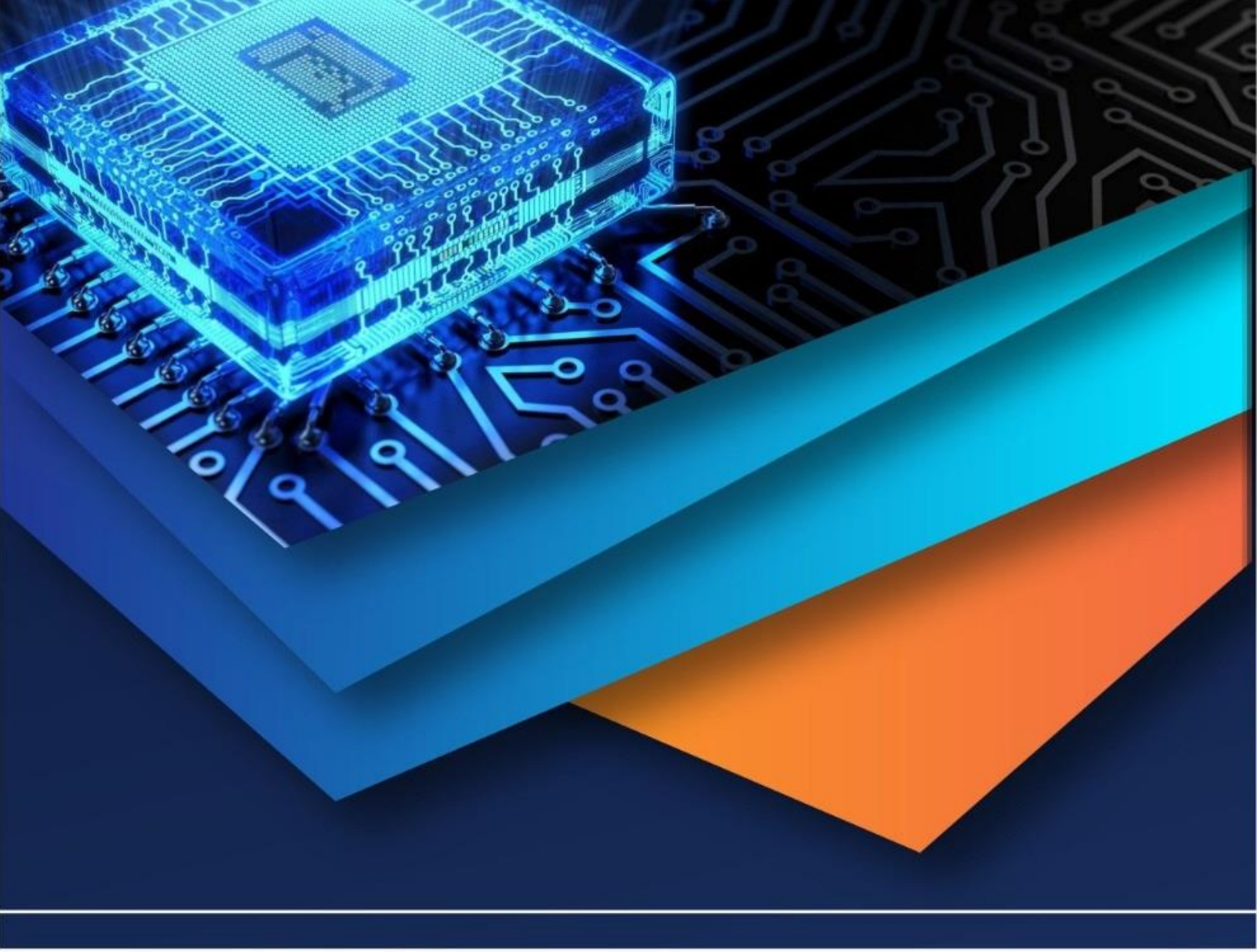

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