Improving Network Performance by Minimizing Congestion in MANET

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Abstract- *In the MANET Congestion is the major concern. By which packet loss occurs in the network and the packets are failed to reach to the destination. Bypass route is one of the option to transmit the data to the other path. But the bypass route is time consuming technique to overcome this problem we apply leaky bucket algorithm at node. We initially detect the congestion in the path by calculating the capacity of the link and if the congestion detected then we applied Leaky Bucket Algorithm for the storing of data. We can perform this technique on different node. In this paper performance comparison of different number of nodes is shown.*

Keywords- MANET, Congestion Control, Proactive and Reactive Routing protocol.

I. INTRODUCTION

A Mobile Network (MANET) is a network that connects nodes wirelessly. There's no requisite of fastened infrastructure and these mobile nodes organize themselves in a random fashion to create a short-lived network with dynamically dynamic topology. Nodes communicate alternative one another and share info to other nodes. So a multi-hop communication happens, wherever many intermediate nodes relay the packets sent by the supply node until they reach the destination node. A mobile impromptu network is employed in several areas, e.g., disaster recovery environments, emergency search and rescue Operations wherever a network association is desperately needed. MANET is characterized by restricted resources adore information measure, battery power, and space for storing. These networks area unit totally distributed, and may work anyplace while not the assistance of any fastened infrastructure as access points or base stations [1].

II. ROUTING PROTOCOLS

Classification of routing protocols in MANET:-

The routing protocols in MANET are classified depending on routing strategy and network structure. According to the routing strategy the routing protocols can be categorized as Table-driven and source initiated, while depending on the network structure these are classified as flat routing, hierarchical routing and geographic position assisted routing.

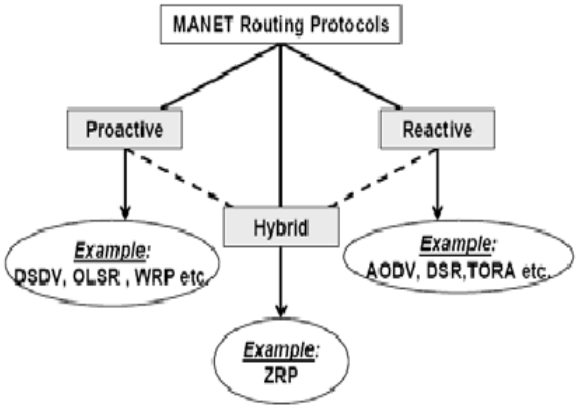


Fig. 2 Routing Protocol

Proactive (Table driven) routing protocol:-

These routing protocols are similar to and come as a natural extension of those for the wired networks. In proactive routing, each node has one or more tables that contain the latest information of the routes to any node in the network. Each row has the next hop for reaching a node/subnet and the cost of this route. Various table-driven protocols differ in the way the information about a change in topology is propagated through all nodes in the network. There exist some differences between the protocols that come under this category depending on the routing information being updated in each routing table. Furthermore, these routing protocols maintain different number of tables. The proactive protocols are not suitable for larger networks, as they need to maintain node entries for each and every node in the routing table of every node. This causes more overhead in the routing table leading to consumption of more bandwidth. Examples of such schemes are the conventional routing schemes, Destination Sequenced Distance Vector (DSDV) [4].

Reactive (On-Demand) routing protocol:-

Reactive routing is also known as on-demand routing protocol since they don't maintain routing information or routing activity at the network nodes if there is no communication. These protocols take a lazy approach to routing. They do not maintain or constantly update their route tables with the latest route topology. If a node wants to send a packet to another node then this protocol searches for the route in an on-demand manner and establishes the connection in order to transmit and receive the packet. The route discovery usually occurs by flooding the route request packets throughout the network. Examples of reactive routing protocols are the dynamic source Routing (DSR), ad hoc on-demand distance vector routing (AODV) [5].

Hybrid routing protocol:-

These protocols try to incorporate various aspects of proactive and reactive routing protocols. They are generally used to provide hierarchical routing; routing in general can be either flat or hierarchical. In a flat approach, the nodes communicate directly with each other. The problem with this is that it does not scale well; it also does not allow for route aggregation of updates In a hierarchical approach, the nodes are grouped into clusters, within each cluster there is a cluster head, this acts as a gateway to other clusters, and it serves as a sort of default route. The advantage of a hierarchical structure is that within a cluster, an on demand routing protocol could be used which is more efficient in small-scale networks. Example of a hybrid routing protocol is the Zone Routing Protocol (ZRP) [6].

III. CONGESION CONTROL

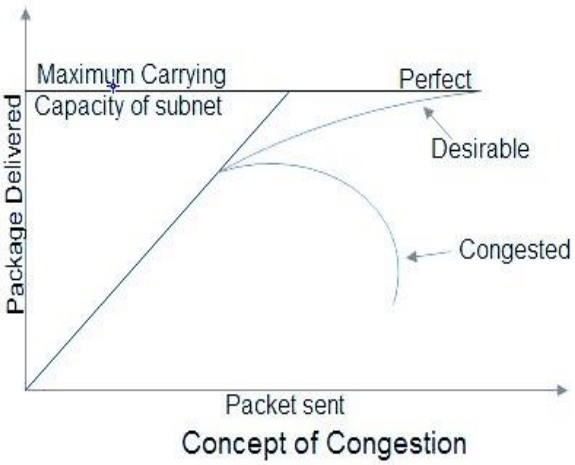
Mobile Ad-hoc network is the self-configuring and infrastructure-less style of the network with features like distinctive practicality like quality, dynamic configuration, self-configuring and localized administration. Congestion is like traffic in network. Congestion is stated occurring in network, which slows down the network latent period. Congestion happens in MANETs with restricted resources. Acknowledgements to free movements of mobile nodes in any direction cause congestion drawback within the network.

Effect of Congestion:-

1. It causes packet losses.
2. Information measure degradation and delay.
3. Energy wastage.

It is additionally chargeable for link failure drawback and degrades transmission rate [3]. Due to congestion the information within the network is lost. To avoid wasting the information or minimize the information losses we are able to apply two styles of congestion mechanisms.

One is preventive and different is recovery. In this paper, we'll work on preventive mechanisms of congestion management during which techniques and algorithms are going to be applied before occurring congestion.



Concept of Congestion

IV. LITERATURE SURVEY

Mr.C.Rangarajan, Mrs.S.Sridevikarumari, Ms.V.Sujitha et al. [2017] presented that, Mobile Ad Hoc Networks (MANETs) are kind of wireless network with self-administrating characteristics, where the nodes get associated in a spontaneous

or ad hoc basis. MANET is not an infrastructure based network and there exist no centralized resources. This paper surveys the recent protocols which are proposed to overcome the routing issue [4].

Shweta Kadam, Sameer Nagtilak et al. [2017] presented that, Ad-hoc network is defined as the temporary networks were nodes are moving without any fixed infrastructure or centralized administration. Here every node acts as both router as well as host. The topology of these nodes is dynamic, self-configurable and highly deployable. There are so many routing protocols which are defined for MANETs. As many packets are transmitted by various nodes over the network, the chance of dropping packets in the network increases over great extent. When the offered load on the network exceeds congestion occurs, which leads to packet losses. There are so many proposed protocols that are adaptive to congestion and deals with congestion. This paper discusses the congestion control protocols, AODV and Enhance AODV. Enhance AODV is modified version of basic AODV routing protocol which controls congestion very effectively than AODV routing protocol. The performance parameters such as packet delivery ratio, packet loss ratio, average end to end delay and throughput are discussed [5].

Rajkumar L. Biradar et al. [2015] presented that, in this paper, mobile ad hoc networks (MANETs) have received increasing attention in recent years due to their mobility feature, dynamic topology, and ease of deployment. It is a self-organized wireless network which consists of mobile devices, such as laptops, cell phones, and Personal Digital Assistants (PDAs), which can freely move in the network. In addition to mobility, mobile devices cooperate and forward packets for each other to extend the limited wireless

Transmission range of each node by multi-hop relaying, which is used for various applications, e.g., disaster relief, military operation, and emergency communications. Security is one crucial requirement for these network services. Implementing security is therefore of prime importance in such networks. Provisioning protected communications between mobile nodes in a hostile environment, in which a malicious attacker can launch attacks to disrupt network security, is a primary concern [6].

Sonam S. Bhavsar, Varsha R. dange et al. [2016] presented that the paper mainly studies and compares the performance of MANET routing protocols namely PSR, DSR, DSDV and AODV under various traffic loads with various maximum TCP congestion window size to improve congestion control in the routing. The metrics used to compare routing protocol performance are packet delivery ratio, average routing load, the average end-to-end time required with delay and average network throughput and mainly to overcome congestion situation and avoid packet loss in wireless networks [7].

Sapna Khurana, Dr. Suresh Kumar et al. [2017] presented that, Wireless ad-hoc network is becoming one of the most animated and dynamic field of communication Because the mobile devices and wireless network has increased significantly in the recent years. Mobile ad-hoc network (MANET) uses wireless connections to connect various networks. There are number of issues and challenges in MANET. Due to many number of nodes transmitting packets over the network, the chances of losing the packets over the network increases to a great extent. Also, with the increase in size and quantum of data packets, the congestion over the network increases which may also lead to packet loses. The objective of this paper is to study the comparison of various protocols based upon parameters such as Throughput performance, Packet drop ratio, Data error, Packet delivery rate. This study will facilitate the researcher in this field to undertake development of optimized new technique [8].

V. PROPOSED FRAMEWORK

In MANET, congestion happens because of link failure or because of the high speed of packets transmission. Once the serious packet flow happens within the mobile unintended network and therefore the capability is a smaller amount than the link or node capability then they start dropping the packets that are liable for low network performance. Within the existing technique, they reduced congestion by forwarding in multiple ways or finding the bypass route. Once the chance is known of link failure then it buffered all the packets to its previous node. However if buffer overflow then it'll additionally produce congestion.

To eliminate this buffer overflow downside, we have a tendency to apply leaky bucket formula (LBA) at nodes. We determine the probabilities of link failure then we apply LBA at the node so it reduces the traffic. Exploitation this

Congestion can scale back and it additionally reduces the employment of traffic rending perform.

Leaky Bucket:

The leaky bucket is employed to implement traffic policing and traffic shaping within the network. A Bucket that having a little hole at a bottom. We have a tendency to fasten the speed of information packets running into the bucket, the speed at that the information packets come from that little hole is constant.

Figure (a) shows this state of affairs. The rule works equally to the manner associate actual leaky bucket holds water. The leaky bucket takes information and collects to its most capability. Once the bucket is full, any further information packets getting into an overflow from the bucket. The host is allowed to place one packet per clock tick onto the network. This ends up in a consistent flow of packets, smoothing outbursts and reducing congestion if the bucket (buffer) overflows then packets are discarded. The leaky bucket enforces a relentless output rate (average rate) in spite of the business of the input will nothing once the input is idle. [10].

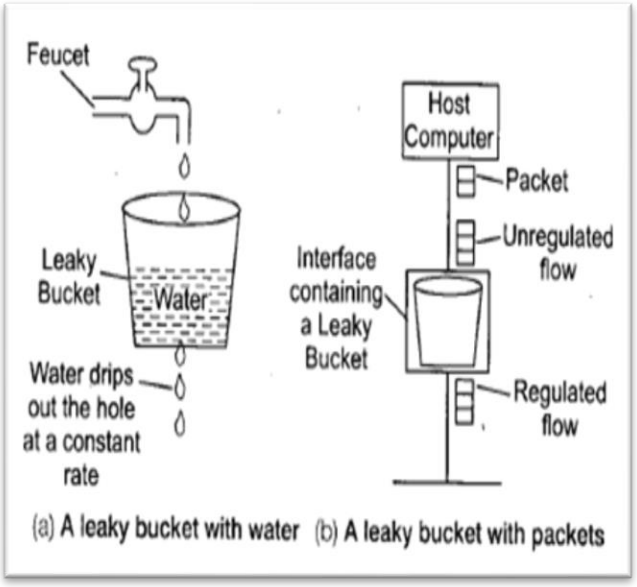


Fig. 3 Leaky Bucket

Proposed algorithm:

- Select sender S and receiver R in the network.
- Send the data from sender on a path.
- Calculate link lifetime (signal strength, node's remaining energy, route expiration time, node velocity.
- If Link lifetime ≤ threshold
  Then send message to node and apply leaky bucket algorithm ( )
  Else
  Send the data from the same path and continue
- Exit

For leaky bucket algorithm ( )

- while (incoming packet):
  Add packets to bucket: rate * time_ passed
- Check if we have any packet:
  If (no, full token available):
  Drop Packet
- else:
  Send packet
- available_ packets = available_ packets – 1

VI. RESULT

To verify the effectiveness and feasibility of the proposed framework. We have shown the results using charts along with PDR, throughput and Routing overhead which shows that how much effective is the proposed method.

Packet Delivery Ratio:

It is the ratio of received packets to the total number of data packets sent by source. Packet delivery ratio value is also much improved for each mobile device in mobile ad hoc network using proposed framework. Leaky bucket algorithm helped improving PDR value of data packets when the number of packets is regular in wireless network. Other category in the chart shows the result for PDR value for data packets in mobile ad hoc network that even when the number of devices is more, proposed framework still optimizes the increased PDR Value.

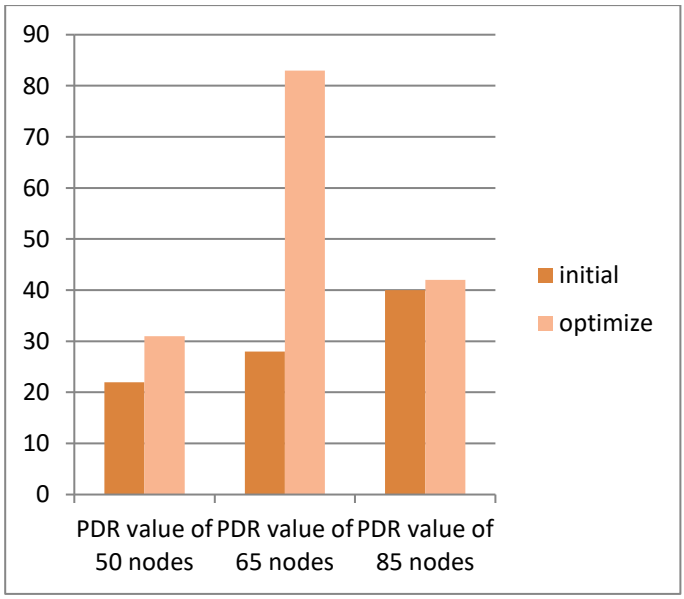


Chart 1.PDR evaluation

Throughput:

The total number of packets delivered to the higher layers per second. Throughput chart shows the evaluation of three scenarios where one shows the result with possible number of data packets in mobile ad hoc network, In which the throughput value is improved using proposed framework .On the other hand when there are more number of mobile nodes in the network is considered using proposed approach the throughput value is being optimized increased as well.

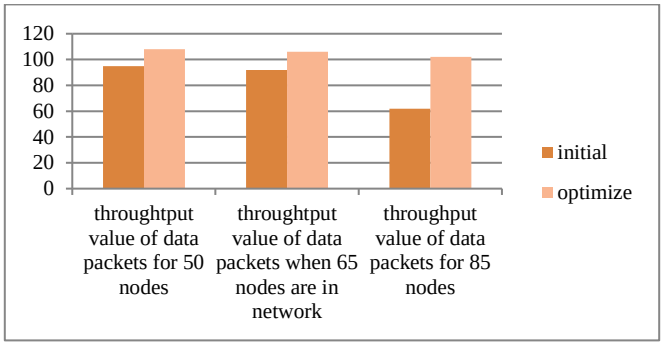


Chart 2.Throughput evaluation

Routing Overhead:

The chart represents the results of routing overhead, In chart the first category of the chart shows the result when using the leaky bucket concept used in our proposed framework. The proposed approach has less routing overhead than the base approach. Since the overhead should be Minimum except as the routing increases.

Whereas the proposed framework also works well when there are more active nodes available in the network. Using this routing overhead was found a bit less when there are more active or participating devices in Mobile ad hoc network.

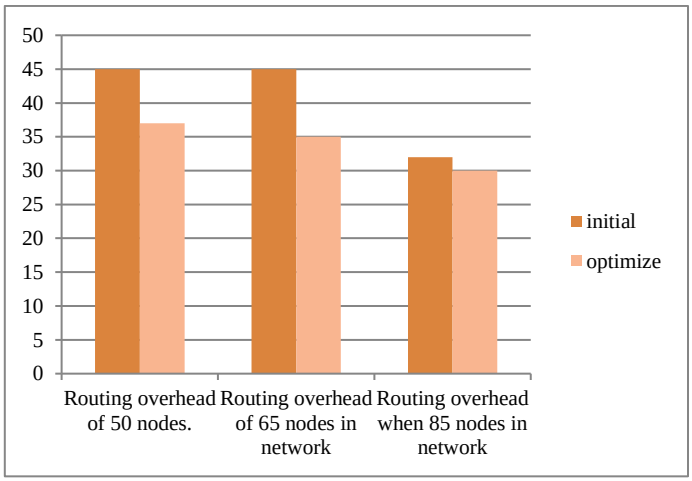


Chart 3.Routing overhead evaluation

Comparative Study of Proposed Framework on Different Nodes:

Active Nodes in Network	PDR Value	Throughput	Routing overhead
When 50 Active mobile nodes	Increased	Increased	Decreased
When 65 active mobile nodes	Increased	Increased	Decreased
When 85 active mobile nodes	Increased	Increased	Decreased

Above table shows the comparative study of proposed technique when different active mobile nodes are available in the network. If we compare the result of proposed framework With the existing technique it gives the better result. so it shows increased and efficient result on different node. When active mobile nodes will increase in network proposed algorithm will work efficiently as well. But we can see when active mobile nodes will increase in network PDR value, throughput and routing overhead will increased as according to the active mobile nodes so we can say that this technique will work on different active nodes. we can keep this for the future work. We can compare the existing work with the new algorithms and technique for enhanced work.

VII. CONCLUSION & FUTURE WORK

This paper has presented a study on congestion control using leaky bucket algorithm with its definitions, architecture and various challenges and solutions which come across. Simulation results are studied to prove that how the congestion can be Minimize in the proposed technique. We improved the network performance by reducing the overhead and increase the throughput and packet delivery ratio of the network. Network performance can be increased by controlling the congestion in MANET.

The focus of the study in our future research work is to propose an extension of the existing conventional routing protocols. There are various challenges that need to be met, so these networks are going to have widespread use in the future. New algorithms and frameworks can be introduced to optimize packet loss, improved throughput and packet delivery ratio.

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