CONGESTION CONTROL IN MOBILE AD HOC NETWORK: A LITERATURE SURVEY

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ABSTRACT

Abstract- Congestion is a serious problem in mobile ad hoc network. In such network each and every node behaves as the router and has the capacity to convey the packet from correspondent to respondent. Because of the limited capacity of the bandwidth every node may transmit the packet at the same time due to this congestion arises which incur long delay and high packet loss which degrades the performance of the network. This network has dynamic topology and has shared behavior, it automatically forms the network temporarily which helps in transmission earl. To overcome these difficulties many approaches has been suggested earlier. This paper, presents the overview of the existing approaches and also discussing difference between these congestion control techniques.

Keyword : *- Congestion, Mobile ad hoc network, Bandwidth, Shared behavior, Dynamic topology*

1. INTRODUCTION

Wireless is a novel technology that enables clients to get the data and administrations irrespective to the geographic position. People can use and surf the Internet with PCs (e.g., workstation, palmtop, cell phone, and PDA) at whatever point and at every possible prospect. By and large, the wireless systems can be grouped into two sorts: Infrastructure network and ad hoc network. The mobile ad hoc network (MANET) is a self-sufficient gathering of multipurpose clients who impart through generally bandwidth compelled wireless connections. Meanwhile the hosts are mobile; the system topology may change quickly and capriciously after some time. One of the vital task that ad hoc network ought to perform is congestion control.[1] The principle goal of congestion control is to confine the delay and buffer overflow brought about by network congestion and give better execution of the network. In wireline network, congestion control is actualized at the transport layer and is regularly structured independently from the elements of other layers.[2] Since wired connections have fixed limits and are autonomous, this approach is all around legitimized and has been widely studied [2]. In any case, these outcomes don't matter straightforwardly to ad hoc network in light of the fact that the ad hoc network bring about a lot of packet loss, high delay, unfair scenarios, and low throughputs. In ad hoc network, every mobile node has restricted transmission limit and buffer and they for the most part intercommunicate by multi-hop relay.

Fig. 1: Mobile ad hoc network architecture [13]

1.1 Routing Protocols

MANET routing protocols [17] could be comprehensively characterized into two significant classes: Proactive, Reactive and Hybrid Routing Protocol. In proactive protocols consistently become familiar with the topology of the network by trading topological data among the network nodes. In this manner, when there is a requirement for a route to a destination, such route data is accessible right away. On the off chance that the network topology changes too regularly, the expense of keeping up the network may be exceptionally high. On the off chance that the network movement is low, the data about genuine topology may even not be utilized. The case of this protocol is DSDV [3], OLSR [4], and so on. The reactive routing protocols depend on a type of query-reply dialog.[5] Reactive protocols continue for setting up route(s) to the destination just when the need emerges. They needn't bother with the occasional transmission of topological data of the network. The case of this protocol are DSR[6], AODV[6]. Frequently receptive or proactive component of a specific routing protocol probably won't be sufficient; rather a blend may yield better arrangement. Subsequently, in the ongoing days, a few crossover protocols are likewise proposed. Instances of mixture routing protocols are ZRP[7] and SHARP[8]. There is another measurement for ordering routing protocols: congestion versatile routing versus congestion versatile routing. We note that the current routing protocols are congestion un-versatile [10-12]. While setting up another route, it continues as before until versatility or disappointment brings about separation. During packet move among source and destination, congestion may occur, this isn't taken care of by the current routing protocol. It might likewise prompt the accompanying issues: (I) long postponement, (ii) numerous packet misfortunes and (iii) low throughput. The above issues become increasingly unmistakable in the huge scale transmission of traffic-serious information, for example, mixed media information likely and the negative effect of parcel misfortune on the administration quality is of more noteworthiness [2]. Not at all like settled networks, for example, the Internet, in a powerful network like a MANET, it is costly, as far as time, overhead, to recuperate from congestion [2].

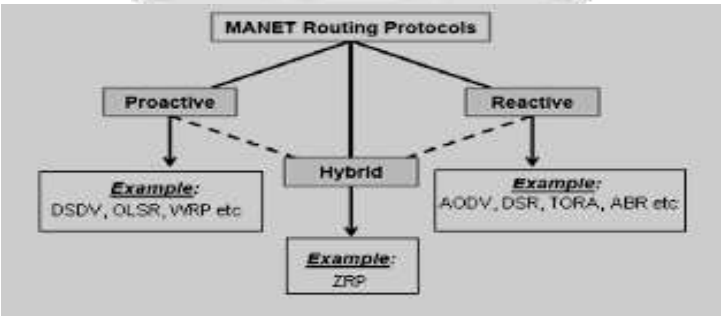

Fig.2: Classification of routing protocol [9]

1.2 Challenges in MANET

The resulting rundown of issues shows the deficiencies and confinements that must be overpowered in a MANET environment:[14,15]

- **Restricted wireless transmission range:** The radio gathering will be confined in the wireless networks and subsequently amount of information; it can give a lot lighter than what a bound network can give. This includes routing methodology of wireless networks that must be use data transfer capacity in a perfect way. This can be accomplished through ensuring the overhead as least as possible. The limited transmission range additionally upholds restriction on routing methodology for continuing the geographical data. Especially in MANETs as a result of normal varieties in topology, safeguarding the topological information for each node incorporates more controller overhead which brings about extra transfer speed depletion.[14]

- **Time-fluctuating wireless connection qualities:** Wireless channel is obligated to a scope of communicate issue, for example, way harm, declining, mediation and impediment. These highlights oppose the arrangement, information rate, and consistency of these cordless transmissions. Indeed, even two unique key limitations, Nyquist's and Shannon's hypotheses that standard over capacity to convey the data at assorted information degrees can be estimated.

- **Broadcast nature of the wireless medium:** The communicate idea of the radio channel, for example, transmissions arranged by a gadget is built up by all gadgets that are in its straight transmission covering the zone. A gadget can get access to the common medium when its interchanges can't upset any consistent session. [14]

- **Connectivity Efficiency and Cost Objective:** So as to set up a network in which the prerequisite of nodes and arrangement cost of static nodes must be considered. While setting the basic nodes in the network more fixation ought to be offered on to boost the network and to have a base expense of the route. Be that as it may, to accomplish both cost destination and availability proficiency while spreading the basic node in the wireless network is viewed as a NP-complete problem.[15]

- **Limited physical security:** Wireless Ad hoc networks are generally a great deal of powerless against physical security dangers than fixed link networks. There is greater plausibility of forswearing of-administration assaults, listening stealthily, and parodying in these networks. That is the reason it generally stays a significant worry for the researchers.[15]

- **Mobility Prediction**: Mobility expectation of a node is the estimation of its future areas. The meaning of area relies upon the sort of wireless network. In framework networks area alludes to the passages to which the versatile terminal is associated. Its primary preferred position is to anticipate the connection termination time to improve node availability and routing execution. [15]

1.3 Pros and Cons of MANET [16]:

Pros:

1. Detachment from dominant network administration.
2. Each and every node can take part in both the roles i.e. of router and host showing self-governing nature.
3. Self-governing and self-healing nodes, does not entail human interposition.

Cons:

1. Resources are inadequate due to numerous constrictions like interference circumstances, noise, etc.
2. Nonexistence of authorization amenities.
3. More susceptible to to attacks due to restricted physical safekeeping.

2. CONGESTION CONTROL IN MANET

Congestion is a condition in correspondence sorts out in which an abundance of packets is appeared in a piece of the subnet. Congestion may happen when the heap on the system is more outstanding than the breaking point of the system. Congestion prompts packet misfortunes and information transferability incitement and sits around idly and vitality on blocking improvement. On the Internet when congestion is done it is routinely focusing on a solitary switch; in light of the bestowed halfway of the MANET congestion won't over-burden the flexible nodes yet affects the whole extension zone. At the point when the routing protocols in MANET are absolutely not cognizant about the congestion, it realizes the extra issues.[18]

- Long delay: This holds up the network of finding the congestion. Exactly when the congestion is increasingly cautious, it is smarter to pick a trade way. Anyway, the prevailing on-request routing protocol concedes the route searching for a procedure.
- High overhead: More taking care of and correspondence endeavors are favored for another route presentation. If the multipath coordinating is utilized, it needs additional exertion for keeping up the multi-ways paying little personality to the being there of exchange route.
- Many packet misfortunes: The congestion control strategy exercises to diminish the over-burden in the system by likewise decreasing the sending rate at the sender part or by dropping the packets at the middle nodes or by executing both the network. This causes an expanded packet misfortune rate or the least throughput. [18]

There are various sorts of congestion that happens, for example, Instantaneous Congestion, Baseline Congestion, Flash Congestion, and Spiky Delay, etc.[19]

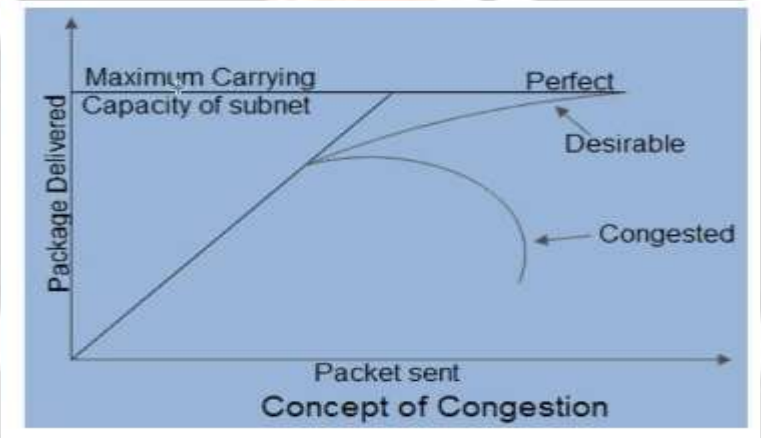

Fig. 3: Concept of Congestion

2.1 Conges-tion Control Tech-niques

The strategy which is utilized to anticipate or control the congestion is known as congestion. Congestion control can by and large separation into two subdivisions:

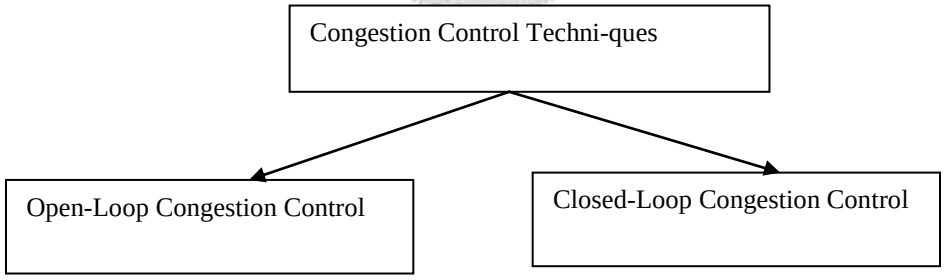

Fig.4: Types of Congestion Control Methods [20]

2.1.1 Open-Loop Congestion Control

In this procedure, the strategy forestalls the congestion before occurring. It very well may be forestalled either by the source or destination. There are many open-circle congestion methods as pursue:

2.1.1.1 Retrans-mission Policy

In this technique, packets ought to be retransmitted if a portion of the packets are defiled or it isn't conveyed to the beneficiary. This sort of innovation upgrades organize congestion. To improve the exhibition, it requires planning the retransmission clock so that it can lessen the congestion.[22]

2.1.1.2 Window Policy

At the sender end, the congestion relies upon the window type. In the Go-back-n window, numerous packets are detested, in those packets, a portion of the packets effectively get by the recipient. The copy packet builds organize congestion. That is the reason it is required to send a lone particular packet that has been lost during transmission and a Selective recurrent window ought to be utilized. [21]

2.1.1.3 Discarding Policy

The switch utilizes a decent disposing of plan in which the switch disposes of the less important and defiled packet from the transmission. Along these lines, it lessens congestion.

2.1.1.4 Acknowledg-ment Policy

At the collector end, the affirmation of getting a packet or not is likewise significant and it influences the congestion. There are numerous networks are accessible to forestall the congestion that is identified with the affirmation of packets. In one methodology the collector sends the affirmation of numerous packets rather than a solitary packet.[22]

2.1.1.5 Admi-ssion Policy

There are utilizing a component to anticipate congestion in confirmation approach. Prior to transmitting the packet. The switches should check the necessity of resource of a network stream. On the off chance that there is any congestion in the network, at that point to counteract the congestion switch deny building up a network association.

2.1.2 Closed-Loop Conges-tion Control

The closed-loop conges-tion control method is utilized to treat or mitigate congestion after it occurs. A few strategies are utilized by various protocols; some of them are:

2.1.2.1 Back-pressure

This is the technique wherein a congested node doesn't get packets from the upstream node. The upstream node becomes congested and afterward it isn't accepting the packets from higher nodes. This kind of technique is just used to apply to the virtual circuit. What's more, in these circuits, every node takes the data of its higher upstream node. We can say that the backpressure strategy proliferates in the invert request of information stream. It is a node to the node congestion control approach.[22]

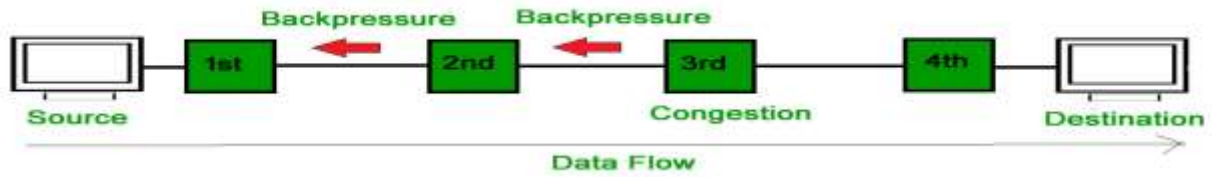

Fig. 5: Back-pressure procedures of Congestion Control

In the event that a node becomes congested [23], at that point it backs off or quits accepting the packets from the nodes from which it is getting packets. In the event that this limitation perseveres for long, at that point packet sending nodes themselves become blocked which thus proliferates the confinement on their former nodes. Be that as it may, this strategy is of restricted utility as it very well may be utilized for the association situated networks supporting Hop by Hop stream control.

2.1.2.2 Choke Packet Tech-nique

In the Choke packet strategy datagram and virtual networks both are utilized. To advise the congestion a packet is sent by a specific node is known as choke packet. Every switch allots the utilizations to the network and it screens its resources. At the point when resource utilizes more network than its doled out worth then the switch sends a choke packet. This packet is sent by the source and it is the sign of diminishing the traffic.

The choke packet [23] is a control packet produced at the blocked node and this packet is transmitted back to the source node to limit the traffic stream. As the source gets the Choke bundle it needs to decrease its transmission rate until it quits accepting the choke packets. Be that as it may, this technique is an unrefined strategy as a choke packet doesn't show to the sending source, the status of conveyance (receipt/non-receipt) of the packets.

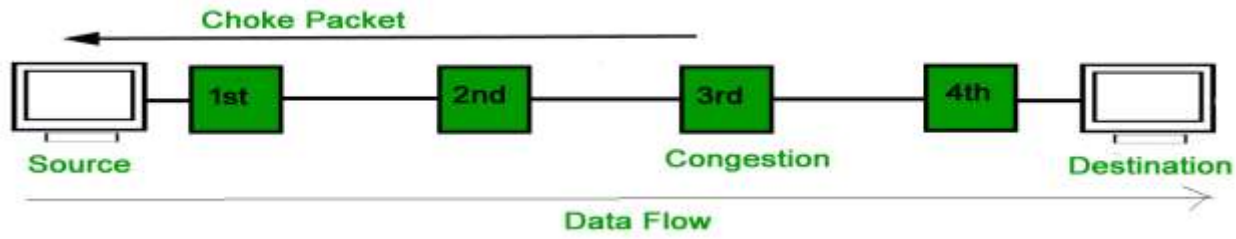

Fig. 6: Chock Packet techniques of Congestion Control

2.1.2.3 Impli-cit Signaling

In this sort of strategy, the congested node and source don't speak with one another. On the off chance that a sender transmits so a lot of information and the sender doesn't get any recognize that the recipient gets the information then it can accept that their congestion can happen. Along these lines, the sources surmise about network congestion.

At the point when the sending source comes to know about congestion [23] at a node if the spread postponements of packets are distinguished that is the deferral is longer than fixed engendering deferral and it might at last lead to bundle dispose of. Be that as it may, the sending node ought to have a network to identify expanded postponements and packet disposes of. The benefit of certain criticism is straightforwardness in the switches; switches are left to concentrate just on resource assignment and don't need to compute and create a suitable input signal. Be that as it may, the planning components must be known to the end has for verifiable input to be helpful; something else, the watched presentation might be deceiving and not precisely depict the genuine congestion condition of the network. For instance, with FIFO planning an expansion in the rate may prompt an expansion in the watched throughput, in spite of the fact that lines may have just fired structure up and the all-out deferral has expanded.

2.1.2.4 Expli-cit Signaling

On a basic level, express criticism can be as a congestion warning or rate sign. Because of the impediments in the data that can be conveyed in protocol headers unequivocal criticism can be double or multivalued (typically constrained to few qualities: "how much congestion has been experienced"). On account of double criticism, the fitting working point is found through a cycle procedure of network input and host modifications. For unequivocal input, the main strategies proposed for TCP/IP networks is the ICMP Source Quench messages and Explicit Congestion Notification (ECN) proposition. The ICMP Source Quench message is sent by the IP layer of a host or switch to throttle back a sender on the off chance that the host/switch comes up short on cushions or discards datagram ICMP Source Quench is once in a while utilized in the Internet, and in spite of the fact that there is no considerable proof, the present inclination is to belittle this message since it expends transmission capacity on

occasion of congestion, and is commonly an incapable and uncalled for fix to congestion . In the ECN criticism plot, the switch sets a piece in the bundle header (CE bit) at whatever point it recognizes beginning congestion. The recipient duplicates this bit into the header of the affirmation bundle, and the stream control network at the sender is answerable for changing the window (or rate) in light of a specific calculation. The algorithm utilized for congestion recognition and window alteration as reactions to express input are a piece of the line the board and stream control instruments, separately. Explicit criticism suggests an additional network in the switch, however then again, it gives increasingly quantitative control data which can be important for the alteration procedure. Express rate sign is another strategy for unequivocal criticism where the switches perform rate designation and the determined rates are unequivocally imparted back to the sources (by means of the collector) as data in the packet headers; it has been utilized in ATM organizes yet not on the Internet [21].

2.2 Differences in Open and Closed Loop Conge-stion Control Techniques

This section of the research paper gives the major difference among the open-loop congestion control and closed-loop conge-stion control techniques which is depicted in form on table 1.

Table 1: Differences in Open and Closed Loop Congestion Control

Open Loop Congestion Control	1. In open look congestion is controlled before it happens. 2. Open look does not need end to end feedback to make things work. 3. This control policies try to prevent congestion. 4. Congestion can be handled by either source or destination. 5. This type of congestion control does not require end-to-end feedback
Closed Loop Congestion Control	1. Congestion is handled after it occurs. 2. It needs some kind of feedback to adjust modifications. 3. Such control policies try to alleviate the effects of congestion. 4. Congestion can be handled by either source. 5. This congestion control adjusts the cell-rate based on feedback received

3. RELATED WORK

Ritika Mehra and Manjula Saluja anticipated an algorithm Adaptive Congestion Control Mechanisms in Mobile Ad-Hoc Networks Nowadays, not just cell phones, however furthermore, workstations PDAs are used by individuals in their master and secret lives. These components are used independently for the most bits that are their solicitations that don't collaborate. Here and there, however, a bunch of portable networks structure an unconstrained, temporary web as they way each and every other. This grants for example individuals at an experience to allot reports, introductions and advantageous utilitarian data. The normal TCP congestion control network can't get a handle on the unmistakable properties of an open wireless channel. TCP congestion control works incredibly well on the Internet. In any case, versatile specially appointed networks show a little remarkable property that extensively adjusts the plan of fitting protocols and protocol stacks in the completion, and of congestion control component

specifically. As it wound out, the immeasurably unique nature in the versatile impromptu web is exceedingly dangerous for normal TCP. Unforgiving throughput debasement and huge decency difficulties are a tad bit of the perceived congestion associated issues. This paper is concerning grouped congestion control instruments in Mobile Ad hoc networks.[23]. *Mohsen Yaghoubi Suraki et al* anticipated a Fuzzy Cross-Layer Congestion Control in Mobile Ad Hoc Networks. Portable specially appointed networks (MANETs) are an assortment of versatile nodes associated together with no system and focal the executives. Congestion control is a significant issue in MANETs and TCP congestion control instruments are unequipped for overseeing uncommon qualities of the wireless direct in specially appointed networks. Also, a few network layers are included and changing every parameter on those layers can influence different ones. A cross-layer approach is anticipated in transport, network, and MAC layers in which the Fuzzy Logic Network is utilized in transitional and destination nodes as a unique device for controlling the congestion issue in MANETs. In the network layer, the DSR routing algorithm is utilized and messages traded among nodes are placed into the ACK packets. The reproduction results show that in this strategy, start to finish delay is decreased more for UDP packets and less for the TCP packet. Additionally, organize throughput expanded and packet misfortune rate somewhat improved.[24] *Phet Aimtongkham et al*. recommended an algorithm Congestion Control and Prediction Schemes Using the Fuzzy Logic Network with Adaptive Membership Function in Wireless Sensor Networks. Network congestion is a key test in resource compelled networks, especially those with constrained transfer speed to suit high-volume information transmission, which causes the ominous nature of administration, including impacts, for example, packet misfortune and low throughput. This test is significant in wireless sensor networks (WSNs) with limitations and requirements, including constrained registering force, memory, and transmission because of independent batteries, which limit sensor node lifetime. Deciding a way to maintain a strategic distance from congested routes can draw out the network. Along these lines, we present way assurance design for WSNs that considers. The design is isolated into 3 phases, barring the last criteria for way assurance: (1) beginning way development in a top-down various leveled structure, (2) way induction with vitality mindful helped routing, and (3) congestion expectation utilizing exponential smoothing. With a few elements, for example, bounce tally, remaining vitality, cushion inhabitance, and sending rate, we apply fluffy rationale systems to decide legitimate loads among those variables notwithstanding streamlining the weight over the enrollment capacities utilizing a bat algorithm. The recreation results demonstrate the predominant presentation of the anticipated strategy as far as high throughput, low bundle misfortune, adjusting the general vitality utilization, and delaying the network lifetime contrasted with cutting edge protocols.[25] *Y. Zhang et al.* thought about the vitality of SNs, which incorporates the energies of a specific SN and its neighbors and the way data, in the level-based way assurance as the contributions of FLS for choosing the bunch head (CH); this technique is named the Energy-Efficient Distributed Clustering algorithm dependent on fluffy methodology with non-uniform conveyance (EEDCF). The CH transmits to the following CH toward the sink node. The principle constraint is that, on account of meager arrangement, EEDCF tends to underperform.[26].

4. CONCLUSION AND FUTURE WORK

Congestion is the serious problem occurs in the network due to its dynamic behavior and limited bandwidth which degraded the performance of the network like increases overhead, time delay and packet loss. To control the congestion over network various researchers proposed different scheme which diminishes the above issues takes place in the network. This paper addresses the congestion, issues and also present the survey of the congestion control scheme and give the comparison between these schemes. After analysis it is found that some scheme enhances the overhead while decreasing the time delay and packet loss. So in future work, we need to develop such congestion control techniques which reduces the overhead over the network while maintaining the time delay and packet loss.

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