A REVIEW ON CONGESTION CONTROL ALGORITHMS IN MANET

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Abstract- In wireless network communication mobile communication has becomes very significant. MANET is a temporary network that means nodes transfer without any fixed infrastructure. In MANET changes the network topologies due to nodes are movable and also nodes are commonly communicated with each other over various wireless links. In MANET routing is a problem because there is no router between source and destination so mobile nodes also themselves act as the routers. In MANET, routing based on the topologies, router source. 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.

Keywords- MANET, Congestion Control.

I. INTRODUCTION

A Mobile Ad hoc Network (MANET) is a type of ad hoc network [1]. Ad hoc means set or occurrence whenever important and not having plan in advance. Ad hoc is a LAN which permits new network devices to be inserted quickly. Mobile ad hoc network contains a collection of autonomous nodes which forms a short-term network without any fixed environment or central controller. For introducing network wireless connections (Wi-Fi) are used or any other average such as satellite or cellular transmission. Each device in a MANET is free to move self dependently in any direction. . In MANET each node (Mobile Device) acts as a router, which helps in sending forward packets from a source to destination. MANET nodes can be own devices such as lap- top, mobile phones and PDA .MANET can change place of location and configure itself on the fly.

Mobile Ad hoc Networking (MANET) is a group of mobile nodes that are connected over different wireless links. In There is no existence fixed infrastructure in MANET. The network topologies may randomly change in a non-expected manner from time to time because nodes are free to move in MANET. The network topologies may transform as nodes move, so the modify in network topologies must be made known to the other nodes to updated the existing network topologies. Routing is the topic in MANET because it contains no router. So, each device must perform as a router for sending any packets among each other.

There are three types of MANET. It includes Vehicular Ad hoc Networks (VANETs), Intelligent Vehicular Ad hoc Networks (In VANETs) and Internet Based Mobile Ad hock Networks (iMANET)

We are having many protocols for routing in multipath. The multipath routing protocols to enhance the quality of service in MANET through providing reliable communication. Mobile nodes communicate with each other in a multi-hop fashion In MANETs. That means a mobile node transfer a packet to a sink via middle nodes. The availability of each node very important. Otherwise, overall performance of the network may be precious by single middle node

A. Application of MANET

- Military or police exercises.
- Disaster relief operations.
- Mine cite operations.
- Urgent Business meetings.

B. Advantages of MANET

- They provide access to information and services regardless of geographic position.
- These networks can be set up at any place and time.

C. Disadvantages of MANET

- Limited resources and physical security.
- Intrinsic mutual trust vulnerable to attacks.
- Lack of authorization facilities.
- Volatile network topology makes it hard to detect malicious nodes.
- Security protocols for wired networks cannot work for ad hoc networks.

II. MANET CHARACTERISTICS

Mobile ad hoc network [7] nodes are furnished with wireless transmitters and receivers using antennas, which may be highly directional (point-to-point), Omni-directional (broad-cast), in all probability steerable, or some combination. At a given point in time, depending on position of nodes, their sender and receiver coverage patterns, Transmission levels and co-channel interfering levels, a wireless connectivity in the form of a random, multihop graph or "ad hoc" network exists between the nodes. This topology may change with time as the nodes move or adjust their transmission and reception parameters. [4] The main MANET uniqueness that can cause packet loss is: mobility, wireless channel, and power constraints.

A. Mobility

All devices in MANET are free to move, so an active connection should be kept alive to carry mobility. The host moves the topology will alter and this may lead to one of the following situations:

a) Route Failure: they are recurrent events due to mobility in MANET. And it necessary to reestablish a new transmission route to regulate to the topological changes. Once route failure occurs, it may go with a frequent of route change and failure, packet rearranging in the sender and the receiver side, not to forget some packets will drop in the way.

b) Network Partition: a network split occurs when a node in a MANET transfer away from the network thereby occurring an isolation of some part of the network by splitting it into two individual parts. These one-off parts are called partitions.

B. Wireless Channel

Mobile nodes use wireless channel as a way to send and receive data. However, it is known that wireless channel is not strong, unreliable and unsafe from outside signals. In other words, wireless channel prone the following complexities:

a) Contention The use of common wireless channel restrictions the ability of a node to send packets. Two types of contention

(i) Interflow contention which refers to the contention practiced by a node due to transmission by in close proximity flow.

(ii) Interflow contention which points to the argument within same node due to the frontward data sending's and reverses ACK transmission. Commonly, contention may provide packet loss and delay.

C. Power Constraints

Mobile node is commonly a small device with a limited power supply and processing power. However, each node acts as a host and a router concurrently because not all mobile nodes exchange a few words directly with each other and this requires an additional energy. This imposes a route change or network splitting when node energy is low.

III. CHALLENGES OF MANET

There are some other challenges and complexities which are discussed below [5]:

- In MANET, scalability is required as it is mainly developed for communications in military establishments. The network grows, as the number of users increases many folds, each mobile device must be capable to handle the intensification of network to accomplish the task.
- MANET is an infrastructure less network. Here each device can communicate with every other device, hence it becomes difficult to manage and detect the faults. The use of this topology results in frequent network partitions, route changes, and possibly packet losses.
- Each node in the network is self-determining. Each node has its own equipment with different transmission/receiving capabilities of other nodes, which results in asymmetric links between nodes in transmission. Routers are not used between devices in MANET.

IV. CONGESTION IN MANET

Congestion [2] is a situation in communication networks in which too many packets are present in a part of the subnet. Congestion may occurs when the load on the network (number of packets send to the network) is greater than the capacity of the network (number of packets a network can handle). Congestion leads to packet losses and bandwidth degradation and waste time and energy on congestion recover. In ad hoc network with shared resources, where multiple senders are compete for link bandwidth, it is almost necessary to adjust the data rate used by each sender in order not to overload the network. Packets that arrive at a router and can't be promote are drop, as a result an excessive amount of packets arriving at a network bottleneck leads to many packet drops. 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. Many 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.

[3]Additionally, the lost packets often trigger retransmission, which means that more packets are sent into the network. Network congestion can severely deteriorate throughput of network. If no appropriate congestion control is performed this can lead to a congestion collapse of the network, where most no data is successfully delivered.

- When the load in the link goes beyond the carrying capacity.
- When the broadcasting packets in network are surplus in the nature.
- When more number of packets field has becomes time out and retransmitted.
- When the number of node increases.

V. CONGESTION CONTROL IN MANET

MANET is [1] no fixed infrastructure and there are no any separate network elements called routers and hence the mobile nodes themselves act as routers. Congestion in routing in MANET is a main problem in MANET. Congestion may arise when load on the network is high. 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.

[7] Packet failure in MANETs is primarily caused due to obstruction. The packet loss can be condensed by involving congestion control over a mobility and failure adaptive routing protocol at the network layer.

VI. CONGESTION CONTROL ALGORITHMS

A. Drop Tail Algorithm

Drop Tail (DT) algorithm [6] was deliberates by F. Postiglione et al. It has a great accuracy, easy and generally make use of the algorithm in the present networks, as the packets drops from the full queue buffer tail. This algorithms major advantage is suitability, effortlessness to its decentralized nature and heterogeneity. Though, this algorithm also has some severe disadvantage, such as no security alongside the mischievous or non responsive flows, lack of fairness and no comparative QoS (Quality of Service). QoS is of scrupulous apprehension for constant transmission of multimedia information and high- bandwidth video [15]. This type of transmitting the content is complicated in the current Internet and network through DT.

B. DECbit Algorithm

The earliest example of congestion detection at gateways is provided by the DECbit congestion avoidance scheme. In this scheme the congested gateway uses a congestion-indication bit in packet headers to provide feedback on congestion. When the average queue lengths exceed one, the gateway sets congestion signal bit in the header of incoming packet. The sources use the window based flow control system. They update their windows of data packets one time every two round excursion times. If at least half of the packets in the last window had the congestion signal bit set, then the window size is decreased exponentially, or else it is increased linearly. The main disadvantages of this method are averaging queue size for rather short periods of time and no difference between congestion detection and indication. The solutions of these problems were attempted by RED algorithm.

C. RED (Random Early Detection) Algorithm

RED Algorithm B. Braden et al., had been proposed to be primarily used in the performance of AQM (Active Queue Management). The average queue size is calculated upon the arrival of each packet, by means of

the Exponential Weighted Moving Average (EWMA). The calculation of the standard queue size is differentiating by means of minimum and maximum threshold to create after that accomplishment.

1. Variations of RED Algorithm

Some important variations of basic RED algorithm are briefly described below.

a) Gentle RED Algorithm: In the original version of the RED algorithm is all of the incoming packets are marked or dropped if qn > max^{th}. This can lead to oscillatory behavior as shown by. The marking probability curve of the gentle variation of RED with maximum buffer size. This algorithm is much more robust to the undesired oscillations in queue size and to the setting of parameters as compared to original RED.

b) Flow RED Algorithm: The Flow RED (FRED) variation was reported in which authors argue that RED is unfair towards different types of traffic. FRED uses per active flow accounting to impose on each flow a loss rate that is dependent upon the flows use of the buffer. The idea behind FRED is to keep state based on the instantaneous queue occupancy of a given flow. If a flow repeatedly occupy a large amount of the queue's buffer space, then it is detect and limited to a lesser amount of the buffer space. Thus fairness among flows is maintained. One of limits of FRED, is the higher queue sample frequency.

c) RED with Preferential Dropping Algorithm: The RED with Preferential Dropping (RED-PD) is an identification based approach which uses preferential dropping to control the high bandwidth non responsive flows. This approach has two most important steps. The first step is to identify the non responsive high bandwidth flows and the second step is to reduce their bandwidth. This algorithm draws heavily from the core stateless fair queuing and the flow random early detection mechanisms respectively. RED-PD uses packet drop history to identify and control the non responsive flows. Its main limitation is that, it cannot control a large number of non responsive flows properly.

d) Adaptive RED Algorithm: The Adaptive RED (ARED) configures its parameters based on the traffic load. An on-line algorithm is given in. According to it, if the average queue size qn is in between min^{th} and max^{th}, then the maxP is multiplicatively scaled up by factor α or scaled down by factor β depending on current status of traffic load, with α =3and β =2. Recently another version of this algorithm was reported by. In this version maxP is increased additively and decreased multiplicatively, over time scales larger than a typical round outing time, to maintain the average queue length within a target range, which is half way between min^{th} and max^{th}. Main advantage of ARED is that it works automatically for setting of its parameters in response to the altering load. Its drawback is that, it is not clear that which best and optimum policy of parameters change is.

D. Proportional Integral Controller Algorithm

In order to overcome the limitations of reply speed, stability, coupling between queue length and loss probability of RED. It can be implemented at a RED router as:

$$p: = a*(q - qref - b*(qold - qref) + pold ; pold := p ; qold := q;$$

Where q is the present queue length, qref is a preferred queue duration and a, b are constants.

E. Choke Algorithm

This algorithm was proposed by Konstantin's Psounis et al., every time the emergence of a new packet take place at congested gateway router, randomly a packet is drawn from the FIFO buffer, and the drawn packet is then differentiate through the arriving packet. But in cooperation together belong to the same flow in the network subsequently both are dropped, also the packet that was chosen randomly be kept integral as well as the fresh arriving packet is admit to the buffer through a possibility depending going on the phase with congestion. It will be the computation of possibility is the similar as RED. This is stateless and easy algorithm where no particular data structure is required. Though, this algorithm is not present fit while amount of flows is huge when comparing to the buffer space.

F. BLUE Algorithms

The basic idea behind the RED queue management system is to detect the incipient congestion earlier and to feed back the congestion notification to the end hosts, allowing them to reduce their sending rates accordingly. The RED queue length gives very little information about the number of competing connections in a shared link. BLUE and Stochastic Fair Blue Algorithms (SFB) were designed to overcome these problems, by using packet loss and link inactive events for protecting TCP flows against non-responsive flows. SFB is highly scalable and enforce equality using an extremely small amount of state information and a small amount of buffer space. It is a FIFO queuing algorithm that identifies and limits the non responsive flows based on an accounting similar to BLUE.

G. REM (Random Exponential Marking) Algorithm

REM as specified by Debanjan Saha is a fresh method meant for congestion control, as it focus to accomplish more consumption of link scalability, capability, delay and minor loss. Its major limits are it does

not give reason to cooperative sources and accurately considered and rigid value of φ have got to be famous internationally.

H. Fair Queuing Algorithms

The Fair Queuing Algorithms (FQ), and Stochastic Fair Queuing Algorithms (SFQ), are mainly used in the multimedia integrated services networks for their fairness and delay boundedness. The frame based class of FQ is called Weighted Round Robin (WRR), which is a router queue scheduling method in which queues are serviced in round robin fashion in proportion to a weight assigned for each flow or queue. Each queue is visited once per round. The Deficit Round Robin (DRR) is a modified version of WRR. It takes into account the lengths of the data packets being served. These algorithms are not used in the Internet. Opposite to FQ lies another algorithm known as Class Based Queuing (CBQ).

I. Core Stateless Fair Queuing Algorithm

The Core Stateless Fair Queuing Algorithm (CSFQ) is a highly scalable approach for enforcing the fairness between different flows without keeping any state in the core of the network. It relies on per flow accounting and marking at the edge of the network, in conjunction with the probabilistic dropping mechanism in the core network. A input impediment to the deployment of CSFQ is that it would require an extra field in the header of every packet, and modification of all routers in the network.

J. Virtual Queue Algorithm

The Virtual Queue Algorithm (VQ) is a radical technique, reported by Gibben and Kelly. In this system, the link maintains a virtual queue with the similar arrival rate as the real queue. However, the capability of the virtual queue is lesser than the capacity of a real queue. When the virtual queue drop a packet, then all packets already enquired in the real queue as well as all of the new incoming packets are marked until the virtual queue become empty again. The fixed size FIFO virtual queue seems to be a weakness of this algorithm

K. Adaptive Virtual Queue Algorithm

The Adaptive virtual queue algorithm was deliberates by R.J. Gibben et al., the ability of the link and the needed consumption maintains a virtual queue at the link. The aptitude and buffer size of the virtual queue is the identical as that of the real queue. On the arrival of every packet, the virtual queue capacity is updated. The adjustment of virtual queue algorithm does not suitably follow the varying traffic model at flow in the network, and it is also FIFO base approach.

TABLE: ADVANTAGES AND DISADVANTAGES OF CCAS IN THE CURRENT INTERNET

S.no	Algorithm	Main strengths	Main weaknesses
1.	DT	simplicity; no State information needed	lacks QoS; no fairness; global synchronization problems; biased for bursty traffic
2.	DECbit use provides good fairness	simple; distributed; optimized; low over head congestion feedback by bursty traffic marking packets; dynamic; provides good fairness	simple averaging; ; biased against
3.	RED & Variants	simple; fair; QoS; EWMA; AQM; unbiased for bursty traffic	sensitive to parameters settings
4.	PI	simple; fast; robust; AQM; less queue oscillations	estimation and setting of constants
5.	Choke	simple; stateless and easy to implement	fairness and scalability problems
6.	BLUE & SFB	low packet loss rate and less buffer needed	not scalable
7.	REM	low packet loss; high link utilization; scalable; and low delay	based on global parameter; lacks QoS
8.	FQ & DRR	bound on delay	expensive to implement
9.	SFQ	Reduced look up cost.	complicated; incomplete fairness; more queues
10.	CBQ	better management of gateway resources	modified Ethernet; no traffic control
11.	CSFQ	Fairness	extra field in packet header
12.	VQ	High link utilization.	fixed & DT type of VQ
13.	AVQ	adaptive to traffic changes	DT used in VQ

VII. RELATED WORK

Heena, Deepak Goyal [5] et al performed a work "CONGESTION CONTROL USING ENHANCE AODV (EAODV) ROUTING MECHANISM IN MANET" The proposed system modifies the existing AODV algorithm by using congestion control phenomena. In this system the node waits for acknowledgement for the threshold period of time. If the acknowledgement not received with in threshold period then the node broadcast again to select alternate path. This paper discusses the congestion control using EAODV. Here we analyze the performance of proposed system which is better than existing system by using various performance parameters on different number of nodes namely packet delivery ratio, end to end delay, packet loss ratio.

Mr. A. Chandra, Ms. T. Kavitha [8] et al performed a work "Adaptive Virtual Queue with Choke Packets for Congestion Control in MANETs" In this paper we made an effort to present a queue management approach. However the approach has outperformed existing queue management techniques RED and REM. Here choke packet mechanism is used to send the feedback to sender. It involves additional overhead to the traffic. Maintenance of virtual queue consumes additional buffer space.

Rushdi A. Hamamreh, Mohammed J. Bawatna [9] et al performed a work "Protocol for Dynamic Avoiding End-to-End Congestion in MANETs" This paper presents current research on solving TCP congestion problems over MANET by presenting most used TCP variants that preserve end to end semantic and there analysis to increase performance of TCP over MANET. As in case of mobile networks, performance of TCP degrades because of its inability to handle efficiently packet losses due to congestion. We have placed special emphasis on TCP-WELCOME, because it is the most successful TCP variant over MANET, due to its ability to differentiate between types of packet losses in MANET. This article proposed a new dynamic mechanism to replace traditional congestion algorithm of TCP-NewReno used in TCP-WELCOME with dynamic minimum congestion path selection through cross layer analysis. With reference to data analysis and the experimental results, it shows that, TCP-DCM handles packet losses problem due to congestion in more efficient way than TCP-WELCOME does. Hence it improves overall throughput and increase TCP performance over MANET.

Md. Manowarul Islam, Md. Abdur Razzaque, Md. Ashraf Uddin, A.K.M Kamrul Islam [10] et al performed a work "MCCM: Multilevel Congestion Avoidance and Control Mechanism for Mobile Ad Hoc Networks" In MANETs, congestion frequently leads to packets loss or delay in packets transmission. Our proposed. MCCM mechanism capable of developing an energy efficient path that ensures maximum use of network resources. The multilevel congestion detection and control mechanism of MCCM improves network performance significantly. The selective data delivery mechanism provides an effective way to mitigate congestion and ensures high data delivery rate, lower end-to-end delay and normalized routing overhead. Thus, MCCM outperforms the state-of-the art protocols and provide high throughput.

Jincheng Huang , Huihui Xiang , and Yaheng Zhang [11] et al performed a work "Stable AODV Routing Protocol with Energy-aware in Mobile Ad Hoc Network" This paper introduces an improved AODV to establish a stable routing, which is based on hop AODV, node mobile speed and node communication status. The results show that the proposed program through pre-alarming significantly improves the transmission rate of data packet and reduces the control overhead and delay caused by unpredictably link interruption. Compared with LAER, it also reduces the variance of the node energy and increases the time of network partition. In the high-speed dynamic network, it exhibits superior performance. When the mobility is low, compared with the method LAER, the delay of the proposed method is slightly high. The proposed AODV is superior to the traditional AODV and AODV based on VON on the aspects of end-to-end delay, routing load and spend. In order to avoid passing the congestion and fast nodes, the number of the control packets in the routing discovery process is minimized. In the future, in a different node density, traffic and mobility model, the proposed protocol will be the important part of research.

Vishnu Kumar Sharma and Dr. Sarita Singh Bhadauria [7] et al performed a work "MOBILE AGENT BASED CONGESTION CONTROL USING AODV ROUTING PROTOCOL TECHNIQUE FOR MOBILE AD-HOC NETWORK" So this paper includes routing protocol we emphasize on more stable path rather than shortest path all the time and as the protocol reduces the probability of link breakage the rate of broadcasting of ROUTE REQUEST, ROUTE REPLY, HELLO, ERROR messages are also reduce. The protocol reduce the topological changes, on the other hand it will also minimize the overhead of broadcasting messages. This protocol can be very efficient at the time of sending the large data where continuous connection among the source and destination is more preferable. If we consider the two graphs in previous section then we can see that both the Line Graph and Bar Graph values of Mobility Aware Routing Protocol (MARP) lies below the Line Graph and Bar Graph values of Non Mobility Aware Routing Protocol (NMARP). So from the above comparative studies which have done for different no of nodes, it can be easily conclude that the Mobility Aware Routing Protocol (MARP) which we have proposed, always gives stable path and selects comparatively static path than the other protocols.

M. Sanabani, R. Alsaqour and S. Kurkushi [12] et al performed a work "A REVERSE AND ENHANCED AODV ROUTING PROTOCOL FOR MANETS" We conducted extensive simulation study to evaluate the performance of EN-RAODV and compared it with that of RAODV and AODV using NS-2. The results show that EN-RAODV improves the performance of RAODV in most metrics, as the packet delivery ratio, average delay, average throughput, routing packet sent and routing overhead.

Ashraf Abu-Ein, Jihad Nader [13] et al performed a work "An enhanced AODV routing protocol for MANETs" In this paper, a PH-AODV routing protocol is proposed, it is a modified version of AODV. The proposed protocol combines the power coefficient and the hop count parameter to improve the performance of AODV. And it is compared with AODV in terms of throughput, end to end delay and number of drop packets. It is observed that the new protocol is much better than original AODV.

VIII. CONCLUSION

In this paper we defined MANET nodes transfer without any infrastructure. There is no fixed router so, each nodes are act as the router. In Wireless network congestion control is a main problem. In MANET congestion is occurs when transmit the packets is greater than capacity of the network. Due to congestion performances of the network have to be decreased. The congestion control increase the packet delivery and decrease the end to end delay, packet loss .Network performance can be increased by controlling the congestion in MANET.

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