Congestion Control Using Varying Queue Base Approach as Well as Multipath Routing Under MANET

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Abstract

Mobile ad-hoc network is dynamic nature because each node moves freely in the network. In MANET can't predict node motion and traffic load of every node, thus range of nodes area unit ideal and range of node area unit vary loaded that leads the matter of congestion onto the network. during this paper we tend to planned a method AOMDV and ranging queue base theme for congestion minimisation, thus terribly 1st we tend to find numerous congestion incidence in network then apply multipath routing moreover as varied queue approach that technique minimize the congestion and increase the performance of the network. We design proposed work and proposed algorithm, and simulate through all network parameters for performance evaluation..

Index Terms— AOMDV, ECODA, Queue base Drop, Average end-to-end delay, Packet Drop, Throughput.

1. Introduction

Mobile ad hoc network (MANET) are collection of mobile hosts which are self-configurable, self-organize and self-maintainable. These mobile hosts interconnect with each other through wireless channels with no consolidated control. The inherently infrastructure-less, reasonable and quick-to deploy nature of MANETs is providing a promise for its use in miscellaneous areas. Over the years, multimedia streaming over the internet has established well with numerous applications including audio/video streaming, TV on demand, voice-over IP and surveillance systems [1].

In MANET, Routing can be possible through either single path or multiple path. Routing protocols that determine and store more than one route in their routing table for each destination node are referred to as multipath routing protocols. In wireless scenarios, routes are broken due to node movement. Also, the wireless links used for data transmission are inherently unreliable and error prone. Therefore, multipath routing protocols are used to overcome the disadvantages of shortest path routing protocols. Multipath routing protocols are used to increase the reliability (by sending the same packet on each path) and fault tolerance (by ensuring the availability of backup routes at all times). It can also be used to provide load balancing, which reduces the congestion on a single path caused by bursty traffic [1].

In this paper we proposed "Congestion Control using varying Queue base approach as well as Multipath routing under MANET" that provides minimum overhead as well as minimum end to end delay and increase the packet delivery ratio using AOMDV and varying queue. In this approach firstly we analyze the packet drop in all available nodes in the network after that apply dynamic queue and then multipath routing. Here we describe related work in multipath routing for minimization data drop. We also describe about problem statement, proposed algorithm, results and working tool.

Congestion control: It is essential to adjust the data rate used by each sender in order not to overload the network, wherever multiple senders vie for link information measure. Packets area unit born after they attain the router and can't be forwarded. Many packets are dropped while excessive amount of packets arrive at a network bottleneck. The packets dropped would've travelled long way and in addition the lost packets often trigger retransmissions. This intimates that even more packets are sent into the network. And so, network throughput is still more worsened by the network congestion. There are unit possibilities of congestion collapse wherever nearly no information is delivered with success if no applicable congestion management is performed [8].

Shared broadcast medium is used in mobile ad hoc networks. Medium capacity which is very inadequate is shared within all the nodes in a collision domain. While delivering data to multiple destinations, multicast communication is of great concern in these networks, since it helps saving resources. Group communication which is an inherent feature of many proposed applications in MANETs is added to this broadcast medium. So, it is important to avoid congestion collapse in wireless multi-hop networks in order to perform efficient congestion control [8].

2. Related work

ChhaganLal et. al. in his titled "A Node-Disjoint Multipath Routing Method based on AODV protocol for MANETs" [1]In this proposed work, A node-disjoint multipath routing method based on AODV protocol. The main goal of the proposed method is to determine all available node-disjoint routes from source to destination with minimum routing control overhead. With the proposed approach, as soon as the first route for destination is determined, the source starts data transmission. All the other backup routes, if available, are determined concurrently with the data transmission through the first route. This minimizes the initial delay caused because data transmission is started as soon as first route is discovered. They also proposed three different route maintenance methods.

Li Qiang Tao et. al. in his titled "ECODA: Enhanced Congestion Detection and Avoidance for Multiple Class of Traffic in Sensor Networks"[2] They proposed a novel energy efficient congestion control scheme for sensor networks, called ECODA (Enhanced congestion detection and avoidance) which comprises three mechanisms: 1) Use dual buffer thresholds and weighted buffer difference for congestion detection; 2) Flexible Queue Scheduler for packets scheduling; 3) A bottleneck-node-based source sending rate control scheme.

M Ali et. al. in his proposed work "Congestion Adaptive Multipath Routing For Load Balancing In mobile Ad-hoc Networks"[3] In this proposed work they present a congestion adaptive multipath routing protocol to increase the throughput and avoid congestion in MANET .when the average load of an existing link increases beyond a defined threshold and the available bandwidth and residual battery energy decreases below a defined threshold, traffic is distributed over fail-safe multiple routes to reduce the traffic load on a congestion.

Soundararajan et. al. in his titled "Adaptive Multi-Path Routing for Load Balancing in Mobile Ad Hoc Networks" [4] they propose congestion controlled adaptive multi-path routing protocol to achieve load balancing and avoid congestion in MANETs. The algorithm for finding multi-path routes computes fail-safe multiple paths, which provide all the intermediate nodes on the primary path with multiple routes to destination. The fail-safe multiple paths include the nodes with least load and more battery power and residual energy. When the average load of a node along the route increases beyond a threshold, it distributes the traffic over disjoint multi-path routes to reduce the traffic load on a congested link.

3. Objective

Our aim is to design an efficient congestion control on the bases of varying queue technique with multipath routing mechanism in mobile ad-hoc network, so that we can minimize congestion of the network as well as routing overhead of the network and also increases packet delivery ratio of the network. For that purpose firstly we will do analysis of packet drop by congestion occurrences in every node that present in network and design a varying queue base multipath routing under MANET that will work according to queue analysis with multipath routing technique and minimize congestion of the network through the varying queue and alternative path base. Our architecture will ensure that there will be minimum dropping of packets in the network and hence ensure that there will be successful data transfer with lowest overhead required.

Importance of the research work

Our research proposal is important for following purpose

- Our work under the mobile ad-hoc environment with dynamic nature that cases our module control congestion and provide best data delivery.
- In our work under the multipath routing strategies so that provides fast and congestion free communication with load balance base.
- It's provides reliable as well as low overhead and increases throughput of the network.

Our proposed work also minimizes the end-to-end delay because multipath routing protocol provides data delivery through more than one path based.

4. Motivation of our work

Mobile ad-hoc network is dynamic in nature with no consolidate control because every node works on temporary based and frequently changes their location, that is why we can't predicate that where the actual destination node is and what movement the nodes can take.Some time it may happen that whole data or part of data is not reached at destination on time because of congestion or by other reasons in the network, since it is dropped in the network. When full data is collected on destination at their transport layer then some part of data get missed because it was dropped in network and at result end data is not fully assembled and finally it get corrupted. So we have a need of such a technology that can send the packet from multiple paths by which if part of data is dropped at any hop, it will never cause loss at the end when it is assembled since it will reach from other hops in network and provide congestion free communication.

5. Problem statement

In previous related work we analyze various research work in the field of congestion control but all are work AODV, DSR or DSDV protocol base

and no one analyze the packet drop in every node of network, but in our approach firstly we analyze the packet drop in each node that present in the network and choose those nodes where maximum congestion occurs than apply varying queue on those nodes to stop packet drops. After applying varying queue we will apply multipath routing technique using AOMDV protocol to avoid routing overhead on queuing node and get efficient minimize congestion through queue as well as multipath routing base that work provide minimum routing overhead and maximum congestion control, all the work done through the network simulator -2 and analyze the network behavior on the bases of network parameter like throughput, packet delivery ratio, routing overhead, end-to-end delay etc.

For this purpose we create on protocol module and inbuilt on the NS-2 after that we create TCL script for invocations of the internal module and configure through updated dynamic queue base approach and analyze the behavior of our network through trace analysis file and network animator file.

6. Overview of the architecture

In this paper, we propose congestion free with no packet drop architecture for mobile ad-hoc networks.

In this work, basically three methods are used to minimize the congestion. It consists of

(i) Multipath routing using AOMDV.

(ii) Varying queue technique.

(iii) Analysis of packet drop using static and varying queue.

In our first method Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV) is used as multipath routing protocol. It is an extension to the AODV protocol for computing multiple loop-free and link disjoint paths. The routing entries for each destination contain a list of the next-hops along with the corresponding hop counts. All succeeding hops have the same sequence number. This helps in keeping way of a route. For all destinations, a node maintains the advertised hop count, which is well-defined as the maximum hop count for total paths, and this is used for sending path advertisements of the target. All duplicate route advertisement received by a node defines a substitute path to the target. Loop freedom is assured for a node by acceptive substitute paths to destination if it's a fewer hop count than the advertised hop count for that target. Because the maximum hop count is used, the advertised hop count therefore does not change for the same order number. When a route advertisement is received for a target with a superior sequence number, the next-hop list and the advertised hop count are reinitialized. So AOMDV provides several substitute paths to send the data packets.

In this work AOMDV provides us at least three alternative path to send the data packets. Load of a node is distributed in at least 3 nodes which is approximately 33% of total load of an intermediate node. So load distribution is very informal through AOMDV.

If large amount of supplementary data packets are comes in the intermediate nodes then some packets may drop by unavailable space in queue of intermediate node, It is just because of queue length is fixed (eg. 10, 20, 50). So in this work we propose varying queue technique. In varying queue technique queue length is not fixed it can vary and dependent on number of upcoming data packets. For this purpose we uses two queues i.e. drop tail queue and priority queue.

Drop tail queue uses FIFO mechanism to manage data packets in the node, but the problem in drop tail queue is static queue size. If static queue size is large and number of data packets are very lesser than queue length than it is wastage of memory, and if static queue size is small than data may be dropped due to overflow of queue. That is why, to remove this problem we uses varying queue technique. Varying queue does not drop any data packet whether queue size is full, because it increases queue length by one if any data packet comes in the queue. If we uses many routing protocols like AODV in the same environment then priority queue provides maximum priority to AOMDV routing protocol as compare to others.

In this work, combination of multipath routing and varying queue provides us a congestion free environment with load balancing and no packet drop.

7. Algorithm of varying queue mechanism for congestion control

Here we develop the algorithm for congestion control using varying queue system very first we create N number of node's and S as sender D as destination nodes after that we create duplex link between nodes after that we create TCP and UDP connection, in intermediate we set as queue, after that we call route function and compute route if destination find so destination node send acknowledgement to the sender node after acknowledgement receives by the senders so sender send's data packet to actual destination through intermediate node's, in intermediate node we set queue with initial 60 as queue limit but if more data comes per second according to that we very the queue size that procedure recursively work and minimize the drop rate of the network.

Steps for Congestion Aware and control

1) Sender S send's data packet through shortest path to destination D;

2) Find out total incoming and outgoing data from each node; // value from trace file

3) Get drop data packet from each node;

4) Get reason of drop from trace file;
5) If (drop-reason == "COL" || "Congestion")
{
*Set qlimBytes = qlim * mean_pktsize;*
if (q ->byteLength()>= qlimBytes))
{ // if the queue would overflow if we added this packet than increase Q by One
qlim = qlim + 1;
*qlimBytes = qlim * mean_pktsize;*
q_->length () + 1;
}
If (qlimitByte > Max-val) // if queue overflow
{ Calculate in coming data rate and outgoing data rate;
If (rate > available) // rate of incoming packet and available capacity
{
Apply TCP acknowledge base approach for controlling data rate;
}} // sender side
6) Sender (rx-ack, time, seq-no)
{
Store ack1, ack2……ackn-1 ackn ; // store in the trace file;
Capture time of ack receives;
Store seq-no for ack;
// calculate delay difference of ack
Old-d = ack2-ack1 //Old-d means initial delay difference
New-d = ackn – ackn-1
// Compare delay
If (New-d > Old-d)
{ Sender set new rate; // on the bases of delay difference }
Else {sender sends data actual rate ;
}}

8. Implementation and results

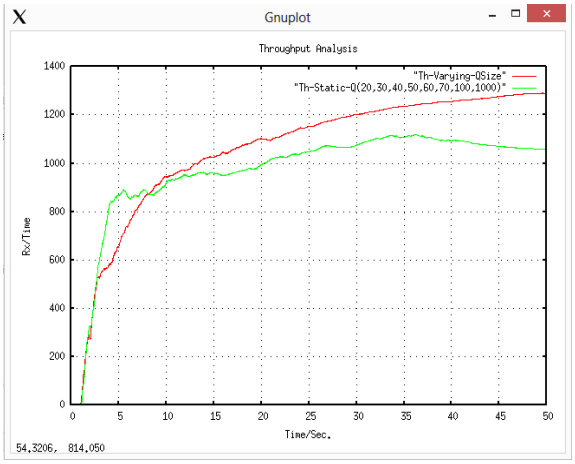
For data collection and implementation we will use Network Simulator- 2 (NS-2). The description about simulation environment is as follows:
Network simulator 2 (NS2) is the result of an on-going effort of research and development that is administrated by researchers at Berkeley. It is a discrete event simulator targeted at networking research. It provides substantial support for simulation of TCP, routing, and multipath protocol. The simulator is written in C++ and a script language called OTcl2. NS uses an Otcl interpreter towards the user. This means that the user writes an OTcl script that defines the network (number of nodes, links), the traffic in the network (sources, destinations, type of traffic) and which protocols it will use. This script is then used by ns during the simulations. The result of the simulations is an output trace file that can be used to do data processing (calculate delay, throughput etc).

Simulation Parameters: We get Simulator Parameter like Number of nodes, Dimension, Routing protocol, traffic etc.
According to below table 1 we simulate our network.

Number of nodes	50
Dimension of simulated area	800×600
Routing Protocol	AOMDV
Simulation time (seconds)	100
Transport Layer	TCP ,UDP
Traffic type	CBR , FTP
Packet size (bytes)	1000
Number of traffic connections	10
Maximum Speed (m/s)	Random

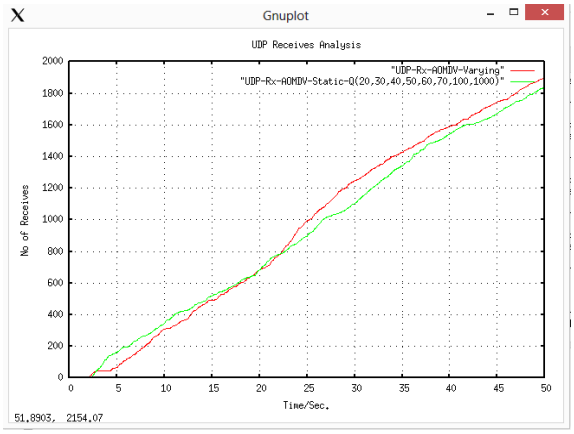
Table 1: Simulation parameters

Throughput Analysis:
Here we show our result through gnuplot in this graph, x axis show simulation time in sec. and y axis shows total received packets according to our representation red line show throughput through varying queue with respect to time, green line shows throughput through static queues.



Graph 1: Throughput Analysis

Gnuplot for UDP analysis in fifty mobile node time:
Here we show our result through gnuplot in this graph, x axis show simulation time in sec. and y axis shows UDP packet receives according to our representation red line show total number of UDP packets receives through varying queue with



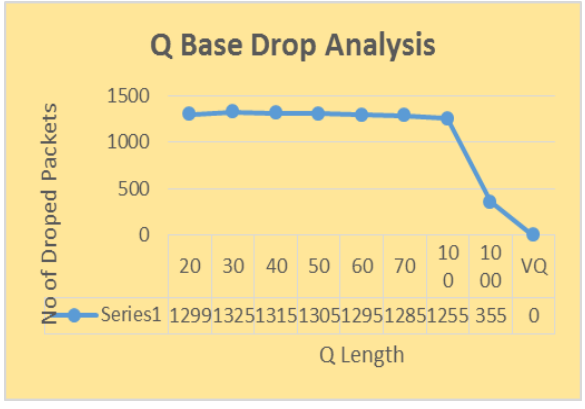
Graph 2: UDP Analysis

respect to time, green line shows total number of UDP packets receives through static queue and blue line shows UDP packet loss. According to graph analysis varying queue performance is better as compare to static queue it receives more UDP packets which shows our varying queue technique is more reliable than static queue.

According to graph analysis we have analyze that varying queue improves throughput performance as compare to static queue.

Queue base Drop Analysis:

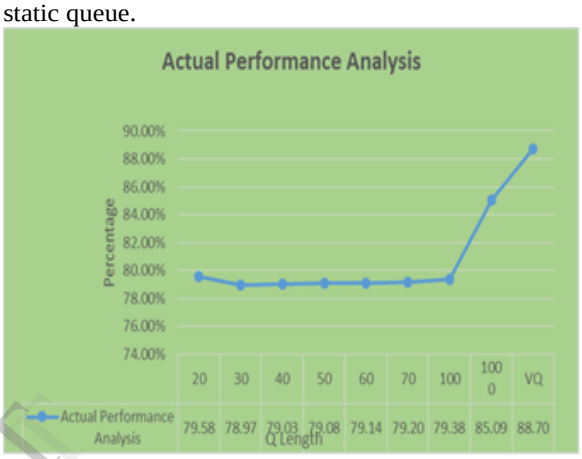
Here we show our result through graph, In this graph, x axis show queue length and y axis show number of dropped packets, According to our representation we use 8 static queues of different size (i.e. 20,30,40,50,60,70,100,1000) and a varying queue. In this graph total packet drops using different size of static queues are shown, Through this result we analyze that total number of packet drop through queue is reduces when its queue size is increases simultaneously and when it uses varying queue than total drops is 0 . So varying queue technique is better than static queue.



Graph 3: Queue base Drop Analysis

Actual Performance Analysis:

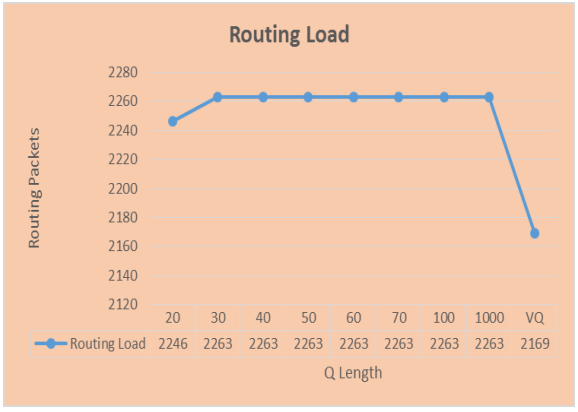
Here we show our result through graph, In this graph, x axis show queue length and y axis show percentage of performance, According to our representation we use 8 static queues of different size (i.e. 20,30,40,50,60,70,100,1000) and a varying queue. In this graph total performance in percentage using different size of static queues are shown, through this result we analyze that actual performance is increases from up to 88.70 when we use varying queue in every node of network. So varying queue's performance is much better than static queue.



Graph 4: Actual Performance Analysis

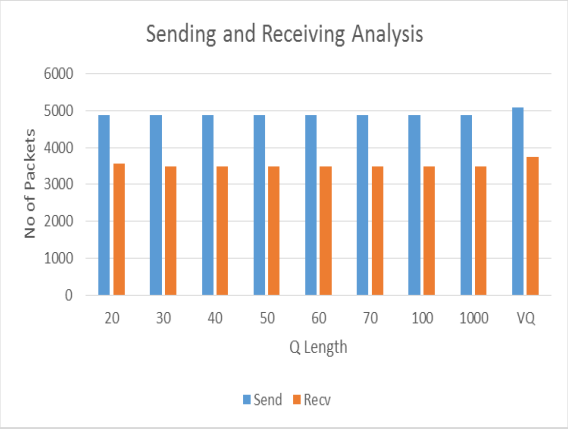
Routing load Analysis:

Here we show our result through graph, In this graph, x axis show queue length and y axis show routing packets, According to our representation we use 8 static queues of different size (i.e. 20,30,40,50,60,70,100,1000) and a varying queue. In this graph routing load of different size of static queues are shown, through this result we analyze that routing load in each node through different static queue size is more and when we use varying queue than routing load is just 2169. So routing load in varying queue technique is much lesser than static queues.



Graph 5: Routing load Analysis

Sending and Receiving Analysis:
Here we show our result through graph, In this graph, x axis show queue length and y axis show number of packets, According to our representation we use 8 static queues of different size (i.e. 20,30,40,50,60,70,100,1000) and a varying queue. In this graph total number of packets sending and receiving in different size of static queues and varying queue are shown, through this result we analyze that total number of packets sending and receiving are improve as compare to static size of queues.



Graph 6: Sending and Receiving Analysis

9. Conclusion

In this paper, we formulated an effective and efficient technique for queue management control, to solve the problem of congestion in TCP/IP networks. So we create the wireless network and apply the queue system in each intermediate node, we use queue system type is Drop Tail, Priority queue and Varying queue system (Proposed queue system). After the simulation we get result on the bases of various parameters like Throughput Analysis, UDP Packet Receives Analysis, Routing Overhead Analysis, Queue base Drop Analysis, Actual Performance Analysis, Routing load analysis and Sending and Receiving analysis in both static queue and varying queue case. We conclude that our proposed varying queue technique case data drop is very lower as compare to static queue model.
Here we also analyse the TCP receiving performance and get the result proposed queue system gives greater receiving percentage as compare to static queue system. We take number of scenario and conclude that above describe point. Proposed queue work according to sender requirement queue system, if sender need maximum queue so varying queue technique increases the queue length and save the data drop from the network and if sender did not need any queue so queue length decreases that is feasible for all wireless communication.
In this study, we have investigated the static and Varying Queue system. First, we have surveyed the existing static queue configuration and implementation and identified potential problems. Then, we have modelled the varying queue-based congestion control system. We have validated this model through simulation experiments. After simulation we get congestion free model where no data drop through lack of queue size. So our proposed model is very efficient to reduce data drop due to fullness of queue length and improve the ad hoc network performance.

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