

A Novel Method for Better Queue Management in MANETS

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Abstract— MANET (Mobile Ad hoc Network) is a collection of nodes or mobile devices that is connected without wires. In MANETs congestion occurs when a node carries too much data such that its quality of service degrades. So various mechanisms have been proposed based on multipath rate, energy-aware congestion control, flow count mechanisms and learning based congestion control. Network based congestion control comprises of managing queues in the network which is an integral part of any network. Previously the work done for queue management is based on FIFO (First in First out) scheme and a mechanism is proposed to count active flows and a queue length is specified on the basis of flow count causing packet loss & delays. This work is about maintaining queue using Round Robin scheme in order to remove starvation problem and packet loss is reduced by using the various parameters i.e. queue length, threshold values for receiving a packet, throughput, average end to end delay in AODV protocol.

Keywords— MANETs, Queue management, FIFO Scheme, congestion, Round Robin scheme, threshold values, multichannel transmission.

1. INTRODUCTION

MANETs (Mobile Ad hoc Network) consist of a self-developing or composing, self-sanative and peer-to-peer network a mesh network that has a central organizer to fixed purpose, assign and optimize the routing table in the network. Congestion is a main issue that can happen in packet switching network. . When the total heft on the network (*i.e.* in network the number of packets sent to the node) is greater than the capacity of the network (*i.e.* a network can possessed total number of packets) congestion may occur in the network. Various mechanisms have been introduced to avoid congestion in the network but Network based congestion control comprises of managing queues in the network which is an integral part of any network.

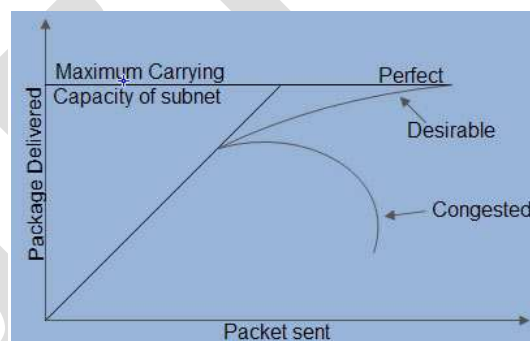


Fig 1: Congestion Control

1.1 Causes of Congestion:

There are numerous causes for congestion control in MANETs:

- When the input traffic rates exceed the capacity of the output lines congestion occurs. If suddenly, a large flow of packets start arriving on three or more input lines and all input lines need the same output line. In this case, a queue will maintain. If there is inadequate space or buffer to hold all the packets, the packet will be lost. This is the primary reason for congestion.
- Another reason for congestion is the routers are too slow to do activities like bookkeeping (updating tables, queuing buffers etc.).
- When the routers' buffer is inadequate to possess packets.

- Congestion can also occur if the processors speed is too low. Slow speed CPU will perform the regular tasks slowly at the routers. As a result, queues are framed even though there is plenty of capacity in networks.
- Congestion can also caused by slow links in the network. If high speed links are use this problem can be solved.

1.2 Congestion control mechanisms based on queue management: A mechanism which is based on Active Queue Management (AQM) and Random Early Detection (RED) such as drop tail technique allows a packet to introduce in a queue until the queue is empty and then drops the all incoming packets as queue or buffer becomes full, it means packet drop in a network is common problem now. Random early detection is a detection approach in which the router detects nascent congestion with prevision of congestion rank or position. Once the congestion is detected, then router chooses the source point to predict the congestion. Two steps involved in RED algorithm are:

- 1) First calculation of average queue length (AQL).
- 2) Second calculation of packet drop probability.

S-SFQ is a single queue design Start-time Fair Queuing (SFQ). It is based on packet timestamps moderately than their order of arrivals. It shows the performance gains of S-SFQ over other queue schemes such as RED and FIFO on the basis of link utilization and flow fairness. It also removes the negative effect of packet loss synchronization problem.

2. RELATED WORK

Prerna et al, [1] proposed how node's buffer space gives brunt to the in-flight packets in ad hoc network by taking mobility. The network condition has been pretended with a restricted size of users. Performance has been calculated on several parameters such as varying queue length and number of dropped packets. He explained a simple flow counting algorithm in this paper. His paper conclude a design which is set of congestion control algorithm in mobile network and implementation is done through simulation on various network parameters such as number of sender increased and varying queue length. It presents the performance of mechanism and how congestion control mechanism performs when we enhance the number of source and usages [2].

Xian Yongju et al, proposed an Active Queue Management (AQM), as packet dropping mechanisms which can desirable adjust to rapid change in queue length, has been a research feature in network congestion control field. But many algorithms have been proposed now have defect in acknowledge speed, stability and sensitivity. But Fuzzy Control can bring concerning advantages into play. This paper analyses ATQL-FEM, an adaptive target queue length Fuzzy Control algorithm [3].

Soundararajan, S. et al., gives a multipath rate based congestion control algorithm. Its algorithm has estimation for rate and rate control mechanisms such that the traffic rate is familiar based on the estimated rate. The estimated rate can be acquired from the middle nodes by the destination node which forward this information to the source. Simulation outcomes show that the planned rate control algorithm outperforms the existing congestion control methods in terms of packet delivery ratio & throughput [4].

V. Thilagavathe et al, Congestion problem is established data link, transport and network layer in MANETs. This paper proposed the cross layer based mechanism which removes the congestion at the transport layer in the network. It is based on ad hoc on demand multipath rate based and energy aware congestion avoidance scheme. This mechanism also uses the additive increase and multiplicative decrease (AIMD) scheme. If it receives the congestion notification then it chooses the congestion free routing path for communication. This technique gains more packet delivery ration and reduced delay in the network [5].

Marios Lestas et al., develop an Adaptive Congestion Protocol (ACP) which is revealed to satisfy all the design necessities and thus outperform earlier proposals. Extensive simulations specify that the protocol is capable to guide the network to a stable equilibrium which is characterize by max-min fairness, small queue size, high utilization, and no observable packet drops. In accumulation, it is found to be scalable with changing bandwidth, number of users and delays utilizing the network. To preserve stability it implements at each link a new estimation algorithm which estimates the numeral of flows utilizes the link. It uses the same representation to create phase portraits which express that the ACP protocol is constant for all delays [6].

S. Floyd, Ed. Et al, it discusses the metrics to be examined in an assessment of new or changed congestion control mechanisms for the Internet. It includes metrics for the estimation of new transport protocols, proposed modifications to TCP variants, of congestion control at application-level, and of Active Queue Management (AQM) mechanisms. It informs us about the performance metrics that congestion control mechanisms should be drafted to optimize, in terms of trade-offs between throughput and end toend delay, fairness between competing flows, and the energy consumed in the network [7].

3. PROPOSED WORK:

As there are many algorithms proposed for the flow based mechanisms to avoid congestion in the network. We have seen queue management is the main concern in order to improve packet delivery ratio & delay in the network. Previously the work done for queue management is based on FIFO (First in First out) scheme and a mechanism is proposed to count active flows and a queue length and drop rate is specified on the basis of flow count. But this causes the problem called starvation.

Following tasks are performed to manage the queue using Round robin fashion:

- Study of existing queue management scheme (FIFO Scheme)
- Implementation of better queue management strategy i.e. Round robin scheme.
- Compare the results by using various performance metrics i.e. throughput, end to end delay, packet delivery ratio and total energy consumed in the system in NS2.

For the tasks to be achieved following work is done:

- ❖ Threshold values settings for receiving a packet is setup.
- ❖ Queue monitoring is required.
- ❖ Packet scheduling is done on the basis of round robin fashion.

Proposed Algorithm:

Following Assumptions have been taken:

1. A flow can obtain the needed congestion feedback information from just links along its own path.
2. Multi-channel transmission support simultaneously.

Following are the steps for our proposed mechanism:

Step 1: Insert new fields RTS/CTS header to modify the 802.11 MAC to carry multi-channel and flow information.

Step 2: Maintain for each node a table to record the packet number and the status of each flow.

Step 3: The node would refuse to receive the packets of this flow by sending CTS-Block, if the packet number exceeds a threshold and a delay sampler is used which creates a delay when buffer gets full in order to minimize packet drops.

Step 4: Until the packet number is less than the threshold, the flow would be started again by sending CTS-Resume to the preceding node.

4. TOOL USED:

For performance evaluation, NS-2.34 simulator is used. The simulation is performed on Ubuntu 10.04. The network consists of 50 nodes displayed on area 1250m * 1250m using 3 CBR connections in the network. The mobility of the nodes is dependent on the Random Way Point Model. For this purpose routing protocol used is AODV protocol.

PARAMETER	VALUE
Simulator	NS-2.34
Total No. of nodes	50
Simulation Time	10,20
Simulation Area	1250m * 1250m
Propagation Model	TwoRayGround reflection model
Routing Protocol	AODV
MAC Protocol	IEEE 802.11

Traffic	CBR
Capture Threshold	0.0002 dB
Carrier sense Threshold	0.3e-20
Receive Threshold	0.80e-10

Table 1: Simulation parameters

5. RESULTS AND DISCUSSION:

Results based on the simulation performed in NS-2.34 simulator are being analyzed. To compare the performance of algorithm, consider the performance metrics:

- 1) Packet delivery ratio (PDR): It is the ratio between packets sent by the source to packets received at the destination.
- 2) Packets collision: In a network, when two or more packets attempts to send at a same time collision occurs.
- 3) Average delay: Delay can be measured as the time taken by the packets to travel across the network from one point to another.
- 4) Average throughput: Throughput is the sum of data rates that are delivered to the destination in the network.

PERFORMANCE METRICS	FIFO SCHEME	ROUND ROBIN SCHEME
Packet delivery ratio (PDR)	75%	81%
Total collisions	642	0
Average Delay	0.3679	0.1286
Average Throughput	294975	304676
Total Energy Consumed(Joules)	37.9387	40.065

Table 2: Performance comparison when simulated for 10 sec

PERFORMANCE METRICS	FIFO SCHEME	ROUND ROBIN SCHEME
Packet delivery ratio (PDR)	89%	92%
Total collisions	656	0
Average Delay	0.6138	0.1562
Average Throughput	303279	314970
Total Energy Consumed(Joules)	49.1836	50.1447

Table 3: Performance comparison when simulated for 20 sec

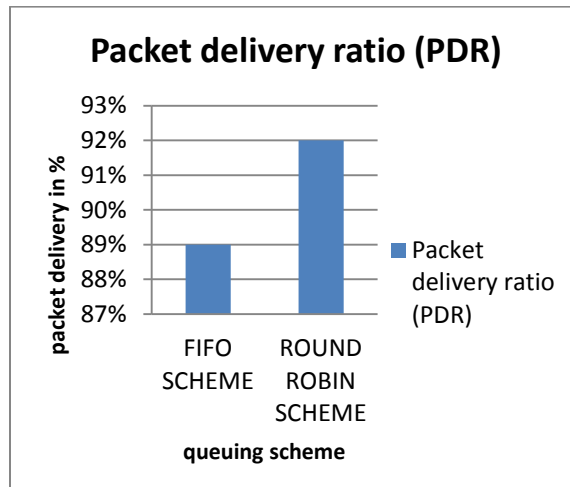


Fig.2 Packet delivery percent Vs queuing scheme

Graph compares the packet delivery ratio of both the queue management schemes during the simulation. This graph shows round robin scheme has more PDR than FIFO.

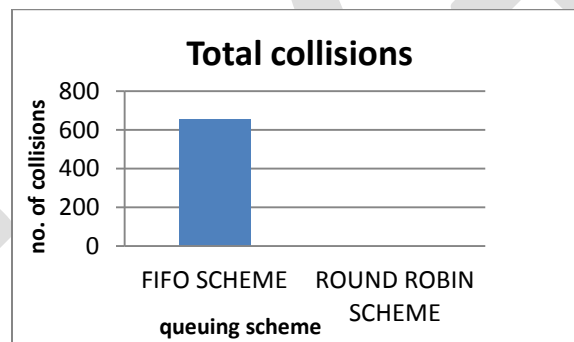


Fig. 3 Total collisions Vs queuing scheme

It compares the total no. of collisions of both the queue management schemes during the simulation. This graph depicts round robin scheme has zero no. of collisions which is the main advantage of using this scheme.

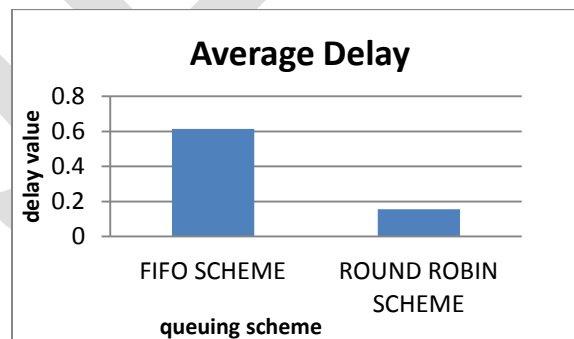


Fig. 4 Average delay Vs queuing scheme

It compares the Average delay of both the queue management schemes during the simulation. This graph shows average delay has been reduced much by a factor of 0.4576 units in round robin scheme.

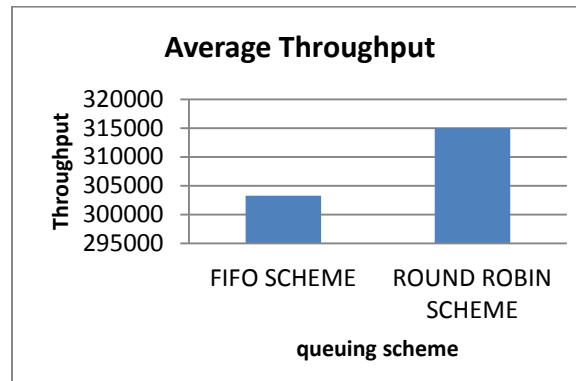


Fig. 5 Average throughput Vs queuing scheme

It compares the Average throughput of both the queue management schemes during the simulation. This graph shows average throughput has been increased by a factor of 11691 units in round robin scheme.

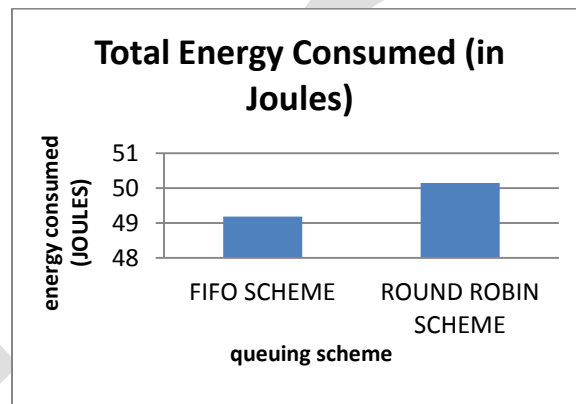


Fig 6 Energy consumed (in joules) Vs queuing scheme

Above graph depicts the energy consumed by both of the queue management schemes, which is nearly equal in both of the schemes.

6. CONCLUSION:

I have analyzed the behavior of existing and proposed algorithm and compare their performance matrices i.e. packet delivery ratio, energy consumed, delay, throughput and total collisions in the network. By analyzing, we found the problem with the existing mechanism and tried to increase the packet delivery ratio. The proposed algorithm consists of queue monitoring, threshold settings and round robin scheme instead of FIFO due to which no. of collisions in the network reduced to zero. We showed that our mechanism provides high throughput and less delay in the network. We found total energy consumed in the Round Robin mechanism is nearly equal to the energy consumed in the FIFO queue management scheme. This mechanism provides superior results than existing mechanism.

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