QUEUE MANAGEMENT TECHNIQUES IN AD-HOC NETWORKS

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Abstract- **MANETs present many challenges, especially when real-time traffic must be supported in terms of providing Quality of Service (QoS) guarantees Providing QoS for real-time applications is still an open issue. MANETs present the worst-case scenario for QoS guarantees due to their distinct characteristics, such as contention from multiple users (when using 802.11) and limited bandwidth. The objective of this project is to develop new active queue management schemes for MANETs that are more efficient compared with existing algorithms. Using simulation, the new queuing schemes are evaluated in a MANET environment, and their performance is compared with other existing QoS schemes, such as Random Early Discard (RED) and Drop tail. Results indicate that Proposed RED minimizes the burst errors due to buffer overflow, thereby improving the performance for real-time traffic compared to traditional Drop tail.**

Index Terms- **Active queue management, RED, Drop-tail, Ad-hoc networks, QoS, Throughput.**

I. INTRODUCTION

An adhoc network is an autonomous collection of nodes that communicate without any infrastructure or centralized administration over a shared wireless channel. The communication is directly between two or more nodes. If the distance between the communicating parties is longer than the transmission range, the information must be forwarded by intermediate nodes, which act as routers (i.e. multi-hop communication).Fig.1 depicts a typical ad hoc network where the links illustrate a node's next hop neighbors. The nodes may be mobile, which in case changes the topology continuously. The network is then termed as a Mobile Ad Hoc Network (MANET). The term adhoc means that the grouping of nodes happens ad hoc by a need for communication. The usage scenarios depicted will demand support for real-time services, and these services will have Quality of Service (QoS) requirements for the delivered performance.

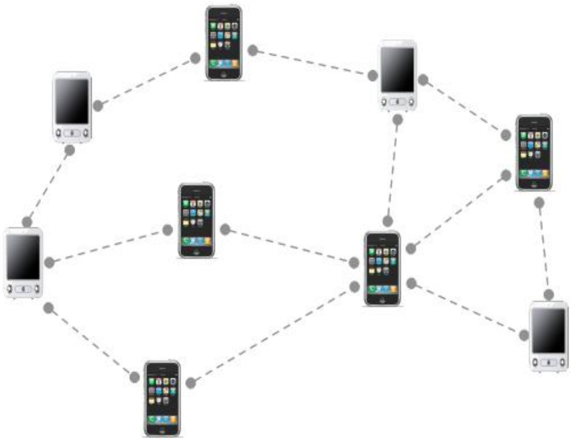

Figure 1. A Mobile Ad Hoc Network (MANET)

The requirements can typically be stated by parameters like loss, delay, jitter, and bandwidth. Ensuring a high quality on the services received, requires QoS provisioning end-to-end in the network. Also, the operations in scenarios like battle fields, emergency, or disaster areas, demand a degree of predictability. Providing a predictable delivery of QoS in MANETs is challenging due to the characteristics of wireless networks, and especially with the presence of mobility. First of all, the available capacity in a wireless network is more constrained than its wired counterpart since the initial capacity is lower, and a node's transmissions will affect all nodes within range. This necessitates that the offered traffic is subject to admission control for avoiding degraded service of the existing traffic. Second, the topology may change quite rapidly due to mobility, causing variability in capacity and traffic load patterns. Consequently, congestion control is therefore needed. The cheapest and most common approach to achieve Qos is scheduling mechanisms and packet discarding policies. A queue scheduling discipline manages the allocation of network resources among different traffic flows by selecting the next packet to be processed. Also when packets arrive faster than that they can be processed, arriving packets are dropped and thus controlling the congestion in the network can be influenced. By assigning different weights to various flows in the traffic, proper selection of the packet to be processed can be done. Furthermore, it can reduce the impact of ill-behaved flows on other flows especially when having a mixture of real-time and non-real-time traffic. The queuing disciplines considered in this paper are: First-In-First-Out(FIFO), Priority Queueing (PQ) and WFQ. We also scrutinize the effect of two dropping policies, drop-tail and random-early drop (RED) [6], on their performance.

II. RELATED WORKS

Several solutions have been proposed in the literature for the Queue Management in Mobile Ad hoc Networks (MANET's). Some of them are as follows:

K. Dinesh Kumar et al propose a predictive queue management strategy named PAQMAN [7] that proactively manages the queue which requires negligible computational overhead and is lightweight. PAQMAN does not require any prior knowledge of the traffic model, this reduces Packet loss ratio, Increases transmission efficiency. The performance has been compared with drop tail and those results show that PAQMAN reduces packet loss ratio while at the same time increasing transmission efficiency.

Zhenyu et al propose an AQM scheme with dynamic reference queue threshold named ARTAQM [8]. Adopting a dynamic reference queue is the prominent feature of ARTAQM. Using an adaptive filtering algorithm NOEKF, the predicted traffic rate can be calculated. By means of measuring PLR and average traffic rate, the estimated average traffic rate in the next time can be deduced. The difference of the estimated average rate and the link capacity is the input of squashing function to adjust the reference queue. Therefore, the relationship between traffic condition and the reference queue length is established. Simulation results is compared with other schemes, ARTAQM offers stable and flexible queue length, lower packet loss ratio and higher link utilization. Simulation results show that ARTAQM outperforms other schemes in queue stability, packet loss ratio and link utilization.

Tolaimate Ichrak et al propose the design of improved active Queue Management [9] control scheme for time delay systems using a time approach and synthesizing the linear fluid model. This method will reduce to delay through time approach. Obtaining a system delay free, author applied to it the fundamentals of control theory as the similarity transformation, the pole placement by feedback, and by duality that construct an observer to the system. The resulting control laws are validated through numerical network estimations.

Torres Rob et al presented an innovative TCP [10] flow control method. This algorithm combines RED (Random Early Detection) with TCP window adjustment to improve the network performance. Leveraging the advantages of RED and window adjustment, the algorithm demonstrates fast response and superior stability with controlled packet dropping rate, while still fully utilizing the network resource. Author presented a novel analytical model based on the discrete Markov process in this research. Analysis and simulation show the effectiveness and robustness of the algorithm. The result of the algorithm shows that while fully utilizing the network resource this scheme achieves increased network stability with desired latency and packet dropping rate.

III. PROPOSED SOLUTION

Random Early Detection algorithm, initialize the threshold parameters (Min_{th}, Max_{th}) to the fixed value when simulation starts, these values remains fixed during the simulation. In MANET, due to quick diversity of changing the network condition, fixed threshold parameters are not appropriate and can degrade network performance. Proposed mechanism works on variable threshold parameters which are changing according to the network congestion condition. In Random Early Detection, queue space utilization is low due to setting of Maxth parameter to the fixed value in queue.

The RED algorithm is as follows

Implementation

Avg-----------0
Count--------------1
For each packet arrival
Calculate the average queue size avg
If min_{th}<= avg < max_{th}
Calculate the probability pa
With probability pa:
Mark the arriving packet
Else if max_{th}<= avg
Mark the arriving packet

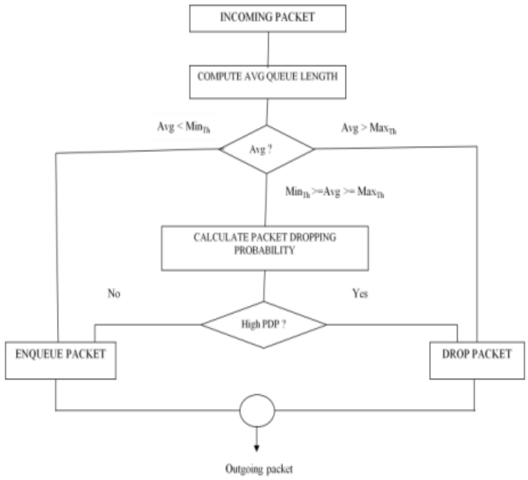

Fig. 2: RED queue management algorithm

To solve this problem Propose mechanism gradually adjust the maximum threshold value Maxth to maximum available queue size, purpose is maximum utilization of available queue space because all the incoming packet are dropped after average queue size reached to the maximum threshold(Max_{th}).

IV. NETWORK PERFORMANCE PARAMETERS IN MANET

Network performance refers to the service quality of providers to the customer. Performance parameters are used to measure the quality of services of the network. These parameters are given below.

A. Average end to end Delay

The average end-to-end delay [1] of data packets is the interval between the data packet generation time and the time when the last bit arrives at the destination. End-to-end delay generally includes all delays, along the path from source to destination. This includes the transmission delay, propagation delay, processing delay, queuing delay experienced at every node in the route.

B. Network Throughput

Network throughput is the average rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot.

C. Packet loss ratio

Packet loss occurs when one or more packets of data travelling across a computer network fail to reach their destination. Packet loss is calculated as total lost packet to the total no of transmitted packets.

V. SIMULATION ENVIRONMENT

The simulation software used for evaluation of the proposed QoS schemes was the Network Simulator 2 (NS2) version 2.1b6 running on a Linux Fedora platform. At the time of writing this thesis, NS2 seems to be the standard tool to simulate ad hoc networks. A typical simulation in NS2 includes several steps. First the user creates the OTcl scripts, which are the input files to the simulator. These files consist of a scenario file that describes the movement pattern of the nodes and a communication file that describes the traffic in the network.

Then the simulator initiates an event scheduler and sets up the network topology using the network objects and the plumbing functions in the library. Also, it informs the traffic sources when to start and stop transmitting packets through the event scheduler. The result of this procedure is the generation of a trace file. The granularity of the trace files is determined prior to simulation in the OTcl scripts. Typically, the trace files are parsed using Perl or another Linux shell script allowing the performance metrics of interest to be obtained. In this section, we also discussed about network configuration used over the network simulator ns2 to simulate the two algorithms RED, and Drop tail and after that we analysed about the results obtained from our simulations. The algorithms compared here are first deployed into the ns2 architecture then following simulation scenario has been generated to compare their performance on the simulation setting as shown in Fig. 3

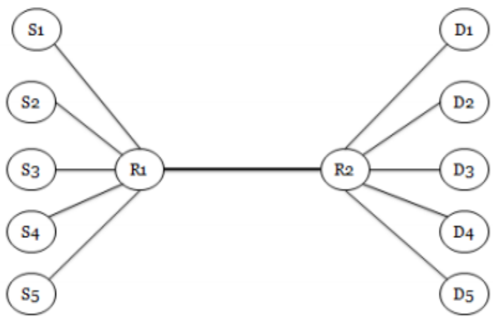

Fig 3 Simulation Scenario

VI. RESULTS AND DISCUSSION

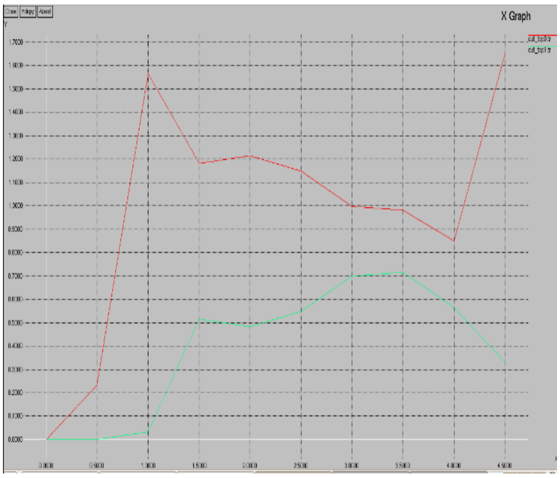

Fig.4 Drop tail

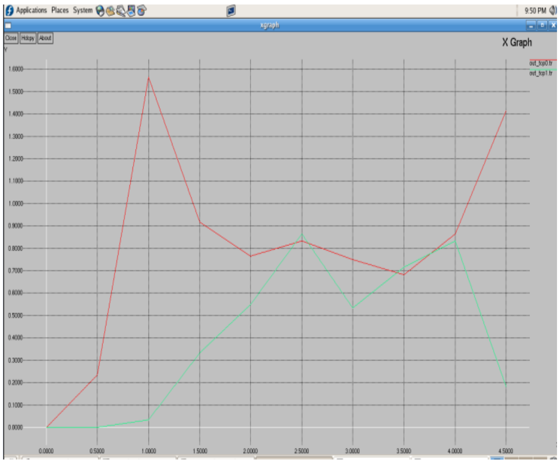

Fig.5 RED

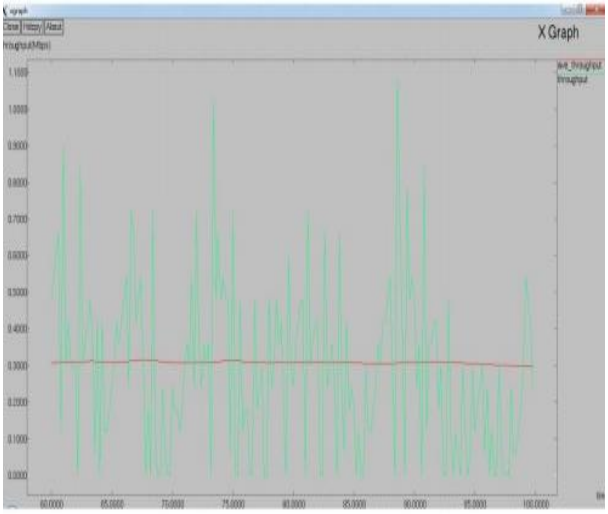

Fig.6 Drop tail throughput

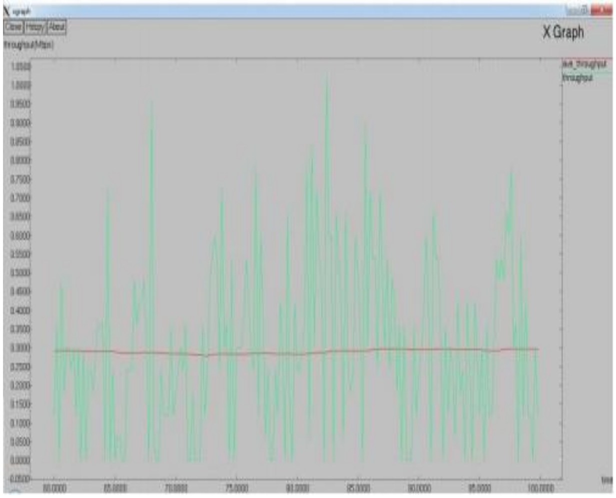

Fig.7 RED throughput

It has been observed that RED had a best throughput and Drop tail had least throughput among all these two algorithms for the simulation achieved at 1.5 Mbps of bandwidth. Fig7 shows comparatively to fig.6 that RED gets the good result and Drop tail gets the poor result. It could be observed one point on throughput graph whenever smooth growth in throughput has been broken. It indicated about a starting point when dropping of packet took place. This achieved point in each algorithm has a same ratio as compared to their maximum achieved throughput

VII. CONCLUSION

A Typically, the performance of a network is measured by using as metrics delay, the packet loss and the throughout. All these metrics are used for the evaluation of the proposed algorithms. However, the traffic under investigation is real-time voice as the packet loss distribution significantly affects its quality; in particular, consecutive packet losses are of interest here. The goal of this project is to avoid the congestion at the gateways. RED gateways are designed to accompany a transport layer congestion control protocol such as TCP. The RED gateways have no bias against bursty traffic and avoid the global synchronization of many connections decreasing their window at the same time.

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