International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume: 3 | Issue: 4 | May-Jun 2019 Available Online: www.ijtsrd.com e-ISSN: 2456 - 6470

Comparative Analysis of Green Algorithm within Active Queue Management for Mobile Ad Hoc Network

Zulai Khan[1], Rashmi Raj[2]

[1]M.Tech Scholar, [2]Assistant Professor
[1,2]Department of Electronics and Communication Engineering
[1,2]Universal Institute of Engineering & Technology, Mohali, Punjab, India

How to cite this paper: Zulai Khan | Rashmi Raj "Comparative Analysis of Green Algorithm within Active Queue Management for Mobile Ad Hoc Network" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-3 | Issue-4, June 2019, pp.935-938, URL: https://www.ijtsrd.com/papers/ijtsrd23950.pdf

IJTSRD23950

ABSTRACT

The Queue Management Techniques play an important role in improving the Quality of Service in Mobile Ad-hoc Networks. The need of congestion control and Queue management is inevitable in Mobile Ad-hoc Network. Understanding and analyzing the latest AQM Techniques give an insight to improving throughput, packet loss rate, average end to end delay and other parameters that severely affect the performance. The performance of mobile ad-hoc networks is evaluated by varying the Channel Error Rate, Bandwidth and Delay at different fragment sizes of different traffic flows. The proposed method performs the network analysis of new Routing protocols. The work proposes to evaluate various Active Queue Management Techniques in a multi traffic environment i.e., sources generating both TCP and UDP traffic classes. The UDP is propagated via CBR and TCP is propagated via FTP. The implementation of the proposed queue management technique has been done in NS-2. In the proposed work we have make NS-2 compatible with GREEN by integrating source code into the ns-2 installation files and using various AQMs in comparison with GREEN to calculate the throughput at various Bandwidths across network. Using various AQMs in comparison with GREEN we have calculated the throughput at various Delays across the network and we have also calculated the throughput at various channels Error Rate across the network. The proposed method has been compared with other primitive AQM techniques so that a repository of best available results can be obtained for design and research purposes. The proposed method has outperformed the existing queue management techniques in number of scenarios.

Keywords: *AQM, MANETs, Throughput, Channel Error Rate, NS-2*

INTRODUCTION

Mobile Ad hoc Networks (MANETs) are self organizing networks formed by a collection of autonomous mobile wireless nodes without the support of any fixed infrastructure or central administration. The remote nodes in MANETs communicate directly with the help of the intermediate nodes which operate as routers. As MANETs eliminate the cost and time of infrastructure deployment, setup, and administration, they have numerous applications, especially in the military and emergency services. Although MANETs have unique applications, realizing them is difficult because of several intrinsic constraints. Unlike their wired counterparts, mobile devices usually have limited resources (battery power, memory, CPU) which limit their transmission range. In addition to this, wireless networks have limited bandwidth and are more prone to errors than wired networks which further impose limits on the amount of data that can be sent. Hence, in order to conserve the limited resource, it is highly desirable that transmission should be as efficient as possible (minimal losses and retransmissions).

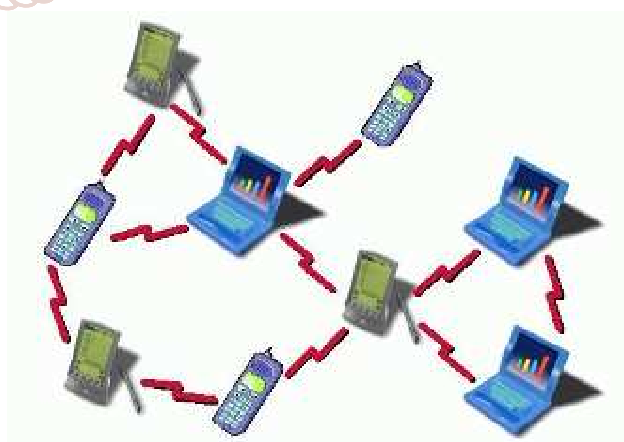


Fig 1: Mobile Ad hoc Network

The mobile network nodes today use Drop tail queue management where packets are discarded when the queue is full. When multiple packets are dropped due to queue overflow, multiple TCP flows (to which these packets belong to) back off. However, as there is a considerable amount of delay between the packet drop at the queue and the notification at the sender, large number of packets may be dropped as the sender continues sending at its current rate. Multiple flows backing off results in under utilization of the queue (no congestion). When these flows sense this (no congestion), they start increasing their sending rates as a result of which after some time the queue overflows again. This phenomenon of alternating periods of under utilization and over utilization is caused by the Drop Tail queue management policy and is called 'Global Synchronisation.

Active Queue Management (AQM)

1) Random Early Detection (RED) was proposed as a solution to the 'Global Synchronization' problem and this opened up a new area of research called Active Queue Management (AQM). The key aims of AQM are to prevent global synchronization, reduce queuing delays and improve resource utilization. AQM has been extensively studied in the context of wired networks (to quote a few). A few approaches have also studied the implications of employing AQM in the fixed wireless side (WLANs in particular)[3] with encouraging results. However, to the best of our knowledge no approach has ever studied the implications of AQM in mobile environments. If benefits in terms of improved performance (reduced packet loss) are to be reaped by deploying AQM in MANETs, it is imperative that any such scheme should be Lightweight, Requires less memory, Processing power and energy. There are few AQM Techniques used in MANETs which are REM (Random Exponential Marking) SFQ (Stochastic Fair Queuing). Random exponential marking (REM) is an attractive adaptive queue management algorithm. It uses the quantity known as 'price' to measure the congestion in a network. REM can achieve high utilization, small queue length, and low buffer overflow probability.

Fair Queuing is a queuing mechanism that is used to allow multiple packets flow to comparatively share the link capacity. Routers have multiple queues for each output line for every user. When a line as available as idle routers scans the queues through round robin and takes first packet to next queue. FQ also ensure about the maximum throughput of the network.

Literature Review

Chung and Claypool et al. (2017) has discussed that in Internet routers, active queue management (AQM) is a technique that consists in dropping or explicit congestion notification (ECN) marking packets before a router's queue is full. An Internet router typically maintains a set of queues, one per interface, that hold packets scheduled to go out on that interface. Historically, such queues use a drop-tail discipline: a packet is put onto the queue if the queue is shorter than its maximum size (measured in packets or in bytes), and dropped otherwise.

Wydrowski Bartek et al. (2016) explained about an active queue management algorithm for a self managed Internet in the paper. The author introduced a new active queue management (AQM) algorithm called GREEN. GREEN provides high link utilization whilst maintaining low delay and packet loss. GREEN enables low latency interactive applications such as telephony and network games. GREEN is shown to outperform the current AQM algorithms. Certain performance problems with current AQMs are discussed.

Fountanas Fengetal et al. (2011) explained about the challenges with Manet. 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 traffic over IP-based networks is still an open issue because existing active queue management schemes have been designed for TCP-compatible traffic. 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 thesis is to evaluate various AQM techniques to comparatively analyze the best Queue Management Schemes for different resource constraint networks.

Methodology

In order to perform the analysis of AQM techniques for the performance evaluation requires a network to be designed that contains a router to router link on which the parameters can be changed. The multiclass traffic network generating both TCP and UDP traffic, topology of the network created is as follows:

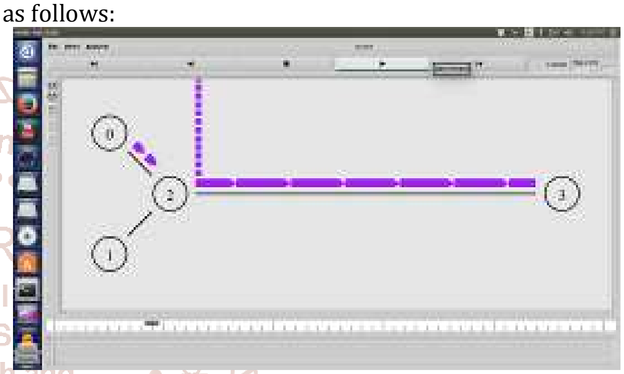


Fig2: Network Scenario with both TCP and UDP sources.

The network has 2 source nodes (S1 and S2), one generating TCP traffic and the other generating UDP traffic to be transferred at the destination node (d). The network parameters are changed on the link (r1-r2) as shown in the Fig 3.

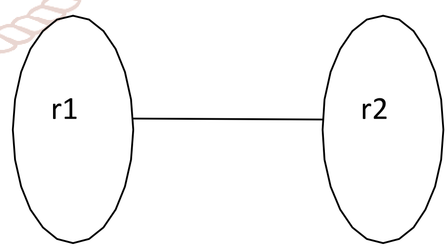


Fig 3: Test Link in the Network Senario

The AQM Techniques are analyzed and the following parameters are changed in the network. In first case, the bandwidth of the main router to router link (r1-r2) is changed keeping the other network parameters unchanged. In the second scenario the delay of the main router to router link (r1-r2) is changed keeping the other network parameters unchanged. In the third scenario the error rate of the main link is changed and in the fourth scenario the packet size is changed.

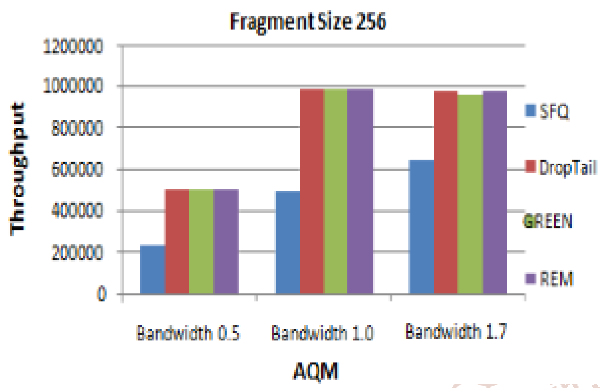
Experimental Results

The simulations are performed on ubuntu 14.14. NS2 is installed with NSG and trace graph to complete the full working model to obtain the results. NSG is used to write TCL scripts from graphical user interface and trace craft is used to analyze the output trace files.

Performance Evaluation of GREEN with other AQMs (Throughput Vs AQM) at varying Bandwidths

Fragment Size 256kb			
Bandwidth	**0.5 Mbps**	**1.0 Mbps**	**1.7 Mbps**
AQM	**Throughput bps**		
SFQ	232945	488854	642924
DropTail	500462	989088	978119
GREEN	500457	983500	962756
REM	500462	989088	978119

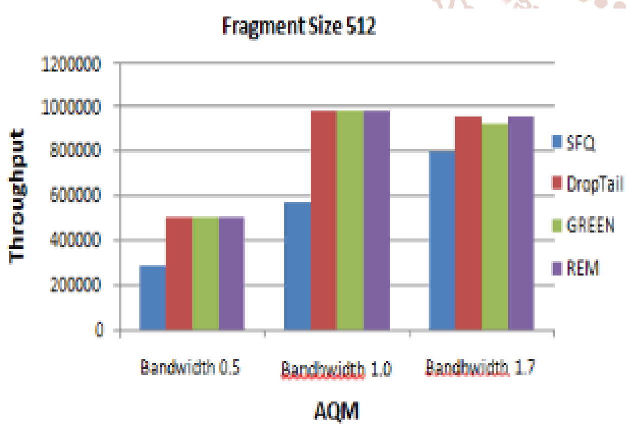
Table 1: Throughput of UDP traffic in various AQM schemes at fragment size256 kb at different bandwidth



Graph 1: Analysis of Throughput vs AQM for different bandwidth at fragment size of 256 kb

Fragment Size 512 kb			
Bandwidth	**0.5 Mbps**	**1.0 Mbps**	**1.7 Mbps**
AQM	**Throughput bps**		
SFQ	282848	572620	798883
DropTail	500917	982102	954370
GREEN	500916	983932	927374
REM	500917	982102	954376

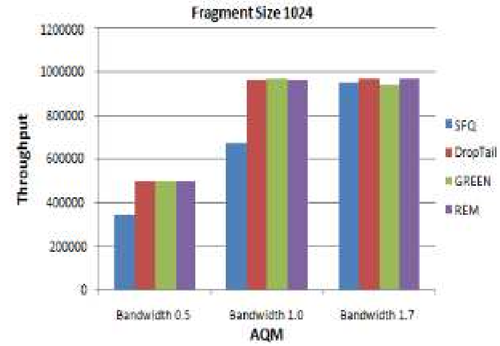
Table 2: Throughput of UDP traffic in various AQM schemes at fragment size 512 kb



Graph 2: Analysis of Throughput vs AQM for different bandwidth at fragment size of 512 kb

Fragment Size 1024 kb			
Bandwidth	**0.5 Mbps**	**1.0 Mbps**	**1.7 Mbps**
AQM	**Throughput bps**		
SFQ	340195	669993	950820
DropTail	501767	962573	967213
GREEN	501792	966053	937213
REM	501767	962573	967213

Table 3: Throughput of UDP traffic in various AQM schemes at fragment size 1024 kb at different bandwidth



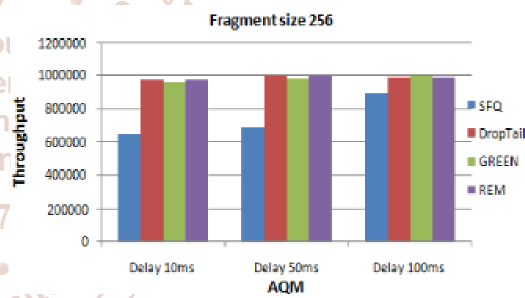
Graph 2: Analysis of Throughput vs AQM for different bandwidth at fragment size of 1024 kb

Performance Evaluation of GREEN with other AQM (Throughput Vs AQM) at varying Delay

In this scenario the bandwidth and the channel error rate of the network link was kept constant [BW = 1.7Mbps and Channel error rate = 0]

Fragment Size 256 kb			
Delay	**10ms**	**50ms**	**100ms**
AQM	**Throughput (bps)**		
SFQ	642924	689479	894320
DropTail	978119	993948	986499
GREEN	962756	980447	994413
REM	978119	993948	986499

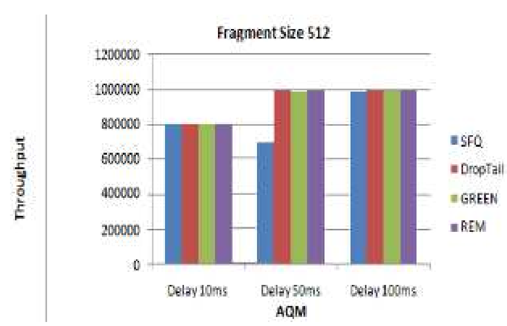
Table 4: Throughput of UDP traffic in various AQM schemes at fragment size 256 kb at different delay



Graph 4: Analysis of Throughput vs AQM for different bandwidth at fragment size of 256 kb

Fragment Size 512 kb			
Delay	**10ms**	**50ms**	**100ms**
AQM	**Throughput(bps)**		
SFQ	798883	767225	986965
DropTail	954376	989758	995345
GREEN	927374	982309	991620
REM	954376	989758	995345

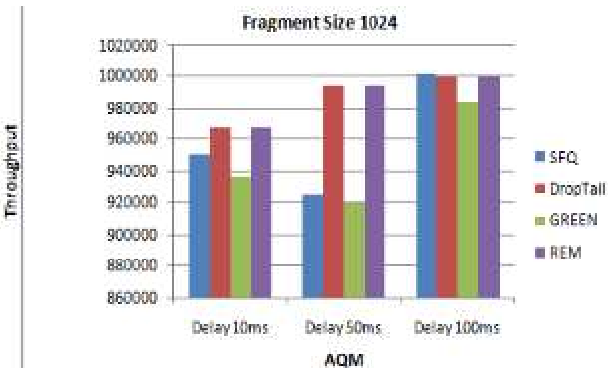
Table 5: Throughput of UDP traffic in various AQM schemes at fragment size 512 kb at different delay.



Graph 5: Analysis of Throughput vs AQM for different bandwidth at fragment size of 512 kb

Fragment Size 1024 kb			
Delay	**10ms**	**50ms**	**100ms**
AQM	**Throughput(bps)**		
SFQ	950820	925319	1001821
DropTail	967213	994536	1000000
GREEN	936248	919923	983607
REM	967213	994536	1000000

Table 6: Throughput of UDP traffic in various AQM schemes at fragment size 1024 kb at different delay



Graph 6: Analysis of Throughput vs AQM for different bandwidth at fragment size of 1024 kb

Result Analysis

During the result analysis following observation has been observed:

- In case of erroneous channels GREEN performs for superior than REN
- Throughput Vs AQM (Varying Bandwidths) from Graph 1 to Graph 3 SFQ has worst throughput for all Bandwidths. GREEN, REM and Droptail have Best throughput for all Bandwidths.
- The Throughput increases as Bandwidth increases for constant fragment sizes.
- The Throughput increases as the fragment size increases for constant Bandwidth.
- The Throughput increases as Delay increases for constant fragment sizes. The Throughput increases as the fragment size increases for constant Bandwidth.

ACKNOWLEDGEMENT

I express my sincere gratitude to the I.K.Gujral Punjab Technical University, Jalandhar for giving me the opportunity to work on the thesis during my final year of M.Tech. I owe my sincerest gratitude towards Dr. Tarun Kumar Lohani, Director Engg, Universal Institute of Engineering and Technology, Lalru, for valuable advice and healthy criticism throughout my thesis which helped me immensely to complete my work successfully.

I would like to express a deep sense of gratitude and thanks profusely to **Er. Rashmi Raj** Assistant Professor, Department of Electronics & Communication Engineering, UIET, who was the thesis Supervisor. Without the wise counsel and able guidance, it would have been impossible to complete the thesis in this manner.

I would like to thank the members of the Departmental Research Committee for their valuable suggestions and healthy criticism during my presentation of the work. I express gratitude to other faculty members of Electronics & Communication Engineering Department, UIET, for their intellectual support throughout the course of this work.

REFERENCES

[1] Barlow, D., Robbins, A.D., Rubin, P.H., Stallman, R. and Oostrum, P.V. 1995. "The AWK Manual Edition 1.0", Wiley Publishing,Inc.

[2] Bhaskar Reddy, T.B. and Ali, A. 2008. "Performance Comparison of Active Queue Management Techniques", India Journal of Computer Science, Department of Computer Science and Technology, S.K. University, Anantapur, Vol. 4, No. 12, pp 1020-1023.

[3] Chung, J. and Claypool, M. 2005. "Analysis of Active Queue Management", Computer Science Department Worcester, Polytechnic Institute Worcester, USA.

[4] Dana, A. and Malekloo, A. 2010. "Performance Comparison between Active and Passive Queue Management", International Journal of Computer Science, Vol. 7, Issue 3, No 5, pp 13-17.

[5] Feng, W., Kandlur, D., Saha, D., and Shin, K. 2001. "BLUE: A New Class of Active Queue Management Algorithms", In Proceedings of 11^{th} international workshop, Network and Operating System Support for Digital Audio and Video, USA, pp 41-50.

[6] Fountanas, L. 2001. "Active queue management mechanisms for real-time traffic in manets" Thesis, Naval Postgraduate School, Monterey, California.