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Review on buffer management schemes for packet queues in wired & wireless network

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Abstract
Mobile AdHoc Network (MANET) is a wireless network with a set of mobile nodes that can communicate with each other with no access point and without any fixed infrastructure. But mobile devices usually have limited resources (battery power, memory, CPU) which limit their transmission range. Hence, in order to conserve the limited resource, it is highly desirable that transmission should be as efficient as possible. MANET can be implemented in any environment because of its dynamic nature. For routing of information packets queuing is done at the buffer and transferred through intermediate nodes to the destination on priority basis which help to improve the overall network performance. This paper provides a review of various buffer management schemes for packet queues in wired & wireless networks (specialy MANET).
Index Terms: MANET, Buffer Management scheme, Packet Queue, scheduling scheme.

I. INTRODUCTION

Mobile ad hoc network is dynamic network topology without any central network for control. All the nodes in the network participate in networking functions like routing and packet forwarding as per the requirement. Nodes which are in direct contact with each other communicate with single hop and those which are not in range takes multiple hops through intermediate nodes to reach destination

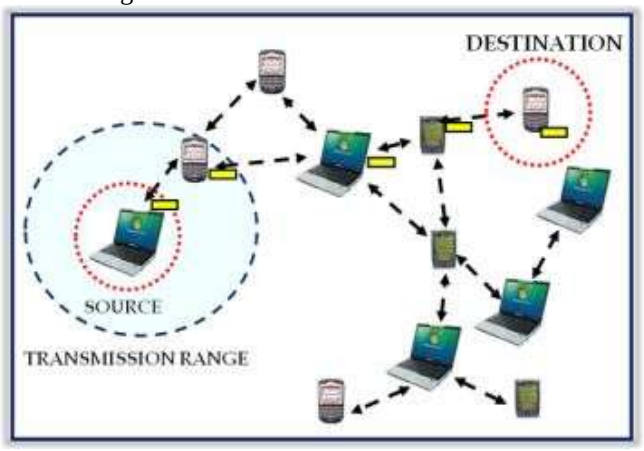

Fig 1: Mobile Ad Hoc Network

Fig.1 shows that source and destination nodes are not in range so packets are routed through intermediate nodes.

When different services are the part of some network, it is necessary to give priority to the packets of delay sensitive services such as Voice over IP (VoIP) and video streaming applications. This is usually referred services also arrive usually at QoS processing hops. In this case, incoming packets are queued in buffer to wait for their turn of processing. There are many variations introduced in the research of QoS paradigm about how these queues are managed at processing hops. Moreover, the buffer size also plays an important role in terms of number of packets that can be held in a queue before dropping the newly arrived packets (a case of buffer overflow)[3].

1.1 PROBLEM FOR PROVISIONING QOS IN MANET

The unreliable wireless Channel: The nature of high bit-error rates of wireless connection might be more profound in a MANET. One end-to-end path can be shared by several sessions. The channel over which the terminals communicate is subject to noise, fading, and interference, and has less bandwidth than a wired network. packet errors can increases to link failure, leading to rerouting, lower throughput, higher packet delay, and packet dropping due to congestion.

Lack of centralized coordination: The main feature of MANET is instant infrastructure. . Since there is no background network for the central control of the network operations, the control and management of the network is distributed among the terminals. In MANET, each mobile terminal is an autonomous node, which may function as both a host and a router. This increases the complexity and overhead.

Channel contention: In route discovery phase needs the common channel, nodes in a MANET use the MAC protocol to find the common channel. Especially IEEE 802.11 Distributed coordination Function (DCF) introduces the problem of interface and channel contention. Hidden and exposed node

problems are also of channel contention [10]. These problems can increase the network collision and reduces the network capacity.

Dynamic Network topology: The topology can be varies due to mobility, since path break can occur frequently. The admitted QoS session may suffer due to frequent path break, thereby requiring such session to be reestablished over new path. The delay due to path reestablishment may increase the packet drop, which is not acceptable in the case of QoS requirements.[9]

Even though MANET networks provides many advantages like scalability, flexibility, robustness, self configuration and self healing, etc. we must not forget it is a resource constrain network with limited bandwidth, energy and power supply and most importantly limited buffer space. Most probably reactive routing protocols are used for transfer of information. In this route to the destination is created only after demand from source, till that time packets are queued in buffer and transferred on priority basis.

Day by day growth of internet is increasing exponentially. So along with the provision of the services, all VOIP and multimedia applications should meet the Quality of service (QoS) requirement. Queuing management algorithm is responsible for accepting the arriving packets or not accepting them and consequently it directly affects the packet loss quantity parameter. This can be possible by smartly choosing the queue management schemes or packet scheduling schemes.

- Queue management schemes for MANET

Queuing is done to provide the services in an orderly manner. In wireless networks many queue management schemes are implemented to maintain the quality of service. From the point of dropping packets, queue management can be classified into two categories;

i. Passive Queue Management Scheme (PQM)
ii. Active Queue Management Scheme (AQM)

Queue management is defined as the algorithms that manage the length of packet queues by dropping packets when necessary or appropriate. passive queue management (PQM) which does not employ preventive packet drop before the router buffer gets full or reached a specified value. Packets are simply dropped when buffer gets full. Even though it is less effective and have several drawbacks, the main advantage of using PQM is that it is easy to implement in network with less computational overheads.

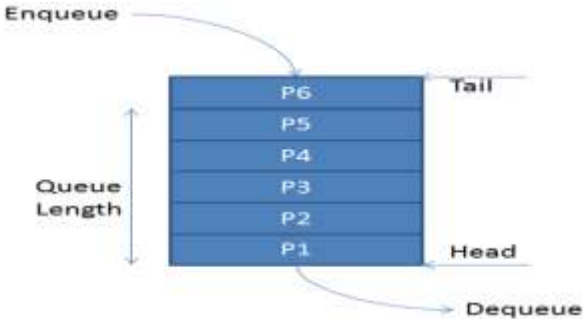

Fig.2 Flowchart of FIFO queue.

Drop Tail is most commonly used algorithm in PQM. It works in (FIFO) first in first out manner as shown in fig. 2. As the name indicates Tail of enqueued packets is dropped once the buffer gets full and keeps on dropping them until the enough space gets created for new packets. The length of buffer is therefore the main parameter that controls the packet drop in this scheme[3] The only two dropping probabilities in Drop Tail are 0 and 1. When the number of packets arrived to the queue larger than the buffer size, the probability of packet dropping is 1. Otherwise the dropping probability is 0 [2]. It is very simple to implement but does not provide fair distribution of buffer space. If multiple TCP connections exist in the system and a buffer overflow will cause TCP global synchronization, which reduce the network throughput.[1].

Active Queue Management employs preventive packet drop before the router buffer gets full. In this scheme, the sending node is notified before the queue is near to be completely filled so that the sender can stop sending data or lower the rate of data transmission [3].there are many AQM algorithms like RED, Adaptive RED (ARED), BLUE etc. RED (random early detection) is the most commonly used algorithm. It monitors the average queue size and take actions on packet (either drop or mark) based on statistical probabilities.

II. LITURATURE REVIEW ON QUEUE MANAGEMENT

P. G. Kulkarni, M. Nazeeruddin, et al [7] presented a predictive queue management strategy named PAQMAN that proactively manages the queue, is simple to implement and requires negligible computational overhead (and hence uses the limited resources efficiently). The performance of PAQMAN (coupled with explicit congestion notification - ECN) has been compared with Drop tail through ns2 simulations. Results from this study show that PAQMAN reduces packet loss ratio (and hence the fraction of retransmissions) while at the same time increasing transmission efficiency. Moreover, as its computational overhead is negligible, it is ideally suited for deployment in MANETs.

P.G.Kulkarni, S.I.McClean, et al [5] presents a proactive prediction based queue management scheme called PAQMAN that captures variations in the underlying traffic accurately and regulates the queue size around the desirable operating point. PAQMAN harnesses the predictability in the underlying traffic by applying the Recursive Least Squares (RLS) algorithm to estimate the average queue length for the next prediction interval given the average queue length information of the past intervals. This predicted average queue length then drives the computation of the packet drop probability. The performance of PAQMAN has been evaluated and compared against the RED scheme through ns-2 simulations that encompass a wide variety of network conditions.

Hariom Soni, Pradeep Kumar Mishra [2] studied and explained RED (Random Early Detectiion) Algorithm with prediction of congestion level and timing in which it became burst. The congestion control mechanism proposed by them is based on controlling congestion before it occurs. They calculated the rate of change in congestion level in regular interval and compared it with the congestion level with the previous interval to predict the behavior of the network. They found RED is better in performance than traditional queue management algorithm

Muhammad Aamir et al [6], introduces a new scheme of buffer management to handle packet queues in Mobile Ad hoc Networks (MANETs) for fixed and mobile nodes is introduced. In this scheme, we try to achieve efficient queuing in the buffer of a centrally communicating MANET node through an active queue management strategy. Firstly we assign dynamic buffer space to each node then we assign a dynamic buffer space to all neighboring nodes in proportion to the number of packets received from neighbors and hence control packet drop probabilities. Through analysis and simulation study we reveals that the proposed scheme is a way to improve the buffer management for packet queues in MANET nodes in terms of packet loss ratio, transmission efficiency, and some other important system parameters.

Tamilarasan-Santhamurthy [2], explained that the primary goal of any ad-hoc network routing protocol is to meet the challenges of the dynamically changing topology and establish an efficient route between any two nodes with minimum routing overhead and bandwidth consumption. The existing routing security is not enough for routing protocols. An ad-hoc network environment introduces new challenges that are not present in fixed networks. So several protocols are introduced for improving the routing mechanism to find route between any source and destination host across the network.

III. CONCLUSION

This paper discuss about various schemes of buffer management in wired and wireless networks. The existing research papers talk about comparative study of queue management techniques like DROP TAIL, RED, PAQMAN etc. From the (analytical discussion and the qos comparison results with previous (our base paper) papers we can conclude that AQM schemes are better in performance than PQM scheme. Further efficiency of network can be improved with some modifications in the existing algorithms.

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