Review Paper on Buffer Management for Packet Queues Using Proactive and Reactive Protocols

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***Abstract*— Mobile Ad hoc Network (MANET) allows portable devices to establish communication independent of a central infrastructure. The wireless links in this network are highly error prone and can go down frequently due to mobility of nodes. Therefore, routing in MANET is a critical task due to highly dynamic environment. Efficient Routing Protocols will make MANET reliable. Mainly protocols are of three kind i.e. Proactive, Reactive and hybrid. But, we will discuss Proactive and Reactive Protocols. In this paper, we present a study on how buffer management is done for queuing the packets and on Reactive (AODV) and Proactive (OLSR) routing protocols. So, this paper presents the review of buffer management for queuing the packets and Proactive and Reactive Routing Protocols in MANET.**

***Index Terms*— Manet, OLSR, AODV, Network Simulator, throuput, Packet delivery ratio.**

I. INTRODUCTION

The basic idea behind mobile ad-hoc networking (MANET) was first championed by the DARPA packet radio networks or mobile packet radio in the 1970s. Since then the technology has evolved significantly and applicable commercial radio technologies, such as IEEE 802.11 Wireless Local Area Network (WLAN) standard, have begun to appear. Previously, most of the interest in MANETs has been from the military side, and commercial interest is a recent phenomenon due to the demand for mobile computing [4]. MANETs have four unique characteristics that differentiate them from the fixed multi-hop networks [4] dynamic topology, bandwidth constraints, energy constraints and limited physical security. The first characteristic implies that nodes can move arbitrarily, changing the topology randomly and rapidly depending on the scenario. The second means that wireless links have significantly lower capacity than wired links, which intensifies congestion problems and requires special consideration for the band width delay Characteristics. The third refers to the fact that some or all nodes in a MANET may rely on batteries for energy, making power conservation a critical design criterion. Finally, wireless networks are generally more prone to information and physical security threats than are fixed, hardwired networks. Thus, security threats must be taken into account in the design and selection of the protocols and in the development of applications. In this network a node are mobile and constantly changes its location from one MANET to another [1].

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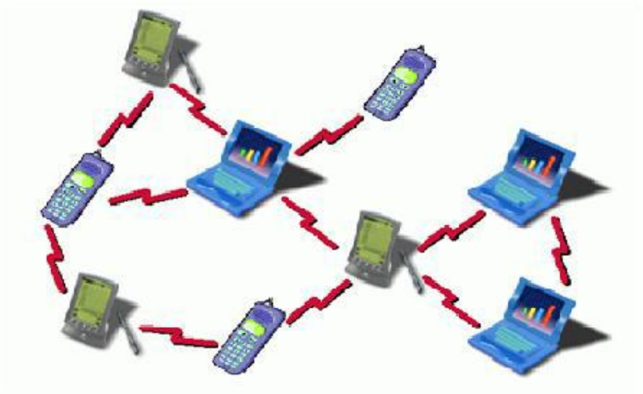

Fig 1: Layout of Manet Network [2]

In MANET each nodes which are participating in the network acts both as host and a router and hence must be able to forward packets for other nodes. A routing protocol is needed for forwarding the packets from one node to another.

A. Routing protocol

These protocols fall into two categories:

a) *Proactive or Table-Driven Routing Protocol(OLSR)*

b) *Reactive or On-Demand Routing Protocol(AODV)*

a) *Proactive or Table- Driven Protocol*

The proactive protocol OLSR (RFC3626) use link state routing algorithm which flood the link information about its neighbors. Every node in the network knows about the other node in advance. All the routing information is usually kept in tables. Whenever there is a change in the network topology, these tables are updated according to the change. The nodes exchange topology information with each other; they can have route information any time when they needed. Some of the existing proactive routing protocols are OLSR, DSDV [2].

➢ ***Optimized Link State Routing Protocol* (RFC3626)**

OLSR is a proactive routing protocol for MANETs. This protocol has the advantage of having routes immediately available when needed due to its proactive nature and also inherits the stability of the link state algorithm. OLSR minimizes the overhead caused by flooding of control traffic by using only selected nodes, called Multi-Point Relays (MPR). The number of retransmissions required to flood a message to all nodes in the network is reduced by this technique. Upon receiving an update message, the node determines the routes (sequence of hops) toward its known nodes. Each node selects its MPRs from the set of its neighbors saved in the Neighbor list. The set covers nodes with a distance of two hops. Only the nodes which are included in its MPR set are responsible for broadcasting the message. OLSR uses HELLO and Topology Control (TC) messages. The HELLO messages are exchanged periodically among neighbor nodes, to detect the identity of neighbors and to signal MPR selection. The protocol is particularly suited for large and dense networks [2].

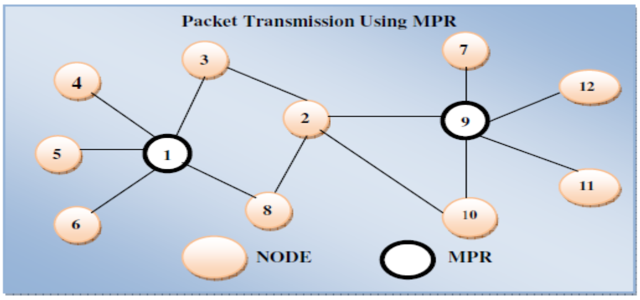

Fig 2: Packet transmission using MPR [4]

OLSR defines three basic types of control messages

i. **HELLO** - *HELLO* messages are transmitted to all neighbors. These messages are used for neighbor sensing and MPR calculation.

ii. **TC** - *Topology Control* messages are the link state signaling done by OLSR. This messaging is optimized in several ways using MPRs.

iii. **MID** - *Multiple Interface Declaration* messages are transmitted by nodes running OLSR on more than one interface. These messages list all IP addresses used by a node.

The Optimized Link-State Routing protocol can be divided in to three main modules:

[1] Neighbor/link sensing
[2]Optimized flooding/forwarding (MultiPoint Relaying)
[3] Link-State messaging and route calculation

b) Reactive or On demand protocol

Reactive protocols are also known as On-demand driven reactive protocols. These Protocols do not initiate route discovery by themselves, until or unless a source node request to find a route. That's why these protocols are called reactive protocols. These protocols setup routes when demanded. When a node wants to communicate with another node in the network, and the source node does not have a route to the node it wants to communicate with, reactive routing protocols will establish a route for the source to destination node.

➢ **Reactive routing AODV(RFC3561)**

AODV is reactive protocol which minimizes the number of broadcast by creating routes on demand. It doesn't need to maintain routes to nodes that are not communicating .AODV handles route discovery process with RouteRequest (RREQ) messages. RREQ message is broadcasted to neighbor nodes. The source broadcasts a route request (RREQ) packet when it wants to find path to the destination. The neighbors in turn broadcast the packet to their neighbors until it reaches an intermediate node that has recent route information about the destination or until it reaches the destination. When a node forwards a RREQ to its neighbors, it also records in its tables the node from which the first copy of the request came. This information is used to construct the reverse path for the route reply packet (RREP). AODV uses only symmetric links because the RREP follows the reverse path of the RREQ. A routing table entry is expired if not used recently. The message floods through the network until the desired destination or a node knowing fresh route is reached [5].

AODV defines three types of control messages for route maintenance:

i. **RREQ** - A *route request* message is transmitted by a node requiring a route to a node. As an optimization AODV uses an *expanding ring* technique when flooding these messages. Every RREQ carries a *time to live* (TTL) value that states for how many hops this message should be forwarded. This value is set to a predefined value at the first transmission and increased at retransmissions. Retransmissions occur if no replies are received. Data packets waiting to be transmitted (i.e. the packets that initiated the RREQ) should be buffered locally and transmitted by a FIFO principal when a route is set.

ii. **RREP** - A *route reply* message is unicasted back to the originator of a RREQ if the receiver is either the node using the requested address, or it has a valid route to the requested address. The reason one can unicast the message back, is that every route forwarding a RREQ caches a route back to the originator.

iii. **RERR** - Nodes monitor the link status of next hops in active routes. When a link breakage in an active route is detected, a RERR message is used to notify other nodes of the loss of the link. In order to enable this reporting mechanism, each node keeps a ``precursor list", containing the IP address for each its neighbors that are likely to use it as a next hop towards each destination.

▪ **Proactive vs. Reactive vs. Hybrid Routing**

The tradeoffs between proactive and reactive routing strategies are quite complex. Which approach is better depends on many factors, such as the size of the network, the mobility, the data traffic and so on. Proactive routing protocols try to maintain routes to all possible destinations, regardless of whether or not they are needed. Routing information is constantly propagated and maintained. In contrast, reactive routing protocols initiate route discovery on the demand of data traffic. Routes are needed only to those desired destinations. This routing approach can dramatically reduce routing overhead when a network is relatively static and the active traffic is light. However, the source node has to wait until a route to the destination can be discovered, increasing the response time. The hybrid routing approach can adjust its routing strategies according to a network's characteristics and thus provides an attractive method for routing in MANETs. However, a network's characteristics, such as the mobility pattern and the traffic pattern, can be expected to be dynamic. The related information is very difficult to obtain and maintain. This complexity makes dynamically adjusting routing strategies hard to implement.

B. Queue Management Scheme

The queue management scheme can be classified into two categories:

a) Passive Queue Management (PQM)
b) Active Queue Management (AQM).

a) Passive Queue Management

In Passive Queue management (PQM) technique, an Internet router typically maintains a set of queues, one per interface, that hold packets scheduled to go out on that interface. 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. PQM does not employ preventive packet drop before the router buffer gets full.

- ***Drop tail***

Drop Tail is a Passive Queue Management (PQM) algorithm which only sets a maximum length for each queue at router. Routers decide when to drop packets. It uses first in first out algorithm. In this, the traffic is not differentiated. Each packet is has the same priority. The router accepts and forwards all the packets that arrive as long as its buffer space is available for the incoming packets. If a packet arrives and the queue is full, the incoming packet will be dropped. The sender eventually detects the packet lost and shrinks its sending window [10]. Drop Tail will keep discarding/dropping the packet until the queue has enough room for new packets. . 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 [7].

b) Active queue management

Active queue management (AQM) is a technique that consists in dropping packets before a router's queue is full. Typically, they operate by maintaining one or more drop/mark probabilities, and probabilistically dropping or marking packets even when the queue is short. 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. Meanwhile, the current length of queue is shortened with the processing and de-queuing of buffered packets. After a sufficient space is again available in the queue, the source can be allowed to send more packets for en-queuing in the buffer and further processing [1].

II. Buffer Management for MANET

Buffer management is used to handle packet queues in Mobile Ad hoc Networks for fixed and mobile nodes. In this we try to achieve efficient queuing in the buffer of a centrally communicating MANET node through an active queue management strategy by assigning dynamic buffer space to all neighboring nodes in proportion to the number of packets received from neighbors and hence controlling packet drop probabilities [1]. Queues represent locations where packets may be held (or dropped). Packet scheduling refers to the decision process used to choose which packets should be serviced or dropped. Buffer management refers to any particular discipline used to regulate the occupancy of a particular queue. In the common case where a *delay* element is downstream from a queue, the queue may be *blocked* until it is re-enabled by its downstream neighbor. This is the mechanism by which transmission delay is simulated. Queues may be forcibly blocked or unblocked at arbitrary times by their neighbors.

A. Queue management scheme

The queue management scheme can be classified into two categories:

1) Passive Queue Management (PQM)
2) Active Queue Management (AQM)

III. Literature Review

Rupali Gupta, Himanshu Aggarwal [1], carried out a comparison of performance of MANET routing protocol on the basis of network density. Two different applications are used which generates different types of data for different node densities in network. After comparison by using different performance metrices it has found that hybrid protocol (GRP) outperform reactive protocol (AODV) and proactive protocol (OLSR) and among proactive and reactive protocol proactive protocol (OLSR) outperforms the reactive protocol (AODV).

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.

Reza Malekian , Aleksandar Karadimce et al [3], explained AODV and OLSR Routing Protocols in Manet and compare them on the basis of some performance metrices. The growing of wireless and mobile technologies has resulted in more and more active researches to be done on scalability, performance, and compatibility of packet routing with minimal changes to the network. In this paper, we review two well known routing protocols in mobile ad hoc networks i.e. Ad hoc On-Demand Distance Vector and Optimized Link State Routing Protocols and compare them in terms of performance.

Ramandeep Kaur et al [4] , studied and concluded that Ad-hoc network can operate without fixed infrastructure and can survive rapid changes in the network topology. In this paper, they analyze the performance of three protocols AODV, DSDV OLSR. The performance of proposed networks is evaluated in terms of packet delivery ratio with the help of NS-3 simulator. Through analysis and simulation result we conclude that OLSR shows better performance over the other two protocols, that is DSDV and AODV.

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.

IV. Conclusion and Future Work

This paper totally speaks about working and description of Reactive and Proactive Protocols in context of buffer management. Some time they may work better and sometime not. The existing research papers have been focusing on performance metric for comparing the performance of Routing Protocols. For simulation of Routing Protocols in MANET mostly used simulation tools are Openet, ns-2, NetSim, GloMoSim and Qualnet. Based the previous study, we concluded that the OLSR are better in terms of security as compared to AODV for queuing the packets in a buffer.

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