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Improving Quality Of The Services In Manet Usign The Hierarchical Fair Service Curve And Fisheye State Routing Protocol

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***Abstract*—Mobile Ad-hoc networks (MANET) is one of the self configuring and infrastructure less connected wireless networks, which consists of the end hosts and routers. The main issue in the Mobile Ad-hoc networks is a bandwidth aware queue management and quality of the services while sharing the packets in the network. These challenges are increasing the traffic in the real time applications, consumes energy in the MANET. So, the proposed system improves the Quality of the Service (QoS) by applying the Hiearchical Fair Service Curve (HFSC) packet scheduling algorithm and the Fisheye State Routing protocol. The proposed algorithm uses the link-sharing services scheme to maintain the real time application with high quality of services, less delay and high throughput. Thus the of the proposed system is implemented in the NS2 simulation tool and the performance is evaluated with the help of the performance metrics such as, Average delay, Average throughput, Routing overhead, Packet delivery ratio**

Keywords—Mobile Ad-hoc networks; queue managemen; Hiearchical Fair Service Curve;Quality of services.

I. INTRODUCTION

In the recent emerging technology the computing devices are placed an important role in the wireless communication technologies. These technologies are used to provide the various networking applications to the end user for enjoying the valuable services [1]. But the provided networking services always have some problems like, not consistently obtainable, trustworthy is the main problem and difficult to provide the networking services based on the people demand [2]. So as to overcome the above difficulties Mobile Ad-hoc Networks (MANET) based network communication technology is developed for establishing the instant communication [3]. This MANET communication applied in various situations like, emergency relief, disaster recovery, battle field communication, mobile conferencing, dynamic database access mechanism, mobile offices, electronic payments and vehicle services and so on [4].

The MANET communication technology wieldy to use for the real time applications and the mobile networking applications because it provides the quality of the services to the user information [5]. Each MANET device is moved frequently in different directions and changes their control or link to the other MANET device. During the control transformation the router should control the traffic of the device because the information presents in each control transmission should be monitored continuously for maintaining the quality of the service [6]. Sometimes the continuous monitoring of the data also leads to misuse the information due to the large number of network and user presents in the MANET [7]. So, the quality of the service has to be improved by applying the scheduling algorithm because the scheduling algorithm maintains the queue which is used to manage the priority of the information and control of the network link.

Scheduling algorithm [8] is the important concept of establishing and managing the quality of the service parameter. This algorithm improves the performance of the networks and establish the QOS guarantees. In the MANET network different time of scheduling algorithms [9] like First In First Out, Last in First Out, Priority Queue algorithm, Weighted Fair Queue and Low Latency Fair Queue algorithms are used for managing the queue. After determining the order of the transmission packets, the transmitted path should be considered. The routing protocol [10] is the standard mechanism for managing the packet transmission route between the mobile computing devices. There are several routing protocol exists on the MANET networks [11] such as, proactive routing, reactive routing, hybrid routing and hierarchical routing, which is able form and detect the particular topology while transmitting the information. This scheduling and routing protocol manage the quality of the services in the real time applications, but it has still some of the quality related issues.

Thus the paper contributes the proposed work to manage the quality of the services in the MANET network. The Hiearchical Fair Service Curve (HFSC) packet scheduling algorithm is used to manage the queue and which is used to determine the number of packets and the priority of the packet while transmitting the information. After that the routing is done by using the Fisheye State Routing protocol for managing the data transmission path in the network, which is used to manage the quality of the services, minimize the response time and high throughput. Then the proposed system is implemented via the NS2 simulation tool and the performance is analyzed using the Average delay, Average throughput, Routing overhead, Packet delivery ratio performance metrics. The rest of the section organized as follows, section 2 discusses about the related works, section 3 deals that the proposed methodology, section 4 discuss that the performance analysis and conclusion is discussed in section 5.

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II. RELATED WORKS

This section deals that the various discussions about the MANET network related scheduling and the routing protocols. Patel et al., [12] propose a new approach called active queue management system. This approach uses to monitor the incoming and outgoing packets because, each device uses the buffering mechanism while transmitting the packet. In this system the dropping and waiting packets are controlled by RED scheme that is used to prevent the packet overflow in the network. This RED scheme adjusts the parameter depending the on the queue condition which lead to reduce the packet delay, increase the throughput and so on. Thus the performance of the system is evaluated using the sender and receiver network length and throughput.

Yan Li et al., [13] improves the quality of the services by applying the Active Queue Management system with the autonomic features which is called as the Autonomic Active Queue Management Scheme. This new approach implements in the NS2 simulation tool for ensuring the quality of the services and reduces the queue structure by adjusting the network parameters in the MANET environment. Thus the performance of the system is evaluated in the multi video stream environment which guarantee the quality of the system.

Muhammad Aamir et al., [14] discusses the active management system for managing the packets in the MANET fixed and mobile device environment. In the active queue management system, the buffer management concept is implemented while requesting the packet transmission. The buffer allocates the space in the dynamic manner which reduces the delay and increases the throughput while exchanging the packets. Then the proposed dynamic buffer management system enhances the quality of the system in terms of the transmission efficiency, packet loss ratio and other important parameters.

Morshed et al [15] proposed a cluster base secure routing protocol, which uses the two different secure authentication methods such as digital signature algorithm and the one way hashing method. The cluster routing protocol forms the cluster, which consists of 4 to 5 nodes and the cluster head and members are changed based on the election. Inside the cluster the authentication is established by using the one way hashing based authentication and other authentication is achieved by using the digital signature process. This authentication process ensures the security and enhances the routing with efficient manner.

Simaiya et al [16] proposed a RED based Active Queue management system for preventing the congestion problems. In this system the incipient congestion details are identified and the notifications are transmitted to the end hosts. The performance of the RED is increased by using the parameter Dq and the probability Pq which provide the highest quality performance while transmitting the packets. Then the queuing probability, length, delay and highest throughput parameters are used to ensure the quality of the services in the MANET environment.

III. PROPOSED METHODOLOGY

This section discusses about the detailed proposed Hierarchical Fair Service Curve (HFSC) packet scheduling algorithm and the Fisheye State Routing protocol based system methodology to managing the quality of the services in the MANET environment.

A. Hierarchical Fair Service Curve (HFSC)

The MANET communication the quality of the service and the queue management is the important issue, so the proposed system uses the Hierarchical Fair Service Curve (HFSC) scheduling algorithm [17 to arrange the packets in the queue form which improves the quality of the service. The HFSC algorithm establishes the quality in both real time applications and the hierarchical link based services. Each node in the HFSC has been used to represent the particular data traffic and the type of the data traffic in the real time application. Sometimes the HFSC has only the single leaf node or it has collection leaf node and the internal node. The HFSC maintains the three important parameters like eligible time, deadline and the virtual time while sharing the link in the queue management process. During the eligible, deadline and virtual time estimation, it maintains the different curves, namely eligible curve,deadline curve and virtual curve, which is used in the time of eligible, deadline and virtual time updating process. When the deadlines are guaranteed the services to the node, the eligible time decides and schedules the services based on the eligible curve and deadline curve. Thus the eligible, deadline and virtual time is calculated as follows,

a.Eligible Time

The eligible time is one of the important parameters in the real time application in which the node or a packet has been waiting for the services at a particular time. The waiting time does not affect the whole process. Then the eligible time is calculated as follows,

$$E(t) = \sum_{i \in s(t)} D_i(b_i^m; t) + \left[max_{i>t} \left(\sum_{i \in s(t)} \left(D_i(b_i^m;\ t') - D_i(b_i^m; t) \right) + \sum_{i \in p(t)} (D_i(t; t') - W_i^{RT}(t)) - C * (t' - t) \right) \right] \quad (1)$$

Where $E(t)$is the eligible time,$b_i^m$is the representation of the last time when session *i*is active.

$s(t)$is the set of active section at the time of t.

$p(t)$is the set of passive section at the time of t.

$\sum_{i \in s(t)} \left(D_i(b_i^m;\ t') - D_i(b_i^m; t) \right)$is the existing activated service at the time of t.

$\sum_{i \in p(t)} (D_i(t; t') - W_i^{RT}(t)) - C * (t' - t$is the maximum number of services required by the session at the passive time t.

$i \in s(t)$is the backlog interval time,

$D_i(b_i^m; t)$is the dead line time.

Based on the equation 1 the packet eligible waiting time is calculated to avoid the dangerous problem in the packet management process.

b. Deadline Time

Deadline time is used to manage the delay while transmitting the packets. In addition the deadline parameter is widely helps to guarantee the less delay in the queue management process which is calculated as follows,

$$D_i(t) = min_{s \in b(t)} \{ W_i^{RT}(s) + S_i(t - s) \} \quad (2)$$

$D_i(t)$is the deadline time.

$W_i^{RT}$is the total number of services received by a particular class by the real time criterion.

$S_i$is the service curve which does not change while the session receives the services.

c. Virtual Time

Virtual time is used to normalize the service for allocating the service curve to a particular node. Finally the virtual time used to meet the hierarchical link sharing in the real time application. Then the virtual time is calculated as follows,

$$V_i(b_i^m; v) = min\{V_i(b_i^{m-1}; v), W_i(b_i^m) + S_i(v - V_{p(i)}^s)\} \quad (3)$$

$V_i(b_i^m; v)$is the virtual time of the particular service.

$W_i(b_i^m)$is the total amount of service receive by the class *i*at the time of b_i^m

$V_{p(i)}^s$is the system virtual time associated with the parent class *i.*

The above three parameters are used during the queue management process. Each real time application having the one leaf node which should satisfy the eligible time and deadline time. If the packet satisfies the above condition, then the network guarantees the quality of the service. The link based services are used to decide the next transmission packets which are identified by using the virtual time. Based on the virtual time the services are allocated to the next packet based on the priority. Then the pseudo code of the scheduling process is described as follows,

Pseudo Code of HFSC based Queue Management Process

Receive packet (I; p) queue *I*have received the packet

enqueue(queue i ; p);

if (not active(i)) ; where *i*is inactive state

*update ed(i; null; p);*update and compute eligible and deadline time

*update v(i; p);*update and compute the virtual time

set active(i); mark i active

get packet() get next packet to send

if (not active(root)) return;

i = mindj fj j leaf (j) ^ active(j) ^ (ej current time)g;

if (exists(i))

p =dequeue(queuei);

update v(i; p); update virtual time

if (not empty (queuei))

update ed(i; p; head(queuei));

else

set passive(i); mark i passive

else

select active session by link-sharing criterion

i = root;

while (not empty(ActiveChildren(i)))

i = minvj fj 2 ActiveChildren(i)g;

p =dequeue(queuei);

update v(i; p)

if (not empty(queuei))

update d(i; p; head(queuei)) update deadline time

else

set passive(i); mark i passive

send packet(p);

After scheduling the packets in the queue, the related parameters like eligible, deadline and virtual time has been updated for establishing the further scheduling process. Then the managed queue used to reduce the delay and usage of the bandwidth. In addition the routing protocol has been implemented for establishing the path while transferring the information or packets which is explained as follows.

B. Fisheye State Routing protocol

The routing mechanism is an important issue in the MANET based wireless communication which is used to increase the reliable communication with minimum cost. In addition, it provides the on demand service based on the user requests without making the delay and increases the throughput. In this proposed system the Fisheye State based Routing protocol (FSR) [18] is used to establish the reliable communication in the MANET environment. The Fisheye is one of the proactive routing protocols which create the topology for managing the node information while transmitting. The topology contains the detailed information about the neighboring nodes and the related service transmission link state. This Fisheye algorithm reduces the bandwidth while exchanging the large amount information in the network. It has the following features such as maintaining the topology, reducing the control overhead. Then the routing is done by using the following steps.

- Each node has been stored link state information while transmitting the information
- Each node updates their status of its neighboring node for further routing process
- Updating the frequent access node and their related path for predicting the alternative path.

Based on the above steps, the routing is implemented and the related pseudo code is shown as follows. Initially the neighboring nodes are empty and the related topology table also empty. Then the sender ID of the entire node has been estimated and the transmitting message is calculated which has the transmitting link state information. After that the routing update process is performed as follows, the topology scanned all the incoming messages and the alternative path has been selected based on the priority and the available path. Finally the routing is performed by Information Dissemination, Route Computation process. Thus the scheduling algorithm and the routing algorithm to ensure the high throughput and less delay while transmitting the information in the MANET environment. Then the performance of the proposed system is evaluated as follows.

IV. PERFORMANCE ANALYSIS

This section discusses that the performance analysis of proposed Hierarchical Fair Service Curve based scheduling algorithm and Fisheye State Routing protocol based routing protocol. Then the proposed system is implemented in the NS2 simulation tool for establishing higher throughput and quality based services in the MANET wireless communication network. Then the following performance metrics such as Average delay, Average throughput, Routing overhead, Packet delivery ratio are used to discuss the performance of the proposed system.

A. Performance measures

a. Average Delay

Average Delay [19] is the time taken for transmitting the packet from source to destination. The delay reduces the route discovery latency and interfaces of the queue also the retransmission delay. Then the average delay time is calculated as follows,

$$Average\ Delay = \frac{\sum Time\ (Destination\ Receives\ Packet) - Time\ (Send\ Packet)}{Number\ of\ packets} \quad (4)$$

b. Average Throughput

Throughput [20] is the total amount of the data received from the source node to the destination node. It depends on the total time taken for transmitting the data which are measured in the bits per second (bits/bps). Then the average throughput is calculated as follows,

$$Average\ Throughput = \frac{\sum Total\ amount\ of\ data\ transmitt}{Total\ Time} \quad (5)$$

c. Routing Overhead

The routing overhead [21] or control overhead used to reduce the network radius and updates with very fast when the network has a large amount of size. In our proposed FSR routing protocol the number of nodes independent of the network size. So, the proposed system manages the large area of network with minimum overhead of managing the topology.

d. Packet Delivery Ratio

Packet Delivery Ratio [22] is the measure which is used to calculate how the packets are delivered based on the quality. It is the ratio between the number of packets sent and the number of packets received by the receiver. The PDR is measured as follows,

$$PDR = \frac{Number\ of\ packet\ received}{Number\ of\ packet\ sent} \quad (6)$$

B. Result and Discussion

This section deals that the result and discussion which used to how the proposed system ensures the quality of the service while transmitting the information in the wireless network. Then the different type of network scenarios has been evaluated using the different mobile nodes like 10,20 and 50 nodes with different speed in terms node mobility throughput, end to delay measures. The following table 1 depicted that the node mobility throughput of FIFO [23], LIFO [24], AODV[25], OLSR [26] and the proposed HFSC and FSR algorithm.

Table 1: Node Mobiltiy Throughput

Techniques	Number of Nodes		
	10	20	50
FIFO	13194613	13271109	13313727
LIFO	14791561	14791763	14791963
OLSR	25337785	25438436	25918050
AODV	25347785	25499430	31698811
HFSC and FSR	31725779	31725979	31726259

From the above table 1 the proposed scheduling algorithm has highest throughput when compared to the other techniques which means the proposed system ensure the services to the different number of nodes with efficient manner. In addition, it ensures the multipoint broadcast so, it provides better throughput. The high throughput, reduces the delay for transmitting the services in the network, which shown in the figure 1.

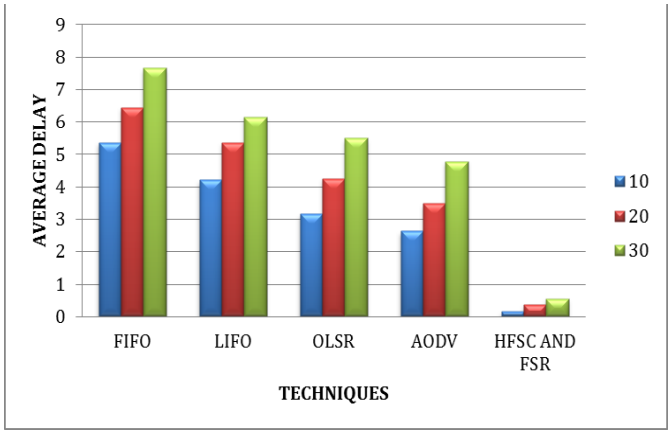

Figure 1: Delay of Number of Nodes

The following figure 2 depicted that the average delay of FIFO [23], LIFO [24], AODV[25], OLSR [26] and the proposed HFSC and FSR algorithm with various packet sending per second.

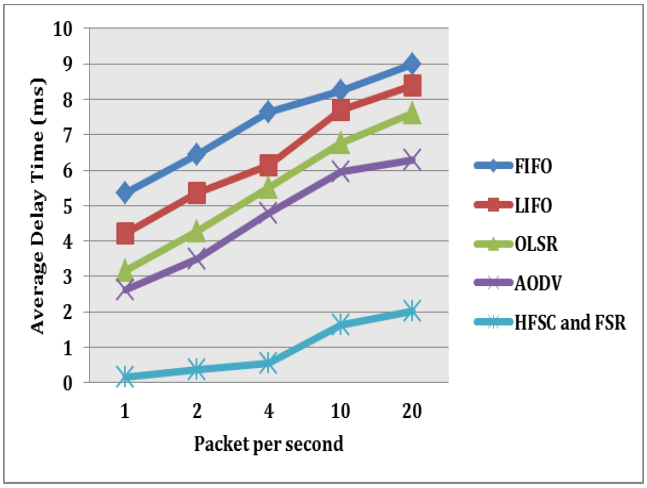

Figure 2: Average Delay

The above figure 2 clearly shows that the proposed system having the minimum delay time when comparing to the other scheduling and routing algorithm. Figure 3 shows that the throughput analysis of the proposed system which is shown as follows. Then the comparison is made with the amount of throughput and the number of packets transmitted per second.

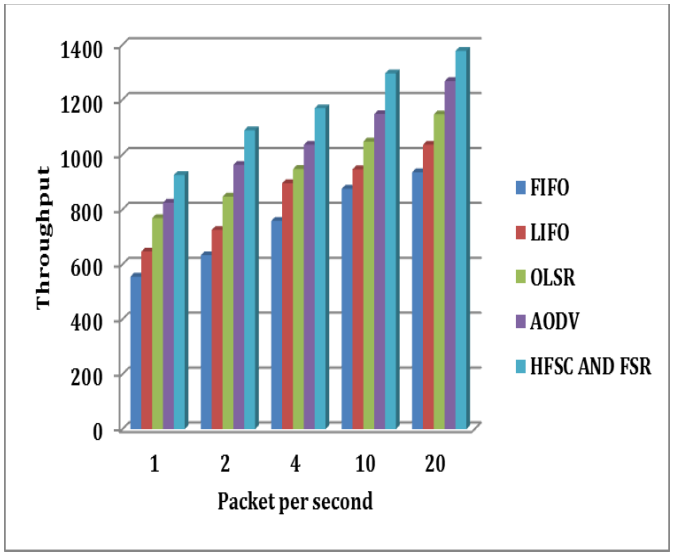

Figure 3: Average Throughput

The above figure 3 clearly shows that the proposed system has the maximum throughput value when compared to the other scheduling and routing algorithm. Figure 3 shows that the packet delivery ratio analysis of the proposed system which is shown as follows. Then the comparison is made with the amount of packet delivery ratio and the number of packets transmitted per second.

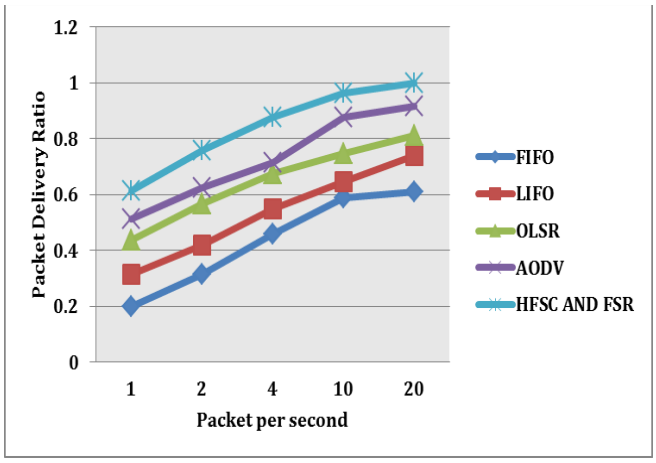

Figure 4: Packet Delivery Ratio

Thus the following figure clearly explains that the proposed system delivery the packet with highest ratio when compared to the other scheduling and routing algorithm. Thus the evaluated performance metrics are clearly showing that the proposed system produces the quality of services with minimum delay and highest throughput.

V. CONCLUSION

In this paper the MANET facing bandwidth related queue management process and the quality of the services are established by applying the Hierarchical Fair Service Curve scheduling algorithm and the Fisheye State Routing algorithm. Initially the packets are managed in the queue based on the eligible time, delay time and the virtual time and the packets are transmitted by maintaining the neighboring topology framework. Thus the proposed system ensures the quality of the services by evaluating in terms of minimum delay, high throughput, and high packet delivery ratio. Thus the of the proposed system is implemented by using the NS2 simulation tool and the performance of the proposed system is analyzed with the help of the experimental results and discussions.

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