HFSC-FSR Protocol Based Quality of Services in MANET

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***Abstract*—** *Mobile Ad-hoc network (MANET) is a wireless network, which does not have any kind infrastructure and it is self-configured. It consists of hosts and routers. A bandwidth queue management and the quality of service are the main issues in the MANET. The quality of service is poor when sharing the data packets between the nodes in the network. In real time application, the traffic and the consumer energy are increased by these kinds of issues in the MANET. To solve these problems we can apply the two algorithms in the proposed system. The Hierarchical Fair Service Curve (HFSC) packet scheduling algorithm and the Fisheye State routing protocol are utilized to get better the Quality of service (QoS). The link-sharing service scheme is used in proposed algorithm, which maintains the real time application QoS, high throughput, and less delay. Therefore the proposed approached are developed by using the NS2 simulator, which evaluates the performance, average delay, throughput, Routing overhead and packet delivery ratio.*

Keywords: *MANET, Routing, Similarity Measurement, HFSC, Quality of Service*

INTRODUCTION

In present days, the gigantic technological rejuvenation of wireless communication has been developed within the MANET. Mobile Ad-hoc network is an infrastructure less network. Since it's highly dynamic and portable of its autonomous nodes and transmission of data in the network is an excellent performance. The nodes are consists of limited battery power and they do more tasks. The control information, data packets, forwarding packets and messages, processing routing logic and etc., these all are the processing tasks of MANET nodes. So, the aim of this proposed algorithm is to optimize the performance of the network. The proposed algorithms are working under the different network parameters. Those are the power consumption, delay management technique, etc. various existing routing protocols are available in the MANET, which is basically two types. One is table driven and another is on demand [1].

The deployment of networks, high-security measures in the network, any end to end transmission, mobile connectivity without failure, anti-jamming mechanism, etc, these are the Mobile Ad-hoc networks essential applications and operations in conflict field and in disaster situations. Without any link failure, all network activity must be done spontaneously even in microsecond level. In order to get any latest command or to discuss before any action from their chief, the soldiers should be able to remain continuously connected with each other in online battle. Here again, some challenges occur because of the penetration of the satellite signals is not possible to caves or dense forest in sometimes or undersea places [2].

The communication devices are acts as an important role in the wireless communication technologies in the recent decade. The various network applications are provided to the end user with the help of these technologies [3]. In some cases, the problems occur in the network applications, which is not consistently obtainable. The reliable is the main problem within the network services based on the people requirement [4]. We can develop the instant communication for solving these difficulties in Mobile Ad-hoc Networks (MANET) [5]. The real-time applications of MANET is an disaster recovery, emergency relief, battlefield communication, dynamic data base access mechanism, mobile conferencing, mobile offices, vehicular services and electronic payments etc., [6]. The MANET is broadly utilized in real-time scenarios and the mobile network applications. It gives the better quality of service to the consumer [7]. Every MANET device is motivated beginning one direction to another direction and changes their control. The router can control the traffic according to their control transmission. Therefore the information is monitored simultaneously to maintaining their QoS [8]. Due to the large number of network, the continuous monitoring of data is misused. Therefore the QoS is improved with the help of applying the scheduling algorithm, which is to maintain the queue to manage the priority to the data in the network. It is an important algorithm to establish and manage the QoS parameters [9] and improve the network performance. It gives the guarantees to QoS. The different kinds of scheduling algorithms are applicable in the MANET [10] such as Last in first out, First In First Out, Priority Queue algorithm, Low Latency Fair Queue algorithms and Weighted Fair Queue These are used for managing the queues. The

broadcast way is chosen to broadcast the information packets. The steering protocol is a method utilized to establish the way among the communication devices [11]. Plenty of routing protocols are available in MANET [12]. For example, proactive routing, reactive routing, hybrid routing and hierarchical routing. These routing protocols are able to develop the paths to transmit the data. These protocols are maintaining their QoS in real time but some issues are yet solved.

RELATED WORKS

This section covers various scheduling and the routing protocols in the MANET. The active queue management system is proposed by Patel et al., [13]. The use of this system is to monitoring the send and receive data packets in the network. Each device contains the buffer to transmit the data packets. Here the sending and waiting data packets are controlled with the help of RED scheme. This is utilized to avoid the information run over in the network. It's adjusting the constraint to decrease the delay packet and raise the throughput. Based on the sender and receiver network length and throughput, the performance is evaluated. The Autonomic Active Queue Management Scheme is established by Yan Li et al., [15]. By applying the Autonomic Active Queue Management Scheme, we can improve the quality of service. This technique is implemented with the help of NS2 simulator. It ensures the QoS and reduces the queue structure. The multi-video stream environment can evaluate the system performance. The active management system is discussed by Muhammad Aamir et al., [16]. In fixed and mobile device environment, the data packets are managed by this system. Here the buffer management scheme is implemented. The buffer dynamically can allocate the packet space and decrease the delay also. It can improve the throughput when data transmission.

It improves the QoS with the help of the transmission efficiency, packet loss ratio, and other important parameters. The cluster base secure routing protocol contains two types of secure authentication methods [17]. One is the digital signature algorithm and another is the hashing method. This protocol forms the cluster and it contains one cluster head. The authentication is developed with the help of hashing method and another authentication is implemented by using a digital signature technique. These processes are used to ensure the security. Simaiya et al [18] proposed a RED based Active Queue management system. It's mainly used for avoiding the congestion troubles. In this scheme, the congestions information's are notorious and the notifications are transmitted to the last part hosts. The recital of the RED is greater than before by utilizing the constraint Dq and the probability Pq. It know how to give the uppermost excellence recital inside the network. Subsequently the length, queuing probability, delay and highest throughput parameters are utilized to guarantee the superiority of the services in the MANET surroundings. S.R.Raja et al [23] proposed a PHY-MAC layer based Qualtiy of Service enhancement with energy efficient protocol with simulation results which is correlate with our propose work.

CONTRIBUTION OF THE PAPER

In this paper it is mainly focused on to continue the QOS in the MANET. The Hierarchical Fair Service Curve (HFSC) packet scheduling algorithm is able to assist to supervise the queue. Its formative the numeral of packets and their precedence as well. Subsequent to the routing, the Fisheye State Routing protocol is running their information a transmission way in the system. In addition to it is utilized to continue the QOS, high throughput and minimize the response time. The present method is developed by utilizing the NS2 simulator and that recital is analyzed by means of Average delay, Routing overhead, throughput and Packet delivery ratio performance metrics.

PROPOSED APPROACH

In this section mainly focused on proposed algorithms, which is called Hierarchical Fair Service Curve (HFSC) packet scheduling algorithm and the Fisheye State Routing protocol based on system methodology. It manages the QoS in MANET. The QOS and the queue management is the significant matter in the MANET communication. Consequently the present work is to run the information packets in the queue. It improves the QoS. In together the hierarchical link based services and the real time applications , this algorithm is used to implement the quality. In the real-time applications, each and every node in the network used to represent the data traffic. This algorithm contains three main aspects, such as eligible time, deadline and the virtual time. During that estimation, it manages that various curves, called as an virtual curve, eligible curve and deadline curve so as to utilize in the occasion of adequate, deadline and virtual time updating process. The deadlines are utilized to give the assurance examine to the node in the network. Service-Time (ST), Allocated-Time (AT) and Virtual-Time (VT) are the three important time intervals can help to calculate and measure the QoS limit achieved using proposed protocol.

Service-Time (ST)

ST is the time is the waiting time of a node/packet to get the service in a real-time application. ST never affects the entire process of application and it can be calculated using the following formula as:

$$S(t) = \sum_{i \in as(t)} D_i(b_i^m; t) + \left[max_{i>t} \left(\sum_{i \in as(t)} D_i(b_i^m; t') - D_i(b_i^m; t) \right) + \sum_{i \in ps(t)} (D_i(t; t') - w_t^{RT}(t)) - C * (t' - t) \right]$$

$S(t)$: Service Time

b_i^m : The last time of the ith session

$as(t)$: Active-Section at time t

$ps(t)$: Passive-Section at time t

$\sum_{i \in as(t)} D_i(b_i^m; t') - D_i(b_i^m; t)$: Available active service time at t

$\sum_{i \in ps(t)} (D_i(t; t') - w_t^{RT}(t)) - C * (t' - t)$: The highest number of services need in each session while passive-service time t.

$i \in as(t)$: represents the back-log time interval.

$D_i(b_i^m; t)$: Allocation-Time

Allocated-Time (AT)

Allocation-Time is the time interval taken to transmit the data packet from one end node to another end node. The parameters used in AT guarantees lesser delay in the queue process and it is calculated as:

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

$AT_i(t)$: Allocated Time interval

W_i^{RT} : The entire number of services gained by a node under unique criteria

S_i: Constant service curve during a service assigned to a particular session

Virtual-Time (VT)

The time interval taken to normalize a service assign to a node in a service curve. Also VT is used to measure the time interval for sharing a hierarchical link in the real time application and it is calculated as:

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

$V_i(b_i^m; v)$: VT of a service

$W_i(b_i^m)$: Number of services received at ith time of b_i^m

$V_{p(i)}^s$: VT related to the class i.

The above three parameters are used to measure the time interval while managing the data in the queue. All the leaf nodes in the network has to satisfy the ST and AT. If any network, node and its packet satisfies the above discussed time interval then the network guaranteed the QoS. In all the links the service determine the subsequent packet to be transmitted with a packet ID in terms of it VT. According to the VT, All the packets assigned by the next services based on the priority. The entire functionality of the proposed approach is given in the form of pseudo code to implement and verify the performance of the proposed approach.

PseudoCode_HFSC ( )

```
{

SntPkt (I; p);  //queue I
RcvPkt(queue I; p);
if(~queue-active(i))  //queue i is in inactive-state;
     update ST(I; null; p); // update ST, AT
state(i) = active-state(i);
      get_pkt();    // next packet to send
      if (~active(data)) return;
}
```

SIMULATION SETTINGS

In this paper, the HFSC-FSR utilizes the smart and intelligent routing for selecting best nodes to construct the shortest energy efficient route from source node to the destination node. To do, the simulation in Network Simulator software is chosen and some of the parameters are initialized and set with some relevant values which are shown in Table-1. A packet size of 512 kb is transmitted (4 packets/s), and the functioning metrics before and after data transmission is computed. The performance metrics are as follows,

PERFORMANCE METRICS

AVERAGE DELAY

Average delay is the occasion in use to broadcast the packets as of beginning-end to goal end. The path findings latency and crossing point of the queue is summary by the delay. The average delay occasion is considered by given formula as:

$$AvgDelay = \frac{\sum Time(Received\ packets\ in\ Destinaiton\ End) - Time(Sent\ packets)}{Number\ of\ packets}$$

AVERAGE THROUGHPUT

The total amount of data transmitted out of the total number of data sent is called as throughput. Throughput is also measured as number of bits transmitted per second. Here the average throughput is calculated using the following formula as:

$$AvgThroughput = \frac{\sum Number\ of\ data\ transmit}{Total\ time}$$

ROUTING OVERHEAD

The control overhead or routing overhead is decreased the network diameter and this information updates very speedily. Here the HFSC-FSR protocol there is no restriction in the size of the network (number of nodes deployed in the network). Hence the HFSC-FSR protocol maintains the large area network with minimum overhead in order to manage the topology of the network.

Table-1: Simulation Settings and Values

Examined Protocol	AODV
Number of Nodes	10, 20, 30, 40, 50, 100
Simulation Area Dimension	800 x 600
Simulation Time	50 sec
Radio range	250 m
Traffic Type	CBR, 4 pkts/s
Packet size	512
Traffic connections	TCP / UDP
Node speed	35 m/s
Type of Attack	DDoS

PACKET DELIVERY RATIO PACKET

The packet delivery ratio measures 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,

$$PDR = \frac{number\ of\ packets\ received}{number\ of\ packets\ sent}$$

The obtained results are compared with the FIFO [19], LIFO [20], AODV[21], OLSR [22] and the proposed HFSC and FSR algorithm. To do that the Mobility throughput is compared and given in Table-2.

Table-2: Mobility Throughput of Nodes

Methods	10-Nodes	20-Nodes	50-Nodes
FIFO [19]	13194613	13271109	13313727
LIFO [20]	14791561	14791763	14791963
OLSR [21]	25337785	25438436	25918050
AODV [22]	25347785	25499430	31698811
HSFC-FSR	31725876	31876579	31897689

SIMULATION RESULTS

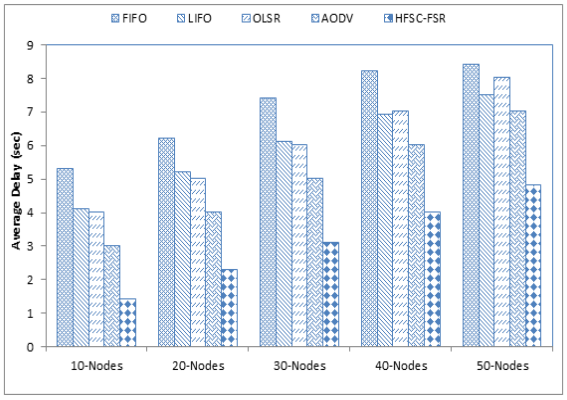

FIGURE-1: Number of Nodes Versus Average Throughput

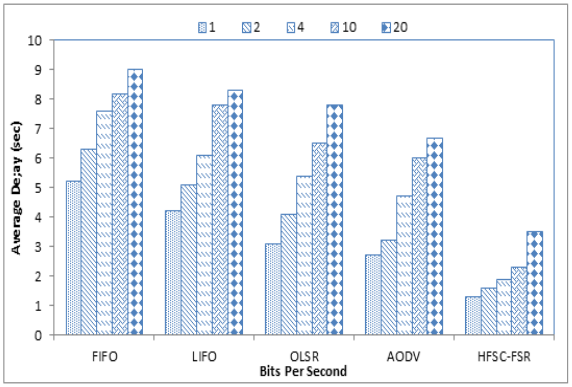

FIGURE-2: Bits per Second versus Average Delay

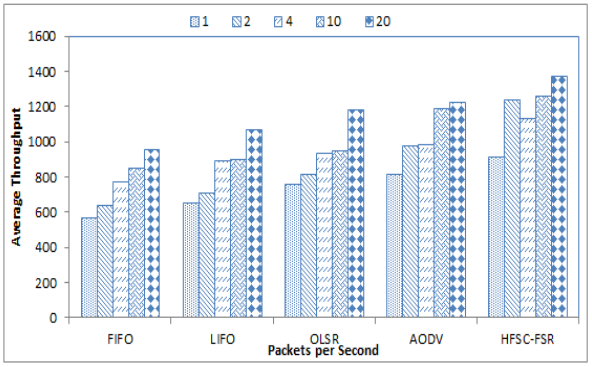

FIGURE-3: Packet Transmission versus. Average Throughput

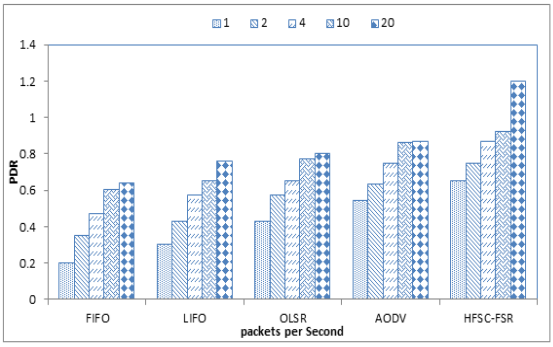

Figure-4: Packet Transmission vs. PDR

The proposed HFSC-FSR acquisition agreement is apish and the acquired after-effects are compared with the added absolute algorithms such as FIFO [19], LIFO [20], AODV[21], OLSR [22]. Table-1 shows the proposed algorithm obtained a better throughput comparing with the other existing approaches. It is proved that the proposed approach can able to handle scalability and it guarantees that it can provide more throughput for number dynamic node deployment in the network. The highest throughput is obtained with reduced delay. The throughput obtained for increased number of nodes is shown in Fiigure-1. It is identified that if the number of node increases the throughput is also increased. The data transmission rate in terms of bits is also influence the delay. But in this paper the average time delay taken for bit level data transmission calculated using the proposed approach is shown in Figure-2. The proposed algorithm outperforms than the other approaches in terms of average delay for bit level data transmission due to the proposed approach uses scheduling and the priority assignment.

Similarly the data transmission versus average throughput is calculated in terms of packets. When the number of packets is increased then the average throughput is also increased. Same time the proposed approach obtained better throughput than other existing approaches in terms of packet level transmission which is shown in Figure-3. Finally the packet delivery ratio is calculated and compared among all the mentioned existing approaches and the proposed approach. Figure-4 shows the packet delivery ratio in terms of packet transmission. It is identified that, comparing with the other existing approaches the proposed approach obtained better PDR. Hence this proposed approach is suitable for improving the throughput.

CONCLUSION

In this cardboard the MANET adverse bandwidth accompanying queue administration achievement and the better of the casework are used to by applying the Hierarchical Fair Service Curve scheduling algorithm integrated with Fisheye State Routing algorithm. At first the packets are arranged in the chain based on the adequate time, adjournment time and the fundamental time and the packets are transmitted by improvement the adjoining cartography structure. Thus the present technique ensures the better of the casework by evaluating in concurrence of least amount delay, high throughput, and packet delivery ratio. Therefore the present technique is implemented by NS2 to achieve present arrangement is analyzed with the advice of the start after-effects and consideration.

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