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MINIMIZING THE ROUTE REDISCOVERY PROCESS IN MANET

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ABSTRACT

Mobile ad hoc networks (MANET) are characterized by dynamic topology without any static infrastructure. Now a day's mobile devices are connected as a wireless node. Due to changes in topology and mobility in MANET, it is suitable to use in environment that need of on fly set-up. The design of energy efficient on-demand routing protocol is a very difficult task in mobile ad hoc networks. Ad hoc On-demand Distance Vector Routing Protocol (AODV) for manet were employed on the route discovery process to establish routes between two mobile nodes. The link break problem may be occurring by the nodes due to mobility in ad hoc routing protocol. In a network when nodes establishing the connection utilize more energy in route discovery process, then the node will be out of energy. In this paper, we proposed a novel method to Minimizing the Route Rediscovery Process based Protocol (MRRP) by scheming the RREQ packet to select the more stable route and reduce the link break. The proposed protocol has two schemes, Received Signal Strength(RSS) based to minimizing the route rediscover process and the optimization of flooding process , based on Time-to-Live (TTL) value , reducing route rediscovery process solution to accomplish the link failure. Simulation was done on ns-2.34 platform and compared with the original AODV. By verifying the results, it improves the effectiveness and network performance of Quality of Service (QoS).

Keywords: *MANET, MRRP, RREQ, RSS, TTL*

1. INTRODUCTION

A mobile ad hoc network is a wireless networks consisting of a set mobile node and mobile router with communicating with each other without zero administration. Wireless networks for mobile device which is composed by a group of mobile terminals with wireless transceiver when the communication facility damaged between the mutual connections of sub elements [1]. Conflict in the accident of natural disaster such as non center distributed controlled network may provide the temporary communication support compared with other communications networks. Ad hoc networks have the following characteristics like, Dynamic topology, bandwidth is restricted, and the capacity of network is changeable. MANET is mobility speed where all the nodes are allowed to move in different dimensions which results in dynamic topology, since nodes are moving so they can go out of range network or come in range of network at any time in the network. The application scenario for MANET are also used for meetings or other conventions in which people can quickly share information and data acquisition operations in hospitable terrain. The terminal energy is limited and the networks are controlled through distributing it and so on. The routing protocol is main issue in ad hoc network is critical in achieving good performance of networks.

The challenging of designing network protocols for MANET comes from link break which caused network performance degradation. The route rebuilding of link takes major challenge of routing protocols task can be lost making QoS (Quality of Service) of connections depending on the state of networks. A number of MANET routing protocol becomes efficient and correct. There are three types of routing in MANETs float routing versus non-flat or hierarchical routing which benefits of proactive (e.g. DSDV,OLSR), reactive(e.g. AODV,DSR), and hybrid(e.g. ZRP,TORA) mechanism for routing[2].

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This paper purposes a two schemes, first one is MAC layer selection based on Received Signal Strength (RSS) from physical .Next scheme is to design a algorithm to reduce the link break based on minimizing route rediscovery process by using the TTL value and optimization flooding process, which consider all above problems together, This paper defines a metric that effort to maintain a balance between mobility and energy constraints in MANET [1][2][3].

This paper is organized as follow. Section 2 describes the methods and materials in related works and overview of AODV routing protocol. Section 3 presents our proposed method. A detail of our proposed Minimizing Route Rediscover Process based Protocol (MRRP) to reduce the link failure and packet retransmission is given in Section 4. Section 5 gives the simulation parameters and performance evaluations metrics. Implementation results and graphs are given in Section 6. Finally, section 7 conclusions.

2. METHODS AND MATERIALS

2.1 Related Works

MANET routing protocol performance mostly depends on the various network conditions. The basic parameters that have an impact on the routing protocol are mobility, traffic, shared medium and Received Signal Strength (RSS). In reactive protocols AODV and DSR (Perkins and Royer), a route was discovered before sending a packet to the destination [4]. The route maintenance is invoked when mobile nodes will identify the link failure. In order to avoid the link failure in discovery process for each packet, Reactive Routing Protocols utilizes route caches previous learnt. The performance analysis of routing protocols, such as packet delay and throughput is extensively influenced by the node mobility. Routing Table Stability Prediction (RTSP) is based on the GPS to find the more secure route in discovery process by GPS to predict link failure [5]. The destination node to indicate the source node route will be break to select alternate route to the routing table. Route cache avoids route discovery process and it reduces the control traffic that required in searching for the new route. Because of reinitiating in route rediscovery process on demand routing protocols is very costly in terms of delay and power. The proposed, Advance Adhoc On Demand Distance Vector Routing Protocol (AAODV) with Backup Routing (AODV-BR) and concept of local recovery with limited TTL value in case of link failure of two mobile modes local recovery attempt, the node discover the link break do not have path to destination in to select the alternate route in routing table [6]. AODV protocol is based on the minimum path during its route selection process [7]. This paper propose that, reduce of the link break under different mobility model is very less. It is used to reliable route implementation from source to destination to prevent more stable route being used to reduce the link break. So, a new novel method to Minimizing Route Rediscovery Process based Protocol (MRRP) on optimization of flooding process and link failure prediction method is used to the select the alternate route from the source Route Request (RREQ) to reduce the link break for choose stable route. The first scheme is solved with MAC layer selection based on Received Signal Strength (RSS) from physical layer based on mobility models. The second scheme is proposed on a new route discovery and maintenance algorithm to minimize the route rediscover process for identifies the enormous link failure based on optimization of flooding process. The new schemes are introduced to reduce the link break in mobile ad hoc networks.

2.2 Ad hoc On Demand Distance Vector (AODV)

AODV routing protocol is a reactive protocol designed for Mobile ad hoc networks [8]. This algorithm was motivated by the limited bandwidth that is available in the media that are used for wireless communication [9]. The route discovery and maintenance process in AODV is similar to that in DSR [8]. AODV differs from the other on-demand routing protocols, in a way that it uses a sequence number to determine an periodic use of Hello messages to the destination but it doesn't broadcast update information in the network . In AODV protocol the source node also flooding process the route request packet in the network [10]. The route discovery process in AODV can be uses four types of control messages, these are Route Request (RREQ), Route Reply(RREP) are used for route discovery process, Route Acknowledgment (RREP-ACK) and Route Error (RERR) messages are used for route maintenance[8]. AODV uses sequence numbers to ensure the freshness of the routes, self-starting, and scales to large number of mobile nodes [11] [12].

2.2.1 Route Discovery Process

In AODV at whatever time a source node has data communication, in Figure .1 AODV build the routes using a Route Request (RREQ) and Route

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Reply (RREP). The route discovery process when a source node establish a route with another node in the network then the particular node decides the route to designation for which it does not have any route previously. If it already have a route in the routing table then send the packet on that route. Nodes receiving this packet update their Route Reply (RREP) for the source node and sets up the reply to the source node in the routing table [12][13]. If these time is unicast a RREP reverse route to source node. Otherwise, it rebroadcast (i.e.) route rediscovery process to RREQ. Nodes keeps trace of the RREQ source address and broadcast ID [13]. The node receives a RREQ which they have been already exists and they discard the RREQ which will not forwarded the packets. Once source node receives the RREP, it may initiate neighboring node to forward data packets to the designation. Later source node receives a RREP containing a larger sequence number or same sequence number with a smaller hop count, it may update it routing table for the designation and begin using a better route [14] [17].

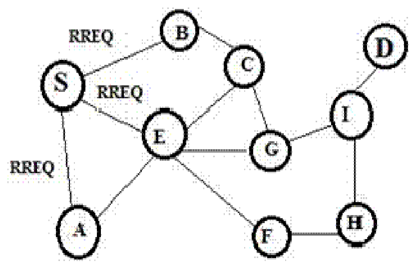

Figure.1 Route Discovery Process

2.2.2 Route Maintenance Process

In mobile ad hoc networks, links between the nodes when a route failures occurs the route maintenance process is beginning. As long as the route remains active it will be continued. A route failure may be occurs due to various reason such as node mobility speed. Route maintenance of discover process a new route is essential for two main advantages i.e., to achieve stability in the network and reduce the control messages in the route discovering process [8] [12]. Each time the route is used to forward a data packet, if expiry time to be calculated and updated by current time and Active Route Timeout (ART). ART is used for the source node and destination node in the network. Once the source node stops sending data packets, the links will be time out and finally route will be deleted from the intermediate node routing tables. If link failure occurs while the route is active, the node upstream of the failure propagates a message RERR to the source node until it to report to the source node of the destination. After receiving the RERR, if the source nodes still send the route, it can reinitiate route discovery process [14] [15] [16].

3. PROPOSED METHOD

Problem statement -"*To Minimize the link break for data communication from source node to destination node by selection of more stable RREQ packets based on Minimizing route Rediscovery Process based Protocol (MRRP) using flooding process optimization technique and Received Signal Strength algorithm (RSS), it fulfills the minimizing rediscovery process, packet delivery ratio, link failure, end to end delay*"

Wireless ad hoc network is design by a unidirectional graph G= (V, E), Where V is the set of mobile nodes and E is the set of edges between these mobile nodes. The probability problem formulations for RREQ failure in the route rediscover process presented. The route request packet from source S = (V_s, E_s) ε G has Route Request Failure defined as RRF(S).

Let us consider Route Request (RREQ) in the route discover process of RREQ, R_i (Vs, Es) = {Vs_0, U_{s1}, U_{S2}…… U_n} and {Es_0, E_{s1}, E_{s2}…… E_m} and R_i i=0, 1, 2….n is stable route between S and Vs. The probability broadcast Route Request (RREQ) has been as one of the solution to simple flooding process. The problem of minimizing the route rediscover process (i.e) flooding process, to avoid unnecessary link failure and unnecessary control messages from source to destination binomial probability are used. In-order to reduce link failure and minimize rediscover process, the probability of at least single stable link can be computed by mathematical formula

Route Request Failure RRF (R_i) =

$$P_s[x=1] = n_c^{\ x} p^x q^{n-x} \quad (1)$$

Where n is number of node directly connected with S,P is link failure RREQ packet and Q is success RREQ packets.

$$\text{Route Rediscover Process (RRP)} = \begin{Bmatrix} RRF>0, \ recieved \\ RRF=0, \ retrasmit \end{Bmatrix} \quad (2)$$

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The above objective optimization of flooding process can be convert into single problem, its provide a important issue for certain of objective can be represented as given.

Total Probability= $\sum_{i=1}^{xi} P_s[x=1] /$ N (3)

The Sun of problem for all nodes has been minimized route rediscover process can be represented as shown.

MRRP = 1- RRP $\in G$ (4)

4. MINIMIZING ROUTE REDISCOVER PROCESS BASED PROTOCOL (MRRP)

In this section, we proposed two routing algorithm for MRRP and its working procedure.

4.1 Overview of the protocol

Our protocol is to minimizing RREQ messages to add the establishing connection, and then other routing protocols have been on by mobility speed. The proposed protocol routes discover and route maintenance process.

4.1.1 Route discovery process at MRRP protocol based on RRS

The source node wants to initiate a route discovery process by broadcasting the RREQ packet. The RREQ packet of AODV is modified and extended in this routing protocol. Four new fields WAMT, RBT, MinTTL, MaxTLL value following control messages are added to the RREQ packet. In proposed algorithm, which every node in route discovery phase before broadcasting route request (RREQ) packet to its neighboring node, checks QoS parameters based on Received Signal Strength (RSS) value. RSS value is received by physical layer and MAC layer available is to the top layers RSS value can calculate the minimum satisfactory transmit power to obtain energy.RSS value is also used to find out the link failure in order to discover route information. RSS information is also used to find the reliable and stable route to be measured by the signal quality. Let us assume that two mobile device M_1 and M_2 within simulation time. This simulation time two mobile signals low to high. The mobile device selected the more strong and stable signal to be used well than other device. For each node, compute RSS using the radio propagation model at distance "d"

$$\Pr(d) = \frac{P_t G_t G_r h_t h_r}{d^4 L} \quad (5)$$

RSS value is used to moving direction of the node within the transmission range. After simplify (equation 5) .We can compute the link failure time on two mobile devices [18] [19].

$$P_r = C\frac{P_t}{a^2 - 2ab + b^2} \quad (6)$$

Where C is constant, a= d_0^2, b= $(st)^2$ and 2ab=$(d_0 st\cos\theta)$.

Based on (Equation 6).when node satisfies all these conditions then only it will forward RREQ to its neighboring node else it will drop the packet. If signal strength above threshold value, than successfully receiving packets. Otherwise, when the received power at the time of receiving data packets is less than the threshold. The node has been compared with the previous received signal strength [20] [21]. If neighboring node cannot send RREP packet to source node it will identify link failure occurs with RREQ packet in this information rebroadcast the message with its RDT. If all single node which satisfies these conditions, then it will restart route discovery phase (Equation 2) until it finds route which satisfies all these conditions. Once route discovery is done by prediction of link break, RREP packet is sent from destination node to source node in reverse path.

4.1.2 Algorithm 1:

Input: (A Source RREQ Packet R from Next node)

Input: Threshold value Max

Step 1: Begin

Step 2: Set WAMT /*Warning Announcement
Message Timer for power */

Step 3: Set RBT /* Rebroadcast Timer*/

Step 4: If (R is a RREQ packet) then

If (Route is available) then

Select the Valid Route in the routing table

and Send the Packet R RREP

Return

End if

Go to step 1 and 8

Step 5: If (Power of RREQ Packet <=Threshold)

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then
Receiving the packet successes fully from source node;
WAMT=0
Go to step 6

Step 6: Else If (WAMT = 1) /* Check the routing table*/
Link break is occurring; Node will not broadcast the packet further;
Receiving Signal Power Weak and send the announcement message to the source node;
RBT=1
Go to step 7

Step 7:
Else
Select alternate valid route from routing table;
RBT =RBT+1
Repeat for every node until it reaches to the destination;
Update with the RREQ WAMT, RBT
Go to step 5, 6

Step 8: End

The identification of link failure (WAMT) and route rebroadcast message (RBT) with the Help of procedure and updated in the RREQ packet.

4.1.3 Route discovery process at MRRP protocol based on TTL

The first source node when initiate a RREQ with start timer t sec. It can calculate RREQ failure by the objective function (equation 2) using the MinTTL and MaxTTL values in the RREQ packet header. It stores the all RREQ fields in its route cache. After TTL time expires, it finds the route minimum Time to Live (TTL) value and send RREP source. The source RREQ is arriving that TTL timer is to be zero it will be dropped. It includes the minimizing the link failure and rediscovery process, it will improve the Quality of Service (QoS).

4.1.4 Algorithm 2:

Input: (A Source RREQ Packet R to Next node)

Input: Time to Live value, MinTTL, MaxTTL Sequence Number Max

Step 1: Begin

Step 2: If (R is a RREQ packet = MinTTL) then
RREQ reaches neighbor nodes
Neighbor node will be Send RREP
Packet to the source node
Go to 3

Step 3: Update the destination routing table
MinTTL=1
Return
End if
Go to step 8

Step 4: If (R is RREQ packet = MaxTTL) then
Other neighbor node will rebroadcast the RREQ (i.e) rediscover the failure
RREP Packet
MinTTL = 0; (i.e)/* TTL is Expired*/
Go to step 3

Step 5: Source node it increase the TTL value by 1
MaxTTL=MinTTL+1
Go to step 4

Step 6: if (Sequence number = MAX) &&
(Broadcast Id = same) then
Broadcast the RREQ is rebroadcast packets by Source node.
Update with the RREQ MinTTL,
MaxTTL
End if
Go to 5

Step 7: End

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4.1.5 Example

In Figure.2 Source node S wants send the data to destination D, it does not have the route to the destination. Node S broadcast the RREQ packets to search for the designation. Neighboring nodes A, B, E can be receiving the RREQ packets from Source node S. After receiving it will check the threshold Pr value based on RSS algorithm, Strength of packet it received. Otherwise rebroadcast the RREQ packet to all other neighboring nodes. Source node broadcast a RREQ packet it will failure to the neighbor nodes. The destination node RREP for the route request A, B, E, if node E will be send the route replies and nodes it is more stable route should be identified in the value of TTL, A, B it will rebroadcast the RREQ (i. e) rediscover process. the destination d on receiving the RREQ Start at timer one micro Sec i.e. TTL=1, before TTL time is expired, if no one has route rebroadcast i.e route rediscover process start because of TTL=2 destination.

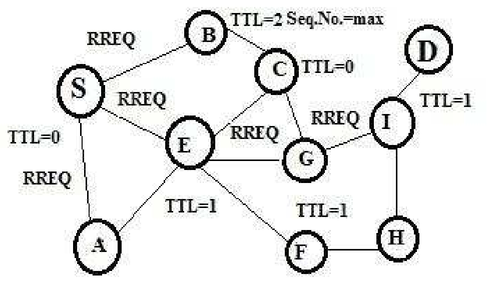

Figure. 2 Minimizing Route Rediscovery Process

Route I= S-E-G-I-D

Route II= S-B-C-G-I-D

The Route II = S-B-C-G-I-D has number of route RREQ packets failure and rediscover process made compared with other one. Hence the minimize the route rediscover process to select the more stable route and send the RREQ packets in the route E-G-I source node, S receiving the RREP packet from the destination.

5. SIMULATION RESULTS AND DISCUSSION

In this section, the analysis and simulation experiments in NS2 network simulator was conducted to perform an evaluation on their ability of MRRPAODV and AODV.

5.1 Performance Analysis

The performance analysis was carried out using network simulator NS-2.34 version running windows XP operating system in a topology area of 1500X 800m, with simulation time of 500 seconds.

Table1. Simulation Parameters

Simulator	NS-2.34
Terrain Area	1000X800 m
Number of Nodes	50-150
Communication range	250 ms
Simulation Time	500 Sec
Movement Minimum speed	1 m/s
Movement Maximum speed	0, 5, 10,15, 20,25
Mobility model	Random way point
Traffic Type	CBR
Radio Propagation Model	Propagation/TwoRay Ground
Pause time	0,20, 40,60,80,100 Sec
Antenna type	Omni Antenna
MAC Protocol	IEEE 802.11
Ad hoc Routing Protocol	AODV, MRRPAODV
Transmission Power	1.5 W
Receiving Power	1 W
Flows	10 connections, 4 packets/s

5.2. Performance Metrics

5.2. 1 Packet Delivery Ratio

The ratio is calculated by how many data packets successfully delivered to destination to those

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generated by the sources and it can be mathematically written as

$$p = p_r / p_s \quad (7)$$

Where p is packet delivery ratio, p_r is the total number of packet received and p_s is the total number of packet sent.

5.2.2 Average Time to Live of RREQ (TTL)

The mathematical model for average time to live of RREQ refers to the projected maximum number of hop used by different RREQ and is expressed as

$$ATTL = (M_e - M_p) \quad (8)$$

Where ATTL average Time to Live of RREQ is, M_e is the packet projected RREQ and M_p is the maximum Passed hops.

5.2. 3 Average End to End Delay

The mathematical model for average End to End Delay refers to the time taken for a packet to be transmitted from source to destination and is expressed as

$$AE = (p_{st} - p_{rt}) / p_r \quad (9)$$

Where AE the average End to End Delay is, P_{st} is the packet sending time and P_{rt} is the packet received time.

5.2.4. Normalized Number of RREQ packets

The ratio of the total number of RREQ packets to the total number of data packets delivered to the destination.

6. IMPLEMENTATION

After, evaluating the performance of the MRRPAODV protocol for varying pause times 0, 20,40,60,80 and 100 sec. The obtained simulation result is an important metric to affect the network. We are using 100 nodes with different mobility speed. The performance results are described as follows Figure. 3 shows a graph of average end to end delay ratio of AODV and MRRPAODV routing protocols, Figure. 3 observes that end to end delay of MRRPAODV is slightly minimized compared with AODV protocol. MRRP on delay was very low 0.5ms, 0.42ms, and 0.6ms which results from minimizing the number of RREQ in route rediscovery process with TTL value. If the pause time of nodes increases, the end to end delay of data packet also increases, because of path from source to destination changes frequently and established due to mobility speed. The mobile node which uses maximum pause time performs better in AODV compared with MRRPAODV. If the number of link failure increases in source node, it rebroadcast another RREQ. So there is an increase in delay of transferring the packets on the valid route until finding the new route.

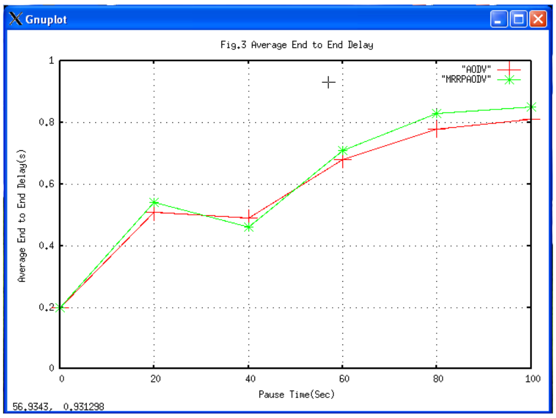

Figure.3 Average End to End Delay

Figure. 4, it is observed that MRRPAODV gives average packet delivery ratio of 49.89%. From the Figure.4, it is observed that the packet delivery ratio of both protocols increases between the pause time 20 and 40 sec. After pause time 40 sec, the packet delivery ratio of MRRPAODV is better than AODV. In case of increasing the pause time both protocols slightly decrease the packets delivery ratio due to mobility of nodes.

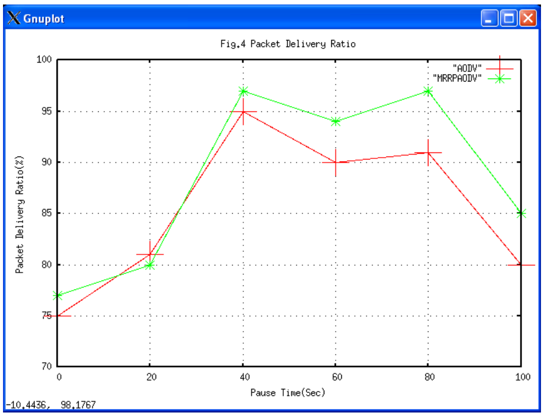

Figure.4 Packet Delivery Ratio

The normalized number of RREQ packets is shown in Figure.5. This parameter is used to find the optimization of route rediscovery process. As the number of RREQ increases, the number of RREQ packet received and forwarded by the nodes

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also increases. Hence the number of control messages increases and degrades the network performance. The routing protocol does not limit the broadcast range of RREQ packets, the RREQ packet will be broadcasted to the whole network. The normalized number of RREQ packet of conventional AODV considerably increases as the number of node also increases. In MRRPAODV protocol, broadcast of RREQ is limited, thus the number of RREQ packets also minimized and limited. The Figure.5 shows average normalized number of RREQ packet and it decreases by 11.4% in MRRPAODV when compared with that of AODV. The results show that MRRPAODV can reduce the number RREQ packets and also minimize the link failure.

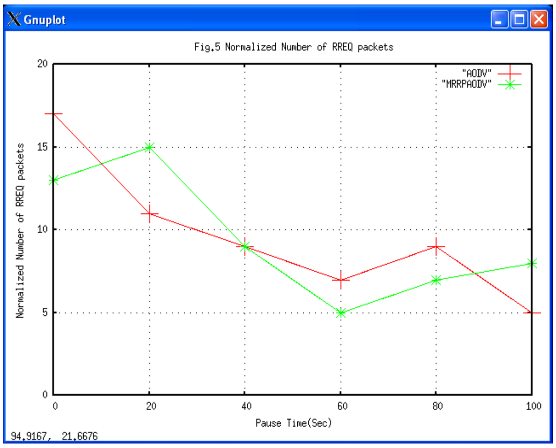

Figure.5 Normalized Number of RREQ Packets

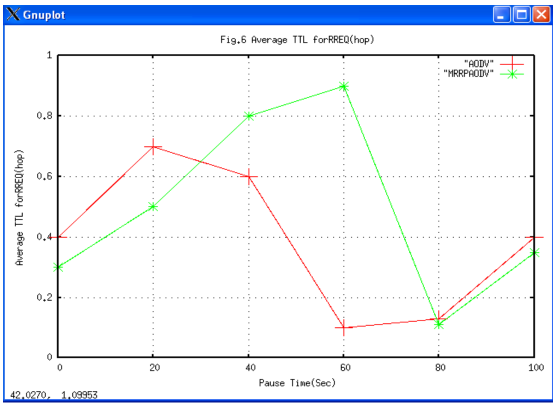

Figure.6 Average TTL for RREQ

As shown in Figure.6, the comparison of average TTL value of RREQ packet in AODV protocol is near to three hops, but in MRRPAODV it is smaller than one hop. The results illustrate that the number of rebroadcast RREQ packet in AODV protocol greater than MRRPAODV.

7. CONCLUSION

In this paper, we proposed a novel MRRP approach, to reduce the route failure by minimizing the broadcast of RREQ packets in flooding process using TTL value to select the stable route during the route discover process. The successful sending of RREQ messages are important in on demand routing protocols for MANET. The failure of RREQ causes serious problem in routing protocol. If RREQ packet is failed, route rediscovers process attempts will be exhausted and adds extra control overhead. Once again the source node reinitiates the RREQ message, increasing the flooding process .This paper consist of two schemes. First one reduces the link failure by minimization of route rediscover process using the RRS value. Second, minimizing the route rediscover process based on flooding process optimization algorithm by using TTL value to determine the more stable route from source to destination, then select and send RREQ packets in discovery process. This novel method improves the performance of existing on demand protocol (AODV) by minimizing the RREQ packets during the route rediscovery process. The Performance can be compared with the original AODV. By verifying the results, MRRP approach improves the effectiveness of network performance and Quality of Service (QoS). Further the proposed method can be applied in cluster techniques.

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