Most Favorable Control Routing Technique

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Abstract - Mobile Ad-hoc Networks (MANET) is a self-administrating network, which consists of wireless mobile nodes that communicate each other without using any fixed infrastructure. Broadcasting plays a vital role, where a source node will transmit a packet to all other nodes in the network to find the destination. Flooding is a broadcast mechanism where every node in the network retransmits a packet to its neighbors upon receiving it for the first time and lead to broadcast storm problems. To overcome these problems, Most Favorable Control Routing Technique is proposed

KEYWORDS: *MANET, ROUTING, PERFORMANCE, AODV.*

I. INTRODUCTION

Wireless technology is one of the fast emerging technologies in the field of networking. The basic design goals are the exchange of information between end users without having any kind of physical connectivity between the devices and supporting mobility of the nodes. The fast growth in the field of wireless technologies is due to the emergence of devices like laptop, tablet, wireless modems and wireless routers that support wireless Local Area Network, which give the user the comfort mobility. With the steady increase in the number of users and mobility, the design of infrastructure becomes costly. This was the time when the Mobile Ad hoc network appeared.

Wireless ad hoc networks (also referred to as packet radio networks and multi hop radio networks) consist of mobile nodes communicating over a shared wireless channel. Contrary to cellular networks, where the nodes are restricted to communicate with a set of carefully placed base stations. MANET, being an infra structure less network, does not have any base station, the structure of MANET and link between nodes change dynamically (David Johnson and David Maltz, 1996) . Due to the any two nodes in wireless ad hoc network are allowed to communicate directly if they are close enough, else nodes use multi hop routing to deliver their packets to distant destinations. Each node must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic.

The major advantage of ad hoc networks is the “On Demand Setup” where all the nodes which want to have connectivity from their own network without the dependence on any infrastructure. This becomes a major use in places of disaster recovery, Defense applications (army, navy, air force) and Academic institutions, where there needs to be a fast communication set up. There is no need of any infrastructure like routers, as all the nodes can act as routers to establish connectivity and start the communication process. This inherent characteristic boosts up the use of ad hoc networks.

For all those reasons, mobile ad hoc networking is one of the most innovative and challenging areas of wireless networking and this technology promises to become increasingly present in everybody’s life.

This might bring a new research focus on the problem that might be to realize minimizing the drainage of battery power, controlling the congestion in Ad hoc networks. This offers many opportunities for a protocol design to find the efficient route discovery as well.

II. MOST FAVORABLE CONTROL ROUTING TECHNIQUE

In a MANET, several system parameters affect network performance, such as node, node density and congestion, because the nodes in a MANET are randomly situated and the topology changes frequently. In the existing AODV routing protocol, the routing table is checked to see whether the route is available so that the source node can transmit a packet to the destination node.

If a route was found, then the node proceeds to transmit the packet; else, it broadcasts a RREQ (route request) packet to the destination node, which on receipt of it sends a RREP (route reply) to the source node. Usually, routing protocols are based on a simplistic form of broadcasting called flooding in which re broadcasting of packets, contention, collisions and broadcast storm problems are the issues that affect performance of routing MANET.

This Most Favorable Control Routing technique segregates the network into five regions according to the means of neighbors. After segregation of the network, it initiates a most favorable route discovery process. In this process, node's neighbor information is the pointer to decide whether a current node is in dense area; the information is collected by broadcasting "hello" packet every second for only one hop.

This packet will ensure that every node has an updated neighbor list. With respect to the number of neighbors for each node, three threshold values are computed to identify whether the region is in high dense, medium dense, medium, low sparse or medium sparse and the rebroadcast are dynamically adjusted. From the collected information of neighboring nodes the first threshold value Average (n_1) is calculated by dividing the total number of neighbors for each node by total number of nodes in the network using equation $n_1 = \frac{\sum_{i=1}^{N} N_i}{N}$, where n_1 is the average number of neighbors; N_i is the number of neighbors of each node; N is the total number of nodes. Using threshold value Average the next threshold value Minimum (n_2) is calculated using Equation $n_2 = \frac{\sum_{i=1}^{r} N_i}{R}$, dividing the total number of neighbors below Average by the total number of nodes whose neighbors are below Average, where n_2 is the mean minimum number of neighbors; N_i is the number of neighbors of each node below average; R is the total number of nodes whose neighbors are below average using the threshold value Average the next threshold value Maximum (n_3) is calculated using Equation $n_3 = \frac{\sum_{i=1}^{k} N_i}{K}$, dividing the number of neighbors of each node above average by the total number of nodes whose neighbors are above average. where n_3 is the mean maximum number of neighbors; N_i is the number of neighbors of each node above Average; K is the total number of nodes whose neighbors are above Average.

The nodes having the value of neighbor nodes less than threshold value minimum n_2 are identified and segregated into low sparse region. The nodes having the value of neighbor nodes greater than are equal to minimum n_2 threshold value and less than average threshold value are identified and segregated into medium sparse region. The nodes having the value of neighbor nodes equal to average threshold value are identified and segregated into medium region. The nodes having the value of neighbor nodes greater than average threshold value and less than are equal to maximum threshold value are identified and segregated into maximum dense region. The nodes having the value of neighbor nodes greater than maximum threshold value are identified and segregated into high dense region.

The steps involved in Most Favorable Route discovery algorithm is given below,

Step 1. On hearing a broadcast packet m at node X;
Step 2. Get the average number of neighbors (n1), minimum numbers of neighbors (n2) and maximum number of neighbors (n3) .
Step 3. Get the total number of neighbors (n).
Step 4. If packet m received for the first time then
Step 5. If n<n2 then
Step 6. Node lies in the low sparse region = Cmin
Step 7. If n>=n2&&n<n1 then
Step 8. Node lies in the medium sparse region = Cmin1
Step 9. If n==n1 then
Step 10. Node lies in the medium region = Cmid
Step 11. If n>n1&&n<=n3 then
Step 12. Node lies in the medium dense region = Cmax1
Step 13. If n>n3 then
Step 14. Node lies in the high dense region
Step 15. If counter threshold value>RREQ_RETRIES
Step 16. Free the RREQ packet
Step 17. Else
Step 18. Rebroadcast the packet
Step 19. End If

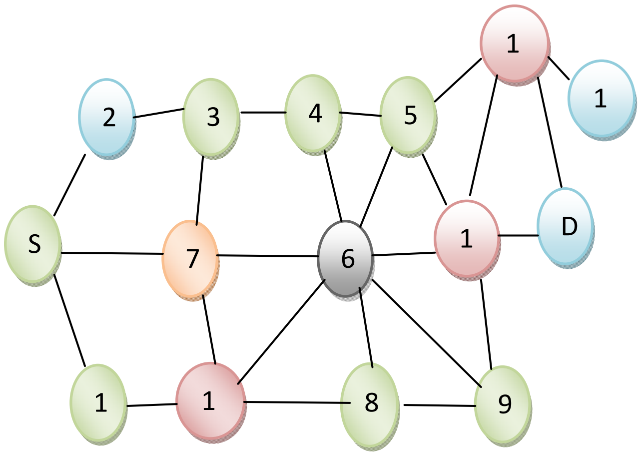

Figure1. Network classification

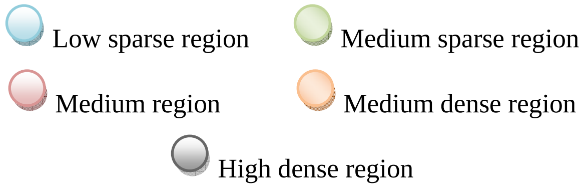

Figure 1 shows that, the total number of nodes is equal to 15. The total number of neighbors is calculated based on one-hop neighbors of each node and the value of 47 is obtained. Therefore,

AVG = Total number of neighbors / Number of nodes = 47/13 = 4

MIN = Total number of neighbors below average / Number of nodes below average = 26/10 = 3

MAX = Total number of neighbors above average / Number of nodes above average = 12/2 = 6

Based on the regions segregated the rebroadcasts are dynamically adjusted by enabling the rebroadcast or interrupting the packet rebroadcast. The simulation results reveal that total number of possible rebroadcasts of Route request packet (Total no of ReBroadCast) using the Most Favorable Control Routing (MFCR) is less in number compared with normal AODV algorithm.

III. Performance Evaluation

The objective is to evaluate the performance of efficient broadcasting using Most Favorable Control Routing Technique (MFCR) in a simulated environment. Three performance parameters are used: packet delivery ratio ,routing overhead and end to end delay. The impact on these metrics at various CBR sending rate and maximum speed for the proposed schemes are studied. The results are collected as average values of over 10 runs of each simulation setting. The simulation results of the proposed scheme are compared with AODV and found that the proposed schemes have outperformed the traditional AODV at the time of link breakage.

IV. Simulation Setup

A simulation model is set up for experimentation and performance evaluation of the proposed algorithm with NS-2 simulator. The MAC layer protocol used in this simulations was the Distributed Coordination Function (DCF) of IEEE 802.11 . DCF uses Request-To-Send (RTS) and Clear-To-Send (CTS) control packets for unicast transmissions. Broadcast packets are sent using the unspotted Carrier Sense Multiple Access protocol with Collision Avoidance (CSMA/CA) . A two-ray propagation model was also used in the simulations. Wave LAN was modeled as shared media radio with a nominal bit rate of 2 mb/s and the radio range was 250 m. The trace was constant bit rate (CBR). The source and destination of each CBR flow was randomly selected but not to be identical (sources and destinations of different flows might coincide). Each source transmitted 512 bytes of data packets at a specified rate (packets per second). The mobility model was random waypoint, where the speed of a node was randomly chosen from 0 m/s to a given maximum value, and the node stayed for a pause time after reaching a waypoint. The field configuration was 1400 m^2 with 100 nodes.

V. Performance Metrics

The three important performance metrics considered for performance evaluation are;

- Packet Delivery Ratio (PDR)
- Routing Overhead
- End to End delay

Packet delivery ratio is the ratio of the data packets delivered to the destinations to those generated by the CBR sources; also a related metric, received throughput (in kilobits per second) at the destination has been evaluated in some cases.

Routing overhead is the number of routing packets transmitted per data packet delivered at the destination.

End-to-end delay include all possible delays caused by buffering during route discovery latency, queuing at the interface queue ,retransmission delays at the MAC , and propagation and transfer times.

VI. Result Analysis

The impact on these metrics at varying network load and maximum speed for the proposed algorithm and the existing algorithm are computed. The results obtained are represented in table format. The effect of CBR sending rate on Packet delivery ratio is shown in Table 1 for Most Favorable Control Routing Technique (MFCR) and AODV. It may be noted that the packet delivery ratio of both protocols decreased as the CBR sending rate increased. If the CBR sending rate increases, the probability of losing a packet will be high. However, MFCR has higher packet delivery ratio than has AODV.

Table 1 Packet delivery ratio over Network Load (packets/sec)

CBR sending rate (packets/sec) of 512 bytes	**Packet delivery ratio**	
	MFCR	**AODV**
3	95	90
6	84	80
8	76	70
10	61	55
12	52	50
16	45	40

The effect of varying Maximum speed on Packet delivery ratio for MFCR and AODV is shown in Table 2. The results are represented, the packet delivery ratio begins to decrease as route breaking shall occur frequently. However, the MFCR protocol, with its efficient route discovery and preventive congestion mechanism, offers increased packet delivery ratio as compared with AODV.

Table 2 Packet delivery ratio over Maximum speed

Maximum speed	**Packet delivery ratio**	
	MFCR	**AODV**
10	90	70
20	88	75
30	86	80
40	84	74
50	82	73
60	80	69

The effect of varying CBR sending rate on routing overhead for MFCR and AODV is shown in Table 3 The results are represented the total number of RREQ, RREP, RERR and CSP packets transmitted during the simulations. If CBR sending rate increases, the wastage of control packets tends to rise. Compared with AODV, MFCR incurs lesser wastage of control packets.

Table 3 Routing Overhead over Network Load (packets/sec)

CBR sending rate (packets/sec) of 512 bytes	Routing Overhead (Number of control packets)	
	MFCR	AODV
5	10000	10000
10	18000	32000
15	28000	48000
20	35000	50000
25	40000	55000

The effect of varying Maximum speed on routing overhead for MFCR and AODV is shown in Table 4. If CBR sending rate increases, the wastage of control packets will be more. Compare with AODV, MFCR protocol is wasted less number of control packets.

Table 4 Routing Overhead over Maximum speed

Maximum Speed	Routing Overhead (Number of control packets)	
	MFCR	AODV
10	17500	10000
20	18000	11000
30	18500	12000
40	19000	13000
50	19200	13800

The effect of varying CBR sending rate on End-to-End delay for MFCR and AODV is shown in Table 5. The delay a packet suffers from the source to reaching the destination. If CBR sending rate increases, the end-to-end delay will also increase. From the Figure, it may be understood that AODV-EBRP has shorter end-to-end delay than AODV.

Table 5 End-to-End delay over Network Load (packets/sec)

CBR sending rate (packets/sec) of 512 bytes	End-to-End delay in Seconds	
	MFCR	AODV
4	0.0	0.0
6	0.7	1.0
8	1.1	2.0
10	2.0	3.0
12	2.3	3.7
16	2.8	4.2

The effect of varying Maximum speed on End-to-End delay for MFCR and AODV is shown in Table 6. If node mobility increases, the end-to-end delay will also increase. Route failure probability is reduced in MFCR.

Table 6 End-to-End delay over Maximum speed

Maximum speed	End-to-End delay in Seconds	
	MFCR	AODV
10	0.40	0.60
20	0.40	0.60
30	0.41	0.61
40	0.43	0.70
50	0.45	0.80

VII. CONCLUSION

In this paper we proposed Most Favorable Control Routing discovery algorithm. The implementation of most favorable method has provided optimal route discovery solution. The proposed route discovery technique is able to overcome the broadcast storm problems associated with flooding. To ensure the necessary QoS in terms of delay & bandwidth while sending packets, reduce the redundant rebroadcast of packets ensuring the increase in packet delivery ratio, less routing overhead and minimum end to end delay.

VIII. REFERENCES

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