RESEARCH ARTICLE OPEN ACCESS

Enhance Quality of Service (QOS) By Using AODV Based Routing Algorithm in MANETs

Ala Anjaneyulu
M.Tech
Department of Information Technology (Software Engineering)
Gayatri Vidya Parishad College of Engineering (Autonomous)
Visakhapatnam
Andhra Pradesh - India

ABSTRACT

Mobile Ad hoc Networks is a collection of wireless mobile nodes. Due to the mobility of mobile nodes, topology changes every time dynamically. Mobility of nodes results in breakage of the links due to ever changing topology of the nodes. If the wireless mobile nodes increases of the ad hoc network more link errors are likely to occur. When this happens, route repair is typically performed to establish a new route. Such route repair mechanisms suffers with the problems like high control overhead and long packet delay making them inefficient due to frequent failures of intermediate connections in an end-to-end communication. When there is a breakage in the intermediate link, it is favourable to discover a new route locally without resorting to an end-to-end route discovery by using local route repair (LRR). In some situations, each intermediate node cannot repair the break link and cannot find a new route to the destination. Then, the source node will consequently receive a route error (RERR) message.

Energy depletion of nodes in Wireless Ad hoc Networks is one of the prime concerns for their sustained operation. Link failures occur not only of mobility nodes and it also occur due to low energy of nodes. In this paper, a proposed new AODV based routing algorithm to overcome the disadvantages in LRR. In this algorithm, to configure one of the node as a guard node and that must be middle of the source and destination in that network. The guard node should be stable throughout the entire data transmission.

Keywords:- MANETS, Local Route Repair, AODV, Residual Energy, Guard node.

I. INTRODUCTION

A Mobile Ad hoc Network (MANET) [1] is a set of mobile nodes which do not have any centralized node to take control over the network. Wireless receiver and transmitter plays the main role in Ad hoc networks to communicate with other nodes. These wireless receiver and transmitters allow a node to communicate with other nodes in a particular radius. The major characteristic of MANET is multi hop communication i.e. if a node needs to forward the packet outside its radius, then it should have a support from other nodes in the network. So, each node must be a host as well as router at the same time depending on the situation. The topology of the network changes regularly due to mobility the mobile nodes are, move into, move within or move away of from the network.

In MANET, a wireless node has a responsibility of being the destination; source an intermediary node of data transmission depending on the requirement. When a wireless node is in intermediate position between two nodes, then it acts as a router which, can forward and receive data packets to its closest neighbours that are nearer to the destination. Due to dynamic environment of Ad hoc network, mobile nodes hold on going rather than stay still. Therefore the time to time change in network topology occurs.

Types of Routing Protocols

There are many routing protocols for implementing Ad hoc networks. Depending on these two requirements, the routing protocols are divided into three types:

1.1 Proactive Routing Protocols

Proactive routing protocols are also called as “Table driven” routing protocols. By using proactive protocols, each and every node in the network have constantly access to the routes for all available nodes and will keep up to date data of routing.

So, when a source node gets a route, it gets one immediately. In these routing protocols each and every node which is in the network should keep a regular view of the topology. If any change which occur in the topology of the network, the updates must be generated to all of the nodes through the network in order to reflect the change. Examples are DSDV and OLSR.

1.2 Reactive Routing Protocols:

Reactive routing protocols are also named as an “On Demand” routing protocols. These routing protocols don’t maintain any information about the routes. In reactive protocols, if a node wants to communicate with some other node within the Ad hoc network, it applies route discovery mechanism.

The routes will be maintained at the time of communicating or some time period. However, if these routes are required frequently, the can be stored. The main problem of these protocols is the routes discovery latency. Examples are AODV and DSR.

1.3 Hybrid Routing Protocols

These protocols which have aggregate both the feature of proactive and reactive routing protocols. It reduced the route discovery latency in reactive protocol and decreases the control overhead in proactive routing protocols. This protocol is based on hierarchical or layered system structure.

AODV:

AODV [2] is an on demand routing protocol. AODV supports both unicast and multicast communication between nodes. AODV uses hop by hop routing which means routing not only involve source node but also intermediate node takes part in it. AODV is most used protocol in ad hoc networks. AODV uses symmetric links between neighbouring nodes. AODV combines the features of DSR and DSDV. AODV uses a broadcast route discovery mechanism as is also used in the DSR. To maintain the most recent routing information between nodes it borrows the concept of destination sequence numbers from DSDV. AODV involves separate process for route discovery and for Route maintenance. AODV also uses routing table for maintaining routing information. This is called route table management [2].

1. Route Discovery:

First source node initiates the Route Discovery [2] process when it needs to communicate with another node. To discover a new path, source node broadcast a route request (RREQ) packet to all its neighbours. When the RREQ packet goes to intermediate nodes that node first check its routing table. If a valid route is present then the node reply with a RREP packet and if not then the node rebroadcast the RREQ packet to its own neighbour. If a node gets more than one copy of a RREQ packet for the same broadcast id then the node drop that packet and does not forward duplicate copy. Route discovery set a path in two phases one is reverse path set-up and other is forward path set-up.

1.1 Reverse Route set-up:

For reverse route formation, a node must store the address of the neighbour in its routing table from which the RREQ packet has been received first [2].

1.2 Forward Route Set-up [2]: When an intermediate nodes receive RREQ packet. The node first checks the RREQ destination sequence number with the one that is present in its routing table. If the intermediate node’s sequence number is less than that in RREQ packet, then the intermediate node does not use that route and send no reply to sender. If sequence number at intermediate node is larger or equal to the RREQ sequence number, then the node reply to the neighbour from which the RREQ packet has been received with a RREP packet. As the RREP travels back to the source, each node along the path set up a forward pointer to the node from which the RREP came. If a node receive more than one route reply, then it forward that route reply RREP to source only whose current destination sequence number is high or at least equal to the destination sequence number present at node but with small hop count. It also ensures that the routing information is up to date and quickest. As the source node receives first RREP, it starts transfer of data.

2) Routing Table:

AODV has separate routing table for both unicast and multicast routing. The routing table has all the useful information for a node like sequence number, lifetime of a route, hop count etc. Besides these values it also has an entry for a timer called route request expiration time [2] and route cache timeout [2] after which the route is considered as invalid. Like DSDV, its routing table also has sequence number for all routes. These sequence number ensures loop free path. This information helps when any link between the paths breaks. When a new route is discovered then the node first checks the destination sequence number present in its table. Destination sequence number gives information about the freshness of route [2].

3) Route Maintenance [2]:

During data delivery if the source node moves away the path is lost than it can reinitiate the route discovery process. When an intermediate node on the route moves away from the path then a route error message is sent to source. To detect link failure hello messages and link layer acknowledgement is used [2]. When a link break is noticed on source node then the source node can re-initiate route discovery if the route still needed by the source. AODV used so much because it can handle different types of mobility rate with different types of data traffic. AODV also reduces routing overhead of control packets and modifications are further applied to improve scalability of the protocol. AODV applies local repair when the upstream node is closer to the destination [3].

II. RESEARCH ON LOCAL REPAIR

Various novel algorithms have been proposed by researchers to improve AODV when links break. Srinath, P., Abhilash, P., & Sridhar, I. presented a strategy called Router Handoff. In this approach if at a certain point a node that detects one of its links weakening, it pre-emptively hands off routing information to a node that is suitably situated. This resulted in routing around the weak links and prevented the route from being broken [7]. Crisostomo, S., Sargento, S.,Brandao, P., & Prior, have proposed a Pre-emptively Local Route Repair scheme aiming to avoid route failures by pre-emptively local repairing routes when a link break is about to occur. Their Proposal was to enhance node information referring to link stability to its neighbours resorting to HELLO messages which were appended with a mobility extension containing the position of the node, a motion vector and a timestamp associated with it. Based on the concept of localizing the route request query, Pan, M., Chuang, S. Y., & Wang, S. D. have proposed an approach to repair error links quickly. The authors have tried to improve the current implementation of local repair in AODV in order make the implementation cost effective. The metric used to evaluate the mechanism is based on no. of successfully transmitted packets in a period [5]. Bai-Long, X. I. A. O., Wei, G., Jun, L., & Si-Lu, Z. have proposed a new mechanism for route repair by modifying the information contained in the packets(RREQ and RREP) of AODV-LLR so as the repair is only confined to the vicinity of the broken links. In this mechanism if the intermediate node detects that the link to the next hop is broken, it then consults its routing table. If it finds a valid entry for next-to-next hop node, the intermediate node increments the SC (Sequence Counter) for the destination and broadcasts a Repair_RREQ message with a TTL=k for the next-to-next hop node. If the Repair_RREQ message reaches the next-to-next hop node through some other intermediate node, it generates a Repair_RREP and unicast the message to the Repair initiator [4]. AODV as described by Perkins, C., Belding-Royer, E., & Das, S. [6] tends to repair the broken route if the node is near to the destination node. Otherwise, if the break node is very distant from destination node, a RRER message is propagated back to source node and the source node rebroadcast RREQ to find a new route. Unlike AODV, the approach proposed in this paper can repair break route without considering the distance between the broken node and the destination node.

III. EXISTING SYSTEM

In existing system, AODV protocol used for route selection and route maintence. In this protocol, if any link failures occur while data transmission the RERR message send to source node, then source node reinitiate the route discovery process for establish new path. This is the one way to find the whole new route from the source to destination. The other method, called Local Repair, is to find a new route from the upstream node of the broken link to the destination. In other words, if any intermediate detect link failure then that node broadcasts RREQ message to find a new route to destination instead of sending Route ERROR (RERR) message to the source to initiate a new whole route discovery process. However, in certain cases, the local repair causes the network performance degradations. If the local repair is not successfully completed, the source repair process needs to be started, so that the delay to recover the broken link increases more. In particular, when the route to be locally repaired is long, the performance degradation increases because other links in the upstream route can be broken during performing the local repair.

IV. PROPOSED SYSTEM

In this thesis, proposed a new AODV based routing algorithm to overcome the disadvantages in LRR. In this, to set one node as a guard node and that must be middle of the source and destination in that network. The guard node should be stable throughout the entire data transmission. Source selects path from source to destination based on the remaining energy values of the node. Each node calculates their remaining energy values by own and broadcast to their neighbours. Remaining energy calculated by using below formula:

In Transmit mode:

Residual Energy (RE) = (Initial Energy)-(Transmit Power) (Transmit Time)

In Receive mode:

Residual Energy (RE) = (Initial Energy)-(Receive Power) (Receive Time)

Proposed Algorithm:

1. First source node send route request (RREQ) to all neighbors.

2. Which nodes receive RREQ from their neighbor nodes, calculate residual energy. This process continues until reach the destination.

3. Destination node send route reply (RREP) along with residual energy to source node according to arrival of RREQ.

4. Source node after receiving RREP from destination, it calculates total residual energy for each path. After that source nodes select path with path having total residual energy in that path.

5. Before sending the data, source node send entire routing information to guard node along with selected path.

6. After that source node send data via selected path.

7. While data transmission, if any link failures occur:

7.1 If it is nearer to destination, then it uses local route repair. If it is not repair within the time, then it send route error (RERR) packet to guard node. If it is not nearer to destination, then it send RERR packet to guard node.

7.2 When guard node receive any RERR from neighbors, first it will check time interval.

7.3 If the link fail time is longer than initial data transmission time, then guard initiate the reroute discovery process to establish path from guard node to destination.

7.4 If the link fail time is no longer than initial data transmission time, then it select which path having highest total residual energy from routing table which is send by source to guard node at the time of before initial data transmission.

V. RESULTS AND ANALYSIS

To evaluate our proposed routing algorithm, an extensive simulation study is performed using the NS-2 simulator [9]. We compare this proposed routing algorithm with the LLR routing protocol. The simulation is carried out for 100 seconds and using a topology size of 1000 meter * 1000 meter. We use the two Ray ground as a model of propagation and the Constant Bit Rate (CBR) as a traffic type.

In this section, we evaluate the performance of the different routing protocols using the following metrics:

1. Packet Delivery Ratio
2. Throughput
3. End to End delay

1. *Packet Delivery Ratio*: The packets percentage successful deliver at destination are called as Packet delivery Ratio (PDR) or Packet Delivery Fraction (PDF). These Xgraphs give you an initiative about the PDF performance in case of AODV based LRR and Proposed AODV based new routing algorithm. The PDF value is completely depend on the ratio of send and receive it means if ratio are equal of any value then the PDF is shows the full performance. In this Xgraph the performance of proposed scheme are slightly more than normal routing. This described clearly that in proposed scheme the more number of packets are deliver in network and also receives in network as compare to previous.

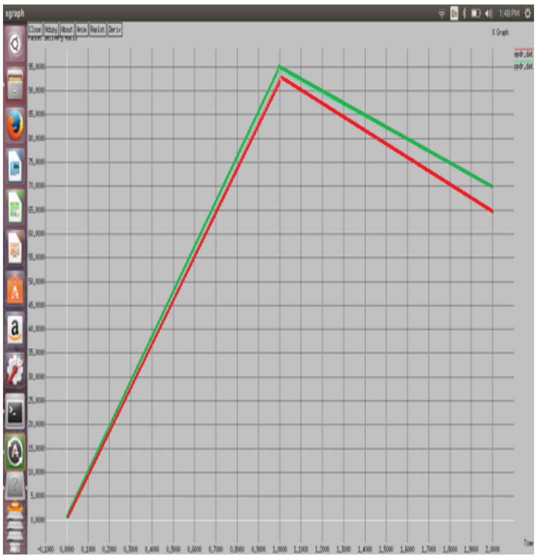

Figure 4.1.3: X-graph for Packet Delivery Ratio of proposed and existing system

2. Average End to End Delay: The average amount of time required to send the data packets from source to destination. In this xgraph the end to end analysis in case of old and proposed scheme are assessed. Here the end to end delay in case of Old scheme is more than proposed scheme the.

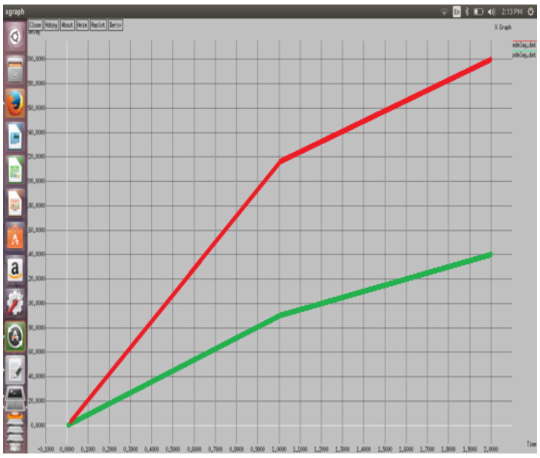

Figure 4.1.3: X-graph for End to End delay of proposed and existing system

3. *Throughput:* The packets receiving measured in network in per unit of time are evaluated through performance matrices Throughput. The packet successful receiving is enhanced in case of keep on delivery of packets and if the link is break then in that case the packet transmission is affected. In this xgraph the throughput analysis in case of Old and Proposed scheme are assessed. Here the maximum throughput in case of Old scheme is about 220 pks/sec. at time about 20 sec but in case of proposed scheme the throughput is more than about 320 pks/ sec. due to the AODV based routing algorithm. It means the proposed scheme improves the routing capability of AODV protocol.

Figure 4.1.3: X-graph for Throughput of proposed and existing system

VI. CONCLUSION

In this paper, reviewed some of the techniques that have been proposed for local route repair by various researchers to increase the efficiency of the standard route discovery and maintenance procedures employed by AODV protocol. In addition, proposed a new routing algorithm of route repair which can be incorporated in standard AODV for improved performance. The results indicate that proposed algorithm enhanced the performance in terms packet delivery ratio, the average End-To-End delay and the throughput.

REFERENCES

[1] G. Perkins, Ad Hoc Networking, New York: Addison Wesley, 2000.

[2] C. E. Perkins and E. M. Royer, "*Ad hoc On Demand Distance Vector Routing*". Mobile Computing Systems and Applications, 1999. Proceedings. WMCSA '99. Second IEEE.

[3] C. Perkins, E. Belding-Royer and S. Das, "Ad hoc On-Demand Distance Vector (AODV) Routing", IETF, RFC 3561, July 2003.

[4] Bai-Long, X. I. A. O., Wei, G., Jun, L., & Si-Lu, Z. (2006,June). *An improvement for local route repair in mobile ad hoc networks.* In ITS Telecommunications Proceedings, 2006 6th International Conference on (pp.691-694). IEEE.

[5] Crisostomo, S., Sargento, S., Brandao, P., & Prior, R. (2004, May). *Improving AODV with preemptive local route repair*. In Wireless ad-hoc networks, 2004 international workshop on (pp. 223-227). IEEE.

[6] Pan, M., Chuang, S. Y., & Wang, S. D. (2005, December). *Local repair mechanisms for on-demand routing in mobile ad hoc networks*. In Dependable Computing, 2005. Proceedings. 11th Pacific Rim International Symposium on (pp. 8-pp). IEEE.

[7] Perkins, C. E., & Royer, E. M. (1999, February). *Ad-hoc on-demand distance vector routing*. In Mobile Computing Systems and Applications, 1999. Proceedings. WMCSA'99. Second IEEE Workshop on(pp. 90-100). IEEE.

[8] Srinath, P., Abhilash, P., & Sridhar, I. (2002, December). Router handoff: A preemptive route repair strategy for AODV. In Personal Wireless Communications, 2002

[9] Network Simulator, http://www.isi.edu/nsnam/ns.