An Approach to Link Failure in MANET

Charu Gupta and Pankaj Sharma

Department of Computer Science & Engineering ABES Engineering College
Ghaziabad, India

Summary
Mobile Ad Hoc Network (MANET) is one of the most promising wireless network architectures. It is a wireless network of mobile devices which are configured itself. The major issue created due to nodes mobility in the Ad hoc network is Link Failure, if routing protocol give quickly responses to the network topology than it will be avoided. By reactive protocol like AODV, packet dropping rate, end-to- end delay will increase and packet delivery rate will be reduced. As having such disadvantages, we suggest a new Algorithm which acquaint a method of link failure prediction and consequently execute a rapid local route repair. Simulation proves that this new algorithm minify packet dropping rate and end-to-end delay and maximize packet delivery rate. We can reduce the delay results from sending link failure information back to the sender which is one of the major advantage of this new approach. It will result in much better and efficient AODV routing protocol in terms of the metrics: End to-end delay, Packets dropped, Routing overhead.

Keywords
MANET; Link failure AODV.

1. INTRODUCTION

A mobile Ad-Hoc network (MANET) [1] is a self-configuring, infrastructure less network composed of mobile devices connected by wireless link. It is dynamic in nature in terms of movement of mobile nodes. Each mobile node acts as a router and maintains a table to ensure route traffic orderly. It is one of the challenging task in MANET. These networks consist of wireless transmitters and receivers with omnidirectional and directional antennas. In infrastructure less and disaster situations there is a need of this kind of networks which are good candidates for" anywhere and at any time". Examples of MANET application consist of disaster recovery and military application. It is not limited to this application only, can be used in any scenario. For an example, an Ad-Hoc network is formed by connecting all machines in a group of people coming for a business meeting at a place when no network services are available. Any message sent by mobile node is consecutively received by all of its neighbouring nodes. If any node wants to send message to a mobile node which is not under the transmission range of the sender node then the intermediate nodes act as router and forward the message. It is not feasible to acquire fixed paths for sending the message because of node mobility. It leads to numerous routing protocols proposed for Ad-Hoc wireless networks. It is classified into proactive or reactive based on how route information is maintained.

As different Ad hoc routing protocols have been developed and implemented and classified into various classes. Ad Hoc On Demand Vector Routing (AODV) and Dynamic Source Routing (DSR) are standard routing protocols which are most commonly used. Several other protocols are being developed or modified both proactive and reactive routing protocols like Dynamic Destination-Sequenced Distance-Vector routing' (DSDV),Optimized Link State Routing (OLSR), Topology Broadcast Based on Reverse Path Forwarding (TBRPF), Signal Stability based Adaptive routing (SSA), and mixed routing protocols such as the Zone Routing Protocol (ZRP) and many others [2].

One of the most common and widely used reactive routing protocol for Ad hoc network is AODV [3]

It searches for route when required by source node i.e. on demand. It possesses the characteristic of maintaining the routes in the case of dynamic network where each node is moving. It incurs low processing and memory overhead which in turn minimizes the overall network utilization makes it appropriate for the MANET.

Furthermore, this protocol makes use of sequence number for loop freedom mechanism in each route. The steps to send a packet from sender to destination through AODV are as follows: Firstly, the source node starts route discovery through broadcasting Route Request (RREQ) packet then adjacent nodes will forward RREQ until the packet is reached at the destination or RREQ arrives at the node that has a new fresh route to the destination. Secondly, a Route Reply (RREP) is sent by receiver to the source (originated route). Once the sender-node receives a RREP, it can initialize using this path for data packet transmission. In the case of link failure, Route Error (RERR) is sent back to the source node. It is generated by the node at which link failure is occurred.

In this paper we discusses a new Divert Link Failure Algorithm, which predicts the link failure, and perform local route repair with low end-to-end delay and packet dropping and increases packet delivery rate.The rest of the paper is structured as follows. In section II we present related work carried out in this field; in section III we present an introduction to the working of AODV protocol;

Manuscript received November 5, 2014
Manuscript revised November 20, 2014

in section IV we present our proposed work along with algorithm; in section V we conclude the work.

2. RELATED WORK

Long-lived Route Protocol is proposed in [4] which is used to measure the probability of wireless link between two nodes at time t, t0, given that a link exists between them at time t0.

It selects the route with largest minimum link probability i.e. the longest-lived route rather than the normal shortest hop route.

A model based on link prediction is proposed in [5], which determines the state of link and prior to link breakage route is maintained. It forecast the link status and if any of the hop nodes presumes that link is going to be broken it will notify the source node to discover the new acquirable route ahead of link breakage. It doesn't examine much about the RREP back on the reverse route reconstructed on the link failure and link propagation delay at the time of RREQ propagation. It turns out in congestion, delay, overhead and Bandwidth miss utilization. However, its not much different from standard

AODV link failure mechanism because in this case of link failure no one considers the prevention of reverse route propagation back to the source node. This is the concerned topic of research. This paper discusses a protocol which proves better than the Long-lived Route Protocol and link state prediction methods in the way it handles the link failure.

3. PROBLEM IDENTIFICATION

Fig 1 illustrates how AODV standard routing protocol behaves in the concern of link failure. As Figure 1 describes, after the link is broken Current Node (C) sends an Error message to the sender. Then the sender will rebroadcast again a new route request throughout network. Results in congestion, delay, overhead and so on. In the standard AODV protocol, upon a link failure, the node that detects the link failure sends an error message packet back to the source, the source then will initiate a new route discovery [6]. As shown in Figure1, the distance, where the link failure is happen, is far from the source. Whatsoever, to re-establish a new global route discovery from the source, it clearly causes a significant overhead, network congestion as well as high bandwidth utilization.

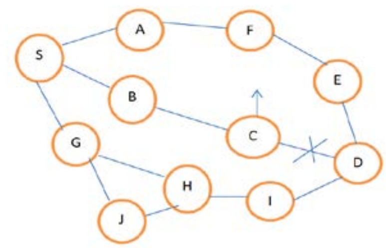

Fig 1: AODV Link Failure

4. PROPOSED ARCHITECTURE

Working and Architecture

AODV routing algorithm is used in this proposed mechanism as AODV is a proactive approach. Initially AODV finds the path if the source node 'S' wants to transmit the data to the destination node 'D'. Each node between the route from 'S' to 'D' maintains a table containing the values of source address, RSS(Request Signal Strength) of last hop ,Address of last hop, distance variation, difference in RSS.

A. RSS Calculation [7]

One way to calculate RSSI value is with the help of two ray ground model:

$$P_r(d) = \frac{P_t * G_{t*} G_r * h_t^2 * h_r^2}{d^4 L}$$

Where

Pr: Power received at distance d

Pt: Transmitted signal power

Gt: Transmitter gain (1.0 for all antennas)

Gr: Receiver gain (1.0 for all antennas)

d: Distance from the transmitter

L: Path loss (1.0 for all antennas)

ht: Transmitter antenna height (1.5 m for all antennas)

hr: Receiver antenna height (1.5 m for all antennas)

NS2 supports the RSSI measurement. The signal strength is measured at one node .Let's assume two wireless nodes are at certain coordinates at the beginning of the simulation. One of the nodes starts to transmit UDP and TCP packets through its wireless interface with given transmit power and antenna gain. We specify the propagation model as a Random way Model and thresholds for carrier sense sensitivity and receive sensitivity. These thresholds define probability of successfully received packet.

B. Difference in RSS

Each node gets the RSS value of its last and the next hope and update the difference of its last RSS and New RSS value in the table respectively.
After at a fixed interval of time each hop match its RSS difference with the threshold value (THRS) if it is found below the THRS then a new link is need to be established.
All these parameters can be calculated. If any node in the path found that if any parameter in a table is below the threshold value than the last hop node considers that the link is going to be breakdown. If it is so then a PRMA (possible route maintenance algorithm) is called to make a link between only those nodes which are going to be break down.

C. PRMA (Possible route maintenance algorithm)

In this approach a HREQ (Help request) signal is transmitted to the last hop and the last hop will search a new path for only those links which are going to be break down. Let As shown in figure 1, there is a route SBCD. The relative mobility of node C results in the link breaks. Node C would set the route leading to node D as invalid and C instead of sending RERR back to source node carries out local repair. For the local repair, If node F receives RREQ and has a route to node D, it will return RREP and establishes a route entry in its routing table with D as its destination node. Similarly H also receives RREQ and has a route to node D, it will also return RREP and establishes a route entry in its routing table. In this way Local Route Repair process is completed. The REPLY is sent back to the source node, which contains number of hop information. The source node sends the data using the shortest route

```
If A (source) wants to send data to B (destination) then
{
 AODV (); finds a route between A and B.
            {
            For (each node between A and B)
            For (each link between A and B)
               {  Manage a table containing parameters
                 RSS of last hop, Address of last hop,
               Distance variation, difference in RSS.
                 }
Case 1: if( difference in RSS > Th
            {  PRMA (); }

Case 2: if( distance variation > DTh)
            {  PRMA (); }
PRMA ()
{  it sends a packet LBD (link break down) to the last node
and call AODV();             }
```

5. CONCLUSION

- The proposed study will be more beneficial at large network. As the number of nodes increases it take lesser end-to- end delay than AODV due to lesser retransmissions compare to AODV.

ACKNOWLEDGEMENT
I wish to express my deep gratitude to Mr. Pankaj Sharma, Assistant Professor, IT Department, and ABES Engineering College for providing his guidance and support. He not only provided me help whenever needed, but also provided me the resources to complete my work.
I am thankful to Dr. A.K. Sinha, for the motivation and inspiration that triggered me for the thesis work.
I am also grateful to Mr. Himanshu Tyagi and my friends for encouraging me and providing useful information during my work.

REFERENCES

[1] Joo –Han Song and Victor C.M.Leung , "Efficient On Demand routing for Mobile adhoc Wireless access networks", ieee journal on selected area in communication, vol -22, no. 7, September 2004.
[2] Ammar Zahary and Aladdin Ayesh , "Analytical Study to Detect Threshold Number of Efficient Routes in Multipath AODV Extensions" Faculty of Computing Sciences and Engineering De Montfort University Leicester, LE1 9BH, UK, 2007.
[3] Zheng Kai, Wang Neng LIU Ai-fang, "A new AODV based clustering routing protocol" Dept. of Computer CI Dept. East China Normal University Shanghai HP Shanghai, China, 200062 Shanghai, China, 200002, IEEE, 2005
[4] Rajiv Misra, C.R.Mandal, "Performance Comparison of AODV/DSR On-demand Routing Protocols for Ad hoc Networks in Constrained Situation" School of Infomation Technology Indian Institute of Technology, Kharagpur(India) IEEE, 2005.
[5] He, D.; Jiang, S. and Rao, J.; ."A Link Availability Prediction Model for Wireless Ad Hoc Networks"., Proceedings of the International Workshop on Wireless Networks and Mobile Computing, Taipei, Taiwan, April 2000, pages D7-D11.
[6] Qin, L.; ".Pro-active Route Maintenance in DSR, M. Sc. Thesis,School of Computer Science", Carleton University, August 2001.
[7] McDonald, A. B.; and Znabi, T.; . "A Path Availability Model for Wireless Ad Hoc Networks"., Proceedings of IEEE Wireless Communications and Networking Conference 1999 (WCNC.99), New Orleans, LA, USA, September 1999, pages 35-40.
[8] Nitin Manjhi and Nilesh Patel ; "Signal Strength Based Rou te Selection in MANETs", International Journal of Compute r Science and Telecommunications Volume 3, Issue 7, July 2012.