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Cluster Based Route Discovery Technique for Routing Protocol in Manet

Poonam Thakur
Department of Computer Science and Engineering, Lovely Professional University, India.

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ABSTRACT
Mobile Adhoc Networks (MANETs) as the name signifies is a network formed by collection of mobile adhoc devices (nodes). MANET is an autonomous decentralized wireless network where each node is free to move anytime anywhere. Routing always being the most researched topic in the cases of networks. Routing in MANETs is mainly of two types proactive and reactive. This paper presents a route discovery technique used in the reactive routing protocol i.e. AODV. Simulation results using NS2 are also shown which proves that this route discovery technique works better than the original route discovery used earlier.

Introduction

Mobile Adhoc Networks are becoming quite common networks due to our changing daily lives. They have been gaining popularity with the use of portable devices like laptop computers and mobile phones. Guaranteeing delivery and the capability to handle dynamic connectivity are the most important issues for routing protocols in MANETs. Mobile Ad Hoc Networks (MANETs) [1] [2] can be characterized as having a dynamic, multihop, potentially rapid changing topology. MANET is formed by a group of nodes that can transmit and receive data and also relay data among themselves. The design of MANETs is also constrained by various constraints like: dynamic topology, reserved energy nodes, large networks, QoS, Limited physical security. Therefore routing is a tough task in these networks.

Routing protocols can be classified as Proactive, Reactive and Hybrid, based on their mode of functioning, basis of gathering information and type of target applications. A proactive routing protocol maintains the route from each node to every other node in the network at all the times, with the help of tables. Any changes in the network topology are propagated in the entire network by the use of updates. Reactive routing protocols also known as On Demand Routing Protocols are mostly the source initiated routing protocols where the route is created only when it is required and initiated the some node be it source or destination. These protocols are mainly characterized by two main phases: route discovery phase in which the optimal route is found from the source to destination and route maintenance phase. Route updation phase is also found in some protocols. DSR, AODV, TORA, SSR, CBRP, ABR are a few of the reactive routing protocols. In this paper I have provided a cluster based route discovery technique for Adhoc on demand routing protocol. A number of route discovery techniques have been designed up till now like SDSS-R, SDSS-M [7]. But we have given a cluster based route discovery algorithm which has shown better performance than the earlier used algorithms. Section II describes the working of AODV routing protocol, section III gives the cluster based algorithm designed by us and section IV shows the simulation results obtained. Finally conclusion and future work is given in section V.

AODV Routing Protocol

Adhoc on demand routing protocol is a reactive protocol which works in two phases mainly i.e. Route discovery phase and route maintenance phase. AODV is a source driven routing protocol. It is a kind of improvement of DSDV table driven routing approach. It is classified as a pure on demand route acquisition system because it creates routes only when they are needed. In this way it reduces network traffic. As long as the endpoints of a communication connection have valid routes to each other, AODV does not play any role. AODV is loop free and when link breakages occur, immediate notifications are sent to the affected nodes. AODV uses destination sequence numbers to provide a fresh route. A RREQ (Route Request) packet is broadcasted to all its neighbors whenever a new node wants to try and find a route to another node. The RREQ propagates through the network until it reaches the destination. The route reply (RREP) packet is then sent back to the source. Hello messages are broadcasted periodically to the immediate neighbors; this acts as an advertisement of the presence of the node and neighbors using routes through the broadcasting nodes will continue to mark the routes as valid. If a hello message doesn't come from a particular node, the neighbor can assume that the node has moved away and mark that link to the nodes as broken and notify the affected set of nodes by sending a link failure notification to that set of nodes. Route table in AODV keeps track of the following information: Destination IP address, destination sequence number, hop count, next hop, life time, active neighbor list, request buffer.

Route Discovery

A node broadcasts a RREQ when it needs a route to a destination, initiating a route discovery process. Each node broadcasts the RREQ to its neighbors until a route to the destination node or destination is found. To ensure loop-free and most recent route information, every node maintains two counters: *sequence number* and *broadcast_ id*. The broadcast_id and the address of the source node uniquely identify a RREQ message. broadcast_id is incremented for every RREQ the source node initiates. An intermediate node can receive multiple copies of the same route request broadcast from various neighbors.

Tele:
E-mail addresses: akku786@gmail.com

In this case – if a node has already received a RREQ with the same source address and broadcast_id – it will discard the packet without broadcasting it furthermore. When an intermediate node forwards the RREQ message, it records the address of the neighbor from which it received the first copy of the broadcast packet.

This way, the *reverse path* from all nodes back to the source is being built automatically. The RREQ packet contains two sequence numbers: the source sequence number and the last destination sequence number known to the source. The source sequence number is used to maintain "freshness" information about the reverse route to the source while the destination sequence number specifies what actuality a route to the destination must have before it is accepted by the source. After broadcasting a RREQ, the node waits for a RREP. If the reply is not received within a certain time, the nodes may rebroadcast the RREQ or assume that there is no route to the destination. When the route request broadcast reaches the destination or an intermediate node with a fresh enough route, the node responds by sending a unicast route reply packet (RREP) back to the node from which it received the RREQ. So actually the packet is sent back reverse the path built during broadcast forwarding. Various self selection route discovery strategies have been designed since far to improve the performance of AODV. We have designed one such cluster based route discovery strategy to improve the performance of AODV route discovery. Our hypothesis was that our algorithm will outperform its counterparts like SDSS-R, SDSS-M approaches.

Cluster based proposed algorithm

The algorithm we have designed is a cluster based route discovery algorithm for AODV. The nodes in the network are first divided into clusters and then the communication process takes place with the help of cluster head (CH). During the communication process the nodes are checked whether they are alive or not, within the range of the CH or not. After that packet transfer will take place according to the conditions defined below in the algorithm. Each node has a particular weight and id which will help in communication process. The CH is selected on the basis of weight. The algorithm is as follows:

Algorithm

Cluster based route discovery

Assumptions:

- Nodes are mobile.
- Random Waypoint Mobility model is used for implementing the mobility.
- All the nodes are present in one of the clusters formed.
- Each node has a CH selected on the basis of Id
- Each node has two tables associated with it a) routing table (RT), contains information of all nodes within the cluster b) Cluster member table (CT), and contains the information of the CH of the particular cluster under which the node comes.
- Each CH has three tables associated with it a) mobile node table (MT), contains the information of all the nodes under it b) Neighbor CH table (NT), contains information of the neighboring CHs. c) History table (HT), and contains the information of few previous packet transfers.

Algorithm:-

1. When a source node(s) wants to send a packet to destination node (d), it checks its RT:

1.1. If it is empty, as in the beginning, it will send RREQ to CH, the CH will send a message back informing the node about all the nodes present within the cluster, and sends the RREQ further to the destination node (d).

1.2. The node (d) can be within the cluster or outside the cluster.

1.3. If the node (d) is within the cluster of the node (s), it will find out the shortest path to the node, all the communication will take place through this path and it will be saved in the Rt of node.

1.4. Else

1.5. If node (d) is outside the cluster, as can be found by CH, it is the responsibility of the CH to carry out all the communication.

1.6. Within the cluster (intra-cluster) the communication is handled by the node itself and outside the cluster (inter-cluster) it is handled by CH.

2. The nodes will always have updated routing tables.

3. Whenever a new node enters or leaves a node CH informs all the nodes and CHs about the change.

4. In the case of inter-cluster communication,

4.1. In the beginning CH broadcasts the RREQs to all the CHs, when the HT is empty.

4.2. If there is some information related to the particular destination node (d), the CH will send the RREQ only to that particular CH which has send RREP in that case.

4.3. If the route still exists, the communication will take place through that route, else an error message is sent back by the CH.

5. Each CH checks their MT to find out the (d) node and sends the RREQs to the node and the RREP packet to the source CH.

6. To avoid broadcasting of RREQs every time a new inter-cluster communication is to take place, ht tables are maintained by CHs which avoids the broadcast of RREQs.

7. HT tables, contains the information of few previous communications (for a specific time period can be set by the use of timers) so that the broadcast of RREQs can be limited.

The algorithm is applied for the route discovery in the case of AODV routing protocol. The random way point mobility is taken under consideration during simulation so as to make the nodes mobile. The route maintenance and route updation phase remains the same as that of the simple AODV. The simulation results are shown in the next section.

simulation results

The simulation is carried out using NS2 and the simulation **parameters set are as given in the table:**

Parameter	Value
Number of nodes	15,50
Area of topography(x-axis)	500
Area of topography(y-axis)	500
Cluster (time)	5
Packet size	1024 bytes
Traffic type	Cbr
Maximum packets	10000
Data interval	0.5
Pause time at simulation	0.02
Simulation time	100 sec
Simulated routing protocol used	AODV

We have used three main performance metrics to measure the performance of our proposed algorithm. These are: Throughput, delay, control overhead. Throughput is defined as the measure of useful packets received at all the destinations at a particular point of time. Delay is defined as the delay experienced by the packets when traveling from source to destination in the destination. Control overhead is defined as the number of control packets transferred in the network in a particular period of time. The results we have got applying these simulation parameters are:-

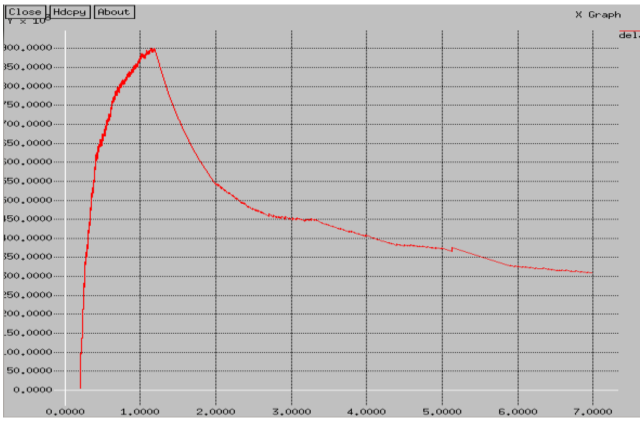

Figure 1: Delay

In the above figure, the x-axis denotes the time per second, the y-axis denotes the source and destination data delay. In the beginning of data transfer delay increases to a certain value because the new routes have to be found. Later on with increase in time, the delay gradually decreases, finally becoming constant for the particular network scenario.

So we can say that delay in the case of cluster based route discovery algorithm is high in the beginning of routing process and as the time increases it gradually becomes a constant.

Figure 2: Throughput

The x-axis shows the number of nodes and y-axis gives the transmissions per second. We can see that the throughput is high when the number of nodes is less, but as the number of nodes increases the throughput goes on decreases. This is mainly due to the mobility of the nodes and the cluster formation process since each time a new node enters the network, it has to be placed in some of the clusters. The complete cluster formation procedure has to be followed again.

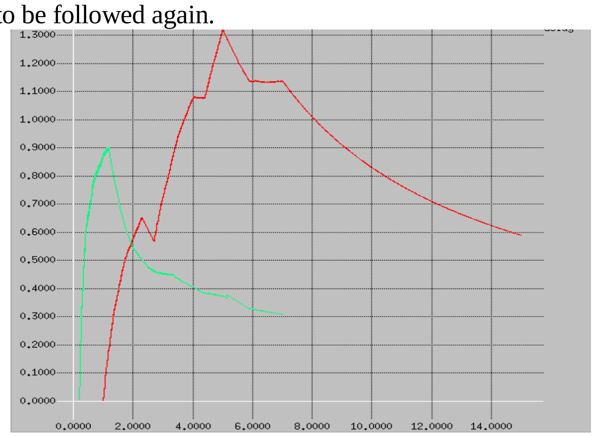

Figure 3: Control Packet

The x-axis denotes the number of nodes and y-axis denotes the control packets transferred. We can compare the delay of AODV with our algorithm; the control packet overhead in the case of our algorithm is shown by the green line and that in the case of AODV by the red line. It can be seen that the control overhead in the case of AODV is more because of the broadcast of packets, each time the data is to be transmitted between the nodes.

Conclusion and Future Enhancement

From the results we can conclude that our algorithm has performed better as compared to other previous route discovery algorithm like SDSS-R SDSS-M. The algorithm has shown good performance compared to AODV routing protocol, in terms of delay and control packet overhead. The security provided by over algorithm is also good as compared to basic AODV protocol, since every time a node enters the network it is checked whether it is a trusted one or not seeing the routing tables. The channel contention is also less in our case comparatively to AODV because of fewer packets transferred between the source and destination nodes. Our algorithm out performs the AODV in terms of efficiency also because of the use of shortest route followed for packet transfer between the nodes. Thus we can say, using the cluster based route discovery approach leads to the increase in performance of the basic AODV routing protocol.

In the future we can apply this route discovery algorithm in other reactive routing protocols of mobile adhoc networks like DSR. The algorithm can be modified to work on high mobility real life scenarios. Number of nodes can also be increased so as to check whether it performs well in that case or not. Obstacles can be introduced during the route discovery process. The performance of this cluster based approach can also be compared to other reactive routing protocols of mobile adhoc networks.

REFERENCES

1. Humayun Bakht, "Survey of Routing Protocols for Mobile Ad-hoc Network", International Journal of Information and Communication Technology Research, Vol. 1, No.6, Pp. 258-270, 2011.

2. Changling Liu, Jorg Kasier, "A Survey of Mobile Ad-hoc Network Routing Protocols", University Of Ulm Tech. Report Series, Nr. 2003-08, Pp. 1-34, 2005.

3. C. E. Perkins, E. M. Belding-Royer, and S. R. Das, "Ad hoc On-Demand Distance Vector Routing," Internet Engineering Task Force, 2002.

4. CHANDRIMA CHAKARBARATI & RITUPARNA CHAKI, "Improved cluster based route discovery algorithm for Adhoc networks", IEEE 201

5. Z.J.Haas, M.R. Pearlman, and P.Samar, "The Interzone Routing Protocol for Adhoc Networks", Internet Engineering Task Force draft, 2002.

6. W.R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, "An Application-Specific Protocol Architecture for Wireless Microsensor Networks", IEEE Transactions on Wireless Communications, Vol. 1, No.4, Pp. 660-670,2002.

7. MEHRAN ABOLHASAN and JUSTIN LIPMAN, "Efficient and highly scalable route discovery for On-demand routing protocols", Proceedings of the IEEE Conference on Local Computer Networks 30th Anniversary (LCN'05)

8. S. Ramanathan, M. Steenstrup, "A survey of routing techniques for mobile communication networks, Mobile Networks and Applications", Pp.89-104, 1996.

9. M.Sreerama Murty and M.Venkat Das, "Performance Evolution of MANET Routing Protocols using Reference Point Group Mobility and Random Way Point Models, International Journal of Adhoc , Sensor & Ubiquitous Computing March 2011.

10. Yogesh Chaba, Yudhvir Singh (2009), "Performance Evaluation and Analysis of Cluster Based Protocols in MANETs", proceeding of International Confrenec on Advances in Computing, Control, and Telecommunication, pp. 64-66.

11. M.Sreerama Murty and M.Venkat Das, “Performance Evalution of MANET Routing Protocols using Reference Point Group Mobility and Random Way Point Models, International Journal of Adhoc , Sensor & Ubiquitous Computing March 2011.

Biography

Poonam Thakur

Educational background

- Senior secondary, D.A.V Solan Himachal Pradesh India, 2005.
- Diploma in Computer Science, Govt. Polytechnic College, Solan, Himachal Pradesh, India, 2008.
- Bachelor of Engineering in Computer Science and Engineering, Sant Longowal Institute of Engineering and Technology, Sangrur, Punjab,India,2011.
- Pursuing M tech in Computer Science and Engineering, Lovely Professional University, Punjab, India.