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Empirical Study of Advance Channel Information of AODV Protocol in Mobile Ad-Hoc N/W

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Abstract**—***Mobile ad hoc network (MANET) is a recent trend and it has to face different challenges and issues. An ad hoc network (or mobile ad-hoc network) is a collection of mobile nodes (moveable device) that dynamically form a temporary network, without the use of existing network topology (or it may be any predefined topology in any instance). When two nodes are not within the radio range of one another, they use intermediate nodes to route packets for them. Routing in MANET is a hottest topic for researchers, due to nodes mobility, dynamic topology, frequent link breakage, limitation of nodes (memory, battery, bandwidth, and processing power), and lack of central point like base stations. The mobility of nodes and instability of the wireless environment may result in link breaks between neighboring nodes, even causes the route to be invalid. This paper focuses on the mobility of the source node and intermediate node which may result link failure. If a source node moves, it is able to reinitiate the Route Discovery Protocol (RDP) to find a new route to the destination using path updating. For intermediate node link break a Local Repair Procedure is used to update the path. This main objective of this paper is new path updation technique and resolving link failure in AODV with the use of AMAODV. Computer simulation using GNS3(graphic network simulator 3) simulator on window07 operating system shows the behavior and performance improved in AODV routing protocol based on the newly proposed technique.*

Keywords:— *Source node(S-node), Destination node (D-node), Route Request (RREQ), Route Reply (RREP), Complete Transmission message (CTMASG), Link recovery message (LRMASG) Broadcast storm problem, flooding, average route fading duration*

1. INTRODUCTION

MANET (Mobile Ad hoc Network) is a mobile multi-hop, wireless self-organized distributed network. The primary objective of routing protocol is to discover the route. The routing protocol for MANET undertakes to setup and maintain routes between nodes. Basically ad-hoc network include two types of routing technique-first is Table driven and another is On-demand routing technique. In

MANET, continuously changing network topology causes link breakage and invalidation of routes. The highly dynamic nature of wireless network imposes high restrictions on routing protocols. This paper is mainly focus on on-demand, source initiated protocols, which set up and maintain routes from the source to the destination on an "as needed" basis. The well known best reactive protocol which is used to discover the route when the topology changes, is AODV. The very most challenging issue in wireless network is routing packets from one another.

When a link break in an active route occurs, the node upstream of that break may choose to repair the link locally. In this paper, we have proposed a local repair scheme based on link breaks for MANET. When a link break occurs, the destination node classifies the link breaks and adopts different methods for different link breaks. The rest of the paper is organized as follows. Section 2 discuses on detailed description of AODV (Ad hoc On-demand Distance Vector Protocol). Section 3 describes the previous research work on AODV. And a newly constructed path updation technique is discussed in section 4. Section 5 will include the simulation graph of Advance AODV.

2. WORKING OF AODV ROUTING PROTOCOL

AODV is a representative of reactive routing protocols of MANET. The protocol consists of two parts: route discovery and route maintenance. AODV discovers routes on an as needed basis via a similar route discovery process. AODV relies on routing table entries to propagate an RREP back to the source and, subsequently, to route data packets to the destination. AODV uses sequence numbers maintained at each destination to determine originality of routing information and to prevent routing loops. All routing packets carry these sequence numbers. Whenever a packet is to be sent by a node, it first checks with its routing table to determine whether a route to the destination is already available. If so, it uses that route to send the packets to the destination. If a route is not available or the previously entered route is inactivated, then the node initiates a route discovery process. A RREQ (Route REQuest) packet is broadcasted by the node. Every node that receives the RREQ packet first checks whether it is the destination for that packet and if so, it sends back an RREP (Route Reply) packet.

An important feature of AODV is the maintenance of timer-based states in each node, regarding utilization of individual routing table entries. A routing table entry is expired if not used in recent times. A set of forerunner nodes is maintained for each routing table entry, indicating the set of neighboring nodes which use, that entry to route data packets. To control network-wide broadcasts of RREQ packets, the source node use an expanding ring search technique. In this technique, source node starts searching the destination using some initial time to live (TTL) value. If no reply is received within the discovery period, TTL value incremented by an increment value. This process will continue until the threshold value is reached. When an intermediate node forwards the RREQ, it records the address of the neighbor from which first packet of the broadcast is received, thereby establishing a reverse path.

The RREQ packet gets relayed back to the source through the reverse route. The source node then updates its routing table and sends its packet through this route. During the operation, if any node identifies a link failure, it sends a RERR (Route ERRor) packet to all other nodes that uses this link for their communication to other nodes.

2.1. Drawbacks of Aodv

It is possible that a valid route is expired. Determining of a reasonable expiry time is difficult, because the nodes are mobile, and sources' sending rates may differ widely and can change dynamically from node to node. Moreover, AODV can gather only a very limited amount of routing information; route learning is limited only to the source of any routing packets being forwarded. This causes

AODV to rely on a route discovery flood more often, which may carry significant network overhead. Uncontrolled flooding generates many redundant transmissions which may cause so-called broadcast storm problem. The performance of the AODV protocol without any misbehaving nodes is poor in larger networks. The main difference between small and large networks is the average path length. A long path is more vulnerable to link breakages and requires high control overhead for its maintenance. Furthermore, as a size of a network grows, various performance metrics begin decreasing because of increasing administrative work, so-called administrative load.

Maintain Quality of Service (QoS) in the time of link breakage is another challenging issue in AODV. QoS routing is an essential part of the QoS architecture. Before any connections can be made or any Resources reserved, a feasible path between a source destination pair must be established. QoS routing is a routing mechanism under which paths for flows are determined on the basis of some knowledge of resource availability in the network as well as the QoS requirements of the flows or connections.

The objectives of QoS routing are threefold: (1) find a feasible path between a source destination pair (i.e. a path that has sufficient available resources capable of satisfying the QoS requirements), (2) Optimize the use of network throughput and network resources and (3) Adapt to network congestion, providing smooth performance degradation to lower-priority traffic. It is important to note that QoS routing and resource reservation are separate issues. In this paper, we will discuss about the QoS routing.

3. PREVIOUS PROPOSED AODV

3.1 Ad hoc On Demand Multipath Distance Vector Routing (AOMDV):

Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV) protocol is an extension to the AODV protocol for computing multiple loop-free and link disjoint paths. In the time of route discovery process in AODV, AODV uses sequence numbers maintained at each intermediate node to determine originality of routing information and to prevent routing loops. All routing packets carry these sequence numbers. Whenever a packet is to be sent by a node, it first checks with its routing table to determine whether a route to the destination is already available (under the duration of path fading time). If so, it uses that route to send the packets to the destination. If a route is not available or the previously entered route is inactivated (faded), then the node initiates a route discovery process. A RREQ (Route REQuest) packet is broadcasted by the node. Every node that receives the RREQ packet first checks whether it is the destination for that packet and if so, it sends back an RREP (Route Reply) packet.

The routing entries for each destination contain a list of the next-hops along with the corresponding hop counts. All the next hops have the same sequence number. This helps in keeping track of a route. For each destination, a node maintains the advertised hop count, which is defined as the maximum hop count for all the paths, which is used for sending route advertisements of the destination. Each duplicate route advertisement received by a node defines an alternate path to the destination.

AOMDV can be used to find node-disjoint or link-disjoint routes. To find node-disjoint routes, each node does not immediately reject duplicate RREQs. Each RREQs arriving via a different neighbor of the source defines a node-disjoint path. This is because nodes cannot be broadcast duplicate RREQs, so any two RREQs received by the intermediate node via a different neighbor of the source could not have followed the same node. In an attempt to get multiple link-disjoint routes, the destination not replies to duplicate RREQs, the destination only replies to RREQs arriving via unique neighbors. After the first hop, the RREPs follow the reverse paths, which are node disjoint and thus link disjoint. The trajectories of each RREP may intersect at an intermediate node, but each takes a different reverse path to the source to ensure link disjointness. The advantage of using AOMDV is that it allows intermediate nodes to reply to RREQs, while still selecting disjoint paths. But, AOMDV has more message overheads during route discovery due to increased flooding and since it is a multipath routing protocol, the destination replies to the multiple RREQs those results are in longer overhead.

3.1.1 Disadvantages of AOMDV:

The only drawback of Multi-Path Routing Load Balancing Protocols such as AOMDV is the use of a large number of control packets for calculating and maintaining multiple routes between a source and destination but such disadvantage is minimized in the network conditions as the rate of control packets generated by AOMDV is slightly higher than the rate generated by the Single-Path protocols at high load and density nodes. Ad hoc On-Demand Multipath Distance Vector (AOMDV) routing protocol to accommodate channel fading. On the other hand if there are only 1 intermediate node between source and destination node, in the condition of failure of intermediate node, S-node have to broadcast the RREQ message for finding D-node.

4. ADVANCE MULTI-ROUTE AD HOC ON-DEMAND DISTANCE VECTOR ROUTING PROTOCOL (AMAODV)

S. Baronia, (2013) et.al, proposed AMAODV. I introduce Advance Multi-route Ad hoc On-demand Distance Vector Protocol (AMAODV) work on the concept that, it finds the different route from source to destination; Each RREQs arriving via a different neighbor of the source defines a node-disjoint path. This is because nodes cannot be broadcast duplicate RREQs, so any two RREQs arriving at an intermediate node via a different neighbor of the source could not have followed the same node. In an attempt to get multiple link-disjoint routes, the destination not replies to duplicate RREQs, the destination only replies to RREQs arriving via unique neighbors (by which it gets the first RREQ message), but it (D-node) store the all path from source to destination in cache.

Source-node will start data transmission, on that route by which it gets RREP message. After sending the whole data packets, S-node send a ‘CTMASG’ (Complete-Transmission Message) packet to D-node.

If ‘route broken’ situation will occur during the time of transmission, D-node will not get the CTMASG.

After a certain time interval (which is lesser than the average route fading duration) D-node will send a ‘LRMASG’ (Link Recovery message) packet to S-node by the use of stored route in it from S-node to D-node. On the same time Route Error (RERR) packet will be send by broken route node to S-node. [Until and unless RERR message is not received, S-node will not react on any LRMASG]. After receiving LRMASG, S-node again start transmission by that route with D-node, which reached first to S-node [under the consideration that, first packet traveled the shortest path, or the path with lower network congestion] all other link recovery message will be discarded. If no LRMASG packet will reach under the average route fading duration (ARFD), S-node will stop transmission under the consideration that, D-node is switched off. And it will again start route discovery process after a certain period of time (depend on the constraints of the network), by the Idea of channel aware advance AODV routing technique (CA-AAODV).

4.1 Channel Aware Advance Aodv Routing Protocol (Ca-Aaodv)

We introduce an advance, channel-aware version of the AODV routing protocol. The key aspect of this enhancement, which is not addressed in other work, is that we use specific, timely, channel quality information allowing us to work with the ebb-and-flow of path availability. This approach allows reuse of paths which become unavailable for a time, rather than simply regarding them as useless, upon failure, and discarding them.

On one hand though the process of flooding helps the sender to dynamically obtain the location of the destination and the route over which information could be transmitted, it unnecessarily augments the load on the network as all the nodes in the network participate in the process of flooding. If flooding is carried out frequently then it may altogether lead to the instability of the network. The direct implication of this observation is that flooding should be kept as infrequent as possible. One standard way to reduce the flooding mechanism is to provide the nodes with a small cache where the routes could be stored for future reference.

In CA-AAODV, each node contain a small cache which contain a some information which help to reduce flooding by find the destination path after the first time detection of D-node.

If any nodes want to transmit the data to any node, it makes a table in its cache, for channel reference. Table contains 4 attribute:

1. Destination node no.
2. Couple neighbor
3. Crossed route hope
4. Life time of any route/route

S-node stores the neighbor node as a couple node with destination, by which it find the D-node. After finding the destination node by broadcasting the RREQ packet, route will be stored in table with its life time value, if S-node again wants to transmit the date to the same destination with in life time duration of route, S-node will forward RREQ message only by that route. Life time value of route is depends on the network constraints (average route movement time).

If D-node will not found under the duration of life time route value, or life time value was expired, on that condition, S-node forward RREQ packet only to the neighbor node which is stored in table, couple with destination node, with increased route hope [Time to live] value. Route hope increment will be done by the use of the value, stored in 'Crossed route hope' column or by the threshold value. If value of 'crossed route hope' is 2, it means in the time before it, destination is situated after the 2 route hope count value from source node. This value will be increment exponentially for this time transmit ion of RREQ packet. If D-node was not found, then S-node will stop transmission under the consideration that, D-node is switched off. And it will again start route discovery process after a certain period of time (define by the network administrator) by the broadcasting the RREQ message in the network.

Table 1: Channel Aware Routing

D-node	**Couple Neighbor**	**Crossed route hope**	**Life time of any route/ route**
10	3	2	**5 sec/ 1->3->7->10**

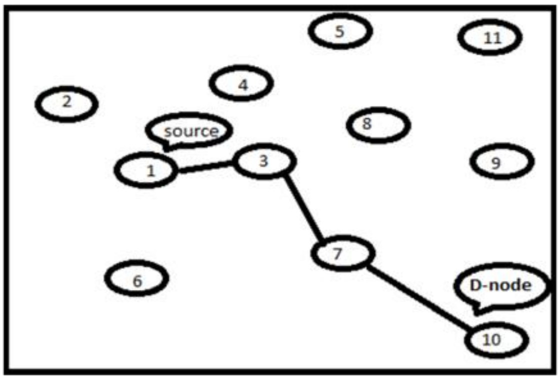

Figure 1 : Filter Node Source to Destination

5. CONCLUSION AND FUTURE WORK

Mobile ad hoc networks are self-organizing, rapidly deployable and require no fixed network infrastructure. It is hoped that in the future, ad hoc networks will emerge as an effective complement to infrastructure wired and wireless LANs and even wide-area mobile networking services, such as PCS. In order to achieve this status, however, applications and services equivalent to those available in these environments must be made available to ad hoc network users.

By utilizing the Advance Multi route AODV and Channel Aware routing protocol we can not only decrease the network congestion by reducing flooding, occurred due to rapidly finding the destination in continuously changing topology, but also, it provide the guarantee of completion of data transmission in the case of link failure.

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