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MAODV with Core-node using Path Amassing

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ABSTRACT
Ad-hoc network means a collection of wireless mobile nodes moving in some area without any backbone infrastructure such as Access point and the devices connected to it for communication. As the nodes moves randomly in any area the topology is also changing arbitrarily. The network disconnection occurs frequently. This project proposes a difference of the AODV protocol, which selects interior nodes using path's accumulation information, and then recognized multi paths based on interior-node's information. Proposed algorithm accumulates the reset time to build the new path and also reduces the reset control messages by using the interior-node information when the network gets disconnected.

General Terms
Protocols, Algorithm

Keywords
MAODV, Ad-hoc, Core-Node

1. INTRODUCTION
Routing support for mobile hosts is presently being formulated as mobile IP technology when the mobile agent moves from its home network to a foreign (visited) network, the mobile agent tells a home agent on the home network to which foreign agent their packets should be forwarded. In addition, the mobile agent registers itself with that foreign agent on the foreign network. Thus, the home agent forwards all packets intended for the mobile agent to the foreign agent, which sends them to the mobile agent on the foreign network. When the mobile agent returns to its original network, it informs both agents (home and foreign) that the original configuration has been restored. No one on the outside networks need to know that the mobile agent moved. But in Ad Hoc networks there is no concept of home agent as it itself may be moving. As the nodes moves in any direction in the network, the topology of the network changes frequently. Routing protocol for ad-hoc networks can be group according to the way in which nodes obtain routing information and according to the type of information they use to compute preferred paths. In terms of the way in which nodes obtain information, routing protocols have been categorized as on-demand and table-driven. In on-demand routing protocols, nodes maintain path information for only those destinations. Examples of this approach are AODV [2], DSR [3], and TORA [4]. In table-driven routing protocols, each node maintains path information for each known destination in the network and updates its routing-table entries as needed. Examples of table-driven algorithms based on distance vectors are the routing protocols of the DARPA packet radio network [5], DSDV [6], and WRP [7].

2. RELATED WORK
In this section 2.1 describes the the AODV protocol and its Packet format for controlling network path. Section 2.3 describes advances in AODV protocol.

2.1 Adhoc On-demand Distance Vector
The Ad Hoc on Demand Distance Vector (AODV) routing protocol builds on the DSDV algorithm. AODV is an improvement on DSDV because it typically minimizes the number of required broadcasts by creating routes on a demand basis, as opposed to maintaining a complete list of routes as in the DSDV algorithm. AODV classify as a pure on-demand route acquisition system, since nodes that are not on a selected path do not maintain routing information or participate in routing table exchanges.

When a source node desires to send a message to some destination node and does not already have a valid route to that destination, it initiates a path discovery process to locate the other node.

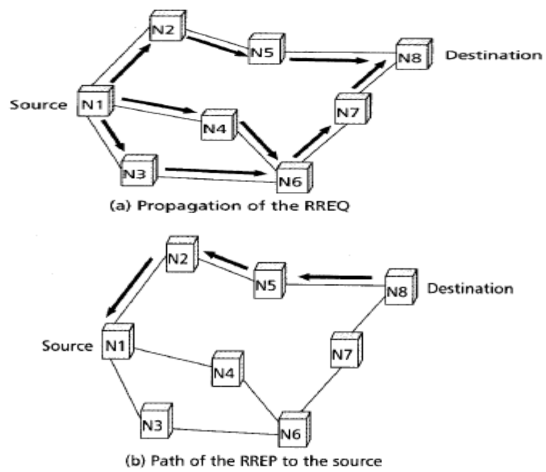


Fig. 1 Path in the AODV

Type	J	R	G	D	U	Reserved	Hop count
RREQ ID							
Destination IP Address							
Destination sequence Number							
Originator IP Address							
Originator sequence Number							

Fig. 2 RREQ Packet Format

It broadcasts a route request (RREQ) packet to its neighbors, which then forward the request to their neighbors, and so on, until either the destination or an intermediate node with a fresh enough routes to the destination is located. Figure 1(a) illustrates the propagation of the broadcast RREQs across the network. AODV utilizes destination sequence numbers to ensure all routes are loop free and contain the most recent route information. Each node maintains its own sequence number, as well as a broadcast ID. The broadcast ID is incremented for every RREQ the node initiates, and together with the node's IP address, uniquely identifies an RREQ. Along with its own sequence number and the broadcast ID, the source node includes in the RREQ the most recent sequence number it has for the destination. Intermediate nodes can reply to the RREQ only if they have a route to the destination whose corresponding destination sequence number is greater than or equal to that contained in the RREQ. During the process of forwarding the RREQ, intermediate nodes record in their route tables the address of the neighbor from which the first copy of the broadcast packet is received, thereby establishing a reverse path. If additional copies of the same RREQ are later received, these packets are discarded.

Once the RREQ reaches the destination or an intermediate node with a fresh enough route, the destination intermediate node responds by unicasting a route reply (RREP) packet back to the neighbor from which it first received the RREQ(Fig.4). As the RREP is routed back along the reverse path, nodes along this path set up forward route entries in their route tables which point to the node from which the RREP came. These forward route entries indicate the active forward route. Associated with each route entry is a route timer that will cause the deletion of the entry if it is not used within the specified lifetime. Because the RREP is forwarded along the path established by the RREQ, AODV only supports the use of symmetric links. Routes are maintained as follows. If a source node moves, it is able to reinitiate the route discovery protocol to find a new route to the destination. If a node along the route moves, its upstream neighbor notices the move and propagates a link failure notification message (an RREP with infinite metric) to each of its active upstream neighbors to inform them of the erasure of that part of the route. These nodes in turn propagate the link failure notification to their upstream neighbors, and so on until the source node is reached. The source node may then choose to reinitiate route discovery for that destination if a route is still desired.

2.2 Various Extensions of AODV

In Adaptive Backup Routing(ABR) protocols[8], if a link break occurs then primary route is replaced by alternate route by performing a handshake process with its immediate neighbors to repair the broken route which leads to occur routing overhead.

Ad-hoc On-demand Multiple route Distance Vector(AOMDV)[12] detects the link-disjoint and multiple loop-free routes due to this many efficient routes can be missed due to the restriction of link-disjoint routes, which leads to consume too much memory with increasing in routing overhead. One drawback with AOMDV is that it deletes links when they seem to be failed.

SMORT [10] is another multipath extension to AODV and it finds multiple fail safe routes. A route between source and destination is said to be fail to the primary path if it bypasses at least one intermediate node on primary path nodes as well as links can be common in fail safe path. Routing process concept consists of route discovery, route reply and route maintenance.

AODV-BR [11] is an extension to AODV routing protocol. RREQ is flooded into the network in the route discovery phase. Each RREQ packet carries a unique identifier to detect and drop duplicate packets. An intermediate node on receiving a non-duplicate RREQ records the previous hop and the source node information in its route table. RREP is sent back to the source upon reception of first or subsequent RREQs by any intermediate node having route to the destination. AODV-ABR [8] is a modification of AODV-BR which in itself is a modification of AODV. The route discovery cycle is the same as that of AODV-BR except that AODV-BR forms mesh structure by overhearing RREP packets only, while AODV-ABR overhears both data packets and RREP packets to form alternate routes. . If a link break occurs then primary route is replaced by alternate route by performing a handshake process with its immediate neighbors to repair the broken route.

Multiple Route AODV (MRAODV)[13] reduces routing overhead by extending the waiting time of RREPs until detecting all possible routes included by all RREPs. MRAODV mechanism tends to wait for long time to check if there are more available routes including inefficient routes.

3. PROTOCOL CONCEPT

This algorithm reduces the packets which carry the control information in a network like RREQ, RRER, RREP packets. It selects the Core nodes to forward the RREQ packets to establish the connection to the destination node. This reduces the extra load on the source node and also saves the lot of time to send the error message to the source node. It means that the Core-node reinitiate the path without knowing to the source node. If link break occur the core node sends the data through the secondary path.

3.1 Route Discovery Process

AODV drops the packet if it get the duplicate packets in the network but this algorithm flood the packet instead of dropping it. Before sending the packet to the next node the control packets pass through the node, nodes ID is attached to packets payload. As shown in the figure the packet send to the next node.

Type	J	R	G	D	U	Reserved	Hop count
RREQ ID							
Destination IP Address							
Destination sequence Number							
Originator IP Address							
Originator sequence Number							
Accumulation Path							

Fig. 3 Modified RREQ Packet Format

In modified format, RREQ packet stores the information for data transfer route. If link break occur, the network removes the loop by using stored node ID's information. From this accumulated node information, algorithm selects the CORE-nodes that forward a RREQ packet for multi-path. As shown in Figure 4, two packets are sent at the same time towards a destination node. Those nodes store path in Accumulation PATH variable of RREQ packet. Using the information accumulated in the path of two packets, the destination node D selected node 5 and node 12 as CORE-nodes.

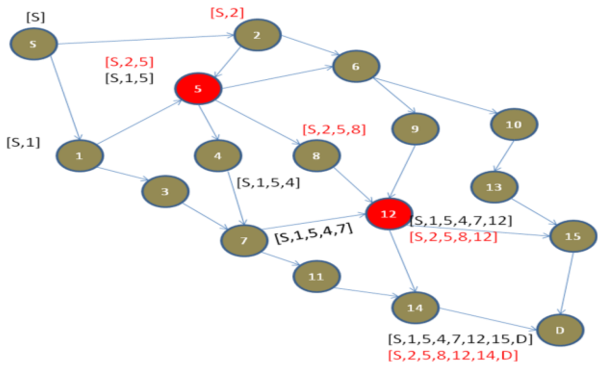


Fig . 4 Path creations from source to destination

As shown in figure there are multiple path from the source node to the destination node. At the end the multiple path has found to the destination node having same source node, then it selects the two path having min length among them. Path which is having minimum length among two act as a primary path and other is secondary path. Reply packet (RREP) is send through primary as well as secondary path to the sender node by unicast.

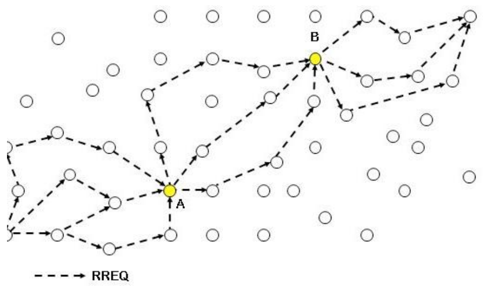
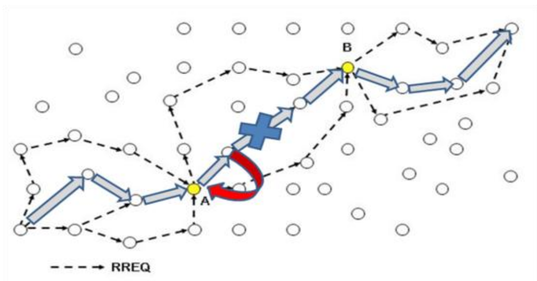


Fig. 5 Route discovery process

3.2 Route Recovery Process

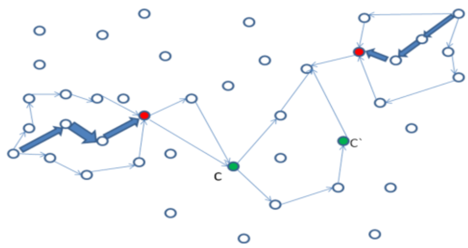
When the link break occurs to the path AODV does the route recovery with the help of control packet. Upstream node detects that it is Core-node. If the upstream node is Core-node it starts the transmission through the secondary path and restarts the data transfer. If the upstream node is a Core-node then the control packet is transfer to the Core-node with the error (RRER) message to the Core-node. It tells the Core-node about the link break. Then the Core-Node detects the previous broken link's information and Core-node selects node of the secondary paths and restarts the data transfer. So the algorithm does not require flooding the control message so to reduce the route recovery latency.



Primary path ------ Secondary Path - RERR

Fig. 6 Route maintenance process

If links break successively, there are no alternate paths between Core-nodes. In figure 7 Route recovery process must restart in divided sections by CORE-node A and CORE-node B. Also, there will be CORE-nodes (C, C') between the CORE-node A and CORE-node B. And there are many CORE-nodes in the section where a link break frequently occurs and the length of the path is close.



= Primary Path Second Path

Fig. 7 Successful route discovery after link-break.

Therefore, proposed algorithm unlike the AODV, it doesn't need to flood control messages so reduces the route recovery latency. If a link breaks successively, there are no alternate paths between CORE-nodes. Route recovery process must restart in divided sections by CORE-node A and CORE-node B. Also, there will be CORE-nodes (C, C') between the CORE-node A and CORE-node B. And there are many CORE-nodes in the section where a link break frequently occurs and the length of the path is close.

3.3 Pseudo code

Step 1: Route Discovery process

```
If (RREQ==1)
{
  While(search RREQ_ID )
        {
              if(RREQ_ID==N_ID)
        end;
        }
    RREQ_ID = RREQ_ID + N_ID;
}
```

Step 2: Route Recovery process

```
While (check RREQ_ID)
   {
 Count each node
      temp=0;
    Each i=0 to count
      {
       if temp <= AP[i]
       temp=AP[i];
      }
   Ncu =temp;
}
RREP through the primary path.
```

Step 3: Route Recovery in upstream node

```
if ( Nu == Nco )
{
  Data sending through secondary path stored core node.
}
else
{
   RRER send to the upstream node;
   Delete information about broken link;
   Data sending through secondary path;
}
```

3.4 Performance Comparison

Multipath AODV with core node get less time to the route request, route reply and route error packet as compare to the AODV protocol. The role of Core-Node in multipath AODV is to maintain route on be-half of source node because if link break occurs the intermediate node sends the error message to the upstream node/Core-Node instead of source node which saves the time. Then the core node sends the same data from the secondary path and again finds another route from the core node to the destination leads to save time of sending route request and route reply message to and from the source node.

4. CONCLUSION

Path in the wireless network could change frequently as the time progress. As the number of nodes increased in the ad-hoc network flow of the data may increase rapidly. Multipath AODV helps to minimize the number of control packets in the network as the Core node i.e. intermediate node helps to provides alternate path to the destination when a link is broken. This will reduce the recovery latency because source node does not need to reinitiate a route discovery process.

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