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Local Recovery of Routes for Reliability using Backup Nodes in MANETs

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***Abstract*—** A Mobile Ad Hoc Network (MANET) is a self configuring Network of mobile devices connected by a wireless link without fixed infrastructure. In MANETs, data packets fail to deliver to destination node due to packet collision, nodes movement and bad channel condition. When packets fail to be delivered, source node must perform re-route discovery process. In traditional on demand routing protocols, re-route discovery involves high latency and large control message overhead. Hence it reduces the network efficiency. In this paper, reliable route recovery scheme takes advantage of backup route. This scheme provides local recovery of routes for reliability and reduces the number of control messages for network efficiency. RRR-AODV scheme establishes multiple backup nodes for route recovery process implicitly. The backup nodes make routing table and stores data in buffer. If there is any link failure then the backup node sends route change packet to the node which tries for retransmission. This scheme not only reduces message overhead but also improves the routing performance.

***Keywords*—** Reliable Route Recovery Ad-Hoc on Demand Distance Vector (RRR-AODV).

I. INTRODUCTION

A Mobile Ad Hoc Network (MANET) is a self configuring network of mobile devices connected by a wireless link without fixed infrastructure. The mobile devices can communicate with each other only if they are in the transmission range of each other. To enable ad-hoc networking between mobile devices MANET research develops components and protocols. In MANETs, the mobile devices move independently in any direction, hence there is a frequent change in the link to other devices.

In MANETs many routing protocols are introduced. Routing protocols are used for finding hoe to reach the neighbouring nodes for transmission of data packets. The routing protocols are classified into two types: proactive and on demand routing protocols.

In Proactive routing protocol, it periodically updates network topology information. This periodic update wastes network bandwidth and battery power.

In On-demand routing protocol, the source node first discovers the route before sending the data packets to the destination node.

The data packets fail to deliver to the destination due to reasons like packet collision, nodes movement and bad channel condition. To avoid these problems source node must perform re-route discovery process.

Re-route discovery process involves high latency and large control message overhead. This reduces the efficiency of the network. The routing performance degenerates the dense network environment as there is a frequent packet collision in network.

The local recovery of routes for reliability is done with the help of reliable route recovery scheme which provides fast route recovery and reduces number of control messages for the efficiency of the network. It also handles competition problem between backup node and backup node misjudgement problem.

II. ON-DEMAND ROUTING PROTOCOLS

On-demand routing is one of the routing protocols in MANETs. Here whenever the source node wants to send the data packets to the destination node first it discovers the route to destination node. Several protocols have been introduced in on demand routing. One among them is Ad-hoc on demand distance vector (AODV) routing protocol.

AODV:

AODV is nothing but Ad-hoc On-Demand Distance Vector routing protocol. In Ad-hoc On-Demand Distance Vector Routing, each mobile host operates as a specialized router. Routes are obtained as needed on demand.

When the source node wants to send the data packets to the destination node, then it first discovers the path to locate the other node. The source node first floods RREQ packets to all the neighbouring nodes that are present in its transmission range. The neighbour node further floods the RREQ packet to its neighbouring nodes. This continues until the RREQ packet reaches the destination node.

Once the destination node receives RREQ packet it replies the source node with the RREP packet. The RREP packet will be sent in the same path in which it received the RREQ packet. When the source node receives the RREP packet it updates its routing table with the path in which it has to send the data packets.

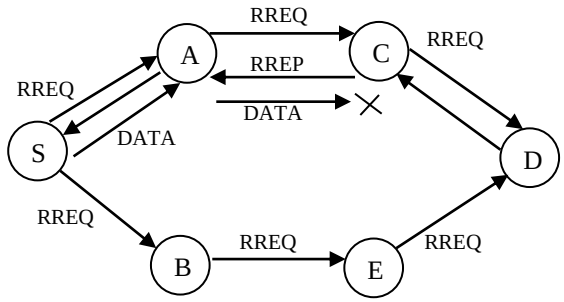

Fig.1 data transmission in AODV

If there is a breakage in the link due to packet collision and nodes movement, then again the source node should discover the new path to the destination node and then the source node sends the data packets from the beginning. AODV gathers only limited amount of routing information and uses large resources. It also needs very high bandwidth and large routing tables. Hence it's not suitable for dense network environment.

III. RELIABLE ROUTE RECIVERY SCHEME

Reliable Route Recovery Scheme is an Ad-hoc on demand distance vector routing protocol. Since it is an on demand routing protocol, the source node before transmitting data packets discovers the route to the destination node. Once the route is discovered then source node sends the data packets through that path to the destination node.

This reliable route recovery scheme has been introduced to improve the performance of the on demand routing protocols, especially Ad-hoc On-demand Distance Vector (AODV) protocol. This scheme employs local recovery of routes for reliability with the help of multiple backup nodes. It also reduces the number of control messages, message overhead and improves the routing performance.

Basically two operations are done in reliable route recovery scheme. They are:

1. Backup Node Establishment
2. Route Recovery Process

A. Backup Node Establishment:

The backup nodes are established when a node overhears the transmitted data from its adjacent nodes. The node which overhears the data is set up as the backup node. When the backup node is set up, it makes a backup routing table and stores the data in the buffer. If the backup node cannot overhear the data then the backup routing table will be deleted.

B. Route Recovery Process:

If any node present in the route tries for retransmission to the failed link, the backup node detects the retransmission. Then the backup node begins fast route recovery process. When retransmission happens the backup node waits for a period of time which is set using random back-off algorithm. Within the back-off time if the backup node does not overhear the acknowledgment then it sends route change packet to the node which tries to retransmit the data packet. The node updates its routing table with the new path and sends acknowledgement to the backup node.

IV. SYSTEM MODULES

A. Route Discovery Module:

Whenever the source node wants to send the data packets to the destination node, the source node floods RREQ packets to the entire network. The destination node after receiving many RREQ packets from different paths sends RREP packet to the node from which it received the RREQ packet. After receiving RREP packet the source node selects the primary route to transmit the data on the basis of their arrival time.

B. Optimal Path Computation Module:

The destination node receives RREQ packets from many neighboring nodes. It replies with RREP packets to all the nodes from which it received the RREQ packet. The source node selects the path based on the RREP packet from which it receives first. The RREP packet from which path the source node receives first, it considers that path as optimal path for data transmission.

C. Establishment of Backup Node Module:

Backup nodes are established by overhearing the transmitted data of the sequent three nodes that are in the original route. Once the backup node is established, it makes a backup routing table and store up data in buffer. If any backup node cannot overhear the data, it deletes the backup routing table.

D. Data Transmission Module:

Once the source node finds the optimal path, it starts sending the data packets through the route that is sent by backup node. If there is any breakage in the link then the backup node comes to know about the failure of the link and it send route change packet to the source node.

E. Route Recovery Module:

The backup nodes listen to the retransmission and then wait for a period of time selected by a random back- off algorithm. If backup nodes do not overhear acknowledgement during the back-off time, backup node send the Route Change (RC) packet to the node that tries retransmission. The node updates the routing table and sends the acknowledgement to backup node once it receives the RC.

V. ALGORITHM FOR ROUTE RECOVERY PROCESS

```
If (the received packet type is a data)
 {
   If (ttl=2sec)
   {
    Create a new entry in a next node routing table;
    Create a new entry in a backup node routing table as
    overhear message;
    If (back-off time =4sec)
    {
     If (received packet is a data)
     {
      Update data in BR table;
      Backup node sends a Route Change [RC] Message to the
      corresponding source node ;
     }
    }
    If (Backup node received Ack)
    {
      Source node sends Ack/Data to Backup node;
     }
    Else
      Backup node sends a RC for Route Recovery ;
  }
 }
```

VI. SEQUENCE DIAGRAM

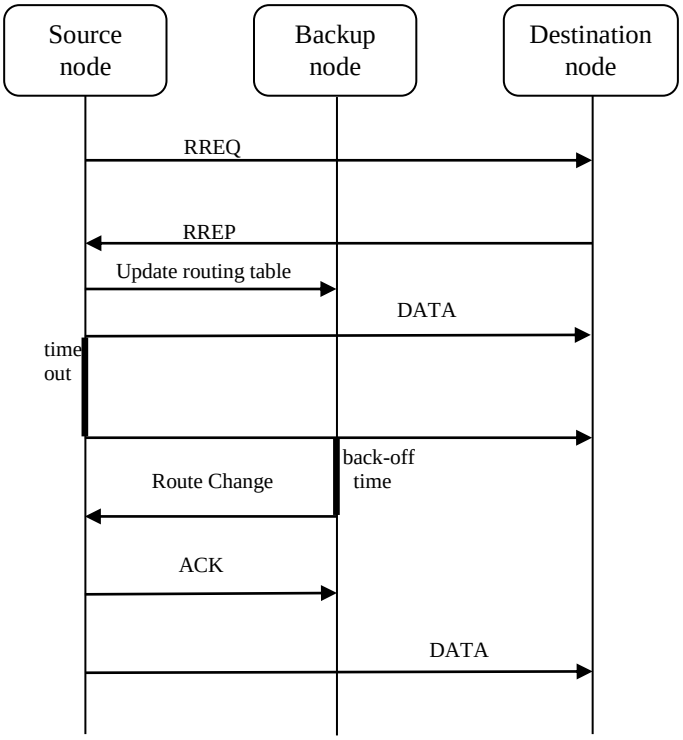

Fig.2 Sequence diagram of route recover process

VII. ADVANTAGES OF RELIABLE ROUTE RECOBERY SCHEME

- No end-to-end routes need to be maintained, leading to high efficiency and scalability.
- No data loss.
- Data can be forward through to neighbor node to the destination node.
- The reliable route recovery scheme employs local recovery of routes for reliability.
- Reduces the number of control messages with the help of backup nodes to improve the efficiency of the network.
- It also considers a backup node's mobility and conducts a route recovery process implicitly.
- Reduces message overhead and also the routing performance.

VIII. CONCLUSION

The local recovery of routes for reliability using backup nodes is done with reliable route recovery scheme. This scheme not only employs local recovery of routes for reliability but also reduces the number of control messages with the help of backup nodes to improve the efficiency of the network. It also considers a backup node's mobility and conducts a route recovery process implicitly. This scheme not only reduces message overhead but also improve routing performance.

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