PERFORMANCE EVALUATION OF DSR USING A NOVEL APPROACH

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ABSTRACT:

In this paper, we propose a novel approach "Routing based on Best First Search Technique (RBFS)" to improve the performance of Dynamic Source Routing (DSR) for mobile ad-hoc wireless networks. The proposed scheme tries to reduce broadcasting of Route Requests during routing. We investigated the QOS metrics namely Average jitter, Average end-to-end delay, Packet delivery ratio and Throughput in various simulation scenarios by varying network size. The simulation results show that the proposed approach achieves better performance than DSR when Average End-to-End delay and Average Jitter performance metrics are considered.

Keywords: DSR, MANETs, RBFS

1. Introduction

Mobile ad hoc network [1 2] is a collection of mobile nodes connected by wireless links without the aid of any established infrastructure. The mobile nodes in an ad hoc network moves randomly resulting in a dynamic topology. The rest of the paper is organized as follows. The operation of Dynamic Source Routing (DSR) and Routing based on Best First Search Technique (RBFS) for MANET is summarized in section 2. The simulation[3] environment is described in section 3. We present results in section 4 and conclude with section 5.

2. PROTOCOL DESCRIPTION

In Reactive routing, the route discovery typically consists of the network-wide flooding of a request message. Once a route has been established, it is maintained by some form of route maintenance procedure until either the destination becomes inaccessible or until the route is no longer desired. Reactive routing protocol [4 5] includes Dynamic Source Routing (DSR)] and Ad hoc On-demand Distance Vector (AODV) [6 7] protocol.

2.1 DYNAMIC SOURCE ROUTING PROTOCOL (DSR)

The nodes in the network co-operate to forward packets to allow communication over multiple hops within the wireless transmission range of one another. Since the number or sequence of intermediate hops needed to reach any destination may change at any time, the resulting network topology may be quite rich and rapidly changing. The DSR [8 9] protocol is composed of two main mechanisms to allow the discovery and maintenance of source routes in the ad hoc network. The following sections explain these mechanisms in more detail.

2.1.1 Route Discovery

When node S wants to send a packet to node D, but does not know a route to D, node S initiates a route discovery process. Source node S floods Route Request (RREQ) packet to its Neighbours and each node appends own identifier when forwarding RREQ as shown in the figure 1.

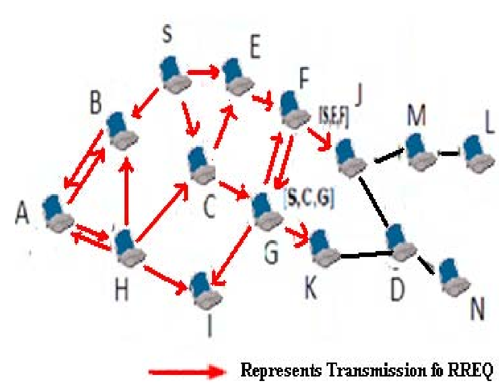

Figure 1: Transmission of RREQS for Route Discovery

When the RREQ is received by the destination node it replies the route reply (RREP) towards the source node via the traversed path as shown in the figure 2.when the RREP reaches the source node, a route from source to the destination is established.

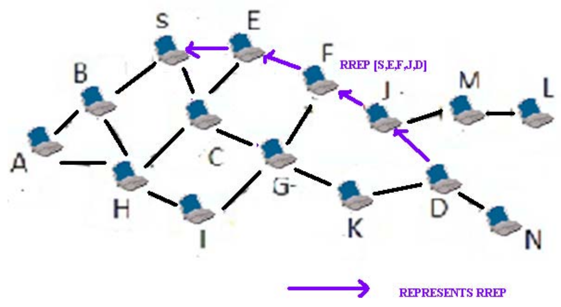

Figure 2: Destination D on receiving the first RREQ sends a Route Reply (RREP)

2.1.2 Route Maintenance

When a link break in an active route is detected, the broken link is invalid and a RERR message is sent to other nodes until the source node is reached. If there is a failure in the current route then for sending other packets to this same destination D, if S has in its Route Cache another route to D, it can send the packet using the new route immediately. Otherwise, it should perform a new Route Discovery for this target

2.2 Routing based on Best First Search Technique (RBFS)

The proposed scheme is based on the Best-First Search Technique [10] which maintains lists for nodes: **open** to keep track of the current fringe of the search and **closed** to record nodes already visited. In this, we order the nodes on open according to the **DELVAL** value which determines the closeness to the source and also to the goal. Each iteration of the loop considers best node on the open list and it is removed from the open list. If it is the Destination, the algorithm returns the solution path that led to the Destination. If the best node is not a destination, then we generate its neighbours or descendants (or children). If the neighbour or child node is already on open or closed, the algorithm checks to make sure that the node records the shorter of the two partial solution paths.

The pseudocode for the Proposed Approach:

```
Function RBFS
  Begin
                    Open: = [source];
                    Closed: = [    ];
           While open ≠ [      ] do
           Begin
  Remove the leftmost node from open, call it X;

If X = destination then return the path from source to X;
Else
  Begin
Generate route requests of X;
Each node which receives RREQ messages sends RESP message back to the node;

The nodes which send RESP messages become the children or neighbours of X;

For each child of X do
Case
  The child is not on open or closed:
    Begin
             Assign the DELVAL value to each child;
              Add the child to open;
     End;
Case
The child is already on open:
    Begin
If the child was reached by a shorter path then Give the node on open the shorter path
     End
Case
The child is already on closed:
     Begin

If the child was reached by a shorter path then
            Remove the node from closed;
            Add the child to open
        End;
    End;
Put X on close;
Re-order the nodes on open by DELVAL value (best leftmost);
End;
Return fail;
End.
```

2.2.1 Route Discovery

When a node wants to send a packet to some destination node and does not have a valid route, it initiates a route discovery process. Source node broadcasts a route request (RREQ) messages to its neighbour nodes. The neighbours which received RREQ messages sends RESP message back to the node. The timing between RREQ message and RESP message is calculated and is known as DELVAL time as given below.

DELVAL time = RESP time - RREQ time.

RESP time: The time taken by the node for receiving the RESP message.

RREQ time: The Starting time of RREQ route requests from the node.

The node for which DELVAL value is less becomes the best node and is also very closer to the source. If the best node is an intermediate node, this node is responsible for transmitting RREQ message for destination. This process is carried out until it reaches a destination. When a Destination is reached, the entire path is generated and RREP message is sent to the source.

For example, node S wants to communicate with node D, node S broadcasts RREQ messages to its neighbour nodes. Each node receiving the route request sends RESP message back to the node as shown in the figure 3.

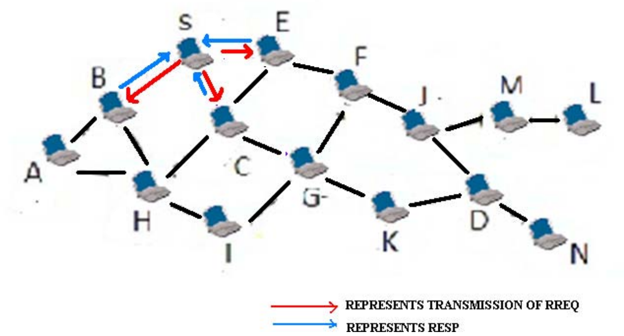

Figure 3: Transmission of RREQs

DELVAL value for each node was calculated. Suppose DELVAL values for the nodes node E, node B, node C is as DELVAL (node E) < DELVAL (node B) < DELVAL (node C). We choose Node E as the best node because of least DELVAL value. Because node E is not a destination, it again broadcasts for destination as shown in figure 4. This process is carried out until we reach a destination node D. Whenever route request reaches the destination, the entire solution path is generated and a route reply (RREP) is unicasted back to its originator as shown in the Figure 5.

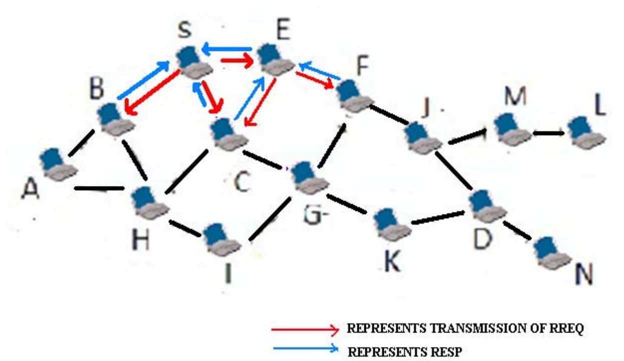

Figure 4: Node E as the best node in one iteration

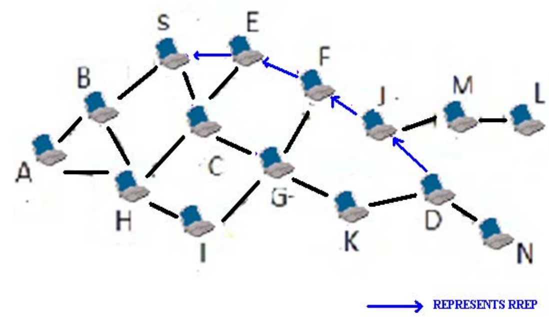

Figure 5: Route Reply from Destination.

2.2.2 Route Maintenance

When a link break in an active route is detected, the broken link is invalid and a RERR message is sent to other nodes. The affected source node may then choose to either stop sending data or reinitiate route discovery for that destination by sending out a new RREQ message.

3. SIMULATION ENVIRONMENT

The simulation study evaluates the performance of Routing [11] based on Best First Search Technique in wireless routing protocols. The simulations have been performed using QualNet version 5.0 [12 13], a software that provides scalable simulations of Wireless Networks. The simulation was carrried out by varying Network size (varying the number of nodes) (one source and one destination) placed in a dimension of 1000m x 1000m area in an environment shown in Table 1.

Table 1

Simulation Environment	
Area	1000m x 1000m
Simulation Time	200 Sec
Nodes	10,20,40,80,100
Nodes Placement	Random
Path loss Model	Two Ray
Mobility Model	Random Way Point
Pause Time	30 sec
Maximum Speed	10mps
Traffic	CBR
Packet Size	512 bytes
MAC layer	802.11

4. Result and Discussion

To evaluate the performance of routing protocols, the following metrics are considered.

1) Average End-to-end delay: End-to-end delay indicates how long it took for a packet to travel from the source to the application layer of the destination.The variation of average end-to-end delay with mobile nodes is shown in the figure 6.

2) Packet Delivery Ratio: The fraction of packets sent by the application that are received by the receivers. The variation of Packet Delivery ratio with mobile nodes is shown in the figure 7.

3) Average Jitter: The delay variation between each received data packet. It measures the stability of the algorithm's response to topological changes. The variation of average jitter with mobile nodes is shown in the figure 8.

4) Throughput: The total amount of data a receiver R actually receives from the sender divided by the time it takes for R to get the last packet. The variation of Throughput with mobile nodes is shown in the figure 9.

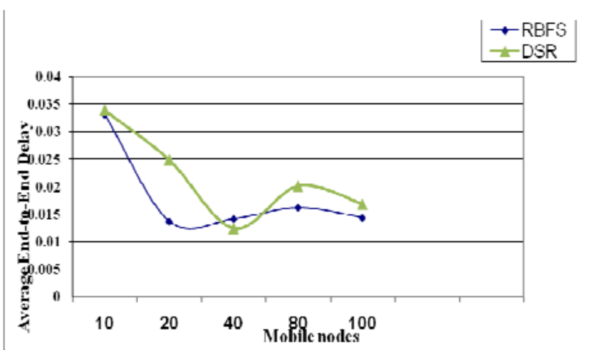

Figure 6: Average End-to-End with Mobile Nodes

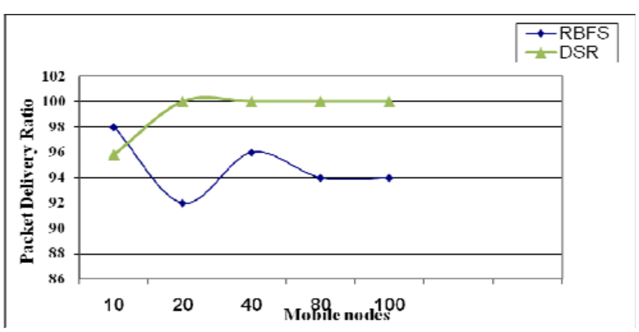

Figure 7: Packet Delivery Ratio with Mobile Nodes

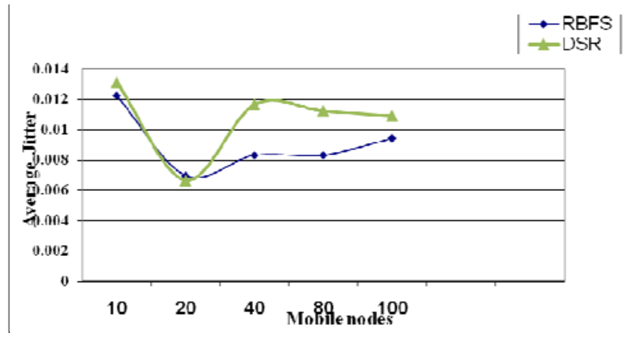

Figure 8: Average Jitter with Mobile Nodes

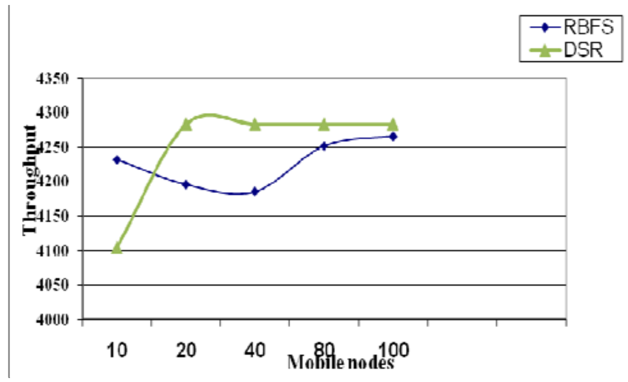

Figure 9: Throughput with Mobile Nodes

5. Conclusion and Future Scope

The proposed technique reduces broadcasting of RREQ messages at each stage while searching for the target. The simulation results show that the proposed approach achieves better performance than DSR when Average End-to-End delay and Average Jitter performance metrics are considered. One of our future research studies is the study of the behaviour of our proposed algorithm with other mobility models.

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