A Novel Optimization of the Distance Source Routing (DSR) Protocol for the Mobile Ad Hoc Networks (MANET)

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Abstract- This paper presents a new scheme for the Distance Source Routing (DSR) protocol which shows the improvement over the two major metrics of the DSR protocol: Route Discovery and Route Maintenance. In addition, we present a mathematical model that includes probability density function for these two observed metrics. Our simulation results demonstrate a significant improvement in the route discovery, transmission time, and the overall network utilization. As an interesting side result, our analysis also shows that the proposed model can be used to effectively reduce the packet losses.

Keywords- DS-CDMA, bit error rate, data throughput, multiuser communications

I. INTRODUCTION

The Dynamic Source Routing (DSR) protocol is dealt under On-Demand Routing (ODR) protocol which is just an exact opposite to the Table-Driven Routing (TDR) [2, 3]. Generally, there are two main phases use in the DSR protocol. One is the Route Discovery (RD) phase which discovers all the possible paths for the packets to be transferred from a particular source to a destination. It is essential to properly maintain the RD phase since maintaining a separate table for storing routing details involves cost issues. The second phase of the DSP protocol is the Route Maintenance (RM) phase which fixes all the possible paths from one particular source to a destination [5]. In DSR, the packets are transmitted only one time for each node. If the node does not receive the packet, the previous node is responsible to make attempts in order to transmit the packet. On the other hand, if the destination node receives the packet successfully, an acknowledgment is transmitted back to the source node for the received packet. Since the use of the DSR protocol does not require the maintenance of a cache table, it allows us to avoid unnecessary updating works which results space and time saving advantages.

In the existing DSR scheme, the malfunctioning of one or more links along a certain route requires the retransmission of all packets back to the originating source node. This unnecessary amount of retransmission results a significant transmission overhead that can severely degrade the overall network performance by increasing the average time delay. In order to minimize the transmission overhead and maximize the network throughput, we present an alternative scheme that can be used to optimize the performance of DSR protocol. Specifically, our proposed scheme suggests improvement in the RD and the RM metrics of the DSR protocol. Based on the proposed optimization, we derive a mathematical model which proves the correctness of the proposed scheme.

II. PROPOSED OPTIMIZATION FOR THE DSR PROTOCOL

Our main goal is to maintain the original underlying architecture of the DSR protocol. Therefore, we consider the DSR scheme as a black box. The DSR protocol fails to maintain route consistency in the presence of broken links. When one of the links goes down, the DSR protocol locates an alternate route and transmits back the packet to the source node where the packet was originated. On contrary to the actual scheme of the DSR protocol, our proposed scheme uses a reserve direction search method. In our proposed scheme, the packets would be transmitted to the immediate prior node where the actual error was occurred. The proposed scheme then finds one or more alternative routes from the current location to the destination. This implies that the whole searching procedure of the proposed scheme will
be done in the opposite direction starting from the destination node. Our simulation results demonstrate that the proposed scheme considerably increases the chance of finding a valid route for salvage packets that are typically stored in the send buffer.

For instance, consider an example for locating a route based on the reverse direction search scheme as shown in Fig. 1. It can be observed that the route finds by the RD procedure from node A (source node) to L would be: \( A \rightarrow D \rightarrow E \rightarrow I \rightarrow L \). During transmission of the packets, it is detected at run time that the shortest link between node \( E \) and \( I \) goes down. Consequently, the proposed scheme immediately starts searching the best available alternate routes. In order to reach the destination node, the proposed scheme locates the neighboring nodes (i.e., node \( B, D, \) and \( H \) from node \( E \)). This process of finding the alternate route from the location of error results an optimal alternate route: \( A \rightarrow D \rightarrow E \rightarrow I \rightarrow H \rightarrow L \). This implies that our proposed scheme neither send any feedback to the destination node \( A \) nor it initiates the route discovery from the source point. Therefore, repeating this search in the reverse direction from the current location of error to the neighboring nodes results a significant increase in the chance of finding a valid optimized route.

A. Proposed Reverse Direction Search Scheme

In order to formulate the proposed scheme, we present a model that shows simple steps that need to be implemented for finding a valid and optimize route in the presence of link failures. The model is presented in Fig. 2. The model is typically divided into two parts. The upper part of the model represents the RD procedure where as the lower part represents the RM procedure. The RD procedure is based on an exhaustive search of an internal cache. During the transmission of a packet, if one of the links goes down, the proposed scheme mentions that the packet will be immediately forwarded to the next available node and starts transmitting from the new location. Unlike the DSR protocol, the proposed scheme minimizes the transmission overhead by avoiding the unnecessary transmission of data to the source node in the presence of a faulty link. In other words, the proposed scheme does not provide any feedback to the source node that leads to a significant improvement in the network throughput. Since the RD can be done on the current node, we do not need to focus on the source node. This implies that the proposed scheme suggests the best