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An Optimized Routing Protocol Algorithm for Mobile Ad-hoc Network

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***Abstract*—Mobile ad hoc network (MANET) is a dynamically reconfigurable wireless network with time-variable infrastructure. MANET has no predetermined topology due to the high level of node mobility. These changes increase the difficulty in finding the routes that the packets use when they are routed. Hence, an efficient and reliable routing is one of the key challenges in mobile ad hoc networks. Here a routing algorithm is proposed using simulation software NS-2.35 to simulate the protocol. Simulation results showed that this algorithm can make the probability of packet delivery ratio more than 99% with fewer networks overhead.**

***Index Terms*— Mobile ad hoc network, Routing protocol, DSDV, DSR, AODV.**

I. INTRODUCTION

Wireless communication is a promising and approaching technology that allows users irrespective of their geographic site to access information and services by electronic means. One of the solutions to these difficulties is wireless local area network based on IEEE 802.11 standard. On the other hand due to rising claim for connectivity in situation/places where there is no base station / infrastructure available ad hoc network came into existence. Wireless networks can be classified into infrastructure networks and infrastructure less networks/mobile ad hoc networks (MANETs). A mobile ad-hoc network is a gathering of wireless nodes that can dynamically be setup anywhere and anytime without using pre-existing fixed network that's why it plays an important role for communications in military operations, emergency operation for disaster recovery, and for missions like search and rescue [1]. Several applicable protocols are available which are intended to form a well-organized and useful MANET. These protocols should have peer-to-peer connectivity among them. It should be distributed in manner such that in order to increase its reliability. MANET should be access point free. A MANET node has the ability to find out an adjacent mode and provision. A routing protocol should be sensitive of excellence of facility. Various researchers working in the area of MANET are demanding to implement the protocols and tools in other applications as well. One of the important research fields in MANET is to establish and maintain the ad hoc network by utilizing the routing protocols.

The paper is organized as follows: Section II of this paper basically gives an overview of few previous works. Section III describes proposed algorithm. Section IV provides the result analysis of the algorithm. Concluding remarks are given in Section V.

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II. Previous Works

Various research works related to ACO and OLSR are proposed in the literature. A hybrid routing algorithm for MANET is described in [2] which are based on ACO and zone routing framework. In [3] the author proposed a new QoS routing protocol combined with the flow control mechanism by ant system. The proposed routing protocol in [3] uses a new metric to find the route with higher transmission rate, less latency and better stability. In [4] the author proposed a new on demand QoS routing algorithm based on ant colony metaheuristic. An algorithm based on ant colony optimization for mobile ad hoc networks has been described in [5]. The drawbacks in [5] are QOS issues end-to-end delay, available bandwidth, cost, loss probability, and error rate. The drawbacks in [5] are addressed in [6] by proposing a hybrid QoS routing algorithm for improving QoS. But the authors described only bandwidth. Other QoS issues are not considered in [6]. Shahab Kamali. et.al [7] implemented a new ant colony based routing algorithm that uses the information about the location of nodes.

Since the topology of the network is constantly changing, the issue of routing packets between any pair of nodes becomes a challenging task. In [2] HOPNET algorithm supports proactive routing within a zone and reactive routing between zones whereas our optimized routing protocol algorithm supports reactive routing. In [3] also both proactive and reactive routing components are used. The major complexity in mobile ad hoc network is to maintain the QoS features [3] in the presence of dynamic topology, absence of centralized authority, time varying QoS requirements etc. As our proposed algorithm is based on reactive routing, whenever there is a change in the network topology it adapt itself instantly and establish the route from source to destination.

PROPOSED ALGORITHM

To improve the performance of AODV and DSR, a new optimized routing protocol algorithm is proposed. In addition to RREQ and RREP messages, the new optimized routing protocol algorithm uses two other routing control messages, the *Hello message* for channel assignment and the *Channel Taken* message for broadcasting that channel is already established.

These algorithms operate in two phases: route discovery and route reply. During the route discovery phase, channel information about a node's k-hop neighbours along the same route is carried by the broadcast RREQ message. Any node that receives the RREQ message updates its next hop table entries with respect to preceding nodes in the path back to the source. Each table entry consists of both the route and the indices of channels that have been taken.

III. Proposed Algorithm

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During the route reply phase, channel information is carried in the unicast RREP message. Upon receiving the RREP packet, each node along the route updates its next-hop table entries, as well as the index of the channel to be used for this link. After the route has been established, each node along the route should have a channel that is different from any of its k-hop neighbours on the same route. A route expires if it is not used or reactivated for a certain period of time. The entry that corresponds to this route will then be deleted from the routing table and the channels assigned to this route will become available for assignment.

If a node on an established route detects that a new route in the neighbourhood is being set up, it shall broadcast a Channel Taken message that carries its own Channel Index. Through Channel Taken messages, channels taken by nodes on established routes can be conveyed to other nodes in the network, up to k hop away.

For all existing protocols, the faster the node moves, the higher rate of packet loss will be. Relatively, AODV protocol is more reliable and its packet delivery fraction is rather high. When the moving speed of node is rather slow, the packet delivery fraction of DSR is most optimal; however, when the moving speed is faster than a certain value, its packet delivery fraction is declining. However, the packet delivery ratio of OPRP is highest as compared to all the existing protocols.

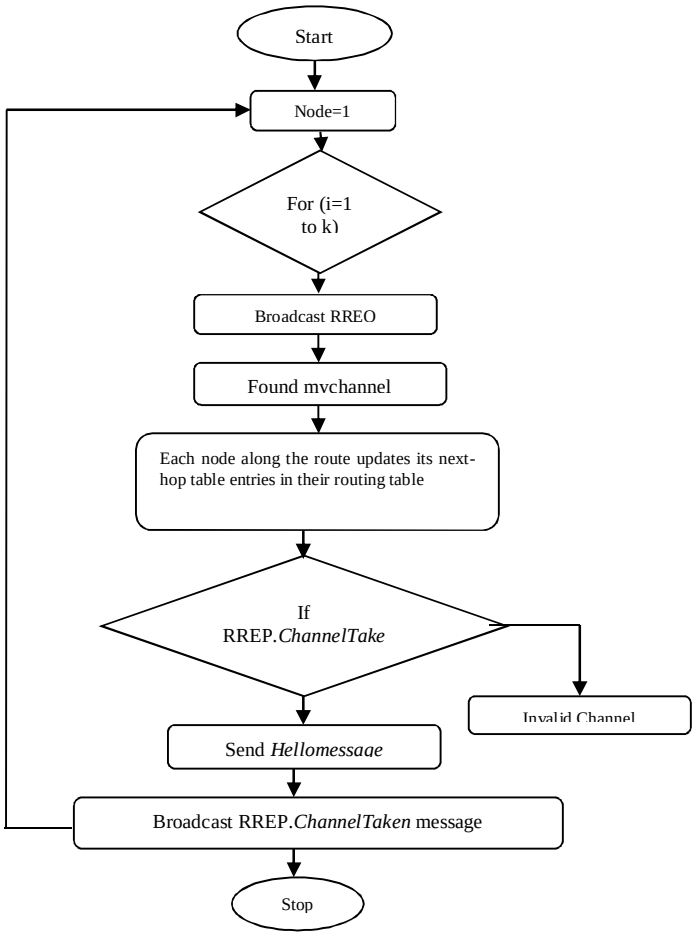

Figure 1: Proposed algorithm

We can find that AODV is always in a stable and low time delay transmission state. When moving speed is low, the time delay of DSDV is the lowest, while in circumstance of high speed, the time delay may be much higher. And in DSR protocol, end-to-end time delay will increase greatly when the moving speed is accelerated. End-to-end time delay is low in case of OPRP when the moving speed is low as well as high.

IV. Result Analysis

An optimized routing protocol is an on-demand routing protocol. It has got multiple route possibilities whereas existing routing protocols that is, DSDV, DSR and AODV doesn't have that property. Due to multiple route possibility, traffic in the network will be more. The packets in Optimized routing protocol will follow multiple route to reach to the destination. So, time consumption will be less. Packet delivery ratio will be highest as compared to DSDV, DSR and AODV because packets will reach to the destination in a small span of time. Average end-to-end delay will also be low due to multiple route possibilities.

a. Packet delivery fraction- Figure 2 demonstrates the comparison of packet delivery fraction of existing routing protocols with Optimized routing protocol. From the figure, we can find that the packet delivery fraction is influenced by the moving speed of nodes. For all protocols, the faster the node moves, higher the rate of packet loss will be. Relatively, Optimized routing protocol is more reliable as compared to DSDV, DSR and AODV and its packet delivery fraction is rather high because packets will reach to the destination in a small span of time due to multiple route possibilities.
b. End-to-end time delay- End –to-end time delay is the time interval between the sending of packet from source node and the receiving of packet by destination node. Figure 3 shows the average end to end time delay in the simulation process. Similarly, from the figure we can find the average end-to-end time

delay is lowest in OPRP i.e. optimized routing protocol due to multiple route property. AODV is always in a stable and low time delay transmission state. When moving speed is low, the time delay of DSDV is the lowest while in high speed circumstance, the time delay may be much higher. And in DSR protocol, end-to-end time delay will increase greatly when the moving speed is accelerated.

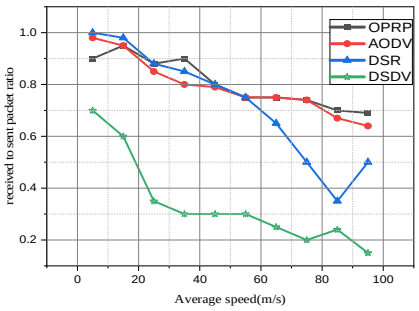

Figure 2: Packet delivery fraction

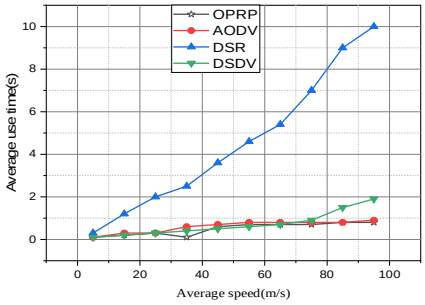

Figure 3: Average time delay

From the Simulation results, it is understood that the performance of the existing protocols varies with respect to multiple parameters. And hence OPRP take over the existing protocols in terms of performance which is also compared in the Table I.

V. Conclusion

In coming years, mobile computing will keep flourishing and an eventual seamless integration of MANET with other wireless networks and the fixed internet infrastructure appears inevitable. The opportunity and importance of ad hoc network is being increasingly recognised by both research and industry community.

Here, an effort is made to develop an optimized routing protocol which have overcome some of the drawbacks of the existing routing protocols i.e. DSDV, DSR and AODV.

The work done on the paper can be extended to include other applications Mobile ad-hoc networks such as those in Fire monitoring, water-leaks monitoring etc. Surveys with changes in parameters can be performed to determine the most robust routing protocol that can be used in scenarios which demand high reliability and efficient usage of energy.

TABLE I: COMPARISON OF DIFFERENT PROTOCOL

Performance Parameters	DSDV	DSR	AODV	OPRP
Route reconfiguration Methodology	Erase route and notify the neighbours	Erase route and notify the neighbours	Erase route and notify the neighbours	Erase route and notify the neighbours
Route metric	Shortest Path	Source route to find shortest path	Shortest path	Shortest path
Routes maintained in	Route Table	Route cache	Route Table	Route Table
Utilizes Route Cache / Table expiration/ timers	Yes	Yes	Yes	Yes
Multiple route possibilities	No	No	No	Yes
Loop free	Yes	Yes	Yes	Yes
Multicast Capability	Yes	Yes	Yes	Yes
Packet delivery ratio	Low	High	High	Highest
Average end-to – end delay	High	Lowest	Low	Low

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