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Adaptive Link Aware on-demand Multicast Routing Scheme in MANET

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ABSTRACT

The main objective of this paper is to propose a new multicast routing scheme to adopt with the dynamic topology of MANET at the same time to provide high multicast efficiency and packet delivery ratio. The proposed scheme is named as Link Aware on Demand Multicast Routing (LAOMR) scheme. In this scheme, initially the source node forms the multicast group by announcing itself as a multicast source agent to all the nodes in the network. The nodes which are eager to join in the group are sending the join request to the source node. Then the source node finds the route to reach the multicast group through some intermediate nodes. The intermediate nodes are not interested to hear the multicast message but they are act as the routers to forward the packets to the multicast group. The intermediate nodes are chosen based on the link residual life (LRL) of the nodes. The node which has the highest LRL and closer to the multicast group is selected as the forwarder node. So, the proposed scheme reduces the link failure in the multicast route and increases the multicast efficiency, throughput. The performance is evaluated by using the simulation results obtained from NS2 Simulator.

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1. INTRODUCTION

Mobile Ad-hoc Network consists of several mobile nodes which are autonomous nodes. They connected with each other by wireless links. In wireless networks the data is transmitted in the form of radio signals. So each and every mobile has the link with the node within the communication range in default. The MANET doesn't have any proper infrastructure and centralized control. The autonomous nodes are having both the transmitting and the receiving device. The MANET attracts the user by providing flexibility and mobility. The multicasting takes a very important part in video conferencing, Cooperative work and replicated database updating etc.

Generally, the multicasting in the MANET is mainly classified into two categories. They are tree based multicasting and mesh based multicasting. The main advantage of tree based multicasting is it provides high multicast efficiency and packet delivery ratio. But it cannot adopt with the high mobility of the nodes in the MANET But, the multicast efficiency is low because of redundant routes. More than a few multicast routing protocols have been suggested for MANET. Some of them are follows:

Multicast operation of the Adhoc Ondemand Distance Vector routing protocol (MAODV) has proposed in [1]. MAODV is a shared tree based multicasting scheme. This scheme picks a sole sender to construct the multicast tree and then shred the constructed tree with other sender. The MOAODV uses the unicast route information of AODV [2] to construct the multicast tree efficiently especially with low control overhead. In this scheme, a group leader is the first node join in the group. Then it floods the group hello messages. An interested node sends the join message to the leader. Then it gets back the immediate reply from any other node in the multicast group. Adhoc Multicast Routing protocols utilizing Increasing ID

numbers (AMRIS) [3] is an on demand shared tree based multicasting protocol. The dynamic session ID is maintained by each node in the multicast session.

Bandwidth Efficient Multicast Routing (BEMR) protocol is proposed in [4]. This scheme is the sender tree based multicast routing scheme. In this scheme, the new member has to make a branch with the new forwarding nodes to join in the multicast tree. When a node wants to join in the group, it floods the join message to the network. The tree nodes only reply to the join message along the shortest path to that node. In [5], the Differential Destination Multicast routing protocol is proposed. It does not follow any multicast routing structure. It encodes the addresses of the multiple receivers, attaches the addresses with the packet header and transmits it by using the unicast protocol [6]. Performance analysis of black hole attacks in geographical routing MANET is discussed in [7]. Secure and Efficient Distance Effect Routing Algorithm for Mobility (SE_DREAM) in MANETs is described in [8]. Computing the available shortest path in routing protocol using current traffic load was proposed. By combining genetic algorithm and open shortest path the route is selected [9].

This paper proposes a new multicast routing scheme called as Link aware on demand Multicast routing scheme. This scheme aims to provide high multicast efficiency and increase the packet loss ratio by constructing the multicast tree with the consideration of link residual life. The following session gives the brief explanation of the proposed scheme.

2. PROPOSED WORK

Multicasting is the process of transmitting the data from single source to the multiple destinations. The multicasting is widely used for the distributed applications such as distance education and video conferencing etc. The multicasting technology effectively utilizes the computer resources and it provides better scalability. In the dynamic environment, it is a challenge to route the data packets towards the multicast group efficiently. Already proposed multicast routing protocols for MANET is failure to adopt with the highly dynamic environment of MANET by means of providing high multicast efficiency and packet delivery ratio. To overcome that, this paper proposes a novel multicast routing technique named as Link Failure aware on-demand Multicast Routing Scheme.

In the proposed scheme, the node which intends to route the data packets act as the source node. The source node forms the multicast group by flooding the group hello messages through the network. The nodes which are want to hear the multicast message send the join request to the multicast source node. The proposed scheme uses the tree based multicasting. In the tree based multicasting, the multicast tree rooted at the sender is created. As all the nodes are mobile nodes, the link between the nodes changes dynamically. So, the tree is formed based on the link residual life of the nodes. The steps involved in the proposed multicast routing scheme are as follows:

Step 1: The source node is act as the leader of the multicast group
Step 2: The source node construct the multicast tree by flooding the group hello messages
Step 3: The multicast tree is rooted at the source node
Step 4: The node which are intends to receive the multicast data send the join message to the source node.
Step 5: After receiving the join message, the source node find out the route to reach that node. The route contains the intermediate node. The intermediate node is chosen based on the link residual life of the node. The link residual life is calculated by using the following formula

$$LRL = {}^{d_t}/_{v_r}$$

Where,

d_t →Distance need to travel to get out of communication range
v_r →Relative velocity
The value of d_t is calculated by using the formula
$d_t = Transmission\ range - Distance\ between\ two\ nodes$

Step 6: The source node construct the tree with the multicast receivers through the intermediate nodes.
Step 7: The source node assigns the group ID to each group.

The source node attaches the group ID with the data. The nodes with the same group ID receive the multicast data from the source node. The ID is used to restrict the data access by all the nodes in the network. The node in the multicast tree can disjoin from the group at any time and any node can join in the group by sending the join message to the source node. Then the source node constructs the branch with that node by finding the route to reach the destination. The proposed scheme reduces the link failure during the communication by considering the link residual life during the construction of multicast tree. The source

node optimizes the number of intermediate nodes by considering the distance while constructing the branch to the receiver node. The proposed multicasting scheme adopt with the highly dynamic environment of the MANET.

The multicast tree construction plays the important role in the multicast routing scheme. Each and every sender node has to construct the tree before multicasting the data. The MANET with highly dynamic nodes changes its topology dynamically. So the multicast tree is also changes dynamically. But the consideration of the link residual life is used to reduce the link failure in the network. The sample multicast tree construction of the proposed scheme is shown in Figure 1. The sender node 0 finds out the route to the receivers via some intermediate nodes. If the receiver is present inside the transmission range in the sense, the sender directly connect with it. The proposed multicast routing scheme provides high multicast efficiency and high packet delivery ratio in the highly dynamic environment.

3. SIMULATION ANALYSIS

The performance of the proposed scheme is analysed by using the Network simulator (NS2). The NS2 is an open source programming language written in C++ and OTCL (Object Oriented Tool Command Language). The nodes have to be configured as mobile nodes by using the node-config command in NS2.The nodes are moved randomly within the simulation area by using the mobility model Random waypoint. The nodes are communicated with each other by using the communication protocol User Datagram Protocol (UDP). The traffic is handled by using the traffic model CBR. The radio waves are propagated by using the propagation model two ray ground. All the nodes receive the signal from all direction by using the Omni directional antenna. The performance of the proposed scheme is evaluated by the parameters Delay and packet loss ratio.

The packet loss rate is defined as the total number of packets lost to the total number of packets sent. It is shown in the figure 1.

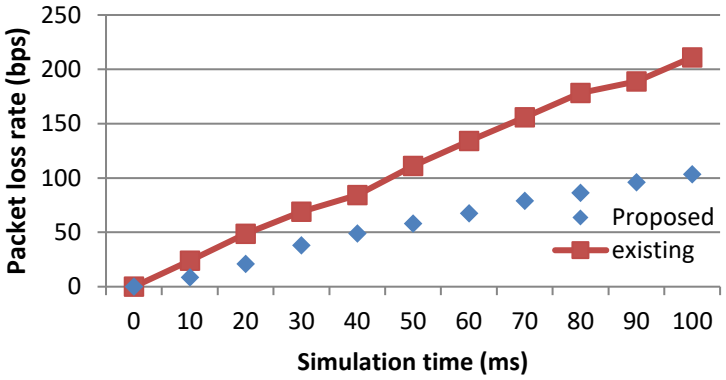

Figure 1. Packet Loss Rate

The delay of the proposed scheme has shown in the figure 2. The proposed scheme has lower delay compared to the conventional scheme.

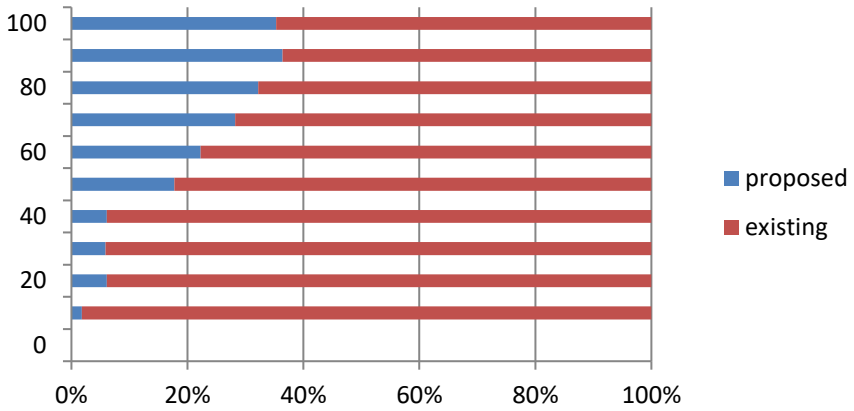

Figure 2. Delay

4. CONCLUSION

In this paper, the Link Aware On-demand Multicast Routing scheme is proposed and the performance is evaluated by comparing the proposed scheme result with the result of traditional multicast routing scheme for MANET is MAODV. The proposed scheme uses the link residual life parameter to adopt with the highly dynamic nature of MANET. This scheme optimizes the path by considering the distance while choosing the forwarder node. Multicast efficiency is high for the proposed scheme by reducing the link failure in the multicast route. The nodes can join in the multicast group at any time and disjoin from the multicast group at any time. Each and every multicast group is assigned with one group ID. The packet sent by the source node is received by the node with same group ID mentioned in the data packet. The node move away from the multicast group deletes its group ID to avoid unwanted flooding of multicast messages. The results show that, the proposed scheme surpasses than the traditional method MAODV.

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