OPPORTUNISTIC ADAPTIVE ROUTING PROTOCOL FOR DELAY TOLERANT MOBILE AD-HOC NETWORKS

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ABSTRACT: It is difficult to maintain the route from source to destination in delay tolerant networks. The opportunistic routing overcomes the issues of route discovery in MANETs. The proposed routing protocol is a table driven approach for routing mechanism. It will effectively find the route between the source and destination by introducing the new concept called as hubs. The opportunistic adaptive routing protocol finds the fitness value of each node participating in the network and includes the nodes in the network which have the highest fitness value. The experimental results show the effectiveness of the algorithm.
KEYWORDS: Opportunistic routing, MANETs, Fitness, Hub, Nodes.

1. INTRODUCTION

In the recent years many routing protocols were proposed for finding the route for packet delivery from source to destination. The division of routing protocols is carried in two categories. One is table driven routing protocols and another one is on demand routing protocols. In the table driven routing protocols each node maintains the table contains the route so that from source can reach any node in the destination. The major table driven routing protocols are Distance Sequenced Distance Vector (DSDV) and Optimized Link State Routing (OLSR). In the on-demand routing protocols, the route is created whenever the communication started. The route is valid till the packet is reached to the destination. The on demand routing protocols are Ad hoc on demand distance vector (AODV) [CE99, TKM10, Guo13] and Dynamic Source Routing (DSR).
Opportunistic routing overcomes the basic pitfalls in the conventional MANET routing like unnecessary packet retransmissions due to lossy wireless network environments [SPV11]. Opportunistic routing allows the coordination among the multiple receivers for successful delivery of packets. In opportunistic routing, the sending node does not preselect any single node to send the unicast packets; it chooses a multiple candidates as intermediate forwarders. Opportunistic routing considers a shared medium as an opportunity rather than as a limitation. The actual forwarder will be selected from a set of candidates that already received the packet. This multiuser diversity property is referred as special diversity among multiple receivers [D+04].
Du et al. [D+13] records advantages of opportunistic routing are as per the following. Opportunistic routing combines several weak links into one strong link which is considered for transmission of packets. Opportunistic Routing might utilize the fastest route which effectively gets the packet as the next packet forwarder. Thus it can exploit out of the long transmissions. Hsu et al. [HLS11] bring up that, Opportunistic Routing can use reinforcement links and it minimizes transmission failures. This enhances unwavering quality of the communication. Test results in [BM05] and [WCL12] demonstrate that OR can possibly perform superior to anything traditional routing protocols.
The rest of the paper is organised as follows. Section 2 deals with the related work of MANETs. Section 3 deals with Adaptive routing protocol for opportunistic Network. Section 4 deals with the Algorithm for adaptive routing protocol. Section 5 deals with simulation environment and experimental results of the proposed model and finally the conclusion is drawn in section 6.

2. LITERATURE SURVEY

The opportunistic routing avoids the overhead of maintaining the topology information and reduces the total packet retransmissions. The packets from the same source to the same destination may take multiple paths based on the opportunistic reception of these packets. The structure of opportunistic routing was initially proposed in ExOR [BM05] to improve the performance of existing traditional routing approaches.
Opportunistic any path forwarding [ZS07, ZJS06] relay on the cost of the path or based on global knowledge of the network to select and prioritize them. In LCOR [H+07] needs to enumerate the nodes to get the least cost path. GaRaF [ZR03] proposed a method with groups and priorities, each forwarding

node neighbors formed as groups and makes priority regions. Therefore, the nodes are who nearer to the destination had the higher priority. Network layer specifies a set of nodes and data link layer involves in the further node selection process [S+04]. A new routing algorithm [LSS11] proposed based on the back pressure to maintain the network stability and minimizes the path lengths between source to destination, it results the fast forwarding with less overhead on the network. Another cluster based mechanism proposed [RYS10] here the carriers used to maintain the connectivity among different cluster of nodes.

Several optimized algorithms [D+15] like Bubblerap and propicman has been compared along with many data dissemination methods in the algorithms. Several other papers also worked on data dissemination methods in opportunistic routing. Public subscribe communication [C+10] implemented in opportunistic routing with socio aware method. Network coding [Y+07] is another complimentary to the opportunistic routing; it creates an encoded packet and obtains maximum utilization by opportunistic listening. Several other methods [Y+07, A+00, KM03] achieves the maximum capacity and coding done at polynomial time. This paper follows the cooperative behavior among the group of nodes to maintain the network stability and energy efficiency.

3. ADAPTIVE ROUTING PROTOCOL FOR OPPORTUNISTIC NETWORK

To perform the opportunistic routing in MANETs, we employ the router mechanism for opportunistic networks. The opportunistic network utilizes the characteristics of network for relaying of messages. The protocol utilizes the Store and forward mechanism for delivering the messages.

The Adaptive routing protocol observes the movement of mobile nodes in day to day life to perform message routing. The main feature of the adaptive routing is it can exploit the periodic movement of the nodes and message routing is done based on this process [V+10]. The proposed routing protocol mainly depends on the hubs. The hubs contain the information of the mobile nodes, routing tables and context information.

The node in the MANET wants to send the message, it will first reach to the hub and the hub is responsible to send the message to the nearest hub of the destination. The routing in the network is considered as graph G (V, E), where V is the vertex denotes the hubs and the nodes moving in the network act as edges E. The routing is processed based on the forwarding table which is residing in the hub for every node.

In ordered to implement the proposed protocol, we have to delimit the hub by identifying the geographical fixed points. In [KOK10], they proposed information sharing process called as floating content which is used for the proposed protocol for managing the anchor zones. The nodes which enter in to the hub region must share their information with the hub.

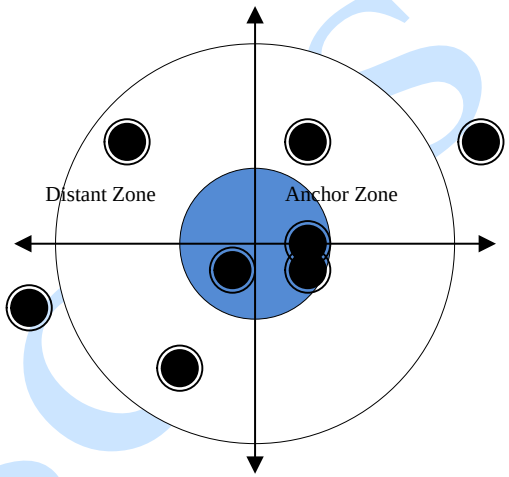

Figure 1: Nodes mobility in the anchor zone and the distant zone [KOK10]

Figure 1 explains about the operating module of the floating content where it can explains about the anchor zone, mobile nodes and communication between them. Content is replicated among nodes inside the anchor zone and remove from the nodes distant from the region.

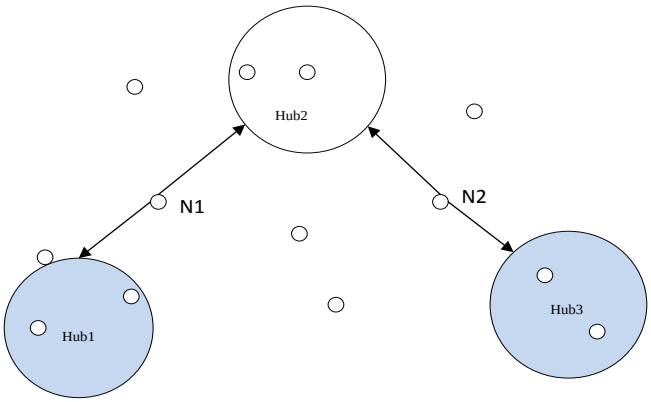

Figure 2: Adaptive Routing Protocol

Figure 2 explains about the adaptive routing protocol where the concentration of nodes is divided in to three hubs. The Hub1, Hub2 and Hub3 are situated in three different regions and the nodes which visit the

hubs two or more times must and should share their information with the hubs. The Node N1 and Node N2 which visits the different hubs named as carrier nodes. The carrier nodes information is stored in the routing table of the hubs.

4. ALGORITHM FOR ADAPTIVE ROUTING PROTOCOL

Algorithm 1 determines about the adaptive nature of the routing protocol. This module deals with the recognition of mobile nodes which perform regular routes between hubs. A fitness table is created with the entries of mobile nodes which are processed under the hub. Fitness value is incremented each time the node visits the hub. Based on the fitness value the nodes are selected for the routing in the MANETS.

Algorithm 1: Adaptive Routing Protocol
Begin
Step 1: if (Hub == found) then
Calculate fitness value of the node to the hub
Step 2: if (fitness value == 0) then
Discard the node details from the table
Step 3: if (fitness value > 0 && fitness value < = 0.9) then
Fitness value = fitness value + 0.2
Step 4: if (fitness value > 0.9) then
Add the node to the hublist(Node ID)
Step 5: for each hub: fitness table do
Update the node entering time and leaving time
Step 6: compare the fitness value of each node the fitness table
Step 7: find the best nodes for network formation based on the fitness value
End

5. SIMULATION ANALYSIS

In this section, we like to analyze the proposed method with various existing approaches to check the performance at different transmission schemes in the network.

A. Simulation setup
To evaluate proposed Opportunistic Adaptive Routing Protocol (OARP), we used NS-2 network simulator. We compare the proposed protocol with TLG, BLR and GPSR. The main objective of simulations is to demonstrate the performance of OARP by placing a rectangular area of size 1000 x 1000 m^2 with free moving of nodes, a random placement of 200 nodes with the transmission range of 250m. All the flows are constant bit rate with a packet size of 512 bytes.

B. Simulation results and analysis
The proposed routing protocol is tested with different network parameters and protocols. This section gives the complete experimentation results of different parameters.
B.1 Delivery ratio: This is the ratio of total number of packets initialized and total number of packets reached to the destination. Figure 3 shows that the delivery ratio is higher than the other existing approaches. The delivery rate is very high during the less network size and less transmissions when the size of network reaches to some threshold value other protocols failing to maintain the delivery ratio but our proposed method outperforms the remaining and giving better output. While implanting this Adaptive routing approach, the delay is avoided. So the algorithm is optimized for less number of iterations due to its location aware identity.

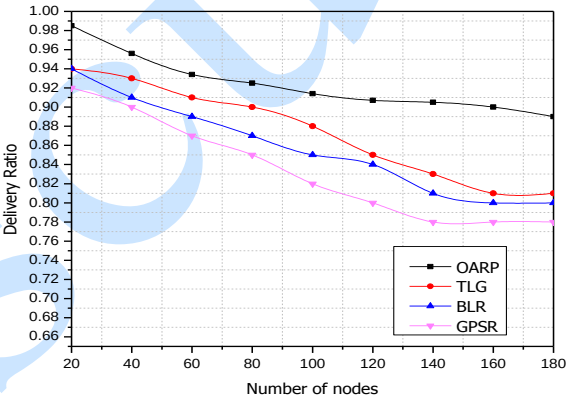

Figure 3: Delivery ratio vs network size

B.2 Packet delay: The packet delay is defined as the end to end difference between selected packets in a flow. Packet duplicating is a serious concern for a beacon-less routing solution. Figure 4 shows the average delay vs network size, in the graph there is a growth in the delay process when increasing the size of the network, but giving the efficient results than other existing approaches.

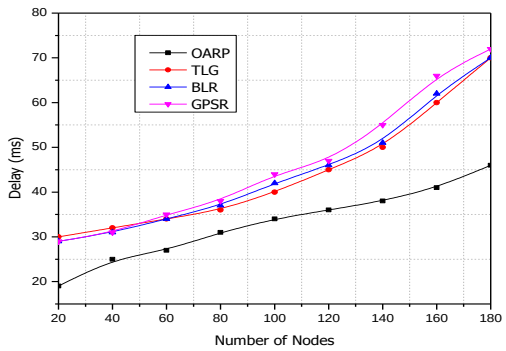

Figure 4: Average delay vs network size

CONCLUSION

The opportunistic adaptive routing protocol provides the better network formation when compared to the existing routing protocols in MANETs. The proposed model monitors the node mobility and records the fitness value of each node in the routing table. The hubs are responsible for maintaining the routing table and observing the fitness value. Opportunistic routing employs the candidates to improve the reliability, packet delivery ratio and other efficiency-related parameters like delay time. It is also possible to implement trust-based mechanism among the nodes in the hubs to achieve the better results.

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