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R2DM ENERGY EFFICIENT MULTIPATH ROUTING FOR WANET

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Abstract: - In modern era use of Wireless Ad-hoc NETwork (WANET) increases rapidly in every sector of life. The main issue of this network is energy efficient multipath routing because nodes are operates with insufficient capacity of batteries. This in-sufficient capacity is constantly change network environment with route discovery and maintenance. Hence, the present paper proposes Route Discovery and Route Maintenance (R2DM) method for energy efficient multipath routing. The basic idea of this method is to select the energy efficient multipath from source to destination and transmit data packet along all paths, as long as at least one of the paths does not fails, destination node will receive the packet.

Keywords: WANET, Route discovery, Route maintenance, Decision maker, Multipath.

1. Introduction

In last two decade the field of Wireless Ad-hoc Network (WANET) [1], [2], [3], [4] has increases rapidly. This network temporarily formed by a collection of stations without relying on any established infra-structure. The communication among stations is via message exchanges through multi-hop wireless links. The topology of this network changes frequently because it does not have centralized infrastructure to support communication among the nodes and nodes are communicated to each other by intermediate hop node. The communicating nodes in WANET acts as a router, as well as a transmitter and a receiver in order to communicate with each other over a shared and limited radio channel. A communication session is achieved either through a single-hop transmission if the communication parties are close enough, or through relaying by intermediate nodes. So it is a special type of wireless network with an association of nodes that co-operate various applications such as tactical networks, emergency services, commercial and civilian environments, home and enterprise networking, education, entertainment, sensor networks, context aware service, e-commerce and coverage extension [5], [6], [7], [8]. The different characteristics and complexities of WANET make the above application as manageable, autonomous and infrastructure-less, multi-hop routing, dynamic network topology, device heterogeneity, energy constrained operation, and bandwidth constrained variable capacity links, limited physical security, network scalability, self-creation, self-organization and self-administration.

The framework of proposed protocol is design by decision maker which illustrate the environment of WANET and demonstrate energy efficient multipath selection by route discovery and route maintenance.

The rest of the paper is organized as follows. In Section 2, we provide background into the area of energy efficient routing for WANET. Section 3 addresses the preliminaries related to the proposed method. The detail of proposed method is described in Section 4. Finally, Section 5 concludes the paper and describes future work.

2. Related Works

Energy efficient routing is the main challenges of the MANET. There have been lot of works are done on energy efficient routing such as Su et al. [9] proposed the fuzzy logic modified AODV routing (FMAR) protocol for multicast routing in mobile ad hoc networks. The main aim of this protocol is dynamically evaluate the active routes based on fuzzy logic weighted multi-criteria. It also helps to managing the limited bandwidths of wireless links. But it has a drawback that the proposed protocol does not considered all possible routes as evaluation of route lifetime by fuzzy logic multi-criteria, so it cannot be determine which routes are highly useful. Therefore, routes cannot repair and maintain partially or completely before they crashed. Huang et al. [10] proposed a novel self-configuring power-saving protocol named SCPS for WANET. In SCPS allows all stations in the power saving mode to adjust their wakeup schedules whenever a station enters or exits in the power saving mode. The adjustment can balance the number of wakeup stations in each beacon interval so that the contention for transmission medium and the collisions in transmission will be im-proved, which results in more efficient energy usage. But it has a limitation that this protocol applied to one-hop WANET only. For extension of this protocol to multi-hop networks is required. Bari et al. [11] proposed an efficient method based on the GA to determine an energy efficient routing scheme for relay node networks. This method helps to scheduling the data gathering of relay nodes, which can significantly extend the lifetime of a relay node network. And this method quickly converges to the optimal solution for smaller networks and as well as larger networks. But it has a limitations like; genetic algorithm is inherently discrete, so it encodes the design variables into bits of 0's and 1's. Therefore, [11] consumes long time for execution and produce non-guaranteed convergence solution. ElAttar et al. [12] proposed a scheme to find an optimized routing that can meet the Quality of Service requirements and the minimized total consumed power of nodes. In addition to that, the network life time must be maximized by considering fairness among power consumptions of nodes. But it has a limitation that, proposed scheme cannot determine which route is more optimal energy efficient and which is less optimal energy efficient. Das et al. [13] proposed a soft computing method (ERPC) for energy efficient routing in wireless sensor net-work. The main aims of this method to demonstrate a strategy of power consumption system in wireless sensor network by using the concept of complete bi-partite graph. The basic parameters of this strategy are power and distance. Finally, it assigns priority to each route and determines the best and worst routing in wireless sensor network. But it has a limitation that the proposed method does not considered hop count and data packet as parameters of energy efficient routing. Because energy efficient routing not considering only energy and distance, it also cover hop count and transmitter packet.

However, none of the above methods demonstrate energy efficient multipath se-lection by route discovery and route maintenance. In the proposed method, we consider the entire mentioned issues based hypothetical example, so it helps to repair and maintain routes completely before they crashed.

3. Preliminaries

The preliminaries related to the proposed method are route discovery and route maintenance, decision maker and multipath. The short descriptions of the above preliminaries are given below:

3.1. Route Discovery and Route Maintenance

Route discovery is the process of finding a route between two nodes within WANET and route maintenance is the process of repairing a broken route or finding a new energy efficient route in the presence of a route failure.

3.2. Decision Maker

Decision maker [14], [15], [16], [17], [18] is a part of mathematical modelling [19] which deals with soft computing and artificial intelligence techniques. It works with inference engine and rule base system. Rule base system is contains knowledge base system which consists of information that helps to construct if then else statement.

3.3. Multipath Routing

Multipath routing consists of finding multiple routes between a source and destination node [20], [21]. These multiple paths between source and destination node pairs can be used to compensate for the dynamic and unpredictable nature of ad-hoc networks. This multipath routing gives up a variety of benefits such as energy efficiency, fault tolerance, load balancing, increased bandwidth, or improved security.

4. Proposed Method

The proposed method is based rout discovery and route maintenance energy efficient multipath routing. The decision of path selection and rejection is taken by decision maker. The complete strategy of proposed method is given in Figure 1.

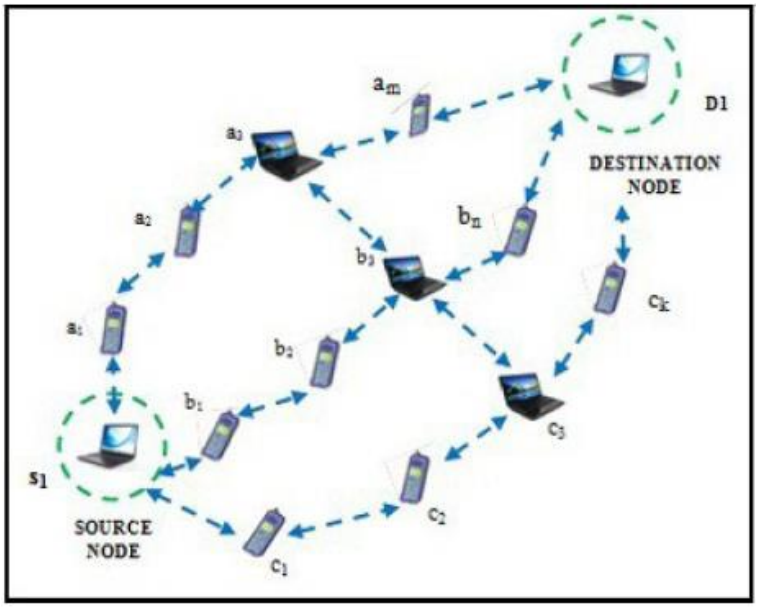

Figure 1: Multipath routing in WANET.

In this section, a hypothetical strategy is designed to demonstrate the route discovery and route maintenance (RD-RM). In Figure 1 node S1 to send data to node D1, it must first discover a route to node D1. Node S1 discovers a route to node D1 going through hop node a1, a2, a3, ….., am-2, am-1, am, and sets up the route 1 (S1, a1, a2, a3, am-1, am, D1). Once the route is established, node S1 can begin sending data to node D1 along the route 1. At the time of data transmission if node am moves out of range due to power failure or insufficient energy then this route will be breaks. Node S1 finds a new route to node D1 through link b3 bn, and thus can begin sending data packet to the destination node D1 . Therefore, new route 4 is (S1, a1, a2, a3, b3, bn, D1). Initially, Routes 1 (S1, a1, a2, a3, am, D1), Route 2 (S1, b1, b2, b3, bn, D1) and Route 3 (S1, c1, c2, c3, ck, D1) in have no links or nodes in common and are therefore node disjoint. Route 4 (S1, a1, a2, a3, b3, bn, D1) and Route 2 (S1, b1, b2, b3, bn, D1) have link b3bn in common. Therefore, these two route are node disjoint but link non-disjoint. In the above hypothetical strategy power failure of a node not only affects the node itself but also its ability to forward packets on behalf of others and thus the overall network lifetime. Therefore, energy efficient routing indicates selecting routes that require minimum distance and sufficient energy. Therefore, to improve the network performance, the nodes should select the best route in terms of its remaining lifetime.

5. Conclusion and Future Work

This paper demonstrates the strategy of route discovery and rout maintenance with energy efficient multipath routing. It provides flexibility against fault tolerance route breakage. This method is a complete fault avoidance energy efficient multipath sys-tem. It initiates different advantages such as energy efficiency, fault tolerance, in-crease bandwidth, or improve security. In real life all route are not highly useful some route are more useful and some are less useful, so future scope to illustrate the strategies of route acceptable and rejected.

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