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NEW APPROACH FOR ENERGY EFFICIENT ROUTING PROTOCOL FOR MANETS USING SPECIAL CROSS OVER IN GENETIC ALGORITHM

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ABSTRACT

Mobile ad hoc networks (MANET) are self-organized networks without infrastructure support. Energy conservation is a very important design issue for routing protocols in mobile ad hoc networks since mobile nodes are powered by batteries with limited capacity. The typical routing protocols of MANETs are mainly the shortest path routing protocols and do not consider the energy conservation issue. Power failure of a node affects the overall lifetime of the network. In this paper a new protocol based upon genetic algorithm has been proposed for energy efficient routing in mobile ad hoc network has been proposed. A new cross over operator is used to generate child node from two parents. The algorithm not only provide best path to transfer data but also alternate paths to transfer data which can be used when one path fails. It increases the overall lifetime of the network and also make the network more reliable.

INDEX TERMS: MANETS, power aware routing, genetic algorithm, wireless networks

1. INTRODUCTION

Mobile Ad-Hoc Networks (MANETs) are wireless networks where a collection of nodes can dynamically vary the topological structure. Active research for MANETs is carrying on mainly in the

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fields of Medium Access Control (MAC), routing, power control, and security. Because of the importance of routing protocols in dynamic networks, a lot of MANET routing protocols have been proposed. MANET routing protocols could be broadly classified into two categories: Proactive and Reactive. Proactive Routing Protocols: Proactive protocols continuously learn the topology of the network by exchanging information among the network nodes. Thus, when there is a need for a path to a destination, such route information is available immediately. If the network topology changes frequently, then the cost of maintaining the network might be very high. If the network activity is low, the information about actual topology might even not be used. Reactive Routing Protocols: The reactive routing protocols are based on some sort of query-reply dialog. Reactive protocols proceed for establishing route(s) to the destination only when there is a need. These protocols do not need periodic transmission of topological information of the network. Hybrid Routing Protocols: reactive or proactive feature of a particular routing protocol might not be enough; instead a mixture might give better solutions. Hence, in the recent days, several hybrid protocols are also proposed.

2. RELATED WORK

Many research works has produced so much innovation and novel ideas in this field. Due to the limited energy resources, there has been research on improving the energy efficiency of wireless ad hoc network. Several ad hoc routing algorithms such as Dynamic Source Routing (DSR), Ad-hoc On-Demand Distance Vector Routing (AODV), Temporally-Ordered Routing (TORA) and Destination Sequenced Distance vector (DSDV) have been evaluated in term of energy consumption [3]. Link quality is a metric that is used by Signal stability based adaptive routing (SSA) [4] to select best link quality route among many different routes. In addition to link quality, SSA also uses location stability as metric. Power aware localized routing [5] achieves the goal by controlling the transmit power of the communication device. Furthermore, power-aware routing is proposed to find a low cost route instead of the shortest routing path [6]. In [7], a RED-based Minimum Energy Routing (REDME) is described, which uses MAC layer buffer queue length as an indicator of the degree of

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congestion. AODV-RSS (AODV with received Signal Strength) [8] uses the received signal strength and changing rate to find a route that can sustain longer. Cross based Power aware cross layer design is based on intermediate nodes to judge its ability to forward the RREQ packets or drop it [9]. Other routing algorithms also prefer the low cost route can be found in [10] [11].

Genetic algorithms (GAs) are search and optimization techniques modelled from natural selection. The GA simulates this process through coding and its operators. The underlying principles of GAs were first published in [13]. A genetic algorithm maintains a population of solutions, where each solution is usually coded as binary string called a chromosome. The best choice of coding has been shown to be a binary in coding scheme [13]. A set of chromosomes forms a population, which is evaluated and ranked by fitness evaluation function. The fitness evaluation function plays an important role in GAs because it provides information about how much good the solutions are. The initial population is usually generated by random. The evolution from one generation to the next population involves mainly three steps: fitness evaluation, selection and reproduction [14].

3. PROPOSED WORK

Genetic algorithms can be used in routing protocols for mobile ad hoc networks. Genetic algorithm can find an optimal path between nodes of the MANET to transfer data. It can also be used to find an energy efficient path to transfer data between two nodes. In this paper a new algorithm using GA has been proposed to find energy efficient path(s) between two nodes. The proposed algorithm also finds alternate paths which can be used when any of the one links fails in the best path. The algorithm has been applied on a sample network of 30 nodes. The sample network is shown in figure-1.

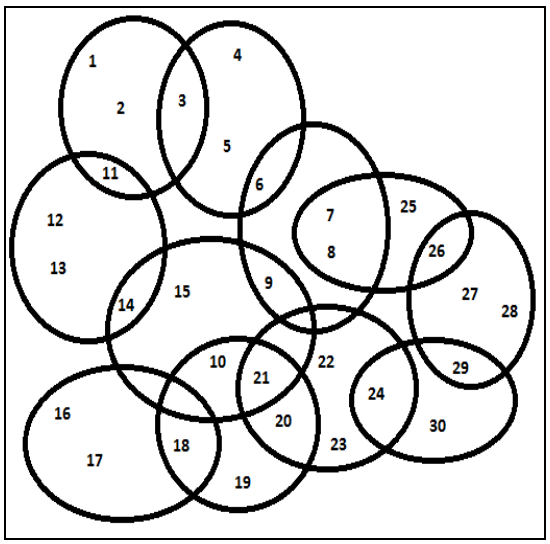

Figure 1: A sample MANET of 30 nodes

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The proposed procedure is as follows: Let suppose node-1 is the sender node and node-30 is the receiver node and algorithm has to find an optimal path between these nodes. A sample population will be generated randomly to transfer data from node-1 and node-30. Let suppose the sample population is as follows:

Path 0 = 1, 11, 12, 14, 10, 20, 22, 24, 30

Path 1 = 1, 2, 3, 5, 6, 9, 7, 8, 26, 27, 28, 29, 30

Path 2 = 1, 2, 11, 14, 10, 18, 21, 20, 22, 24, 30

Path 3 = 1, 2, 11, 12, 14, 10, 9, 15, 21, 23, 24, 30

Path 4 = 1, 2, 3, 4, 5, 6, 8, 9, 7, 25, 26, 29, 30

Path 5 = 1, 3, 5, 6, 8, 26, 29, 30

Path 6 = 1, 3, 11, 12, 14, 10, 9, 6, 7, 25, 8, 26, 28, 29, 30

Path 7 = 1, 11, 13, 14, 21, 9, 10, 18, 19, 20, 24, 30

Path 8 = 1, 3, 4, 6, 7, 8, 25, 26, 28, 27, 29, 30

Path 9 = 1, 2, 3, 5, 4, 6, 9, 14, 10, 19, 21, 24, 30

Path 10 = 1, 3, 4, 5, 6, 8, 26, 29, 30

Path 11 = 1, 2, 3, 4, 6, 8, 7, 9, 10, 18, 21, 24, 30

Path 12 = 1, 3, 4, 5, 6, 7, 25, 26, 28, 29, 30

Path 13 = 1, 3, 6, 7, 25, 8, 26, 27, 28, 29, 30

Path 14 = 1, 3, 4, 5, 6, 9, 8, 25, 26, 29, 30

Path 15 = 1, 2, 3, 11, 14, 10, 18, 20, 24, 30

Path 16 = 1, 2, 3, 5, 6, 9, 8, 7, 26, 29, 30

Path 17 = 1, 3, 11, 13, 14, 15, 10, 9, 7, 8, 26, 29, 30

Path 18 = 1, 3, 11, 14, 21, 20, 24, 30

Path 19 = 1, 3, 5, 6, 8, 26, 25, 7, 9, 10, 15, 21, 24, 30

It has been assumed that every node knows it's neighbors by sending route request and route response messages. Let suppose two candidate solutions generated randomly are as follows:

Path-7 [1, 11, 13, 14, 21, 9, 10, 18, 19, 20, 24, 30]

Path-3 [1, 2, 11, 12, 14, 10, 9, 15, 21, 23, 24, 30]

New children can be generated by using one point crossover. A common route in two nodes has been selected as point of

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crossover. For example node-10 is the node selected for one point crossover. In child-1 first of all all the nodes from the parent one has been copied till node-10 and after that all the nodes after node-10 will be copied from parent-2. Child-1 will also be generated in the same way. By applying this procedure two children generated from parent's route-1 and route-2 are as follows:

Child1 = [1, 11, 13, 14, 21, 9, 10, 9, 15, 21, 23, 24, 30]

Child2 = [1, 2, 11, 12, 14, 10, 18, 19, 20, 24, 30]

This crossover operation can be applied on more parents in the population to generate more children. Then these newly generated children will be added in the population and extended population will be sorted on the cost of the route to transfer data. The same procedure of selection and crossover can be applied many times till the solution converges.

4. CONCLUSION AND FUTURE WORK

In this paper a new algorithm using genetic algorithm has been proposed to find energy efficient routing protocol in MANETS. A new way to apply one point crossover has been proposed to generate children. In future the work can be implemented for the given sample network. In future the proposed algorithm can be applied on a network of 100 or more nodes.

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