IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-6, Issue-8, Aug 2018 E-ISSN: 2347-2693

Credibility of Genetic Algorithm (GA) for Power Efficient Routing and Reactive Protocols in MANET

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Available online at: www.ijcseonline.org

Accepted: 15/Aug/2018, Published: 31/Aug/2018

Abstract- Mobile ad hoc networks (MANETs) does not depend upon the access points or it is an infrastructure less network that connects multiple nodes. The structure of the mobile network may alter frequently and in expected way. In mobile ad-hoc network (MANET), due to mobility of nodes. Energy consumption of nodes is important problem in MANET. In such scenario, link breaks in mobile network, when the battery power of a node is depleted and it results to stops services. Efficient shortest distance paths from source node to destination node is another a critical design issue in mobile ad hoc networks. Genetic Algorithm (GAs) gives the best possible solution to such kind of problems. Genetic algorithm has been used successfully in different applications. Genetic Algorithm will be helpful to minimize the route multiple times when any failure happens during transmission.This paper is giving the brief survey of genetic algorithm in mobile ad-hoc network.

Keywords—Mobile Ad-hoc Network (MANET), Energy Efficient Routing Protocols, Reactive Protocol, Genetic Algorithm (GA).

I. INTRODUCTION

Mobile Ad hoc Networks (MANETs) is a self-organizing, infrastructure less network that connects multiple nodes [1]. The networks do not have any access points or central administration device. MANET allows each node to shift in any direction of the network without any restrictions that is why it changes its links to other devices frequently [2].Mobile Ad-Hoc Networks are supported by battery power, which has finite capacity. Therefore, energy efficient routing is a big challenge in MANET [3]. Power failure creates the problem for the node and decrease its capacity to forward packets to neighbor and other nodes. Battery power of mobile nodes is important part of MANET because mobile nodes continuously utilize its energy [4]. When it not only transmits data packets but also when it remains out of work.

Shortest path is another problem in Mobile ad-hoc networks, which requires calculation of path with shortest distance from source to destination, which will minimize the sum of total cost associated with the path [5].Genetic Algorithm (GA) is very helpful in MANET for searching and to find out the minimum distance path to the destination. Genetic algorithm (GA) is motivated by the procedure of natural selection. Genetic algorithms (GA) generates solutions [6].It uses less battery power and keeps the backups of routes. This will help to minimize the reroute discovery and will take little to resend the data packet to its destination. This paper is giving the brief survey of genetic algorithm in mobile ad-hoc network.

The rest of the paper is organized as follows: Section 2 discusses the MANET routing protocols with pros and cons; Section 3 presents several power efficient routing mechanisms for MANETs; Section 4 presents the genetic algorithm, Section 5 concludes the study.

II. MANET ROUTING PROTOCOLS

Routing protocols are divided into three types according to its behavior. Various MANET routing protocols are available today for searching of path: table driven protocol, on demand protocol and hybrid protocol.

A. *Table Driven Protocols*

In table driven or proactive routing protocol, every mobile node contains separate routing table information for each node which contains latest routing data [8]. Each node sends control messages periodically among the nodes so that every node can update their routing tables.

It continuously updates or evaluates the routes so that, route is immediately known when it is required to transmit the packet. So proactive routing protocol avoids the time delay. But table driven routing is not suitable for extremely

changing networks because updating of routing table will increased the control message overhead which can degrade network performance [9].Destination Sequenced Distance Vector Routing and Optimized Link State Routing etc. are the examples of this kind of protocols

B. On Demand Protocols

A node starts the route searching mechanisms when a node wishes to send the data. It does not have any previous route information of mobile nodes [10]. This reduces network overhead. Examples: Ad hoc On Demand Vector and Dynamic Source Routing etc.

C. Hybrid Routing Protocol

Hybrid routing protocol, takes benefits of table driven and on demand routing protocols. In beginning, routes are set using routing tables (proactive routing protocol) in which paths are available before and then use reactive flooding serves the demand. Zone Routing Protocol is the example for hybrid routing protocol. [11]. Table 1 is showing the Pros and cons of three routing protocols.

Table 1. Pros and cons of various types of protocols.

Protocols	Advantages	Disadvantages
Proactive	Up-to-date routing information	Slow Convergence
	Quick establishment of routes	Tendency of creating loops
	Small delay	Large amount of resources are needed
	A route to every other node in the network is always available	Routing information is not fully used
Reactive	Reduction of routing load	Not always up-to-date routes
	Saving of resources	Large delay
	Loop free	Control traffic and overhead cost
Hybrid	Scalability	Arbitrary proactive scheme within zones.
	Limited search cost	Inter-zone routing latencies.
	Up-to-date routing information within zones	More resources for large size zones.

III. POWER EFFICIENT MANET ROUTING

This paper determines several power efficient routing mechanisms for MANETs. These routing protocols can be differentiated based on the performance of power optimization. A node consumes its battery energy when it send and receive the data packets as well as when it is in idle state [12]. That's why power efficient routing protocols is required. It reduces the active power required to send the data packets and the power when nodes are in idle state.

The two main technique to reduce the active transmission power: load distribution and transmission power control Table 2 shows different types of the power efficient routing protocols.

Table 2: Categorization of The Power Efficient Routing Protocols

Approach		Protocols	Goal
Minimize Active Communication Energy	Transmission Power Control	• Flow Argumentation Routing (FAR) • Online Max-Min (OMM) • Power aware Localized Routing (PLR) • Minimum Energy Routing (MER)	Minimize the total transmission energy but avoid low energy nodes
	Load Distribution	• Retransmission energy Aware Routing (RAR) • Smallest Common Power (COMPOW)	Minimize the total transmission energy while considering retransmission overhead or bi-directionality requirement
		• Localized Energy Aware Routing (LEAR) • Conditional Max-Min Battery Capacity Routing (CMMBCR)	Distribute load to energy rich nodes
Minimize Inactivity Energy	Sleep/Power Down Mode	• SPAN • Geographic Adaptive Fidelity (GAF) • Prototype Embedded Network (PEN)	Minimize energy consumption during inactivity.

IV. GENETIC ALGORITHM

The genetic algorithm archetypal the biological processes to optimized achingly complex cost functions. Genetic Algorithm was modelled by John Holland in 1970's. Genetic Algorithm (GA) is very helpful in MANET for questing and find out the route from sender to the receiver [13]. Basis of Genetic Algorithm is biological neural network. Genetic Algorithm works on outlive of Fitness function. Steps in genetic algorithm are:

- Initialize the population.
- Selection according to fitness.
- Crossover between selected chromosomes.
- Perform mutation.
- Repeat cycle till condition of stop is true.

Figure 2 depicts the four levels of the Genetic Algorithm (GA) cycle which is population (chromosomes), Fitness function or evaluation, Selection and genetic operators. Every cycle brings a new generation provides a way for a given problem.

An initial population of the possible solution is created in the first stage which consists of certain number of chromosomes. Fitness function is calculated in the next stage. Here every individual of the population is examined, with respect to the target. [14]

- Population Initialization

Population is a subset of solutions to the given problem. It is a set chromosomes. In Genetic Algorithm (GA) basically there are two main techniques to initialize a population: Random Initialization and Heuristic initialization.

- Fitness Function (FF)

It is a function which takes the solution as input and generate suitable solution as the output. The quality of the solution depends upon the fitness method or function. The main focus of this algorithm is to find the minimum route cost between sender and receiver.

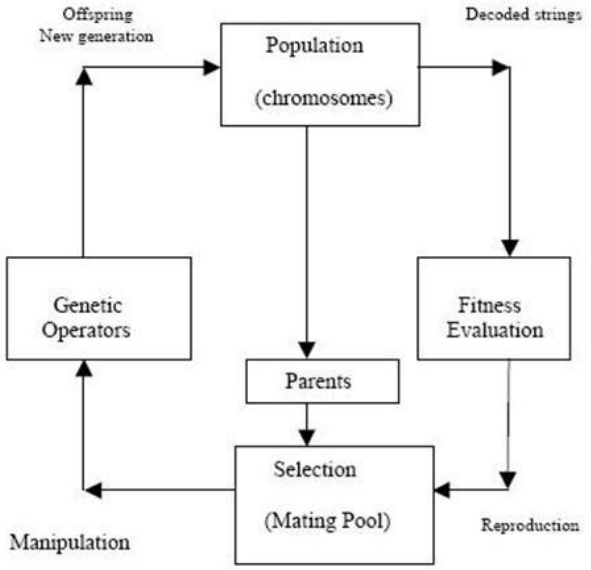

Figure 1. Cycle of Genetic Algorithm (GA)

- Genetic Operators

Genetic Operators is the most important part of the Genetic Algorithm. These operator alters the genetic composition of the offspring. These operators are consists of various key components: Selection, Crossover, and Mutation.

1) Selection: survival of the fittest.

This is the very first operator which is implemented on population. It gives the priority to better individuals and allow to selects the fittest individuals from the generated population and allow them to pass to the next generation. [15].

2) Crossover: In crossover, two individuals are chosen from the population using selection operator.
3)
4) Mutation: There are types of mutation in genetic algorithm like bit flip mutation, random resetting, swap mutation, scramble mutation and inversion mutation

Working principles of Genetic Algorithm (GA):-

Step 1: Get random population and initialize them (t)
Step 2: Umpire fitness of population (t).
Step 3: Do over and over again until completed.

- From population select parents first(t)
- After creating parent population done, commit crossover (t+1)
- Next step is to practice mutation (t+1)
- Umpire fitness of population until we get any best individual.

V. CONCLUSION

Wireless Networking has shown its impact over time and one of the good development done with the help of MANETs. This paper analyses the basic routing protocols with genetic algorithm. Cost of armature needs to be minimize with the motile nature of mobile nodes and achieved via access points (AP) and base stations (BS). There are various routing protocols have been designed. Each routing protocol has its own peculiar must-have. MANETs is growing and changing very fast with many pron's and diverse application zone. An energy potent routing protocol needs to save the battery life of the mobile nodes. Shortest path searching is another main challenge in MANET. Genetic algorithm is very helpful for discovering the shortest path in less duration. Genetic algorithm works efficient than the other routing protocols.

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