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An Approach to Optimize QOS Routing Protocol Using Genetic Algorithm in MANET

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Abstract

Quality of Service support for Mobile Ad hoc Networks is an exigent task due to dynamic topology and limited resource. To support QoS, the link state information such as delay, bandwidth, jitter, cost, error rate and node energy in the network should be available and manageable. QOS is one the basic requirement of a network and when we talk about the Mobile Network this is the highly constraint requirement of a user. To improve the quality of service we use different changes in MANET protocols, its parameter, routing algorithm etc. The proposed work is to define a genetic based routing approach to optimize the routing in MANETs. The genetic approach will generate an optimized path on the basic of congestion over the network. The result path will improve the data delivery over the network. The focus of the paper is to study about MANET, QOS and tries to develop a network on which genetic algorithm is applied to generate an optimized path.

Keywords: *MANET, QOS, Genetic, Delivery, Routing, Optimized*

I Introduction

Next generation of wireless communication systems are engineered to service independent mobile users. These autonomous mobile users (nodes) are connected through wireless links to build a live and on-the-fly network called a Mobile Ad-hoc Network (MANET). The nodes involved in this system should collaborate among themselves and can function as both hosts and routers. They work together only based on the mutual agreement, without knowing about the network topology around them. Hence, maintaining appropriate Quality of Service (QoS) for MANETs is a complex task due to the dynamic behaviour of the network topology.

Commonly, QoS for a network is measured in terms of the guaranteed amount of data which a network transfers from one place to another during a certain time. The QoS is identified as a set of measurable pre-specified service requirements; such as delay, bandwidth, probability of packet loss, and delay variance (gitter). Therefore, a network needs to meet such requirements for the end users to satisfy a particular application while transporting a packet stream from a source to its destination. The traffic types in ad-hoc networks are quite different from other infrastructures and the widespread use of wireless technologies in MANETs make the QoS approaches more complicated.

The application of MANETs was first proposed for military battlefield and disaster recovery. MANETs are mainly used when we require a quick deployment of a cooperative and distributed computing network, such as wireless sensor networks and integrated cellular networks. Accordingly, such networks are demanding to have special features; i.e., autonomous architecture, distributed operation, multi-hop routing, reconfigurable topology, fluctuating link capacity, and light weight terminals. Thus, several interesting issues can be technically involved when designing MANETs; such as security, routing, reliability, internetworking, and power consumption due to the shared nature of the wireless medium, node mobility, and battery limitations. Therefore, providing suitable QoS for delivery of real-time communications in MANETs is more challenging than the ones in the fixed networks.

II MANET

Mobile ad hoc network (MANET) is a wireless network without any fixed infrastructure such as base station. Mobile nodes are connected by wireless links and each node acts as a host and router in the network. Mobile ad hoc networks allows people and devices to seamlessly inter network in areas without any pre-existing communications infrastructure, have wide applications ranging from military operations, natural disaster, search-and-rescue operation and other applications

such as meeting in a room, airport, stadiums and virtual classroom, etc.

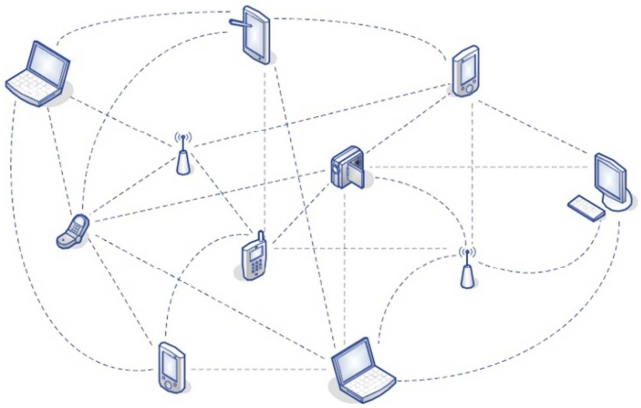

Fig.1. A Mobile Ad-hoc Network (MANET)

Generally in wired networks, QoS parameters are characterized by the requirements of multimedia traffic. But in ad-hoc networks QoS requires new constraints due to highly dynamic network topology and traffic load conditions, time-variant QoS parameters like throughput, latency, low communication bandwidth, limited processing and power capacity than wire-based network.

Moreover, QoS in ad-hoc networks relates not only to the available resources in the network but also to the mobility speed of these resources. This is because mobility of nodes in ad-hoc networks may cause link failures and broken paths. In order to continue a communication therefore, it requires finding a new path.

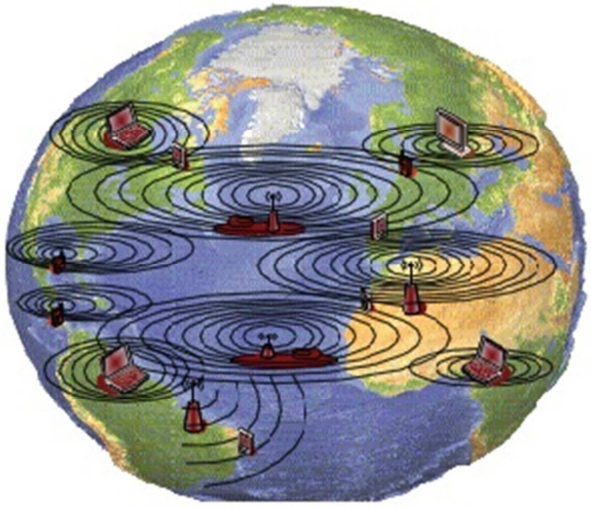

Fig.2. Autonomous nodes in MANET

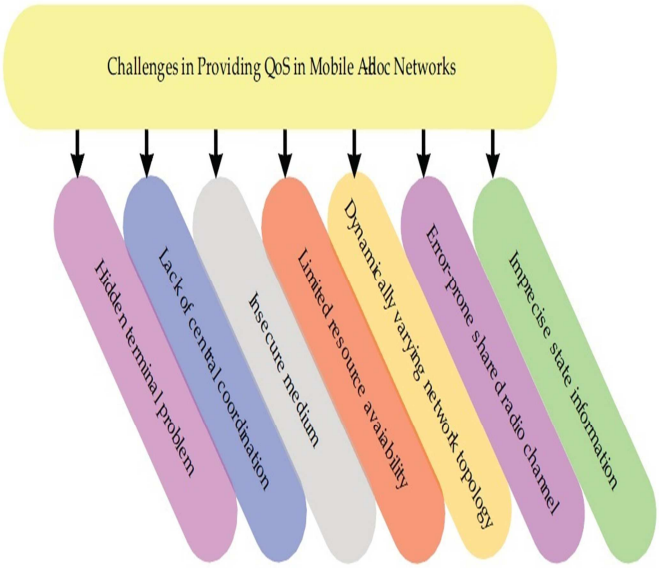

Fig.3. Some challenges when proving QoS in MANET

Fig.4. Major issues that affect the performance and design of mobile ad-hoc networks.

Problems with MANET

i). Asymmetric links: Most of the wired networks rely on the symmetric links which are always fixed. But this is not a case with ad-hoc networks as the nodes are mobile and constantly changing their position within network.

ii). Routing Overhead: In wireless ad hoc networks, nodes often change their location within network. So, some stale routes are generated in the routing table which leads to unnecessary routing overhead.

iii). Interference: This is the major problem with mobile ad-hoc networks as links come and go depending on the transmission characteristics, one transmission might interfere

with another one and node might overhear transmissions of other nodes and can corrupt the total transmission.

iv). Dynamic Topology: Since the topology is not constant; so the mobile node might move or medium characteristics might change. In ad-hoc networks, routing tables must somehow reflect these changes in topology and routing algorithms have to be adapted. For example in a fixed network routing table updating takes place for every 30sec. This updating frequency might be very low for ad-hoc networks.

III Routing Protocol

As in a wired network, application flows in a MANET have different characteristics (e.g. type and volume of information exchanged, lifetime of the interaction, packet inter arrival time, with or without burst) and also different Quality of Service (QoS) requirements (e.g. delay, throughput, high priority processing). Hence, a uniform packet processing is not adequate and a QoS support taking into account various QoS requirements are needed. The overall routing protocol types responsible for transmission of packets between different mobile hosts in ad-hoc network falls into three broad categories

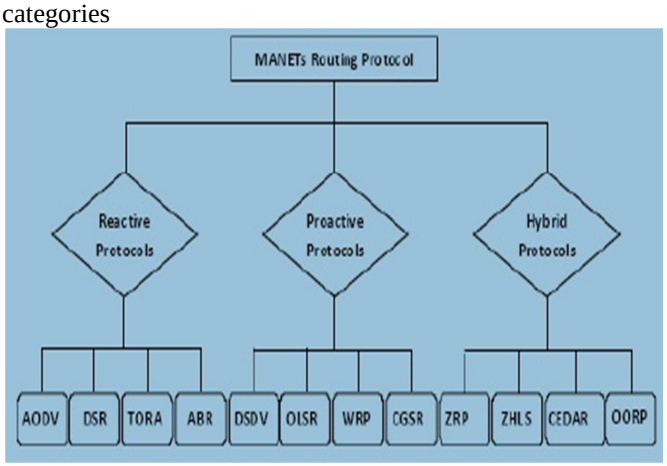

Fig.5. MANET Routing Categories and Protocols

Because of the fact that it may be necessary to hop several hops (multi-hop) before a packet reaches the destination, a routing protocol is needed. The routing protocol has two main functions, selection of routes for various source-destination pairs and the delivery of messages to their correct destination. The second function is conceptually straightforward using a variety of protocols and data structures (routing tables). This report is focused on selecting and finding routes.

There are mainly three types of routing protocols used in MANET.

1. Reactive Routing Protocol (On-Demand): It does not periodically update the routing table.eg. Ad-hoc On-demand distance Vector Routing (AODV), Dynamic Source Routing (DSR), and Temporally Ordered Routing Algorithm (TORA), etc.
2. Proactive Routing Protocol (Table Driven): It periodically updates the routing table. e.g. Optimized Link State Routing (OLSR), Cluster-based Gateway switch Routing (CGSR), etc..
3. Hybrid Routing Protocol (Reactive/ Proactive): It is a combination of both Proactive and Reactive Protocols. e.g. Zone Routing Protocol (ZRP) etc.

IV GA Based Approach

We are providing the solution of above said problem using the genetic approach. There are a few reasons why it can be beneficial to use genetic algorithms for training neural networks. With regard solely to the problem of weight (and bias) selection for networks with fixed topologies and transfer genetic algorithms are particularly good at efficiently searching large and complex spaces to find nearly global optima. As the complexity of the search space increases, genetic algorithms present an increasingly attractive alternative to gradient-based techniques such as back propagation. Even better, genetic algorithms are an excellent complement to gradient-based techniques such as back propagation for complex searches complement to gradient-based techniques such as back propagation for complex searches. A second advantage of genetic algorithms is their generality. With only minor changes to the algorithm, genetic algorithms can be used to train all different varieties of networks. They can select weights for recurrent networks, i.e. networks whose topologies have closed paths. A third reason to study genetic algorithms for learning neural networks is that this is an important method used in nature.

Our proposed methodology involves the following steps:

1. Generate the possible path between source and the destination
2. Analyze and collect all the possible paths between the initial and the Goal State.
3. Repeat Steps 4 & 5 such that most distinguish path not occurred
4. Select Two possible path P1 {p11,p12,p13,….,p1n} and P2 {p21,p22,p23….p2n}
5. Perform Crossover on P1 & P2 such that
   a. Generate a new sequence P3={p31,p32,p33…p3n}, The sequence will be elected on the basis of the frequency of a state at index position i.
6. Performed the Mutation on P3 to perform the pruning on dead nodes.
7. Exit

A suitable encoding is found for the solution to perform optimized route so that each possible solution has a unique encoding and the encoding is some form of a string. The initial population is then selected, usually at random through alternative techniques and fitness of each individual in the

population is then computed i.e. how well the individual fits the problem and whether it is near the optimum compared to the other individuals in the population. This fitness is used to find the individual's probability of crossover. If an individual has a high probability (which indicates that it is significantly closer to the optimum than the rest of its generation) then it is more likely to be chosen to crossover. Crossover is where the two individuals are recombined to create new individuals which are copied into the new generation. Next mutation occurs. Some individuals are chosen randomly to be mutated and then a mutation point is randomly chosen. The character in the corresponding position of the string is changed. Once this is done, a new generation has been formed and the process is repeated until some stopping criteria have been reached. At this point the individual who is closest to the optimum is decoded and the process is complete.

GENETICS TOOLS

A simple genetic algorithm that yields good result in many practical problems is composed of three operators

- **Reproduction**
- **Crossover**
- **Mutation**

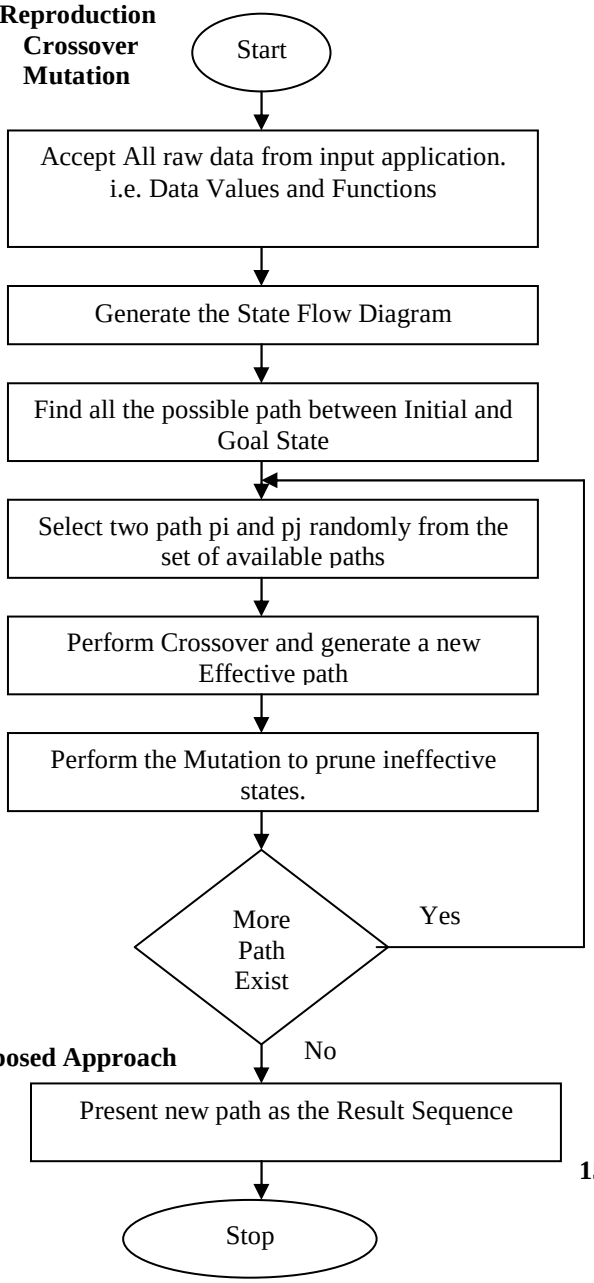

Fig.6. Proposed Approach

The Figure 6 shows the flowchart of proposed approach. Here the steps of the algorithm are described.

V Results and Discussion

Optimization is always the basic requirement of a mobile network. In this proposed work we are improving the service in same area. In mobile network the information is passed to all its neighboring nodes and the process is repeated till the data not arrived at the destination end. The path selected for routing is then used in reverse direction to pass the acknowledgement. In this proposed work we are defining an architecture in which a node will broadcast the information to 4 neighboring nodes in the direction of receiver side. Four neighbor nodes will be selected by using 2 parameters one is the distance and other is load on the node. The proposed work will improve the communication over the network in terms of better throughput and less congestion over the network.

A network architecture is developed by using MATLAB 7.8.

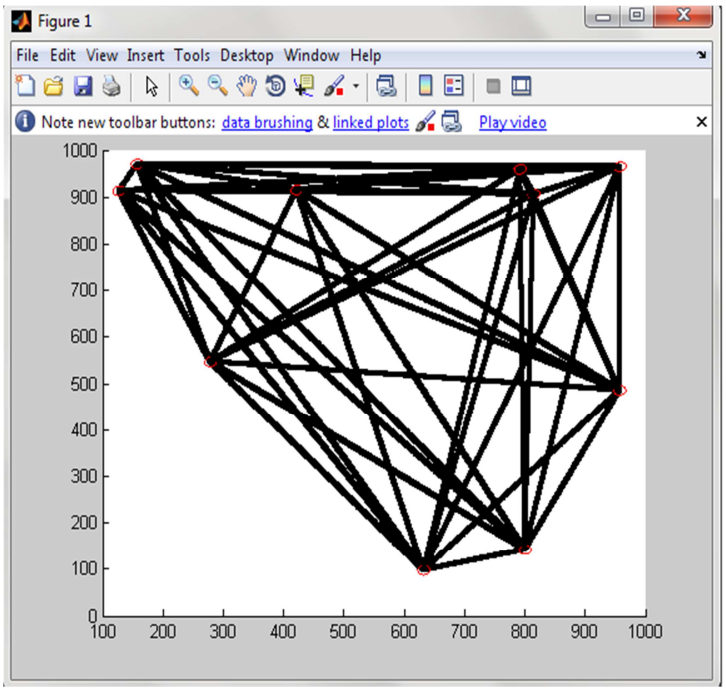

Fig.7. A Developed network

The figure shows the network developed with 10 nodes highlighted by red circle. Each and every node is connected. The designed network is in static form rather than mobile as the MANET implies mobility of network. In this work we use static network because our work is to generate routing algorithm in current situation for data transmission.

VI Conclusion

In this presented work we have generate a new routing sequence based on the Genetic algorithm. In this work we have studied all possible paths between each pair of nodes and find a new efficient routing that is congestion free and that will result more reliable data transmission. As the use of the Genetic approach result the intelligent approach to identify the new route over the network. In future, we try to implement optimization of QoS routing protocol using genetic algorithm.

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