Implementation of ODMRP Based QoS Multicast Routing in MANET

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Abstract - *A MANET is a self healing network and it has an large number of interconnected system with large number of hosts. It is proposed to evaluate the GA-QoS-BEMRP protocol for mobile ad-hoc network to improve the bandwidth effectiveness. QoS BEMRP protocol produces high throughput and less delay compared to other routing protocols. QoS BEMRP create a multicast tree with least amount of bandwidth and end to end delay. NP-Complete is a QoS multicast routing problem. It depends on restricted end to end delay and minimum cost. Two important QoS constraints are end to end and bandwidth constraint. In this paper, presents GA-QoS-BEMRP that is used to determine the Quality of Service (QoS) multicast routing problem. Shared multicast tree is used to provide better bandwidth effectiveness. Simulation result shows that genetic algorithm is efficient and give resourceful bandwidth.*

Key Words: MANET, Multicast Routing, Genetic Algorithm, Share tree based routing.

1.INTRODUCTION

A mobile adhoc network has a collection of nodes and it is the self-attenuate network. Mobile nodes or devices are connect without wires. Each device in an ad-hoc network is in a random motion and change its link regularly. Each node can act as a router and must forward traffic. The network may contain one or more transmitter and receiver. QoS-BEMRP includes the multicast routing problem and bandwidth defiance problem. These two defiance problems are tolerate by using QOS-BEMRP. Following are salient features and characteristics of ad-hoc networks:

- In MANET, each node can act as a router and host.
- MANETs are capable of multicast routing.
- Its operation based on security, routing and host configuration.
- Nodes can join or leave the network concurrently.
- In network, all nodes has the same features and capabilities.
- Resources like channel bandwidth, node resources such as computational power, storage capacity etc.,in ad-hoc networks are very limited.

These characteristics of ad-hoc network has several new challenges in the design of routing protocols. Genetic algorithms are strong and efficient for solving the real time problems. GA is used for measuring scalar performance. GA has been successfully applied for finding finest routers.

QoS-MAODV MAODV is an on exact multicast routing protocol which selects routes on demand. Improved MAODV extends MAODV with the QOS support using the topology. The operation of the MAODV-QOS, Route discovery Source node initiates the path finding by spreading a RREQ with the QOS extension to destination D. RREQ contains the following fields: Source id, seq. no, dest-id, hop count, QOS state (stability level, power level, buffer level), and class. Hop count is the number of midway nodes between the source and the destination. The hop count is related to resource conservation. Power level is used as a designation of routing load of each node. Power level or available battery of a node is coded as high = 11, medium = 10, low = 01, selfish = 00.

QoS-BEMRP has the multicast steering problem which is NP-Complete. It depends on end to end delay and least bandwidth of the tree. QoS-BEMRP is used to obtain and evaluate the main constraint in a network i.e., bandwidth and end to end delay. Genetic algorithm is used for sustaining delay sensitive applications. In this regard, the proposed algorithm is quite used for tree based multicast routing in MANET.

In the ODMRP, the current technique for efficient multicast routing consists in establishing a multicast forwarding tree to forward data packets to their destinations. However, a tree is very flimsy when the nodes favour high mobility. Thus, the ODMRP uses additional links in the underlying forwarding tree structure, which manage to deal with mobility. But this further backup consume in excess of network resources and exhibits a large volume of control overhead.

In this paper, we focus on share tree based multicast routing problem. We propose an efficient genetic algorithm with multicast routing protocol based QoS to find the delay and bandwidth constraint.

2. RELATED WORK

Xian Xiang [11] in this paper RSGM protocol using stateless effective transmission for simple organization. It has less control and delay overhead. However, this scheme has empty zone routing problem. Bulent Talvi [9] in this paper MC-TRACE using factual data communication. It provides better bandwidth effectiveness and energy effectiveness. However, this scheme has high delay and low throughput. The proposed [8], [12] does not work well in tree based approach. Aisha [8] in this paper proposed PBQMRP achieve less packet drop ratio and has less control overhead. However, this paper exploit limited network resources. Nen-chung Wang [6] in this paper proposed PDTMRP using load balance to get better life time of the network. However, this paper result more multicast tree partitions.

3. PROPOSED MULTICAST PROTOCOLS

3.1 Introduction

I have proposed the two best multicast routing protocols of MANET. The routing protocols are:

a) BEMRP

b) ODMRP

c) MAODV

a) BEMRP

BEMRP is the tree based protocol and it is used to find the close to forwarding node. BEMRP is share tree based and it is used to reduce the number of packet transmissions. BEMRP provides able route establishment between two nodes and they communicate economically with each other using shortest path tree. BEMRP has less control overhead and delay. BEMRP supports both multicast and broadcast communication. BEMRP deals with the restricted end to end delay and bandwidth limitation. In BEMRP, each multicast group has a leader. In BEMRP, the multicast tree construction is caused by the receivers. It spreading the Join control packets throughout the network. The node who receives the Join control packet response with Reply packets. When many nodes receives the Reply packet, the receiver choose any one of the neighbour node and send a Reserve packet along the path.

Node who wants to join the multicast group has four step process. They are 1) Reply control packet 2) Reserve control packet 3)Join control packet. In BEMRP, the tree maintenance is done only when the link break is detected. For recovering link failures, two schemes are used.

- Broadcast Multicast Scheme: In this scheme, the upper node has the responsibility for finding a new route to the previous downstream node. Each upstream node floods the multicast packets with partial TTL. After receiving the packet, receiver sends the Reserve packet to the upper node and joins the group again.
- Local Rejoin Scheme: In rejoin scheme, the downstream node in the broken link tries to join the multicast group. When the link between the receiver and its upstream node fails, then receiver sends the Join Control packet with partial TTL. When the tree node receives the Join control packet it reply with Join reply packet.

b) ODMRP

ODMRP is a mesh based rather than a predictable tree based scheme and uses a forwarding. By maintaining a mesh instead of a tree, the drawbacks of multicast trees in ad hoc networks like regular tree reconstruction and non-shortest path in a shared tree are avoided. In ODMRP, it is a mesh based protocol and it forms a loop. This control packet is periodically transmit to refresh the membership information and updates routes in a loop manner as shown in the fig 2.When the Join-Query packets are received by a multicast receiver,and it replies with the Join-Reply to its neighbours. If the node realizes that it is on the path to the source and becomes the part of the multicasting group by setting the FG_FLAG (Forwarding Group flag). When receiving a multicast data packet, a node forwards it only when it is not a spare, hence minimizing traffic overhead.

4. PROPOSED ALGORITHM

Genetic algorithms are known to be strong and effective for solving complex problems. Moreover, these algorithms are heuristic and stochastic in nature; they do not have the chance of getting trapped at local minima. Among the existing residents based algorithms, the most well known branch is the GA. The GA-QOS-BEMRP uses only a simple scalar performance measure; it does not use alternate information. This property makes the GA-QOS-MAODV, GA-QOS-BEMRP and GA-QOS-ODMRP well-suited for general purpose optimization in networks. In networks optimization, the GA-QOS-BEMRP has been effectively applied to find optimal routes, network design, etc. Due to dynamism and unpredictable nature, a MANET is a challenging environment for software designers. In MANET, links can go up and down depending on various physical factors such as movement of hosts, terrain, weather, interference, or available battery power is obtained in figure 1. A tree must be point indexed before encoded with spanning tree encoding. Figure 2 show 2 indexed trees where node is represented by a circle with its pointed index. Initially the weights are assigned randomly. chart 2 Trees with different set of position indices figure2 Spanning Tree Codes for the trees 3.2 Evaluation The performance of the strings, often called fitness, is then evaluated with the fitness function given, representing the constraints of the problem. 3.3 Crossover Position crossover performs conventional one-point crossover on the topology chromosomes of two spanning tree codes to form new topologies while their sequence chromosomes remain unchanged.

4.1 Crossover

Figure 2 shows the Position crossover for the above spanning tree codes with cut point at 5. Figure 5 show the tree topology obtain on or after the spanning tree codes subsequent to the location crossover. The point crossover change the tree construction considerably and gives genetic algorithm the capacity of global investigate . Figure 2 Position Crossover. Trees later than point Crossover 3.4 transformation transformation is a genetic operator second-hand to continue genetic multiplicity beginning one production of a inhabitants of genetic material to the next. Node transmutation and link mutation are the two kinds of alteration operations. The function of change is to make small changes to persons that prevent the entire generation. When a transmutation occurs, a vertex is randomly selected on the tree and a new tree is construct. Link mutation is to cut down a randomly selected sub tree and then grafts it to a randomly selected node in the remaining tree to form a new tree [2]. The inhabitants in genetic algorithm is initialized by randomly giving each gene a random number between 1 and n, the number of nodes. The algorithm terminates if the number of passes cross a given threshold or the average fitness of chromosome in each iteration exceeds a threshold. Finally the obtained structure is an optimized route by which the packet drop are a smaller amount.

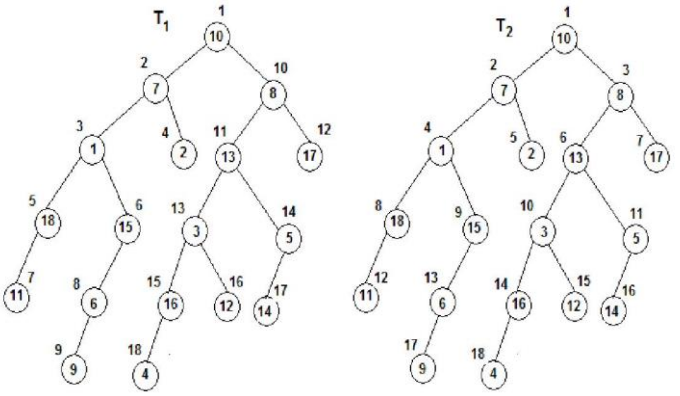

Fig – 1: Trees with a Different Set of Position Indices

4.2 Mutation

Mutation is second-hand to continue genetic mixture on or after one generation of a population of chromosome to the next. Node mutation and link mutation are the two kinds of mutation operations. When a mutation occurs, a vertex is erratically selected on the tree and a new gene is grown there. Link mutation is selected sub tree and then graft it to a erratically selected node in the remaining tree to form a new tree [2]. The population in genetic algorithm is initialized by randomly philanthropic every one gene a random amount connecting 1 and n, the number of nodes. The algorithm terminates if the number of passes cross a given threshold or the average fitness of chromosomes in each looping exceed a threshold. Finally the obtained structure is an optimal route by which the packet drops are less.

New offspring can be generated from a single parent. Mutation can generate a new gene. All individuals are not same. It is fairly simple. Mutation remains changing bits in one of the other numbers. The main aim of mutation is to select a subset of nodes and it break the links into separate sub trees and the selected nodes are connected to the far child node T. Then it reconnect the sub trees into a multicast tree which has least delay path.

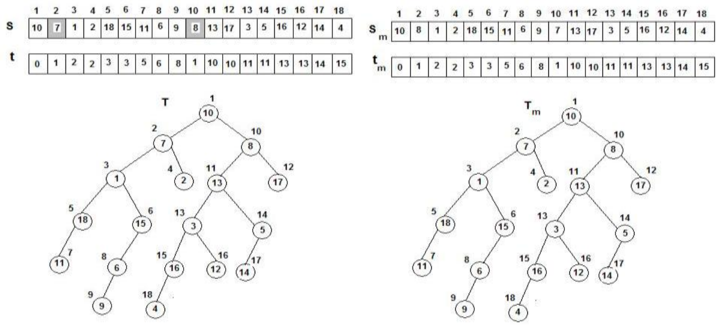

Fig – 2: Trees after mutation

4.3 Analysis of convergence

Proposed algorithm finally converge to the optimal solution. For large network, the optimal solution is used for NP-Complete problem. This problem can be overcome by setting the iteration time of the genetic algorithm.

Table – 1: Comparison of proposed multicast routing protocols

Parameters	GA-QOS-BEMRP	GA-QOS-MAODV	GA-QOS-ODMRP
Need unicast protocol	Yes	No	No
Periodic flooding through network	Yes, Group Leader	Yes, Group Leader	Yes, Group Leader
Group member receive redundant data	No	No	No
Primary Structure	Minimum Spanning Tree	Optimized Tree Structure	Optimized Mesh Structure
Route setup overhead	Low	Moderate	Moderate
Route maintenance overhead	Low	Moderate	Moderate
Data forwarding overhead	Low	Moderate	Moderate
Reliability	High	High	High
Latency	Low	Moderate	Moderate

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5. RESULTS AND DISCUSSION

We have implemented the proposed share tree based genetic algorithm in C++ using the genetic algorithm lib which is in C++ library of genetic algorithm. The performance of GA-MAODV analyzed. Number of senders are increased as 1,2,5,10 and the number of receivers are increased as10,20,30,40,50 then the PDR with no pause time for 0m/s mobility, 1m/s mobility and 20m/s mobility are calculated. The network simulator ns2.26 is used for implementation. The simulation area is 1500x300 meters with 50 nodes. The following figures shows the analysis results for MAODV and GA-MAODV. The simulation environment is given as below,

Table – 2: Simulation Environment

Area	1500 x 300 meters
Number of nodes	50
Simulation Duration	910 secs
Number of repetitions	7
Physical/MAC Layer	IEEE 802.11 at 2Mbps
Transmission Range	250m
Mobility Model	Random way point model
Simulator	ns-allinone-2.26

We run simulations with NS2 to analyze and compare the performance of GA-QOS-MAODV,GA-QOS-ODMRP and GA-QOS-BEMRP

Table – 3 : Parameters used in the simulation

Parameter	Values
Examined Protocols	GA-QOS-BEMRP,ODMRP& MAODV
Simulation area	1500 m x 300m
Number of nodes	50
Moility speed	1-10m/s
Mobility model	Random waypoint model
Node transmission range	150m
Data packet size	256 bytes

Delay multicast tree has high successful ratio because it connect the source and destination node with least delay. Successful ratio of genetic algorithm is,

$$\text{Successful Ratio (SR)} = \frac{\text{Number of routes successfully routed}}{\text{Total number of routing requests}}$$

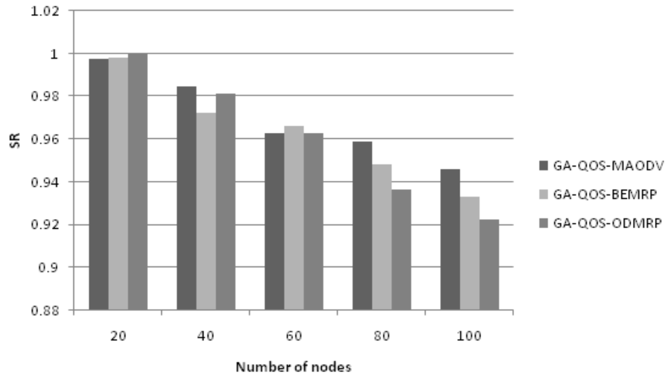

Chart – 1: Comparison of SR between GA-QOS-MAODV ,GA-QOS-BEMRP & GA- QOS-ODMRP

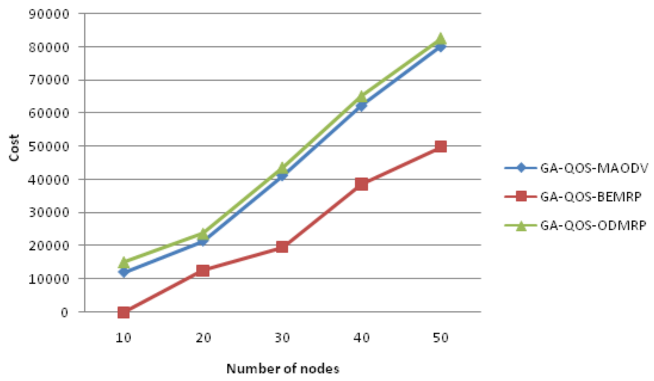

Chart – 2: Comparison of average cost between the GA-QOS-MAODV, GA-QOS-BEMRP & GA-QOS-ODMRP

In chart - 2 proves that the multicast trees have low cost when compared to the source based genetic algorithm.

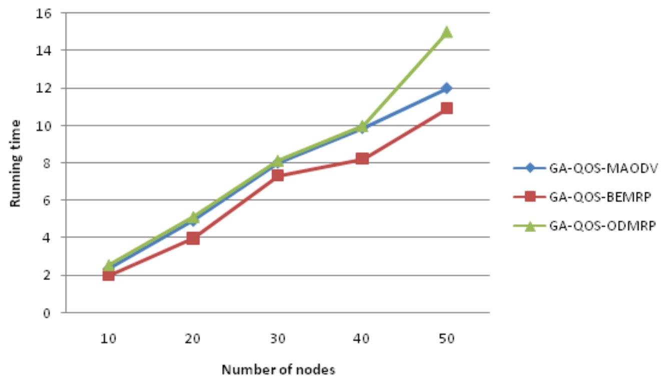

Chart – 3: Comparison of running time between GA-QOS-MAODV, GA-QOS-BEMRP & GA-QOS-ODMRP

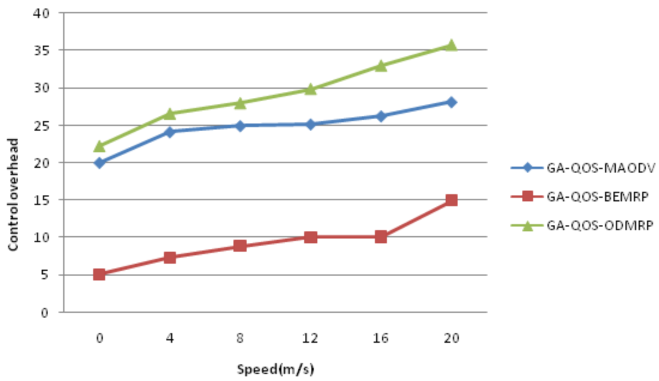

Chart – 4: Analysis of Control Overhead between GA-QOS-MAODV,GA-QOS-BEMRP & GA-QOS-ODMRP

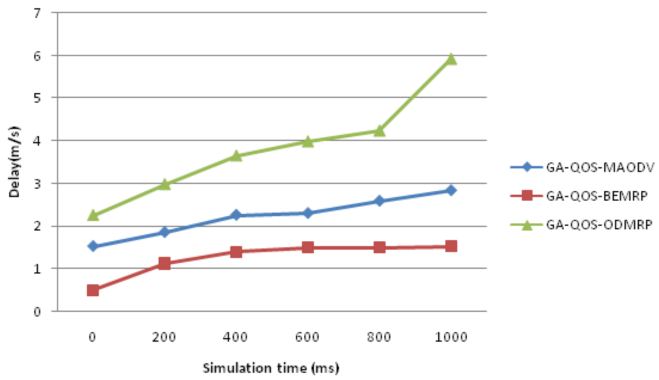

Chart – 5: Analysis of the Latency between GA-QOS-MAODV, GA-QOS-BEMRP & GA-QOS-ODMRP

6. CONCLUSIONS

In MANET, power awareness is a crucial one. To increase the battery lifetime nodes need to reduce their power consumption. In this paper, we proposed a comparison of GA based MAODV,BEMRP and ODMRP QoS multicast routing algorithm. The proposed algorithm is the share tree and mesh based tree algorithm which is used to reduce the bandwidth consumption and end to end delay. The proposed algorithm applies initialization, crossover and mutation operations directly on trees. Because, it simplifies the coding operation. Various of experiments was performed to verify the convergence, SR and running time of the algorithm. The results shows that GA-QOS-BEMRP is very effective and efficient. It outperforms GA-QOS-MAODV and GA-QOS-ODMRP. Future works could apply the proposed algorithm for several routing functions.

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