Genetic Algorithm for Power Aware Multicast Routing

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Abstract— In recent years, communication plays a vital role, whereas the secured communication lags in some other applications. In order to improve the security, the multicast routing protocol is preferred. In multicast routing source based tree is proposed. Source based tree forwarding packets based on shortest path. To calculate shortest path crossover and mutation operation is performed. To reduce the power consumption power aware multicasting is used. Trust management scheme is proposed to improve the security. To reduce the malicious routers which compromises secure routing. In trust management scheme dynamic source routing is used. This Dynamic source routing the routes are created as it required. The source based tree, is to calculate the energy efficiency between the nodes and for calculating Quality of Service (QoS) parameter such as Throughput, average delay and Packet Delivery Ratio. The architecture is developed and implemented using NS 2.35.

Key words: Multicast Routing, Shared based Tree, Dynamic source routing, Quality of Service

I. INTRODUCTION

A mobile ad hoc network (MANET) is a type of ad hoc network that can change locations. It is a self-configuring infrastructure mobile node, which can form a dynamic topology. To maintain all the nodes network connectivity without the aid of any fixed infrastructure point. Each and every node has a routing function and it communicated by forwarding packets via intermediate nodes. If two nodes are within the transmission range of each other, they communicate directly. Otherwise, other nodes are needed to forward their packets. MANET is characterized by non-constrained mobility and easy usage, which makes them very promising.

In multicasting there is at least one sender and several receivers (group of receivers called multicast group). In multicast routing, the router may forward the received packet through several of its interfaces. It is a technique for one-to-many data transmission over an IP infrastructure in a network. The destination nodes send join and quit messages, for example in the case of Internet when the user changes from one channel to another. Multicast uses infrastructure network efficiently by requiring the source node to send a packet only once, even if it needs to be delivered to a huge number of receivers. The nodes in the network take care of returned the packet to reach multiple destinations only when necessary.

Power awareness is resolvable in a mobile wireless network, particularly in a MANET. Nodes need to decrease their power consumption to prolong their battery lifetime. Therefore, the transmission power should be carefully chosen since the large transmission power level leads to the waste of battery strength. Several heuristic algorithms for producing source-based energy-efficient multicast trees have been developed. Since most multimedia applications are delay-sensitive, end-to-end delay should be considered in multicast routing to provide better QoS. However, energy-efficient multicast routing has not always considered the delay metric. Furthermore, the design of quality of service (QoS) multicast routing with multi constrained metrics, that is multi-constrained minimum cost multicast problem, and degree-constrained least-cost multicast routing, has not always considered the energy consumption. Therefore, these QoS multicast routing schemes cannot be directly used in MANETs.

A. Multicast Routing:

Multicast services have been increasingly used by various continuous media applications. Instead of sending a separate copy of the data to each individual group member, a multicast source sends a single copy to all the members. An underlying multicast routing algorithm determines, with respect to certain optimization objectives, a multicast tree connecting the source(s) and group members. Data produced by the source flows through the multicast tree, traversing each tree edge rightly once. As a result, multicast is more resource-efficient, and is well suited to applications such as video distribution.

Multicast routing protocols can be classified as tree based multicast routing protocols. In tree based multicast routing protocols, which is only one path between a source and destination pair. In this protocol efficiency can be achieved and strength is not a critical issue in the stable wired network, most multicast methods are tree-based, either source tree based or shared tree based. They are not robust enough to operate in highly mobile environments. Multicast tree based protocols can be classified into two types: source tree and shared tree based protocols. Here source based tree is used to transmit the data. In source tree based a tree is created by each source and has as many numbers of trees as source. In shared tree based there is single multicast tree for all sources. Mesh based multicast routing protocols also available in multicast routing. This mesh based multicasting protocols provide multiple paths between the source and destination pair.

B. Routing in MANETs

At network level, the routing protocol has to guarantee that a node can be reached from any other node in the network. This objective is difficult to achieve because of the presence of both wireless links and mobile nodes, which call for dynamic reconfiguration of the routing strategy as soon as network connectivity changes. The classical link-state and distance vector routing protocols are not suitable in such case, since they have not been designed for mobile devices with limited resources and which communicate through wireless links. There are three types of protocols proactive, reactive and hybrid.

With proactive protocols (also named table-based) each node maintains information enabling it to decide how to route messages towards any other node in the network.

Such information is usually stored in a certain number of tables (updated over time) providing each node with a view of the network topology. Differences among these protocols reside in the way the topology information is detected and updated, as well as in the type of information that is stored in each such table. Protocols falling in this category do not work efficiently when the topology changes quickly and the number of nodes is high. In fact, network changes require time to be spread among the nodes, and the amount of information to store and update grows linearly with the size of the network. On the other hand, proactive protocols guarantee to find the forwarding path in very short time, because all the necessary information is already available when data have to be transmitted. Moreover, they allow finding, in a simple way, a path based on specific QoS requirements. Destination Sequenced Distance Vector (DSDV) and Optimized Link State Routing (OLSR) are probably the most well-known proactive protocols available nowadays.

With reactive protocols (also named on demand protocols) a path discovery process is started from a source which wants to transmit a packet towards a specific destination. The name 'on demand' is suitable for forwarding path takes place only when data transmission is needed. Once a node determines a route, it will maintain this route for the entire duration of the transmission. In the discovery process of a route towards a destination, the source sends route request messages through flooding. Nodes which know how to reach the required destination send back route reply messages; this message exchange phase goes on until the entire route is defined. The basic principle of reactive protocols enables a smaller overhead, because nodes only maintain information about active routes, instead of keeping in memory an updated view of the overall network. For this reason, they are suitable for highly dynamic networks. Their major drawback clearly resides in the transmission delay incurred when new data have to be transmitted. Most widely used reactive protocol is Ad hoc On demand Distance Vector routing (AODV) and Dynamic Source Routing (DSR) available in MANETs.

II. Related Work

Power consumption in MANETs is an important issue because all or most of the nodes are battery supplied, and the communication infrastructure is composed of the same nodes which are using it. In such context, optimizing energy consumption also means maximizing the overall usability of the network. To reduce the amount of required power, we can adopt techniques at the several layers of the protocols stack, paying attention to the fact that protocol layers are closely coupled from the power consumption perspective. The design of a QoS multicast routing protocol with multi-constrained metrics is not taken into consideration the consumption of battery strength. Thus, the operations of the whole network, some mobile nodes have problems due to lack of balance in their battery energy consumption with energy overhead. Once these selected nodes in the multicast tree run out of residual battery strength, an interruption condition appears that is generated in the link during packet forwarding. During the selected packet forwarding paths many interruptions occurred here. The multicast routing service lifetime will not be maintained until the completion of packet forwarding. The idea is to increase the duration so that all mobile nodes are up stage until one of them is drained of energy. The QoS parameters are called metrics that includes available bandwidth, end to end delay, probability of packet loss, delay variance, expense, throughput, packet delivery ratio and so on. Since various items have different properties, they could be classified into three types, namely additive, multiplicative, and minimal properties. Many related references which have been cited in multicast routing topics usually tackle some of the general QoS metrics such as the bandwidth, packet loss rate, and propagation delay.

A genetic algorithm (GA) is a searching algorithm that uses the genetic operators, crossover and mutation and so on. Genetic algorithm provides the evolution idea using natural selection and the survival of the fittest concept. In each generation, a new population of solutions is produced by exchanging and combining the information obtained from the solutions through the previous generation. Crossover operation is one of the important techniques in genetic algorithm. In which genes of two chromosomes are exchanged. After the exchanged operation the genotypes of two selected chromosomes are merged to make two new offspring. Crossover is also referred to as recombination and otherwise called mating. Two chromosomes with greater fitness values are picked from the chromosome pool. The two new offspring are created and put back into the chromosome pool. After the crossover operation mutation operation is performed. Another important technique is mutation in genetic algorithm. In which new genetic operators are involved into the population by randomly changing some of the genes. In other words, mutation operation gives the genetic algorithm an opportunity to search for new and more possible chromosomes in new areas of solution space. The mutation simply adds genes to the individual's chromosome. After the mutation operation, the multicast tree will be modified because the mutation operator can destroy the tree structure and outgoing degree constraints. The other genetic algorithm operations are available encoding, initial population, evaluation, reproduction, crossover and mutation.

III. Proposed Work

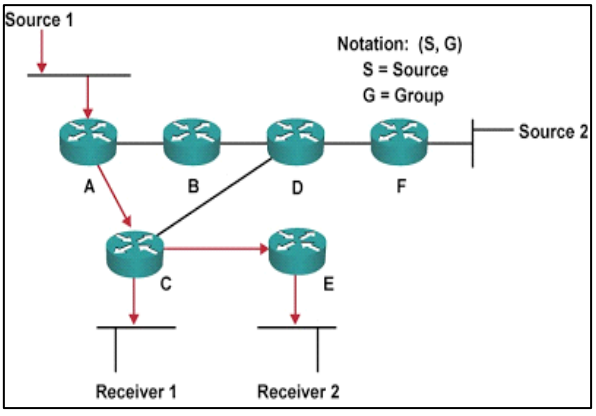

Fig. 1: Structure of source based tree

To improve the security of source based tree trust management scheme is proposed. In this type of multicast topology, multicast Source will be on top of the multicast tree and other multicast routes will be acting like branches.

Logically, source will be the first one and other receivers will be act like a tree branches. In source tree, forwarding of packets based on shortest path. It is based on both the source address S that the packets originate and the group address G that the packets terminate.

To improve the security trust management scheme is proposed. In trust management scheme has two types trust modes: trust from direct observation and trust from indirect observation. With direct observation a trust relationship that formed from direct interactions can be characterised as a direct trust. The trust node observer value is derived using Bayesian inference, which is a type of uncertain reasoning when the full probability model can be defined. Bayesian inference is a method of statistical in which Bayes rule is used to update the probability. With indirect observation, also called second hand information that is obtained from neighbour nodes of the observer node, the trust value is derived using the Dempster-Shafer theory, which is another type of uncertain reasoning when the proposition of interest can be derived by an indirect method. Dempster-Shafer theory also called as evidence theory. Combining these two components in the trust model, we can obtain more accurate trust values of the observed nodes in MANETs.

Dynamic source routing protocol is used to improve the security. Dynamic source routing protocol (DSR) is an on-demand routing protocol. It is designed to restrict the bandwidth consumed by control packets in ad hoc wireless networks. DSR is used to eliminate the periodic table update messages required in the table driven approach. This protocol is truly based on source routing whereby all the routing information is maintained at the mobile nodes. DSR has only two major phases, which are Route Discovery and Route Maintenance. When a source wants to a destination, it invokes the route discovery mechanism to find path to the destination.

To return the Route Reply, the destination node must have a route to the source node. If the route is in the destination nodes route cache, the route would be used. Otherwise, the node will reverse the route based on the route record in the Route Request message header (this requires that all links are symmetric). In the event of fatal transmission, the Route Maintenance Phase is initiated whereby the Route Error packets are generated at a node. The incorrect hop will be destroyed from the nodes route cache; all routes containing the hop are truncated at that point. Again, the Route Discovery Phase is initiated to determine the most possible route.

IV. SIMULATION

The simulation analysis is done by using ns-2.35 software. In multicast routing initially there are 50 nodes are created. The nodes are sending hello messages to the neighbour node. After receiving messages multicast routing operation is performed. Multicast routing sends the messages one source to multiple destinations. This routing operation performed according trust management scheme system. The data is transmitted through the trusted nodes. The performance is analyzed by using graph. Three QOS parameters are analysed packet delivery ratio, throughput and average delay.

A. *Throughput:*

It refers to the average data rate of successful message delivery over a communication channel. Throughput is measured in bits per second.

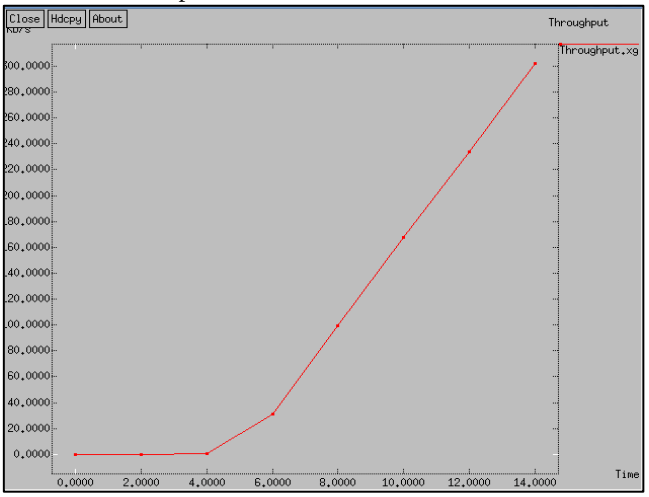

Fig. 2: Throughput

B. *Packet Delivery Ratio:*

The ratio of the number of data packet delivered to the destination.

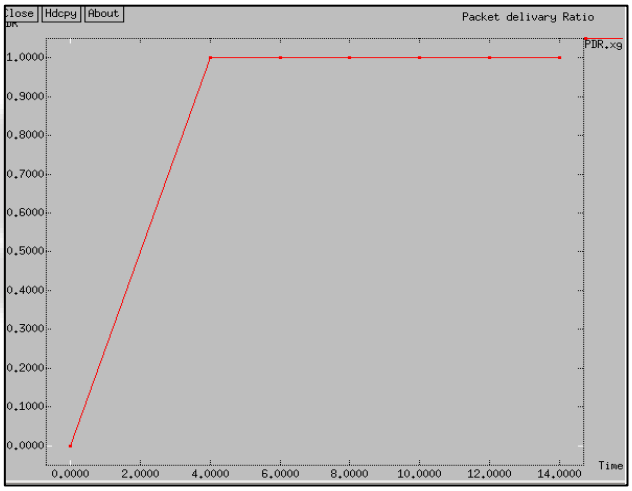

Fig. 3: Packet delivery ratio

C. *Average Energy:*

Average energy refers to average time taken by a data packet to arrive in the destination.

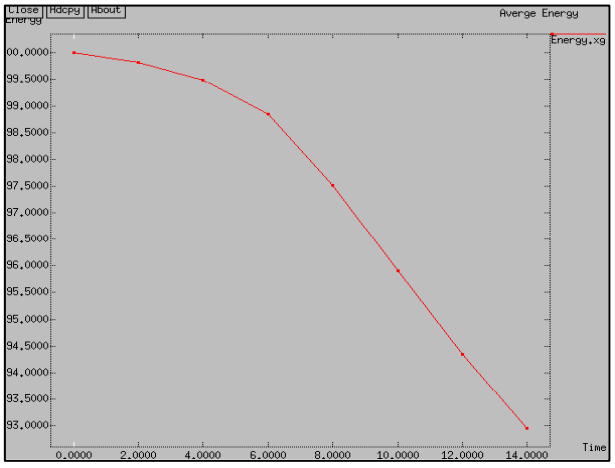

Fig. 4: Average energy

V. CONCLUSION

Power awareness is crucial in mobile wireless networks, particularly in MANETs. Nodes need to reduce their power consumption to prolong their battery lifetime. To improve security in MANETs trust management scheme is proposed. The proposed method provides high throughput, packet delivery ratio and average energy consumption of multicast tree.

VI. ACKNOWLEDGEMENT

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REFERENCES

[1] Ting Lu and Jie Zhu, "Genetic algorithm for energy efficient QOS multicast routing IEEE communications", vol. 17, pp. 31-34, 2013.
[2] Z. Nutov and M. Segal, "Improved approximation algorithms for maximum lifetime problems in wireless networks", Theoretical Computer Science, vol. 453, no. 28, pp. 88-97, 2012.
[3] S. Y. Tseng, Y. M. Huang, and C. C. Lin,"Genetic algorithm for delay and degree constrained multimedia broadcasting on overlay networks", Computer Communications, vol. 29, no. 17, pp. 3625-3632, 2006.
[4] Nicola Costagliola, Pedro Garçia Lopez, Francesco Oliviero and Simon Pietro Romano, "Energy and Delay Efficient Routing in Mobile Ad Hoc Networks", Mobile Netw Appl vol. 17, pp. 281-297, 2012.
[5] Z. Wang and J. Crowcroft, "Quality of service for supporting multimedia applications", IEEE communications, vol. 14, no. 7, pp. 1228-1234, 1996.
[6] F. Xiang, L. Junzhou, W. Jieyi, and G. Guanqun, "QoS routing based on genetic algorithm", Computer Communications, vol. 22, no. 15, pp. 1392-1399, 1999.
[7] C. P. Ravikunmar and R. Bajpai, "Source based delay bounded multicasting in multimedia networks," Computer Commun., vol. 21, no. 2, pp.126-132, 1998.
[8] P. Karthikeyan, S. Baskar and A. Alphones, "Improved genetic algorithm using different genetic operator combinations (GOCs) for multicast routing in ad hoc networks", springer, vol. 17, pp. 1563-1572, 2012.
[9] Dinesh Kumar, Y. S. Brar, and V. K. Banga, "Multicast optimization techniques using best effort genetic algorithms", International science, vol .3, no. 2, pp. 323 -325, 2009.

