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Qos Multicast Routing Algorithm For MANET

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ABSTRACT

Wireless networks are computer networks that are not connected by cables of any kind which enables enterprises to avoid the costly process of introducing cables. Ad hoc wireless communication between devices might be loosely defined as a scheme, often referred to as ad hoc networking. MANET is a type of ad hoc network that has the characteristics of mobility and self-configuring in which each mobile node not only act as a host and it also act as a router. Each node operates with the limited battery power to forward the data packets from the source to a group of the nodes. In a MANET, multicast is a very useful communication system for group-oriented applications, where one-to-many propagations are needed frequently in critical situations. This paper presents a new power-aware multicasting algorithm for MANETs. Here, it uses the residual battery energy for the multicasting from the source to a group of destinations. These networks are lack of fixed infrastructure and nodes are typically powered by batteries with a limited energy supply where in each node stops functioning when the battery drains. Multi-casting procedures for routing in MANET become a major concern to support the propagation of data from a sender to all the receivers. Hence the system propose PUMA (Protocol for Unified Multicasting through Announcements) for performing multi-cast routing. It reduces the load on wireless nodes by selecting the route with minimum energy with maximum hop count within the multicast group. Simulation results show that the performance of the proposed protocol is increased than the existing protocol in terms of throughput, delay, PDR and network lifetime.

Index Terms *— MANET, PUMA, Lifetime Throughput, Delay, PDR.*

1. INTRODUCTION

Mobile ad hoc network (MANET) is a network of mobile nodes connected by wireless link. It is one of the main type of ad hoc network where every node in MANET is mobile. The nature of nodes mobility changes dynamically.

MANET has no fixed infrastructure. Each node functions as network router for routing packets from other nodes and for transmitting and receiving data node act as network host. The Mobile ad hoc network can be One of the important issues of MANET is security. There are various attack occur in MANET due to lack of centralized administration. Attacks occur are denial of services, black hole, resource consumption, location disclosure, wormhole, host impersonation, information disclosure and interference. On security issue in MANET number of researches take place. There are two approaches exist to secure a MANET. These two approaches are prevention based approach and detection based approach. Security of MANET will be enhanced by reducing the probability of attack. Game theory is powerful mathematical tool for enhancing the security of MANET. In MANET, for route discovery routing protocol (AODV) is used. As MANET is dynamic in nature, Ad hoc on demand distance vector routing protocol is used. Ad hoc on demand distance vector protocol is used on demand. Neighbor discovery protocol (NDP) is mainly used for neighboring nodes discovery.

Game theory is used to enhance security in mobile ad hoc networks (MANETs). In existing work only two players are taken in the game model which provides security: an attacker and a defender. This assumption may be efficient for a network with centralized administration, In MANETs it is not realistic, because lack of centralized Authority. In this paper, using advances in mean field game theory, forwarding game theory with multiple players for security in MANETs will be used. The mean field game theory gives a efficacious mathematical tool for problems with a large number of players. The proposed scheme will enable an individual node without centralized administration to make strategic security defense decisions. Also, security defense mechanisms consume precious system resources the proposed scheme considers the security requirement of MANETs as well as the system resources. Nodes in a Mobile Ad hoc network do this by optimizing their decision making based on a framework using game theory. Malicious nodes are detected and data will not send to nodes. Data will be send tothe nodes which are not malicious. Also the Malicious nodes information is broadcasted to other nodes in network so that further data will not send to malicious nodes.

Due to the inherent characteristics of a MANET, such as mobility, wireless communication links and lack of any centralized authority, providing security in a MANET is a challenging task. Moreover, security solutions for fixed wired networks are not easily adaptable to mobile wireless networks. One way of providing security to a MANET is intrusion detection, a process of monitoring activities in the system so as to determine whether there has been any

violation of security requirements. Intrusion Detection System (IDS) is the mechanism used by the nodes of a network for detection of intrusion and has been classified into two broad categories based on the techniques adopted, viz., (a) Signature-based intrusion detection and (b) Anomaly-based intrusion detection. In signature-based detection, knowledge about the signatures of attacks is incorporated in the detection system. At the occurrence of an attack, the characteristics of the attack ismatched with the signatures included in the IDS. If thereis a match, then an attack associated to that signature is said to have occurred. In anomaly-based detection, the IDS does not attempt to find a signature match but searches for anomalous events or behavior. For instance, it could look out for anomalous behavior such as dropping of data packets and events such as erratic changes in the routing table. IDSs can also be categorized based on the audit data used for analysis. Host-based IDSs make use of data obtained from the host for which it checks for intrusion detection. This kind of data could be operating system or application logs on the system. On the other hand, network-based IDSs collect and analyze data from network traffic. In our work, we concentrate on network-based anomaly detection.

While a lot of research effort has been expended in de-signing effective IDSs, not much effort has been made on efficient employment of the IDSs. In a resource-constrained environment, this is of utmost importance. We attempt to address this issue in our work. In most of the existing IDSs for MANETs, a detection system sits on every node, which runs all the time. One common mechanism used by such IDSs is monitoring traffic in the node's neighborhood. Since a node in a MANET may have limited battery power and computational resource, running an IDS all the time may turn out to be a costly overhead. Thus, the challenge is how to reduce the duration of time an IDS needs to remain active without compromising on its effectiveness. This issue may not be much of a concern in a wired network, in which an IDS is deployed mainly in a stationary router or gateway, with virtually unlimited computational and battery power. But this is of significant concern in the case of MANETs, where the mobile nodes themselves not only behave as hosts and routers, but also have to carry out other functions such as intrusion detection either collaboratively or individually. To this end, we propose a distributed scheme for efficient usage of IDSs in a network based on probability theory. We have set a game that involves players (IDSs sitting in neighboring nodes) cooperating to achieve a common goal (i.e., to monitor a single node). To the best of our knowledge, we have not come across any work on cooperating IDSs (to get a security versus energy tradeoff) that models such a situation using game theory. We have presented such a cooperative multi-player game to model the interactions between the IDSs in a neighborhood and used it to validate our proposed probabilistic scheme.

2. RELATED WORK

Multicasting plays a crucial role in many applications of mobile ad hoc networks (MANETs). It can significantly improve the performance of these networks, the channel capacity (in mobile ad hoc networks, especially single-channel ones, capacity is a more appropriate term than bandwidth, capacity is measured in bits/s and bandwidth in Hz) and battery power of which are limited. In the past couple of years, a number of multicast routing protocols have been proposed. In spite of being designed for the same networks, these protocols are based on different design principles and have different functional features when they are applied to the multicast problem. This paper presents a coherent survey of existing multicasting solutions for MANETs. It presents various classifications of the current multicast routing protocols, discusses their operational features, along with their advantages and limitations, and provides a comparison of their characteristics according to several distinct features and performance parameters. Moreover, classifying the existing multicast protocols into three categories according to their layer of operation, namely, the network layer, the application layer, and the MAC layer. It also extends the existing classification system and presents a comparison between them. A survey of the existing multicast routing protocols designed for MANETs. It classify them into three categories according to their layer of operation, namely, the network layer, the application layer, and the MAC layer, and we also presented various classifications based on different characteristics, namely, multicast topology, initialization of multicast connectivity, routing information update mechanism, and multicast group maintenance. It also described several multicast routing protocols according to the classifications we provided, stating their advantages and drawbacks. The major issues and challenges facing multicast routing design are also presented. These issues should be considered in the design of an efficient multicast routing protocol in MANETs. A multicast protocol can hardly satisfy all previous requirements. In other words, one size does not "fit all," but rather each protocol is designed to provide the maximum possible requirements according to certain required scenarios. Even if a multicast protocol meeting all the requirements is designed, it will be very complicated and need a tremendous amount of routing information to be maintained. Moreover, it will not be suitable for environments with scarce resources. Satisfying most of the requirements would provide support for reliable communication, minimize storage and resource consumption, ensure optimal paths (not necessarily as a function of the number of hops), and minimize network load. [3]

A Mobile Ad-hoc Network (MANET) is a dynamic wireless network that can be formed without the need for any pre existing infrastructure in which each node can act as a router. One of the main challenges of MANET is the design of robust routing algorithms that adapt to the frequent and randomly changing network topology. A variety of routing protocols have been proposed and several of them have been extensively simulated or implemented as well. In this paper, we compare and evaluate the performance metrics of three types of On-demand routing protocols- Ad-hoc On-demand Distance Vector (AODV) routing protocol, which is unipath, Ad-hoc On-demand Multipath Distance Vector (AOMDV) routing protocol and Dynamic Source routing (DSR) protocol. This paper investigates all these routing protocols corresponding to packet delivery fraction (pdf), throughput, normalized routing load and end to end delay.

The ns-2 simulation results showed that AODV has always low routing load compared to AOMDV in both static and dynamic network for each set of connections. AOMDV provided better results at high pause time but worst in case of end to end delay. We have also seen that, DSR performed well in terms of end to end delay in both static and dynamic networks. This paper evaluated the performance of AODV, AOMDV and DSR using ns-2. Comparison was based on the packet delivery fraction, throughput, end-to-end delay and normalized routing overhead. Finally concluded that in the dynamic network (pause time 0 sec), the performance of AODV is better as compared to the AOMDV and DSR in terms of packet delivery fraction, throughput and normalized routing overhead. In the static network (pause time 100 sec), AOMDV gives better performance as compared to AODV and DSR in terms of packet delivery fraction and throughput but worst in terms of end-to end delay. We have also seen that DSR routing protocol is best in terms of end-to-delay in both Static and dynamic network for each set of maximum connection . [8]

Mobile ad hoc networks (MANETs) pose particular challenges in terms of Quality of Service (QoS) and performance. This is due to the effect of numerous parameters such as; bandwidth and power constrains, delays, security issues, etc. On the other hand, the degree of freedom enables the wireless mobile nodes to enter and leave the network dynamically. The latter offers redundant paths and dynamic coverage. Particular attention is given to the multipath transmission capability as well as load balancing to have efficient routing possible for heavy multimedia traffics. In this paper, the issues of multipath routing in MANETs are surveyed and performances of such MANETs are compared to discuss the application of multipath routing and its effects on different layers to support QoS. Multipath routing was the main focus of this paper and investigated its effects of multipath routing in variety of protocols including flat topologies (reactive, proactive and hybrid), hierarchical topologies, geographic position assisted routing protocols, power-aware and security enhancement routing protocols.[10]

3. PROTOCOL ANALYSIS

3.1 AODV

The Ad-hoc On-Demand Distance Vector (AODV) routing protocol is designed for use in ad-hoc mobile networks. AODV is a reactive protocol. The routes are created only when they are needed. It uses traditional routing tables, one entry per destination, and sequence numbers to determine whether routing information is up-to-date and maintain the route.The protocol consists of two phases: i) Route Discovery ii) Route Maintenance.

A node wishing to communicate with another node first seeks for a route in its routing table. If it finds path, the communication starts immediately, otherwise the node initiates a route discovery phase. The route discovery process consists of a route-request message (RREQ) which is broadcasted. If a node has a valid route to the destination, it replies to the route-request with a route-reply (RREP) message [5][8]. Additionally, the replying node creates a message so called reverse route entry in its routing table, which contains the address of the source node, the number of hops to the source, and the next hop's address, i.e. the address of the node from which the message was received. A lifetime is associated with each reverse route entry, i.e. if the route entry is not used within the lifetime it will be removed. The second phase of the protocol is called route maintenance. It is performed by the source node and can be subdivided into:

i) source node moves: source node initiates a new route discovery process
ii) Destination or an intermediate node moves: a route error message (RERR) is sent to the source node.
Intermediate nodes receiving a RERR update their routing table by setting the distance of the destination to infinity. If the source node receives a RERR it will initiate a new route discovery. To prevent global broadcast messages AODV introduces a local connectivity management. This is done by periodical exchanges. of so called HELLO messages, which are small RREP packets containing a node's address and additional information. AODV nodes use four types of messages to communicate among each other. Route Request (RREQ) and Route Reply (RREP) messages are used for route discovery. Route Error (RERR) messages and HELLO messages are used for route maintance.

3.2 ODMRP

ODMRP provides richer connectivity among group members and builds a mesh for providing a high data delivery ratio even at high mobility. It introduces a “forwarding group” concept to construct the mesh and a mobility prediction scheme to refresh the mesh only necessarily. The first sender floods a join message with data payload piggybacked. The join message is periodically flooded to the entire network to refresh the membership information and update the multicast paths. An interested node will respond to the join message. Note that the multicast paths built by this sender are shared with other senders. In other words, the forwarding node will forward the multicast packets from not only this sender but other senders in the same group.

Due to the high overhead incurred by flooding of join messages, a mobility prediction scheme is proposed to find the most stable path between a sender-receiver pair. The purpose is to flood join messages only when the paths indeed have to be refreshed. A formula based on the information provided by GPS (Global Positioning System) is used to predict the link expiration time between two connected nodes. A receiver sends the reply message back to the sender via the path having the maximum link expiration time.

Advantages: 1. It proposes an effective “forwarding group” concept. 2. The offering of shortest Paths reduces data delivery latency. 3. The mobility prediction scheme lowers control overhead at mobility.

Disadvantages: 1. It suffers from excessive flooding when there is a large number of senders. 2 The duplicate transmissions

3. 3 DSR

The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self configuring,
without the need for any existing network infrastructure or administration. Dynamic Source Routing, DSR, is a reactive routing protocol which uses source routing, i.e. the source determines the complete sequence of hops that each packet should traverse. This requires that the sequence of hops is included in each packet's header. The protocol is composed of the two main mechanisms of "route discovery" and "route maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network. Route discovery is used whenever a source node desires a route to a destination node. First, the source node looks up its route cache to determine if it already contains a route to the destination. If the source finds a valid route to the destination, it uses this route to send its data packets. If the node does not have a valid route to the destination, itinitiates the
route discovery process by broadcasting a route request message. The route request message contains the address of the source and the destination, and a unique identification number. Route maintenance is used to handle route breaks. When a node encounters a fatal transmission problem at its data link layer, it removes the route from its route cache and generates a route error message. The route error message is sent to each node that has sent a packet routed over the broken link. When a node receives a route error message, it removes the hop in error from its route cache

3.4 PUMA

PUMA-Protocol for Unified Multicasting through Announcements is another mesh-based multicast protocol. The protocol uses a single control message, a multicast announcement that is exchanged periodically by each network node. One of the purposes of multicast announcements is to elect a core member for the group and to ensure that all nodes in the network have a path to the core.

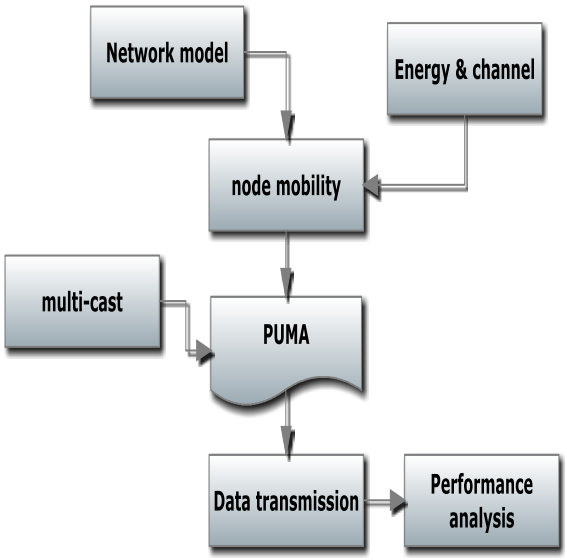
Additionally, all nodes on the shortest paths between any receiver and the core become members of the mesh. Multicast messages are routed to the core until they meet a mesh member; from this point on the messages are footed in the mesh to reach all multicast receivers [9]. Each multicast announcement species a sequence number, the address of the group (group ID), the address of the core (core ID), the distance to the core, a mesh member as that is set when the sending node belongs to the mesh, and a parent that states the preferred neighbor to reach the core. With the information contained in such announcements nodes elect cores, determine the routes for sources outside a multicast group to forward data packets towards the group, notify others about joining or leaving the mesh of a group, and maintain the mesh of the group.

4. PROPOSED WORK

PUMA is based on multicast announcements (MA) and forwards packet from multicast sender to its destination within a multicast group. It elects one of the nodes as core node and thereby informs other nodes of the elected core which is capable of collecting many receivers together. Receiver searches for shortest path between itself and core and then connects the core node. After receiver node selects path which path having minimum energy with maximum hop count path from itself to core node. Through simulation we show that a considerable saving in energy and computational cost is achieved using our proposed technique of optimizing the active time of the IDSs while maintaining the performance of the IDS. The proposed scheme uses local information, thus making it distributed and scalable. Moreover, it works on both static and mobile networks. Each player's (IDS's) objective is to monitor the nodes in its neighborhood at the desired security level in order to detect any malicious activity. Another objective is to conserve its energy. Here, we would like to consider the first objective as the primary goal and the second one as the secondary goal. If the second objective, i.e., saving battery power, were the main objective, each node would independently decide to sleep all the time resulting in a totally in active IDS. Since the nodes are independent, they have to cooperate to achieve the abovegoals.

Advantages: 1.Throughput is increased. 2.Routing overhead is highly reduced .3.Achieves high network lifetime.

SYSTEM MODEL



5. EXPERIMENTAL SETUP

The simulated environment consists of 30 wireless mobile nodes for 20 seconds of simulated time. The scenario containing all movement behavior of the ad-hoc network nodes is generated in advance so that it can be replaced identically for both the protocols. Similar mobility and traffic scenarios are used for all the protocols. Hence the workload is identical for all the protocols. A multicast member node joins the multicast group at the beginning of the simulation and remains as a member throughout the entire simulation.

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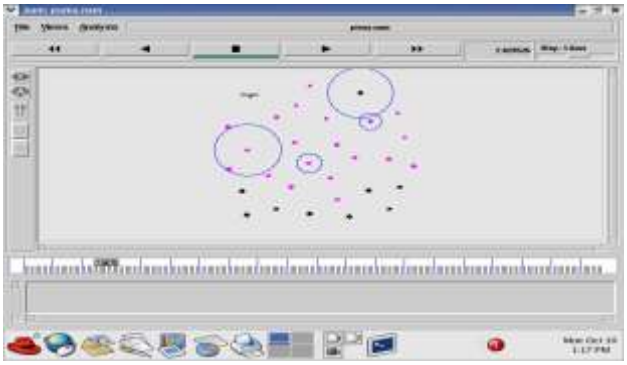

Fig: 1 Simulated environments of 30 mobile nodes

6. PERFORMANCE METRICS

ODMR, DSR, AODV and PUMA's performance was compared on the basis of the following metrics:

6.1THROUGHPUT

Throughput is the number of useful bits per unit of time forwarded by the network from a certain source address to a certain destination, excluding protocol overhead, and excluding retransmitted data packets.

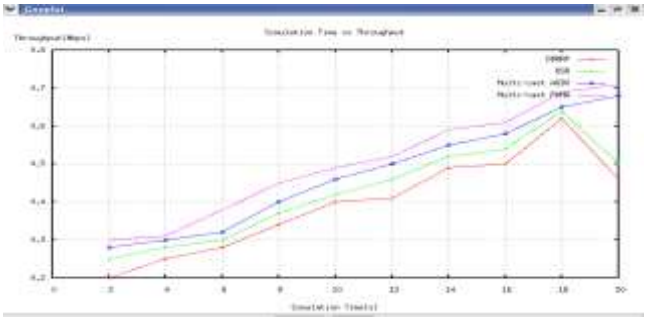

Fig: 2 Throughput

6.2 DELAY

Packet Delivery Ratio is defined as the average of the ratio of the number of data packets received by each receiver over the number of data packets sent by the source.

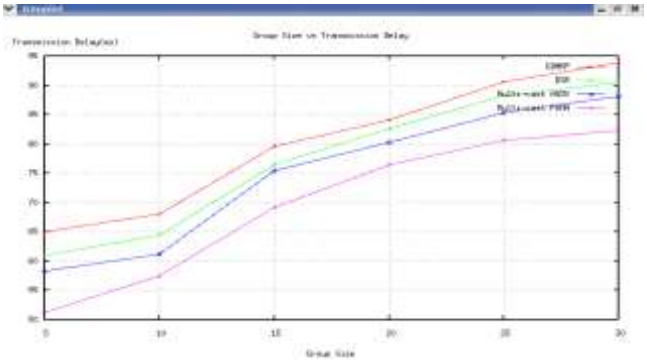

Fig: 3 Delay

6.3 PACKET DELIVERY RATIO

Packet Delivery Ratio is defined as the average of the ratio of the number of data packets received by each receiver over the number of data packets sent by the source.

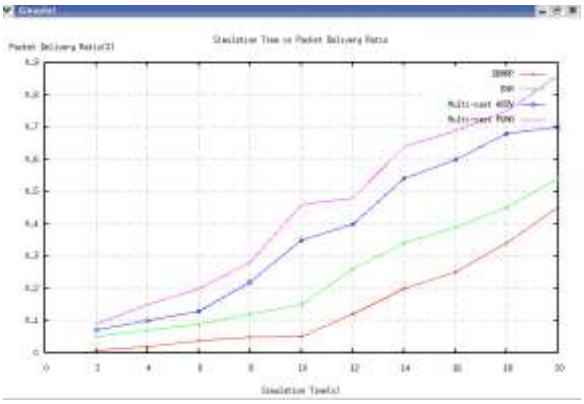

Fig: 4 packet delivery ratio

6.4 LIFE TIME

In this experimental setup, it considered 30 nodes, which are deployed within the defined area. Number of packets sent between 5–20 packets/sec and each node moved 2 mts/sec. Group size versus the network lifetime as shown in Fig. 5 From the results, it concludes that the proposed model is always kept maximum number of nodes alive for longer period of time as compared to others. If the group size is 20, then the lifetime of the proposed model has to be increased.

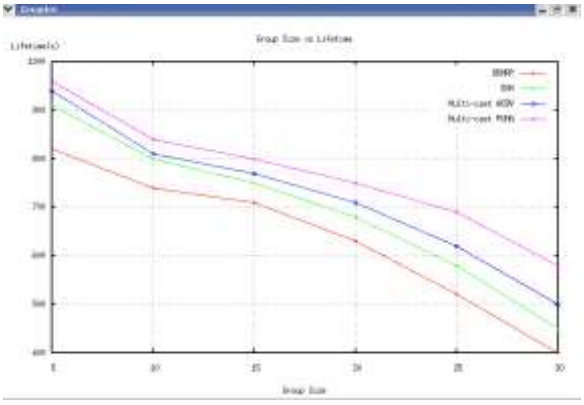

Fig: 5 Life time

CONCLUSION

This paper evaluated the performance of ODMRP, DSR, AODV and PUMA using ns-2. Comparison was based on the packet delivery ratio, throughput, end-to-end delay and lifetime. We concluded that in the dynamic network (pause time 0sec), the performance of PUMA is better as compared to the DSR,ODMRP and AODV in terms of packet delivery ratio, delay, throughput and lifetime. This system proposes a new energy-aware multi-cast routing protocol known as PUMA for reducing the transmission failures. It finds the path for multi-casting with the help of

residual energy and hop count. The simulation results show efficient performance in terms of its parameters like throughput, delay, PDR, and network lifetime.

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