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A Review on broadcasting strategy for Mobile Ad-hoc Wireless Network

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***Abstract*— MANET (Mobile Ad-hoc network) is self-configuring, base-less networks of mobile devices attached wirelessly. Due to active nature of these networks to find route from source to destination, an effective addressing strategy based routing mechanism is a challenging issue. Addressing strategies commonly used are unicast, multicast, broadcast and Anycast. In this paper, broadcasting strategy is discussed in detail which includes their characteristics and applications. The strategy is implemented and simulated using a simulator NS2. Simulated results are discussed on the basis of different factors such as delay, packet loss, throughput and bandwidth.**

***Index Terms*— Mobile ad-hoc networks (MANET); unicast; multicast; broadcast and any cast.**

I. INTRODUCTION

A mobile ad-hoc network (MANET) is a collection of mobile nodes that dynamically establish the network in the absence of intent infrastructure. In mobile ad-hoc network each node behaves as a router for sending and receiving data to or from another. This paper concentrate on the efficiency of the different message transmission strategies in order to allow better service in terms of delay, packet loss, throughput, bandwidth and energy. There are different addressing strategies such as Unicast, Multicast, Broadcast and Anycast. Unicast addressing strategy includes single source and destination as data packet send from single source to specified destination. In Broadcasting a single node sends a data packet to all other nodes in the network. Multicast strategy includes the source that sends a single copy of the packet to multiple group members available at the destination address. Anycasting is the process where communication takes place between a sender (a single node) and the nearest of a group of receiver.

There are various routing protocols in MANET that aim to build an optimal path way with less number of intermediary nodes between source and destination, the route should have less overhead and bandwidth consumption in order to transmit the message on time[1]. These routing protocols are further divided into three categories which include proactive routing protocols, reactive routing protocols and hybrid routing protocols with respect to the routing topology used in MANET [2]. These networks can be used in military to preserves the information network between the soldiers, vehicles, and military head-quarter. These networks also find applications in rescue or emergency operations during conditions of floods, earthquakes or fire. Mobile nodes contain small sized sensors that can be used to collected real time data i.e. temperature, pressure, etc [3].The features of ad-hoc networks introduce various challenges that must be studied carefully before a wide commercial deployment can be expected. Such as

1. Routing overhead: In MANET nodes change their location within network. Therefore some old routes are generated in the routing table which increases unnecessary routing overhead.
2. Packet loss: Packet loss is much higher due to factors such as increased collisions.
3. Quality of service: Because of active nature of ad-hoc network quality of service is necessary to maintain best effort of service.
4. Security: Mobile ad-hoc networks are intrinsically exposed to large no of security attacks [3], [4].

The rest of paper is organized as: Section II provides the information regarding Routing protocols. Addressing schemes are described in section III. Section IV provides an overview of broadcasting strategy and simulation results have been discussed in Section V. And finally the results are concluded in Section VI.

II. ROUTING PROTOCOLS

Routing is a process of selecting a path for sending a data packet from source to destination. One of the most important and a difficult method to maintain in ad-hoc networking is

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the routing mechanism. In MANETs routing protocols are classified into three different categories.

A. Reactive protocols

This is also known as On Demand routing protocol. Route only create when there is request of data transmission. Such protocols are DSR, AODV [5].

B. Proactive protocols

These protocols maintain routes to all possible destinations even while a few of the routes may not be required. Every node in the network maintains tables of routes and when the network topology changes, updates are sending across the network. There is a problem generate by these protocols i.e. more routing overhead. Proactive Protocols are DSDV, OLSR.

C. Hybrid protocols

Hybrid protocols include both reactive and proactive protocol. By maintaining some forms of routing table these protocols reduce traffic overhead from proactive system and or reducing route discovery delays of reactive system. Such protocols are zone routing protocol (ZRP) and TORA.

Zone routing protocol is an example of hybrid protocols.It uses two kinds of protocol ie Intra zone routing protocol (IARP). In intra-zone routing the packet is send within the routing zone of source node to reach the peripheral nodes. Each node collects information about all the nodes in its routing zone proactively. Inter zone routing protocol (IERP) Data is sent from the peripheral nodes towards the destination node. The inter-zone routing discovers routes to the destination reactively.

III. ADDRESSING STRATEGIES OF MANET

There are different addressing strategies such as Unicast, Multicast, Broadcast and Anycast which are studied in detail further.

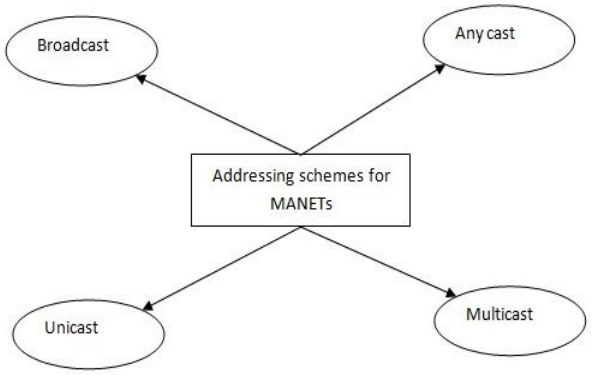

Fig.1. Addressing strategies for MANETs

A. Unicast

Many applications of Mobile ad hoc networks are based on unicast communication. In unicast transmission data is sent from single source to specified destination.

At the time of sending data packet this strategy use the destination address from routing table. The whole process depends upon the destination address. In MANET when unicasting is used every node maintains the routing table. So the only problem occurs that how the routing table to be well-kept in MANET [6-8].

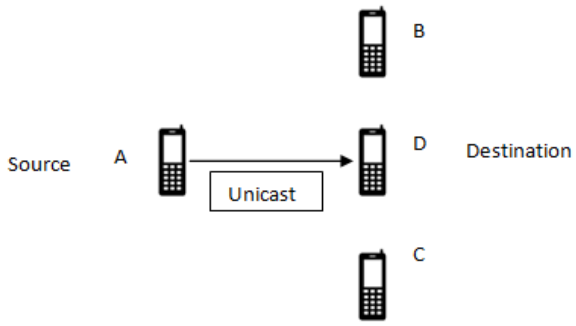

Fig.2. Unicast message transmission in MANETs

B. Multicasting

Multicasting is an essential strategy to support one-to-many transmission of packets between a single source and more destination hosts. In this approach the source sends a single copy of the packet to multiple group members available at the destination address. Multicasting comprises of packets to a group of more hosts called as the multicast group which can be identified by a single destination address [8]. The multicast data will be delivered to all destination hosts identified by the multicast group address.

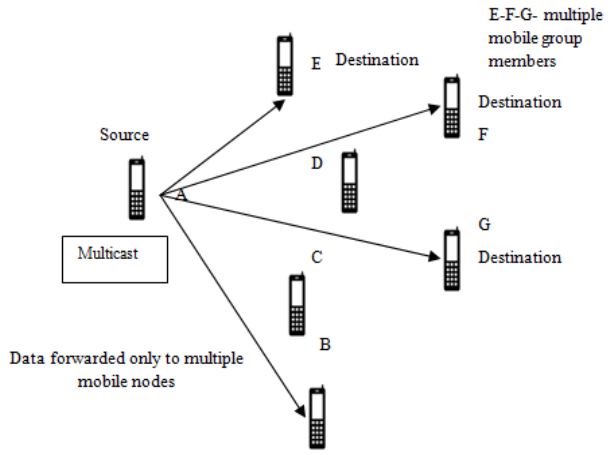

Fig.3. Multicast message transmission in MANET

C. Broadcasting

In ad-hoc networks broadcasting is the most often used operation. It is the term used to describe the data to be forwarded to whole nodes present in the network. The selected nodes are called forwarding nodes. In a localized manner the forwarding node set for broadcast. Each node determines its own status of forwarding or non-forwarding based on local information or the status of node is sensed by its neighbours.

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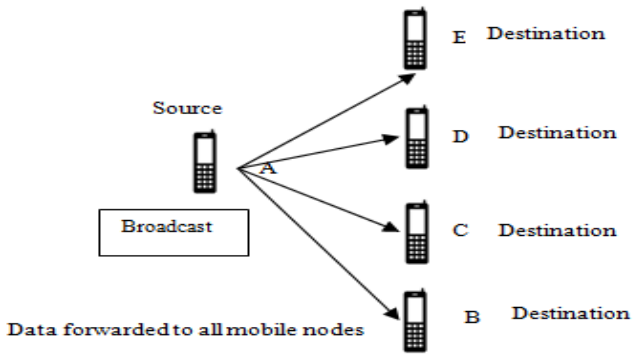


Fig.4. Broadcast message transmission in MANET

D.Anycast

It is one to nearest association used by routers. A packet send to an Anycast address is forward to the nearest router according to routing protocols. The determination of nearest router can be calculated on the basis of number of hops, distance, efficiency, latency, distance and cost.

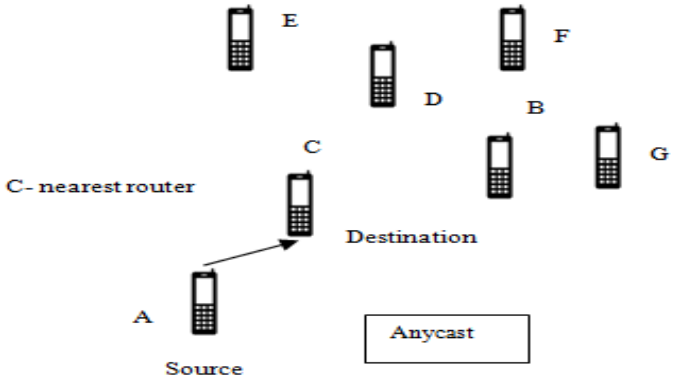


Fig.5.Anycast message transmission in MANET

IV. BROADCASTING

Broadcasting refers to sending a data that will be received by every device in the network. It is the most general communication method, the mobile ad hoc network use broadcasting for route discovery process. It involves flooding a packet from one node to all other nodes within the network. The broadcasting strategy forms the primal communication strategy in MANET [9]. The route discovery process requires transmission of route request (RREQ) packets from source to destination through every forthcoming links. The transmitted RREQ packets are received by all the neighbouring nodes which try to find out whether these packets are already contained (or) not. If the packets are not contained already they are to be retransmitted and this is performed till all the nodes have received and transmitted the broadcast packets at least once. During path failure the source node finds path to the destination. So, the route request packet is send through all the possible nodes and establishes a route to the destination.

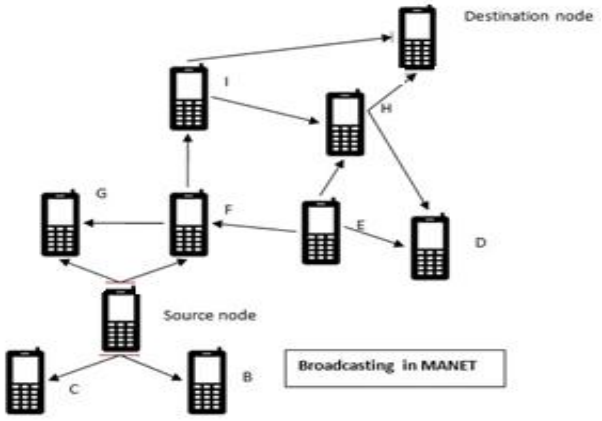


Fig.6. Broadcasting in MANET

Characteristics of Broadcasting

1 Spontaneous: The broadcasting addressing strategy can be performed by a node at any time. Due to this spontaneous triggering it slow up synchronization and no interior information about the connectivity is known.

2 Unreliable: In broadcasting addressing strategy message should be deliver to all nodes within the network. It does not provide any acknowledgement because of, the node gets detached from the network. Therefore redundant retransmissions take place around the sender. The route discovery process using broadcasting strategy introduces redundant retransmissions while sending route request packet. It happens when a node decides to rebroadcast the information to its neighbours where it already holds that information. These retransmissions become useless and can develop broadcast storm problems. The storm problem in broadcast strategy happens due to redundant retransmissions which lead to various drawbacks.

3 Redundant Rebroadcasts: It occurs during the retransmission of broadcasted messages to all (or) some of its neighbours which already carry that message.

4 Collision: There more damages occur due to lack of acknowledgement and absence of collision detection mechanism.

5 Contention: If it tries to rebroadcast the already broadcasted message there is a variance occurs by the nearby neighbour nodes with the host and among themselves [9].

Broadcasting Methods

A. Simple flooding

In this method the source node within the network delivers a message to all of its neighbours where they check whether those messages are already contained within them (or) not. If the results are positive then the packets will be dropped (or) if the results are negative the packets are delivered to all the neighbours. The process is continued until all the nodes are contained with the messages.

B. Probabilistic based method

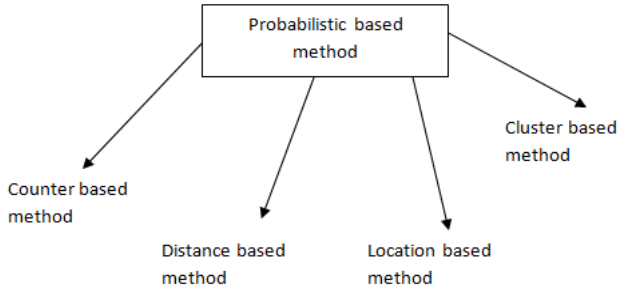


Fig.7. Shows classification of Probabilistic based method

This method involves each node to forward a broadcast message with a probability upon receiving it for the first time.

Advantages: In case of dense networks the number of nodes tends to exchange the similar transmission range but in sparse network the exchanged coverage area is less.

Here, not all the nodes try to rebroadcast which saves energy.

1. Counter based Method: When node efforts to rebroadcast the broadcast message to its neighbouring nodes it will be blocked by a busy medium (or) queuing of messages. Since, there occurs a situation where a node hears the same message again and again from other rebroadcasting nodes before starting the transmission of messages by the node.

2. Distance based method: In this method decision is made based on the distance calculated between the nodes.

3. Location based method: The decision is made upon the location information of the broadcasting nodes. The location information is collected using positioning devices, receivers, etc. It also assists during the route discovery process.

4. Cluster based method: The method divides the network nodes into a number of overlapping clusters. Here the path between the clusters is recorded rather than the nodes [10].

Advantages: It increases the routes lifetime and decreases the amount of routing control overheads.

C. Neighbour based method

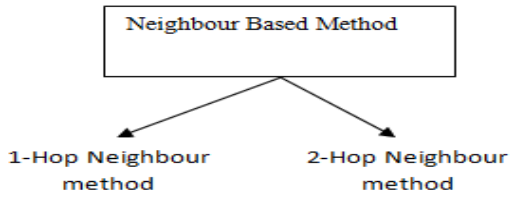


Fig.8. Shows classification of Neighbour based method

This method involves each node to acquire knowledge of its neighbours which is achieved by periodic "HELLO" messages. The nodes upon receiving this message will compare it with the neighbour list of sending node. The receiving node efforts to search additional nodes by rebroadcasting if it results positive else the receiving node will drop that message. The neighbour knowledge methods are achieved as:

1. 1-Hop Neighbour method: It is assumed that each node keeps the information about 1 – hop neighbours. It is obtained by exchanging the "HELLO" messages.

2. 2-Hop Neighbour method: This technique allows a 1 – hop neighbour to be registered as a neighbour for another node. It follows asymmetric links between the nodes. The transmission of information also follows exchange of "HELLO" messages.

D. Area based method

This method is best suited for availing additional coverage area since the node should be located at the boundary of the sender nodes transmission range. By this the rebroadcast achieves additional coverage area. It is to be noted that the receiver should not be present near the sending node, if so it offers quite less coverage area.

Advantages: This method also increases the routes lifetime, and decreases the amount of routing control overheads.

V. SIMULATIONS AND RESULTS

For path establishment broadcasting strategy is applied by using zone routing protocol (ZRP). The simulation work is carried out in NS2 version 2.35 simulator.

The following simulation environment is chosen to implement broadcasting strategy on the basis of different parameters such as delay, packet loss, throughput and bandwidth.

Table.1. Simulation Setup

Platform	**Ubantu**
NS Version	Ns-allinone-2.35
Pause time	0.4s
Simulation time	12s
No of nodes	30
Simulation area size	800*800m
Mobility model	Random Mobility
Traffic	CBR type
Channel type	Wireless
Node speed	150m/s

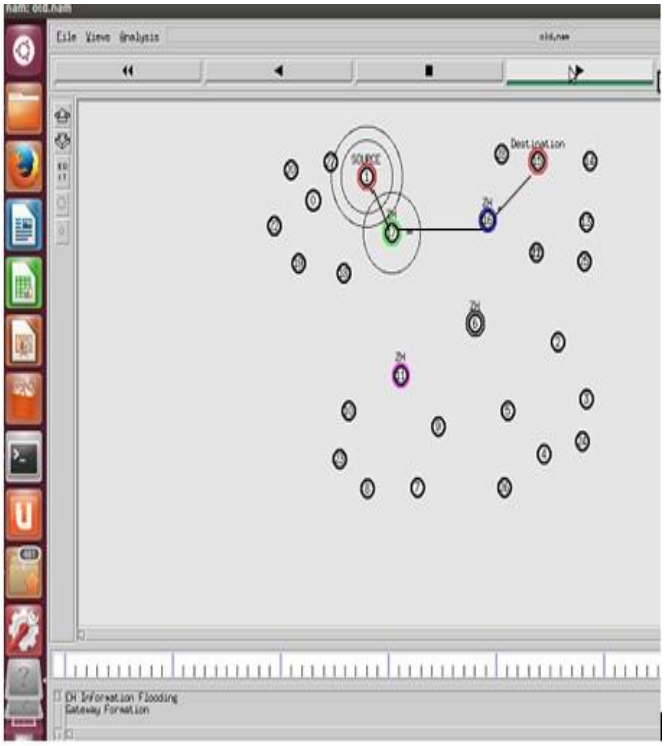
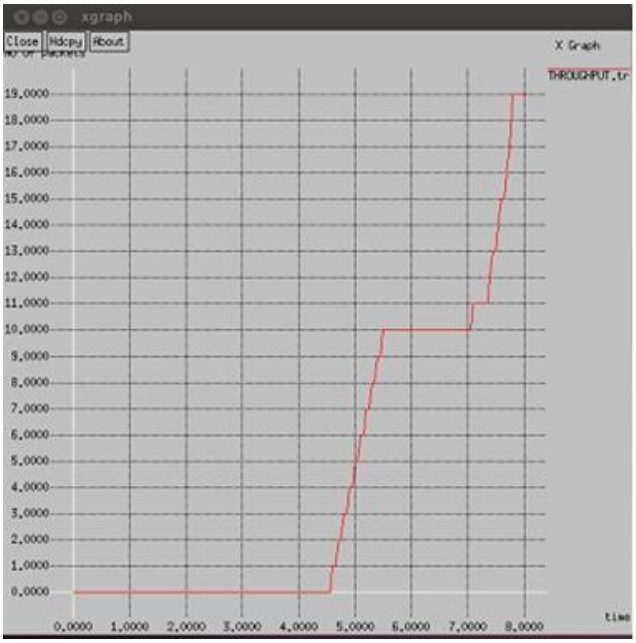


Fig.9. Path established by broadcasting strategy using zone routing protocol (ZRP)

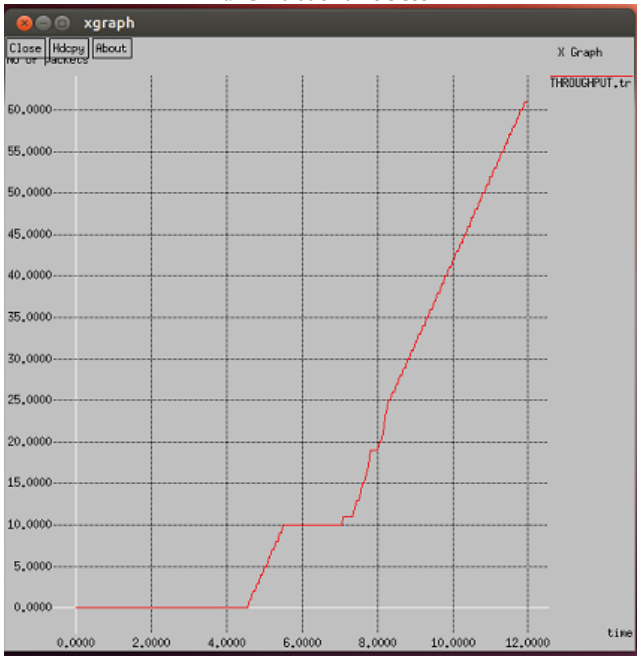
This performance is tested on time intervals of simulation. The time intervals are 8 and 12 milliseconds.

A. Performance analysis

Throughput*:* It is defined as the total number of data packets delivered at destination per millisecond [12].



"a" Simulation time 8 sec



" b" simulation time 12 sec

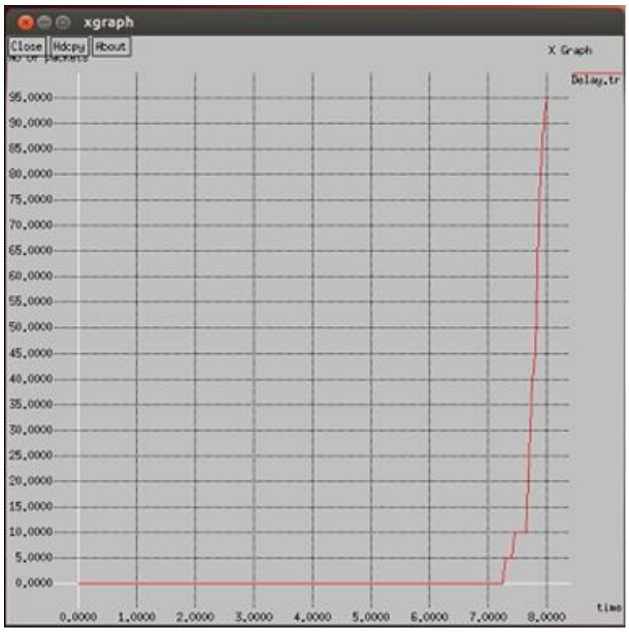
Fig.10. Shows throughput simulation (a, b)

Table II. Throughput

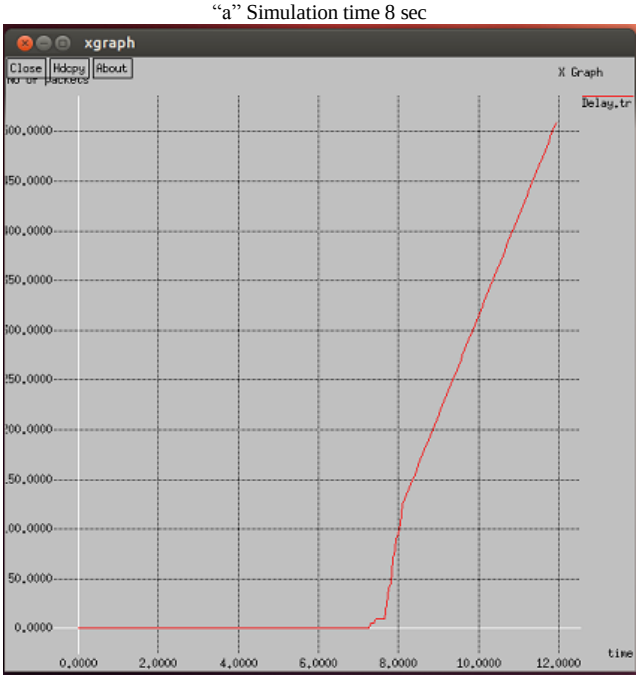
Throughput

Simulation Time	**No of packets Received**
8s	190
12s	600

Delay*:* It is defined as the time taken by the data Packet to reach the destination. It includes all the delays viz. Propagation, Processing, Queuing and Transmission delay [17].



"a" Simulation time 8 sec



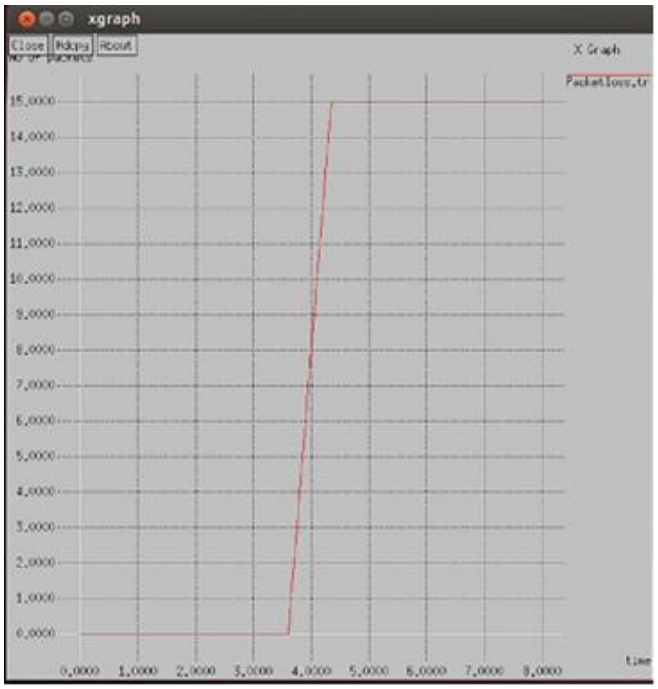
"b" .Simulation time 12 sec
Fig.11. Shows Delay simulation (a, b)

Table III. Delay

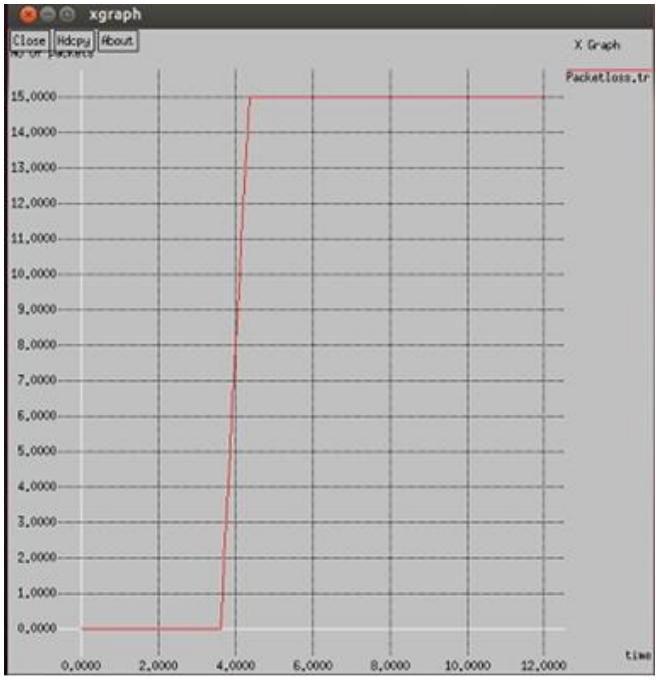
Delay

Simulation Time	No of Delayed packets
8s	100
12s	500

Packet Loss: It is arises when numbers of data packets that can be forwarded by the source node are not able to reach the destination [14].



"a" Simulation time 8 sec



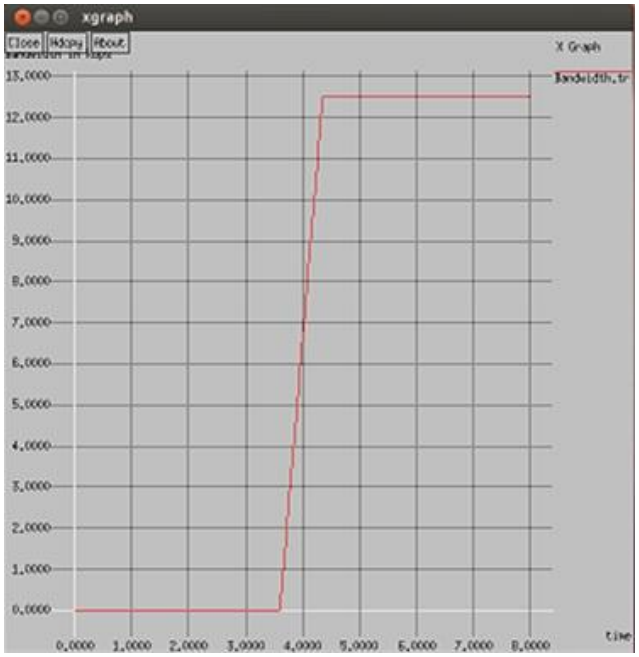
"b" Simulation time 12 sec
Figure.12. Shows packet loss simulation (a, b)

Table IV. Packet loss

Packet loss

Simulation Time	Loss of packets
8s	150
12s	150

Bandwidth**:** The amount of data that can be transmitted in a fixed amount of time. It is a range with in a band of frequencies or wavelength.



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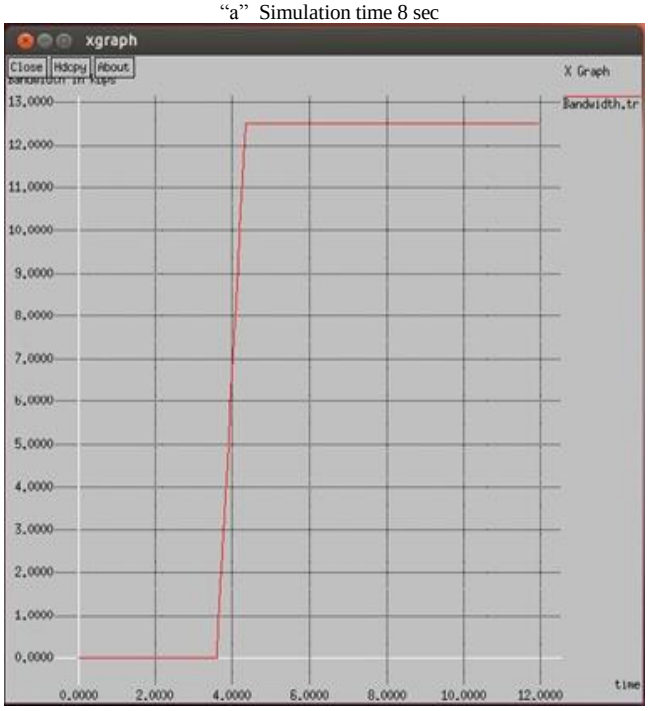

"b" Simulation time 12 sec
Fig.13. Shows Bandwidth simulation (a, b)

Table V. Bandwidth

Bandwidth

Simulation Time	Bandwidth in (kbps)
8s	12kbps
12s	14kbps

VI. CONCLUSION

It has been concluded that due to self configuring nature of mobile ad-hoc network routing is the major issue in Manets. To resolve this issue a path between source and destination can be established using zone routing protocol (ZRP) with broadcasting strategy in the network.The proposed work is implemented in NS2.This paper provides an overview of broadcasting on the basis of different parameters such as delay, throughput, packet loss and bandwidth. Therefore each parameter shows different simulation results at different level of simulation time.

Future prospective of this work includes that broadcasting addressing strategy will be compared with multicasting addressing strategy for efficient path establishment.

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