Performance Comparison Based On Broadcasting Technique In Mobile Ad-Hoc Network

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Abstract---Broadcasting is a fundamental operation in mobile ad hoc networks (MANETs) crucial to the successful deployment of MANETs in practice. In this work, an attempt has been made to compare the performance of three broadcasting techniques in Manet: - Simple flooding based broadcasting (SFBB), Fixed probability based broadcasting (FPBB) and highly adjusted probability based broadcasting (HAPBB). this broadcasting technique has been compared in terms of Three different performance matrices likewise Throughput , Energy and End to End delay.

Keywords*:*- MANET, Simple Flooding, Probability based Broadcasting, Highly adjust Probability based Broadcasting.

I. INTRODUCTION

Mobile wireless networks are an appealing and fast growing option to extend or provide means of communication where it is hard or impractical to use a fixed wired network. Mobility, reduced installation time and long-term cost savings are some of the wireless networks benefits. A Mobile ad hoc network is a group of wireless mobile computers (or nodes), in which nodes collaborate by forwarding packets for each other to allow them to communicate outside range of direct wireless transmission. Ad-hoc networks require no centralized administration or fixed network infrastructure such as base stations or access points and can be quickly and inexpensively set up as needed. Mobile Ad-Hoc network is self organised network. It is a temporary network. The routers, the participating nodes act as router, are free to move randomly and manage themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably. Such a network may operate in a standalone fashion, or may be connected to the larger Internet.

Broadcasting in MANET is a broadcast a message to all other nodes. Broadcasting is a fundamental network element. It may be used for discovering neighbors, collecting global information, naming, addressing, route discovery and maintenance for many routing protocols, and sometimes helping in multicasting. Broadcasting in ad-hoc networks is most simply and commonly realized by flooding whereby nodes rebroadcast each received packet exactly once. Duplicated packets are uniquely recognized by the source node ID and a sequence number. Assuming we have a completely connected network, there may be up to as many transmissions as there are nodes in the network. Especially in dense networks, flooding generate a large number of redundant transmissions where most of them are not required to deliver the packet to all nodes. Nodes in the same area receive the packet almost simultaneously due to the highly correlated timing of retransmissions. This excessive broadcasting causes heavy contention and collisions, commonly referred to as the broadcast storm problem [1], which consumes unnecessarily scarce network resources.

II. RELATED WORK

Ni et al [1] have proposed a fixed probabilistic scheme to reduce redundant rebroadcast by differentiating the timing of rebroadcast to avoid collision. The scheme is similar to flooding, except that nodes only rebroadcast with a predetermined probability P. Each mobile node is assigned the same forwarding probability regardless of its local topological information. In the same work, counter-based scheme is proposed after analyzing the additional coverage of each rebroadcast when receiving n copies of the same packet.

Williams and Camp [5] have classified the broadcast protocols into flooding, probability-based, counter based, Distance based, location-based and neighbour knowledge schemes. Similarly, Neighbour knowledge schemes can be divided into selecting forwarding neighbors and clustering-based. The counter-based scheme inhibits the rebroadcast if the packet has already been received for more than a given number of times.

N. Karthikeyan [6] presented an overview of the broadcasting techniques in mobile ad hoc networks. The comparative study concludes that simple flooding requires each node to rebroadcast all packets. Probability based methods use some basic understanding of the network topology to assign a probability to a node to rebroadcast. Area based methods assume nodes have common transmission distances: a node will rebroadcast only if the rebroadcast will reach sufficient additional coverage area. Neighbor knowledge methods maintain state on their neighborhood via “Hello” packets, which are used in the decision to rebroadcast.

Abdalla M. Hanashi [7] proposed a dynamic probabilistic broadcasting scheme for mobile ad-hoc networks where nodes move according to way point mobility model. The proposed approach dynamically sets the value of the rebroadcast probability for every host node according to the neighbor’s information. The simulation results prove this approach can generate less rebroadcasts than that of the fixed probabilistic approach, while keeping the reachability high. It also demonstrates lower collisions than all the presented approaches.

Zhang and Dharma [8] have described a dynamic probabilistic scheme. They use a combination of probabilistic and counter-based approaches. The value of a packet counter does not necessarily correspond to the exact number of neighbors from the current host, since some of its neighbors may have suppressed their rebroadcasts according to their local rebroadcast probability. On the other hand, the decision to rebroadcast is made after a random delay, which increases latency.

III. Literature Review

The overview of some Broadcasting Technique in MANET is mentioned below.

A. Simple Flooding Broadcasting : In this method, a source node of a MANET disseminates a message to all its neighbors , each of these neighbors will check if they have seen this message before , if yes the message will be dropped, if not the message will retransmitted at once to all their neighbors. The process goes on until all nodes have the message. So the advantage of this method is very reliable for a MANET with low density nodes and high mobility and all the node have message but it disadvantages is very harmful and unproductive as it causes severe network congestion and quickly exhaust the battery power. And also redundant packet is more in the network so there are many chances of congestion and collision. So this problem is called the broadcast storm problem causes of the blind flooding.

B. Probability Based Broadcasting: In probability Based Broadcasting it takes the limit on probability it means it's Broadcasting nature depend on the probability.

1) Fixed Probability Based Broadcasting :

In the fixed probabilistic scheme, when receiving a broadcast message for the first time, a node rebroadcasts the message with a pre-determined probability *p*. every node has the same probability to rebroadcast the message. For example Probability takes 50% then only 50% node is rebroadcast the message so the advantages of this method it decreases redundant packet .so it decreases the congestion and collision in the network. But the disadvantage is that which we takes the probability it is same for all nodes so the poor distribution in the network.

2) Counter Based Broadcasting:

In the counter based broadcast scheme, upon reception of a previously unseen packet, the node initiates a counter with a value of one and sets a RDT (which is randomly chosen between 0 and Tmax seconds). During the RDT, the counter is incremented by one for each redundant packet received. If the counter is less than a threshold value when the RDT expires, the packet is

Rebroadcast. Otherwise, it is simply dropped. The advantages of counter based broadcasting are it saves the energy to network lifetime. It uses channel bandwidth efficiency.

C. Area Based Broadcasting Approach : It takes the common transmission distance and then it will broadcast the message. It consist of following method.

1) Distance Based Broadcasting :

A node using the Distance-Based Approach compares the distance between itself and each neighbor node that has previously rebroadcast a given packet. Upon reception of a previously unseen packet, a RDT is initiated and redundant packets are cached. When the RDT expires, all source node locations are examined to see if any node is closer than a threshold distance value. If true, the node doesn't rebroadcast.

2) Location Based Broadcasting:

Upon the reception of a previously unknown packet, the node initiates a waiting timer and accumulates the coverage area that has been covered by the arrived packet. When the waiting timer expires, if the accumulated coverage area is larger than a threshold value, the node will not rebroadcast the packet. Otherwise, the node will broadcast it.

D. Neighbor Knowledge Based Broadcasting : In neighbor knowledge approach, State on the neighbourhood is maintained by neighbourhood method, and the information obtained from the neighboring nodes is used for rebroadcast. It consists of following methods.

1) Self Pruning:

Self Pruning is an effective method in reducing broadcast redundancy. Each node in this approach is required to have knowledge of its neighbors. The receiving node will first compare its neighbor lists to that of sender's list, the receiving node will rebroadcast if the additional nodes could be reached, otherwise the receiving node will drop the message. This is the simplest approach in the neighbor knowledge method. In Figure 1, after receiving a message from node 2 node 1 will rebroadcast the message to node 4 and node 3 as it is only additional nodes. Note that node 5 also will rebroadcast the same message to node 4 as it is only additional node. In this situation still the message redundancy takes place.

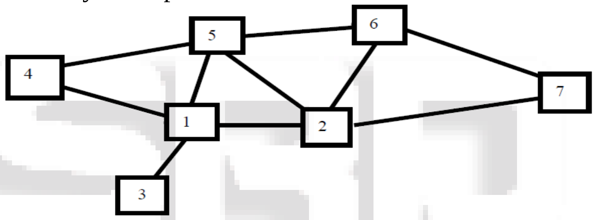

Fig. 1: Self Pruning

2) Ad-Hoc Based Broadcasting:

In this approach, only nodes selected as gateway nodes and a broadcast message header are allowed to rebroadcast the message. The approach is described as follows:

Locate all two hop neighbors that can only be reached by a one hop neighbor. Select these one hop neighbors as gateways. Calculate the cover set that will receive the message from the current gateway set for the neighbors not yet in the gateway set, Find the one that would cover the most two hop neighbors not in the cover set. Set this one hop neighbor as a gateway. Repeat process 2 and 3 until all two hop neighbors are covered.

When a node receives a message and is a gateway, this node determines which of its neighbors already received the message in the same transmission.

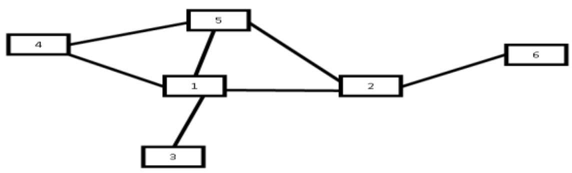

Fig. 2: Ad-Hoc Based Broadcasting

Ad hoc broadcasting approach, node 2 has 1, 5 and 6 nodes as one hop neighbors,3 and 4 nodes has two hop neighbors. Node 3 can be reached through node 1 as a one hop neighbor of node 2. Node 4 can be reached through node 1 or node 5 as one hop neighbors of node 2. Node 3 selects node 1 as a gateway to rebroadcast the message to nodes 3 and 4. Upon receiving the message node 5 will not rebroadcast the message as it is not a gateway.

3) Cluster Based Broadcasting:

The clustering approach has been used to address traffic coordination schemes, routing problems and fault tolerance issues. Note that cluster approach proposed in was adopted to reduce the complexity of the storm broadcasting problem. Each node in a MANET periodically sends 'Hello' messages to advertise its presence. Each node has a unique ID. A cluster is a set of nodes formed as follows. A node with a local minimal ID will elect itself as a cluster head. All surrounding nodes of a head are members of the cluster identified by the heads ID. Within a cluster, a member that can communicate with a node in another cluster is a gateway. To take mobility into account, when two heads meet, the one with a larger ID gives up its head role.

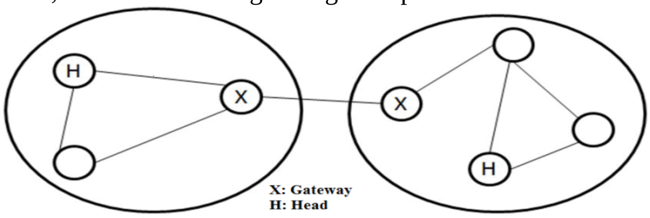

Fig. 3: Cluster Based Broadcasting

In a cluster, the heads rebroadcast can cover all other nodes in its cluster. To rebroadcast message to nodes in other clusters, gateway nodes are used, hence there is no need for a non-gateway nodes to rebroadcast the message. The method saved much more rebroadcasts and leads to shorter average broadcast latencies. Unfortunately, the reachability was unacceptable in low density MANETs.

IV. SIMULATION & CALCULATION PARAMETER

The performance of the simple flooding-based broadcast is evaluated using the ns-2 network simulator. The mobility model used is Random waypoint mobility model because it models the random movement of the mobile nodes. For all the simulations, the same movement models were used.

Table. 1: Simmulation Parameter

Parameter	Value
Simulator	NS-2(Version-2.35)
Routing Protocol used	AODV
Protocol studied	Simple flooding,Probility Based Broadcasting, Highly Adjust Probability Based Broadcasting
Interface queue type	DropTail/ Pri Queue
Antenna model	Omni Antenna
Channel type	Wireless Channel
Radio-propagation model	Two Ray Ground
Network interface type	Wireless Phy
Max packet in interface queue	50
Node Movement Model	Random Way Point model
Traffic Type	CBR
Packet size	256
Bandwidth	22.0e6 (22.0*1000000)
Transmission Range	250m

The Calculation parameter is End to End Delay, Energy & Throughput.

A. End To End Delay(Ms) : A specific packet is transmitting from source to destination and calculates the difference between send times and received times. Delays due to route discovery, queuing, propagation and transfer time are included in the delay metric.

B. Energy(Joule): The entire node has energy to broadcast the message. Basically it is divided in three zones.

1) Normal Zone:

The current energy level is grater then 20 % of their initial energy. This significant of that the nodes are running high on energy.

2) Warning Zone:

Nodes are in warning zone if their current energy level lies between 10-20% of the initial energy. This significant of that the nodes are running low on energy.

3) Danger Zone:

Hear the nodes have less than 10 % of their initial energy .this means that the nodes are really low on the battery level. Hear We Find the Remaining Energy of Nodes and assume that the initial energy is 0.1.

C. Throughput(Kbps)

Throughput is the average rate of successful data packets received at destination. It is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second. A higher throughput directly impacts the user's perception of the QoS.

V. SIMULATION RESULTS

Hear we take Three Scenario 25 node, 50node and 100node in 1000 X 1000m simulation area. All Scenario is Movement Scenario. Simulation time is 10ms.we can measure the result of various parameters with three different techniques Simple Flooding(SFBB), Probability Based Broadcasting(FPBB) and Highly Adjust Probability based broadcasting (HAPBB) using table1 simulation parameter in Ns-2.In a Fixed Probability Based Broadcasting lowest probability has been taken.

Table. 2: Simmulation Results for Average end to end delay (ms)

Technique	Node 25	Node 50	Node 100
SFBB	7.9406	15.379	30.845
FPBB	3.1477	3.232	3.282
HAPBB	6.99174	11.91	22.805

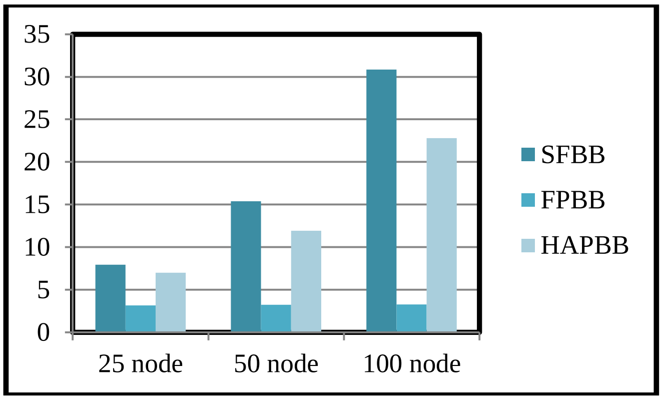

Fig. 4: Performance Parameter of Average End to End Delay (ms)

Table. 3: Simmulation Results for Remainning energy (joule)

Technique	Node 25	Node 50	Node 100
SFBB	0.087976	0.083920	0.071173
FPBB	0.098397	0.099198	0.098397
HAPBB	0.091984	0.089784	0.073497

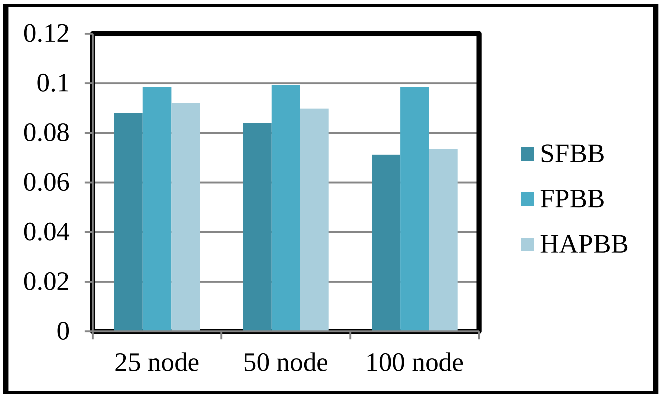

Fig. 5: Performance Parameter of Remaining Energy (joule)

Table. 4: Simmulation Results For Throughput (Kbps)

Technique	Node 25	Node 50	Node 100
SFBB	17.41	63.28	214.22
FPBB	3.48	1.64	7.37
HAPBB	10.24	54.27	160.56

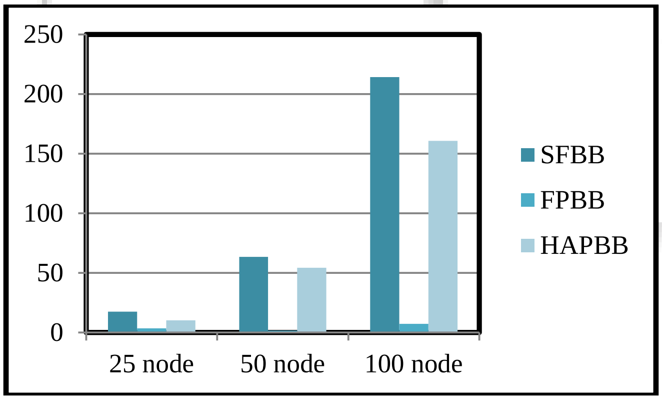

Fig. 6: Performance Parameter of Average Throughput (kbps)

VI. RESULT ANALYSIS

In a simple Flooding we can show that Remaining Energy can less and also all node are broadcast the message so redundant packet is increases. Channel Bandwidth utilized more energy is Less compare to FPBB and HAPBB. Simple flooding cause broadcast storm problem which cause contention and collision. Wastes channel bandwidth by increasing channel congestion. Broadcast Strom problem is increases.

In a Fixed Probability Based Broadcasting we can show that remaining energy high as compared to simple flooding and Highly Adjust Probability Based Broadcasting. And End to End Delay is less than other technique. But we can see the throughput going to very less so message reachability is very less.Assigning the same probability value to all network nodes can results in poor distribution of the probability values. Mainly, using small probability values would aid in greater packet savings, but this may affect reachability especially in sparse networks.

Alternatively, larger probability values are beneficial in sparse networks, but can unnecessary swamp a denser network with unneeded redundant packets in a flooding-like manner.

In a Highly Adjust Probability based broadcast we can get the less end to end delay .Energy is Higher then SFBB .and throughput is more than FPBB. so this are the overcome the problem of FPBB & SFBB.

VII. CONCLUSION

In a Mobile Ad-Hoc Network the performance of HAPBB outperform then the other schemes (fixed probability and simple flooding) in terms of Energy, average end to end delay and throughput. HAPBB also reduces Average end to end delay so data can be transferred quickly. HAPBB reduces load which means less contention and collision of packets. HAPBB reduce the Broadcast storm problem and in terms of energy we can see the highest energy then SFBB. Energy is saved by 58% compared to simple flooding and fixed probability-based broadcast.

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