**Available Online at www.ijcsmc.com**

**International Journal of Computer Science and Mobile Computing**

**A Monthly Journal of Computer Science and Information Technology**

**ISSN 2320–088X**
**IMPACT FACTOR: 5.258**

***IJCSMC, Vol. 5, Issue. 7, July 2016, pg.401 – 408***

# Ensuring Definite Coverage with Optimistic Data Diffusion in MANET

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***Abstract*— Mobile Ad hoc Network (MANET) is an infrastructure less network which is having a collection of mobile nodes. Routing and diffusion are the two major operations of the mobile ad hoc network. The main principle in MANET is the diffusion operation. The current routing protocols are based on simple flooding which results in high packet collision and broadcast redundancy. In this work, an optimistic data diffusion scheme is proposed to determine the full coverage using a small set of forward nodes in mobile ad hoc network (MANET).It guarantee the coverage when the local view of each node on its neighborhood information is updated in a timely manner. Three sufficient conditions namely connectivity, link availability and consistency are proposed for the inaccuracy of the local views. To fulfill those conditions, the local view that constructs the virtual network using the minimal transmission range which maintains the connectivity. Two transmission ranges are used for the collection of the neighbor information and other for the data transmission which creates a buffer zone in the physical networks for the availability of the logical links. At last, the consistency of the local views is ensured by an aggregated local view. The effectiveness of this proposed scheme is confirmed by performance analysis and simulation study.***

***Keywords*— MANET, Diffusion, Coverage, Local view, Transmission range**

## I. INTRODUCTION

A mobile ad hoc network (MANET) is a continuously infrastructure-less, self-configuring network of mobile devices which is connected without wires. In the recent technology, portable devices such as computers having wireless interface allows the communication of mobile users. This results to mobile computing as the users no need to provide a stable location in the network. This provides non restricted movement of nodes. A wireless ad hoc network is defined as a distinct network in which

 

the wireless network interfaces along with a collection of mobile hosts creates a temporary network, without any centralized administration that is mobile switching centers or any established infrastructure such as base stations.

The basic operation is broadcasting [1] a packet to the entire network and it has widely applied in mobile ad hoc network (MANET). In several routing protocols, broadcasting is mostly used for the route discovering process, to remove the non existing path from the routing table when advertising an error message. It is a most reliable mechanism for efficient multicasting [1] in a speed-moving MANET. In MANET along with the different receiving mode, the method of blind flooding is a traditional mechanism which incurs significant collision, contention, and redundancy, which causes to broadcast storm problem in mobile ad hoc network. In MANET, efficient broadcasting ensures the broadcasting coverage while focusing on a node set that selects a small forward node.

The common and basic future of the ad hoc network for mobile is that it enables wireless communications among the nodes that participates without the need of base stations. The communication setup between the two nodes requires support of intermediate nodes which is out of transmission range of each other on which messages are relayed. Broadcast protocols are classified into two different approaches: probabilistic and deterministic. In probabilistic approach, on receiving a broadcasted packet, each and every node forwards the broadcasted message with a probability 'p'. This approach doesn't guarantee the full coverage. Full coverage is guaranteed in the deterministic approach and is divided based on the information of the neighbors: Based on location-information and based on neighbor-set. In this work, the protocols on the deterministic methods are considered that use the information of neighbor set only.

In the diffusion process [1], each and every node has to choose its status of forwarding the packets depending on the neighbor's information which is made from the neighbor-set of the other entire node. This is called self-pruning protocol [2][3]. In Figure 1, all forward nodes are the black nodes and all nodes that are white are the non forwarding nodes. Each circle in the figure 1 corresponds to a 1-hop neighborhood. By default a node that is black is a source node.

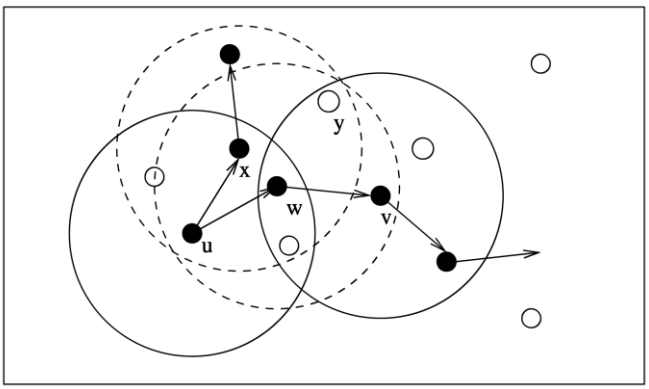


Figure 1: Transmitting Node set in MANET

The delivery of message failure is caused by two sources:

- **Collision**: Another "Hello" message collides with the intended "Hello" message at the destination; therefore the destination doesn't receive any message. In Figure 1, destination node **y** doesn't receive any message as the messages from node **x** and node **w** collide at node **y**.
- **Mobile nodes**: A neighbor which was under the transmission range of the current node now moves out of the

 

transmission range under the current node. In the Figure 1, the node **w** now moving out of the transmission range of node **u**, therefore all the nodes whose branch rooted from node **w** of the broadcasting tree will surely miss the message.

In static networks, results show that the collision effect can be relaxed by a too short of (1ms) delay of forward jitter, where a too high 99 percent of ratio in delivery is achieved. The mobile nodes cause the majority of delivery failures. Therefore in this work, we focus on mobility that is caused on delivery only.

The main challenges are as follows:

1) During the broadcast process, the network topology changes over time.

2) The local (1-hop) information is constructed based on "Hello" intervals. To avoid serious collision among "Hello" messages, nodes start their intervals asynchronously, making it difficult to ensure consistent local/global views among nodes.

3) For k localized solutions, the collection process for k-hop information incurs delay which may not reflect the current network topology when there are mobile nodes, even for a small k in localized solutions.

Therefore, the issues such as the construction of the virtual network from the local views of the nodes might not be in connection i.e., the connectivity issue. Second because of this, the link may not exist in the physical network i.e., link availability issue and the last issue is the global view which is constructed from all the group of local view might not be consistent i.e., consistency issue.

## II. RELATED WORK

This section gives the details of various works carried out in the area of broadcasting data packets across the MANETs.

Khabbazian et *al*. [4], proposed a efficient broadcasting algorithm for sender-based, using one - hop neighborhood information which minimizes the complexity of time to O(n) by computing the forwarding nodes. Also a highly and simple broadcasting algorithm for efficient receiver-based algorithm is proposed. By simulation, the results are confirmed and in the proposed receiver–based broadcasting algorithm, the number of broadcasts can even be less than the best known approximation for the reduced number of broadcasting is shown.

R Pakkala *et al*. [5] proposed an empirical approach is proposed to design and implement the model which ensures secure and efficient data forwarding in the adhoc network. The proposed approach mainly concentrates on providing the data security services such as authentication, confidentiality and integrity in the model. Thereby anomalous activities such as packet dropping or packet modification attacks are easily handled. Also it establishes the more optimal and stable path from source to destination in which the transformed data is forwarded. Results show that proposed approach can achieve both data security and efficient data forwarding together in an intrinsic nature of the network.

In [6], Pleisch *et al.*, has proposed new basic idea for flooding. It depends on the proactive compensation of packets that timely broadcast to each and every node. The constructions of these packets are done from the data packets dropped, using forward error correction based on techniques borrowed. It is resilient to mobility as this method does not depend on network overlays and pro-active neighbor discovery. The evaluation and implementation is done in mistral and the performance and overhead is

 

compared with the pure probabilistic flooding. The results achieve higher node coverage than with pure probabilistic flooding.

R Pakkala and Akhila Thejaswi [7] introduced a new mechanism for minimizing the link failures and maximizing the network lifetime in adhoc network. It provides the security against attacks using new cryptographic mechanism and routes the packets in the efficient path by checking the residual power in each node.

In [8], Yassein *et al*. introduced a mechanism for broadcasting using dynamic probability approach. Here the density of the host is set to the rebroadcast probability in its neighborhood area. The short HELLO packet is used for the information of one - hop neighbors to adjust the probability. This decrease the probabilities of the host, if it is high depending on the average number of neighbors, which indicates in the dense area all the hosts can gain a very large amount of rebroadcasts from all of its neighbors, otherwise, the rebroadcast probability is increased.

## III. PROBLEM STATEMENT

It is obvious that the basic operation in MANET is broadcasting a "Hello" packet to the whole network and is used mainly in the process of discovering the routes in many routing protocols. The main problem in broadcasting a packet in MANET is the blind flooding that causes significant collision, contention and redundancy which leads to broadcast storm problem. The broadcasting protocols may be probabilistic which is prone to be not accurate. These protocols which may use the node information may be of neighbor node, location or directions all are not accurate. They are not properly updated in static networks.

The broadcast protocol has been designed when the issue of broadcast coverage has occurred.

1. Changes occur in the topology of the network during the broadcasting process.
2. The construction of local one - hop information is based on the "Hello" intervals. As the intervals of the nodes start asynchronously, it is very difficult for ensuring the consistent local or global views between the nodes.
3. The collection process of k-hop information may acquire a small k delay in localized solution that doesn't reflect the current network topology. Due to this, the following issues may occur:

    a. ***Connectivity Issue***: The local views of nodes that construct the virtual network may not be connected.

    b. ***Link Availability Issue***: In the physical network the link may not exist.

    c. ***Consistency Issue***: All collected local views which constructs the global view may not be consistent.

## IV. SCHEME DESCRIPTION

The proposed scheme contains a method for mobility control which addresses the issue of connectivity of the network, link availability of the network, and consistency in the network. There are two conditions. The first condition is to ensure the virtual networks connectivity on connectivity of the physical network. The next condition is to ensure the link availability based on the range difference.

 

The mobility management method [9] doesn't correspond to the information of location. It depends on the transmission range *r*1 and the transmission range *r*2, with *r*1 < *r*2. The transmission range *r*1, collects the neighbor set information and also the information of *k* – hop by using the "Hello" messages. The transmission range *r*2 performs the actual transmission.

There are two different stages in the proposed method: (a) Selecting the forward node (b) the process of forwarding. During the broadcasting process, the selection of forward node is done dynamically [12].

- **Forward node selection:** Based on the transmission range r1, using the existing method, a small forward node set is selected.
- **Forwarding process**: If a node is a forward node and if that node receives a message for the first time, using the transmission range r2 it forwards the message.

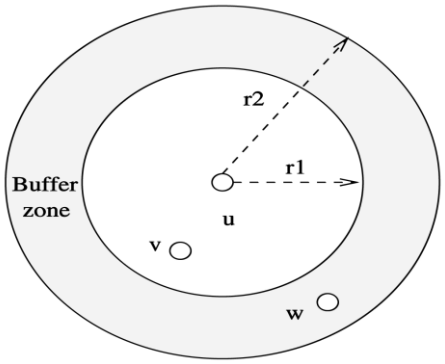


Figure 2: Transmission node selection and forwarding process based on the transmission ranges: r1 and r2

A node which comes inside the range *r1*, of the node ***u*** is called the neighbor of node *u*. All such set of nodes are called the neighbor set of node ***u***. The collection of all such nodes which is reachable that is based on the range *r*2 is named as the effective neighborhood set. The figure 2 shows the difference between the two ranges of transmission, r1 and r2. In the figure 2, we can see that the node *v* is within the node *u*'s neighbor set. And it is also within the node *u*'s effective neighborhood set, but the node *w* is within the node *u*'s effective neighbor set but it is not within the node *u*'s neighbor set.

## V. SYSTEM DESIGN

The proposed system contains mainly 3 modules. They are:

1. Node addition and Mobility Creation
2. Single and Dual neighbor set routing
3. Comparison routing

***Node addition and Mobility Creation***

In this module, the cellular region is created in the simulated model. For the proposed system, according to the number of nodes added, the nodes are placed in the cellular region. Then the static neighbor set algorithm is invoked by the user by selecting the source and destination. The source and the destination node number are also displayed on the screen. Static routing path is also displayed depending on the source and destination node selected.

 

Mobility is also provided to the nodes and the position of some nodes is changed according to the mobility in the cellular region. The change of position of the nodes is monitored.

***Single and Dual Neighbor set Routing***

In this module, each node identifies its forwarding neighbor sets considering its own single neighbor set information. Based on next single neighbor set information is forwarded to link the virtual network based on link availability. The directed graph is designed to model this network and nodes in the directed graph represents mobile node and vertex of graph represents the connectivity established between nodes. Each node identifies its status as forwarding depending on its own local dual neighbor set information. Based on next two different neighbor set information is forwarded to link the virtual network based on link availability.

***Comparison Routing***

The routing comparison takes place based on the following three properties

1. Link
2. Connectivity
3. Availability

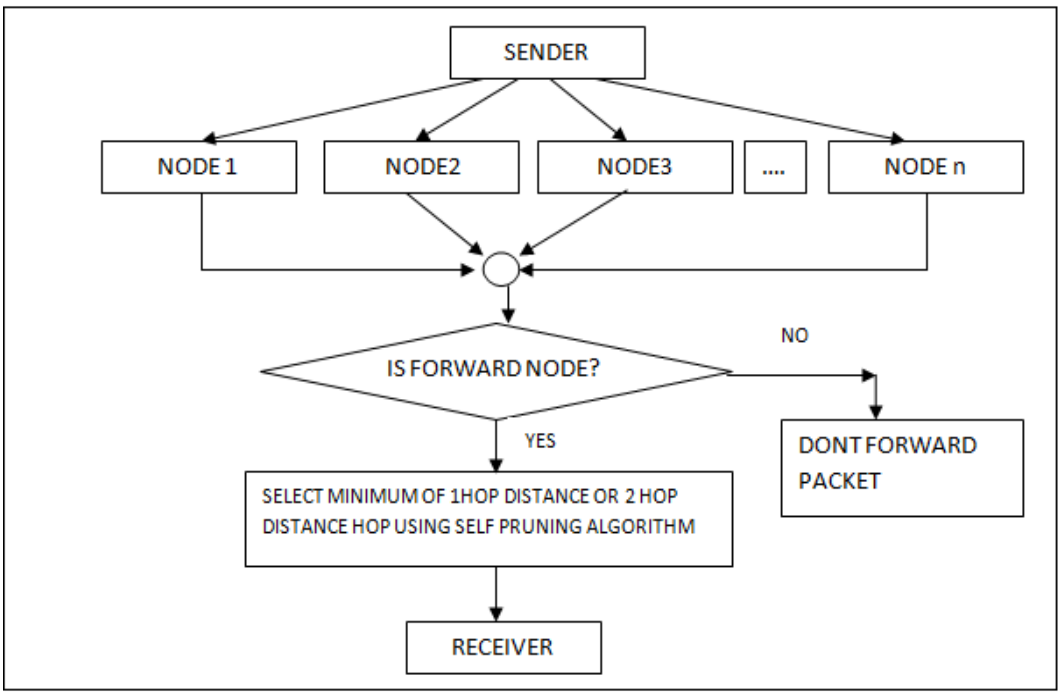


Figure 3: Packet Forwarding

 

## VI. RESULTS

The result analysis shows a 100 nodes dense network with buffer zone width r2 – r1 ranging between 0m to 100m.

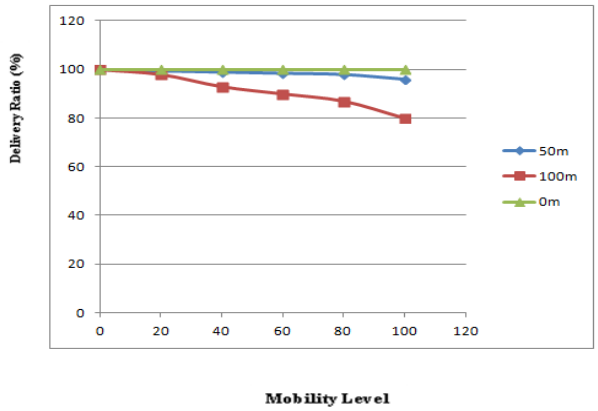


Fig.4: Delivery Ratio of Single Neighbor Set Method in Dense Network

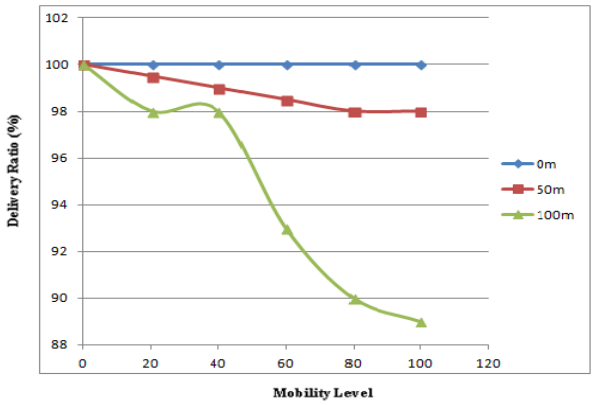


Fig. 5: Delivery Ratio of Dual Neighbor Set Method in Dense Network

## VII. CONCLUSION

This work has presented a method to manage mobility using two transmission ranges. Due to this, there is a flexibility of modifying topology while broadcasting in dynamic environment. The issues for connectivity, link availability, and consistency have also been addressed which is related to the information pertaining to neighboring nodes. Delivery ratio can be increased by using the probabilistic analysis with larger range r1. In this proposed study, the simulation results show that dual neighbor set routing achieves high delivery ratio and broadcast redundancy than single neighbor set routing by modifying range r1.

As a future enhancement, automatic adjustment of width of buffer zone can be implemented.

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