Mobility Aware Refined Counter Based Broadcasting Model of MANET,

[1] Prof. Manjusha Deshmukh, Computer Department, Pillai Institute of Information Technology, Maharashtra, India
[2] Dr. Ratnadeep Deshmukh, Computer Department, Dr. B.A. M. University, Maharashtra, India
[3] Dr. Sangeeta Kakarwal, Information Technology Department, PES College of Engineering, Maharashtra, India

---***---

Abstract - The MANET is a special type of wireless mobile network in which mobile hosts can communicate without any aid of established infrastructure. Broadcast or flooding is a dissemination technique of paramount importance in mobile ad-hoc networks. MANETs are generating lots of interest due to their dynamic topology and decentralized administration. Due to the mobility of nodes there are many problem occurred during the packet transmission. Basic routing protocols such as Ad hoc on Demand Distance Vector (AODV), Dynamic source routing (DSR) could lead to issues such as Broadcast Storm Problem, Large power consumption, link failure due to mobility. Counter-based approaches inhibit a node from broadcasting a packet based on number of copies of the broadcast packet received by the node within a random access delay time. It relies on the threshold value to decide whether or not to forward broadcast packet. In this paper, model is proposed which refines the counter-based threshold based on network density and the mobility of nodes. The paper refined the sparse threshold as low sparse threshold and high sparse threshold and dense threshold as low dense threshold and high dense threshold.

Key Words: MANET, CBB, Counter based, and *Broadcasting, etc…*

1. INTRODUCTION

Wireless networks are becoming more and more important. People want their mobile and fixed devices to communicate with hassle of wires. Preferably communication should be established automatically in ad-hoc fashion. To achieve this, Mobile Ad-hoc Networks will be an important building block. The MANET is a special type of wireless mobile network in which mobile hosts can communicate without any aid of established infrastructure. Broadcasting is a dissemination technique of paramount importance in mobile ad-hoc networks. In routing protocols for ad-hoc networks, broadcasting is part of the discovery phase, which is responsible for finding a communication path to route the application data from a source node to one or more destination nodes. In MANET, the mobility of hosts enhances link breakage probability. This makes routing protocols meant for wired networks to work inefficiently in MANET.

Many routing protocols in MANET have been proposed. They can be categorized into the two broad classes: proactive/table driven and reactive/on-demand based on the way the route information is maintained and stored. In the proactive routing protocol, every node keeps up-to-date information about all nodes in the network. Each node has a complete view of the network topology. The main advantage of proactive routing is the shortest response time to determine a route. However, it wastes the network resources by using control packets and some routes are not used at all. Destination-sequenced distance vector routing (DSDV) [1] is an example of this type. In reactive routing, routes are created only when a node needs to send data to another node in the network (i.e. on demand).

There are no predefined routes. The main advantage is the reduced overhead on the network because there is no need to exchange information about the network topology. On the other hand, it increases the time needed to calculate a route. Moreover, the source must reinitiate a new route request when the old has failed. Ad hoc on demand distance vector (AODV) [2] is an example of reactive protocols.

The simplest way of broadcasting is flooding where each node receives and then transmits the message to all its neighbors. This process continues until the packet has been broad-casted throughout the entire network. The main benefit of using flooding is the ease of implementation. But it suffers from redundancy, collision and contention in the network, such a scenario is referred to as Broadcast Storm Problem [3]. In order to alleviate the broadcast storm problem many broadcast sophisticated solution have been proposed in the last decade.

2. LITERATURE SURVEY

In order to alleviate the broadcast storm problem many broadcast sophisticated solution have been proposed in the last decade. Researchers use different schemes to make a decision of retransmission. Some traditional schemes are probability based, counter based, location based, distance based and topology based schemes [3][4]. In Probability based schemes, a node rebroadcast the message with a certain value of probability p and eliminates it with 1-p. In counter based broadcasting, each node maintains a counter to keep track of duplicate packets; it also inserts a small random delay before broadcasting the packet which causes the timing of the broadcasting be differentiated. This not only allows nodes sufficient time to receive redundant packets but also prevents collision. In distance based schemes, the relative distance between the source and destination node is used to make the broadcasting decision. According to position based schemes, each node must have the means to establish its own position in order to estimate the additional coverage more precisely. This scheme can be supported by the global positioning system (GPS). In topology based broadcast schemes the topological information is used take broadcast decision. It is categorized into Neighbor Knowledge Based Scheme and Cluster Based Scheme. Neighbor knowledge based schemes makes use of neighboring information to make decision of broadcast. In a cluster-based scheme, the network is partitioned into several groups of clusters. Each group has a Cluster Head (CH) with gateways nodes responsible of rebroadcasting the message and select forwarding nodes on behalf of the cluster. Apart from these traditional schemes, there are hybrid schemes which combine the advantages of two or more different broadcast schemes in order to introduce an optimal broadcasting to suppress the broadcast storm problem.

As network topology in MANETs is highly dynamic due to node mobility which often resulted in frequent changes in the node distribution in this network. In Improving the Performance of Probabilistic Flooding in MANET [5], the forwarding probability used for the dissemination of broadcast packets should be set dynamically to reflect the local neighborhood information of a given node.

An Efficient Counter-Based Broadcast Scheme [6] suggested efficient probabilistic schemes for MANETs that combine the features of fixed probability and counter-based scheme in order to mitigate the broadcast storm problem deleterious effects without sacrificing reach ability (i.e. the ratio of nodes that can receive a broadcast packet). The use of single fixed forwarding probability for all nodes in the network regardless of whether the node is in sparse or dense region of the network has make it inflexible in a typical MANET scenario where regions of varying node density co-exist in the same network.

The aim of An Adjusted Probabilistic Counter-based Broadcast Scheme [7] is to significantly reduce the broadcast redundancy without sacrificing network reach ability for a given network topology by dynamically adjusting the forwarding probability at a node according to the counter value of the given node.

The main finding of A New Adaptive Broadcasting Approach [8] is to find an effective solution on Broadcast Storm Problem by adjusting the forwarding probability P based on the global and local neighborhood information and thus reducing dependency on using thresholds to determine the degree level of density for a given node. Many of routing protocols operate efficiently under low network mobility conditions and do not adapt well with high mobility conditions. Therefore, considering mobility is a demanding task that should be performed efficiently and accurately.

Mobility aware Velocity based Broadcasting Scheme [9] eliminates many redundant broadcasts by choosing the nodes with low mobility to discover a more stable path. Thus avoiding the frequent link breakages associated with using unstable paths that contain high mobile nodes.

New Velocity Aware Probabilistic Route Discovery Scheme [10] considers the velocity vector probabilistic route discover in MANETs. The study proposed a high broadcast probability for RNs, while a low value is assigned for U-RNs. Thus it implicitly helps in establishing the most stable routes and excluding most unstable routes. Also the have improved it adding dynamic counter and timer concepts to the mobility aware probabilistic scheme.

Hybrid Broadcasting Scheme [11] aims to reduce the overheads in mobile networks using an adaptive probabilistic flooding scheme based on neighbor knowledge and a forwarding zone criterion. The term „expansion metric‟ (defined below), which differentiates the density of nodes in different areas of the deployed scenario is defined to measure the neighborhood information. In addition, a forwarding zone criterion has been defined to control the forwarding probability. The forwarding zone criterion has two major objectives, i.e. to reduce the control messages due to broken links, and to detect the dissimilarity among the forwarding nodes and select the most dissimilar nodes. The forwarding zone is implemented using a nodes positioning information. This information can be obtained from a Global Positioning System (GPS) or using Received Signal Strength (RSS).

3. MOTIVATION

Due to the dynamic nature of MANET, there are many problem occurred during the packet transmission. Basic routing protocols such as Ad hoc on Demand Distance Vector (AODV), Dynamic source routing (DSR) could lead to issues such as Broadcast Storm Problem, link failure due to mobility. The topology of MANET is often random and dynamic with varying degree of node density in various regions of the network. The network may contain sparse and dense regions. A node is characterized as the sparse node if degree of node is less than the average number of neighbors. Therefore there is less shared coverage. Accordingly, sparse node needs higher chance to broadcast than dense node. Hence the threshold is always very low in sparse region to achieve reach ability. The optimum threshold can be either 1,2 or 3. In the sparse region there is much less shared coverage since there are very few nodes acting as intermediate nodes. If these intermediate nodes are too unstable then there is possibility of link failure which causes decrease in reach ability. Accordingly, sparse unstable node needs lower chance to broadcast than sparse stable node. As given in figure (1), if node 5 is unstable and sparse, optimum threshold can be set to 2 or 3 and node 6 is stable and sparse, optimum threshold can be set to 1.

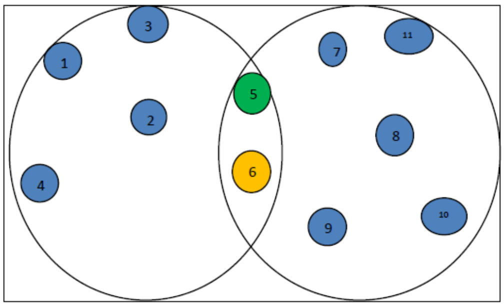

Fig -1: Topology showing Stable & Unstable nodes

A node is characterized as the dense node if degree of node is greater than the average number of neighbors. In dense region there is more shared coverage. If a dense node is stable then there is more possibility of getting the same packet again & again. Also Mobility of node doesn‟t have considerable effect on breakage of link. Accordingly, dense stable node needs lesser chance to broadcast than dense unstable node. Hence the threshold should be always very high if node is dense stable node to achieve considerable broadcast savings. The optimum threshold can be 1 2 4 3 7 8 10 0 6 11 9 5 either 4 or 5. Accordingly, dense stable node needs lower chance to broadcast than dense unstable node. As given in figure (1), if node 5 is unstable and dense, optimum threshold can be set to 4 and node 6 is stable and dense, optimum threshold can be set to 5. Therefore this research study aims in further refining the sparse and dense threshold based on the speed of the nodes.

4. MOBILITY AWARE REFINED COUNTER BASED BROADCASTING MODEL

On hearing a broadcast packet at node N for the first time, it does not immediately broadcast the packet. It waits for Random assessment delay (RAD). It finds the degree of N that is the number of neighbors of node N. If the degree of node N is less than the average number of neighbors then it characterizes current node N as a sparse node, then it finds the speed of sparse node. If the speed of N is less than the speed threshold (That means Current Node is stable node), then it assigns low sparse threshold value to give more chance to broadcast packet. Otherwise, if speed of N is more than the speed threshold (That means Current Node is unstable node), then it assigns high sparse threshold value to give less chance to broadcast packet. If the degree of node N is greater than or equal to the average number of neighbors, it characterizes current node N as a dense node, then it finds the speed of dense node, If the speed of N is less than the speed threshold (That means Current Node is stable node), then it assigns high dense threshold value to give less chance to broadcast packet. Otherwise, if speed of N is more than the speed threshold (That means Current Node is unstable node), then it assigns low dense threshold value to give more chance to broadcast packet. During RAD, the counter is counting the number of repeated packets received. When the RAD expires, if counter c is less than the counter threshold, the packet is broad-casted. Otherwise the packet is dropped.

4.1 Steps for Taking Decision of Transmission

The decision of transmission is carried out in following steps:

Step 1 The average number of nodes can be computed using the equation.

$$\bar{n} = \frac{(N-1) * 0.8 * R * R * \pi}{A} \quad \text{Equation 1}$$

Step 2 The degree of a node can be defined as the total number of neighboring nodes as shown in figure (2)

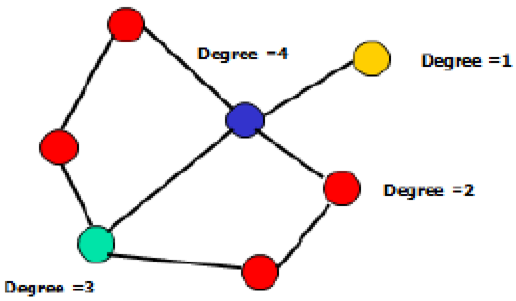

Fig -2: Computation of degree of nodes

Step 3 Based on the information obtained from step1 and step2, a decision of nodes neighborhood (sparse or dense) is made.

Step 4 If the speed of sparse node is less than the speed threshold, then it assigns low sparse threshold value. Otherwise, if speed of sparse node is more than the speed threshold, then it assigns high sparse threshold value. If the speed of dense node is less than the speed threshold, then it assigns high dense threshold value. Otherwise, if speed of dense node is more than the speed threshold, then it assigns low dense threshold value.

5. CONCLUSION

The proposed Mobility Aware Refined Counter Based Broadcasting Model in mobile ad hoc networks (MANETs) is devised to address the issues like Broadcast Storm Problem, Large power consumption, link failure due to mobility. The model determines the counter threshold by considering the network density and the speed of node. Mobility Aware Refined Counter Based Broadcasting

Model combined the counter based scheme and speed based scheme. In the sparse region there is much less shared coverage and if intermediate node to broadcast packet is unstable then there is possibility of link failure which causes decrease in reach ability. Therefore, the sparse unstable node needs lower chance to broadcast than sparse stable node. This helps in increasing lifetime of network in spite of reach ability. In the dense region, there is more shared coverage. If a dense node is stable then there is more possibility of getting the same packet again & again. Also Mobility of node does not have considerable effect on breakage of link. Accordingly, dense stable node needs lesser chance to broadcast than dense unstable node. This helps in optimizing the broadcast.

REFERENCES

[1] C. Perkins, P. Bhagwat, "Highly dynamic Destination-Sequenced Distance-Vector routing (DSDV) for mobile computers", Proceedings of the Conference on Communications architectures, protocols and applications, pp. 234-244, 1994.
[2] C.E. Perkins and E. M. Royer, "Ad Hoc on-Demand Distance Vector (AODV) Routing", Proceedings of the 2nd IEEE Workshop on Mobile Computing Systems and Applications, pp. 90-100, 1999.
[3] Sze-Yao Ni, Yu-Chee Tseng, Yuh-Shyan Chen, Jang-Ping Sheu,"The Broadcast Storm Problem in a Mobile Ad Hoc Network", Proceedings of the 5th annual ACM/IEEE international conference on Mobile computing and networking (MobiCom), pp. 151–162, 1999.
[4] Y. Yi, M. Gerla, T. Kwon," Efficient flooding in ad hoc networks: a comparative performance study", in: Proceedings of the IEEE International Conference on Communications (ICC), Anchorage, USA, 2003.
[5] M. B. Yassein,M. O. Khaoua,L. M. Mackenzie, "Improving the Performance of Probabilistic Flooding in MANET", IWWAN, 2006.
[6] Aminu Mohammed, Mohamed Ould-Khaoua, and Lewis Mackenzie, "An Efficient CounterBased Broadcast Scheme in MANETs", EPEW 2007, LNCS 4748, pp. 275–283, 2007
[7] Aminu Mohammed, Mohamed Ould-Khaoua, and Lewis Mackenzie, "An Adjusted CounterBased Broadcast Scheme for Mobile Ad Hoc Networks", 16 Conferences: Computer Modeling and Simulation, 2008.
[8] Mustsfa Bani Khalaf, Ahmed Y. Al, William Buchanan, "A New Adaptive Broadcasting Approach for Mobile Ad hoc Networks", IEEE, 2010.
[9] Muneer Bani Yassein, Asmahan Abu Al-hassan, Zainab Abu Taye," Performance Analysis of the Effects of Network Density and Network Mobility on Velocity based Scheme in MANET, IEEE, 2010.
[10] D Mustsfa Bani Khalaf, Ahmed Y. Al, Mourad Abed, "New Velocity Aware Probabilistic Route Discovery Schemes for MANET", IEEE, 2012.
[11] D. G. Reina, S. L. Toral, P. Johnson, F. Barrero, "Hybrid Flooding Scheme for Mobile Ad hoc Networks", IEEE,2013.

BIOGRAPHIES

Prof. Manjusha Abhijeet Deshmukh, BE(CSE), Dr. Babasaheb Ambedkar Marathwada University, M.E (CE), Mumbai University. Presently working as Assistant Professor in Department of Computer Engineering, Pillai's Institute of Information Technology, Navi Mumbai (MS). Experience in design, development and implementation of Internet based & desktop based applications. Life member of Indian Society Technical Education, Published 13 research papers in National and International Journals/Conferences. Attended & Organized various ISTE Workshops. Conducted a Content updating Programme as Resource Person on "Java Programming" for the Faculties. Conducted a 1-day & 2-day workshops as Resource Person on "NS2" for the students.. Research areas of specialization are Mobile ad hoc networks Data Mining, Wireless sensor networks, Network Security, and Information retrieval.

Dr. R. R. Deshmukh M.E. (CSE), M.Sc. (CSE) Ph.D. FIETE, Presently working as an in Department of Computer Science and Information Technology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, MS-India. He is a fellow of IETE, Life member of ISCA, CSI, ISTE, ACEEE, IAEng, CSTA, IDES and a senior member of IEEE. He is editor of four books and published more than 40 research papers in reputed Journals, National and international conferences. He is reviewer and editor of several journals at national & international level. He has organized several workshops and conferences. He is nominated as a subject expert on various academic & professional bodies at national level government bodies. He has two research project projects from UGC and received grants more than 10 Lakhs. His areas of specialization are Data Mining, Data Warehousing, Image Processing, Pattern Recognition, Artificial Intelligence, Computational Auditory Scene Analysis (CASA), Neural Networks etc. He won First prize in Inter University State Level Research Festival "AVISHKAR - 2009" .

S. N. Kakarwal received Ph.D., M.E. and B.E. degree in Computer Science and Engineering. She Presently working as Professor in Department of Computer Science and Engineering, P.E.S. College of Engineering, Aurangabad, MS-India. She is a member CSI and ISTE. She was organizing committees of 'Tectrix2K7' and 'Pulses 2011'. Her research interests include Image Processing, Pattern Recognition and Artificial Neural Network. In these areas, she has published 28 research papers in leading Journals, National and International conferences proceedings. She has bagged 3 Best Paper Award.