ISSN:0975-9646

Saranya .S et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 3 (3) , 2012,3938-3941

Improved Boadcast Algorithm for Wireless Mesh Networks

Saranya .S[1] ,T.MohanRaj [2] ,M.Bhanumathi[3]

[1].*Department of CSE, Karpagam University, Coimbatore,India.*
[2].*Karpagam University, Coimbatore, India.*
[3]. *Department of CSE, Gnanamani college of Technology, Namakkal, India.*

***Abstract*: An improved Reliable Broadcasting Algorithm for wireless mesh networks will guarantee to deliver the messages from multiple sources to all the nodes of the network. The solution does not require the network size, its diameter and number of nodes in the network. All nodes have its identity (IP Address) and its position. The algorithm will calculate the relative position of the nodes with respect to the broadcasting source node. The source node will broadcast to their sub nodes. Then sub nodes that are farthest from the source node will rebroadcast and this will minimize the number of rebroadcasts made by the intermediate nodes and will reduce the delay latency. Only a subset of nodes transmits and they transmit only once to achieve reliable broadcasting .The proposed algorithm is contention free, energy efficient and collision free.**

Key words
Broadcasting Algorithm, IP Address, Mesh Networks, Collision, Delay latency.

1. INTRODUCTION

In wireless communication systems, there will be a need for the rapid deployment of independent mobile users. Recently, a number of research groups have proposed more efficient broadcasting techniques whose goal is to minimize the number of retransmissions while attempting to ensure that a broadcast packet is delivered to each node in the etwork. None of these efficient broadcast schemes have been adopted by the unicast protocols mentioned above, perhaps because a unified comparison of these protocols over a wide range of MANET conditions was lacking. Our work addresses that have to reduce the number of retransmission between the nodes in the network. Significant examples include establishing survivable, efficient, dynamic communication for emergency/rescue operations, disaster relief efforts, and military networks . A Mesh Network is a set of nodes communicating with each other via multi-hop wireless links. Each node can directly communicate with only those nodes that are in its communication range. Intermediate nodes forward messages to the nodes that are more than one hop distance from the source. Since the nodes are mobile, the topology of the network is constantly changing. For example, any routing protocols such as Dynamic Source Routing (DSR), Ad Hoc on Demand Distance Vector (AODV) and Location Aided Routing (LAR) use broadcasting to establish routes. The broadcast is spontaneous. Any mobile host can issue a broadcast operation at any time.

The set of applications for MANETs is diverse, ranging from small, static networks that are constrained by power sources, to large-scale, mobile highly dynamic networks. Broadcasting is the process in which one node sends a packet to all other nodes in the network. Broadcasting is often necessary in routing protocols.

Existing broadcasting methods in wireless mesh networks are single source broadcasting algorithms in which only one source node can send the broadcast message to all the nodes in the network. Existing broadcasting algorithms are classified into following types.

1.1 Simple flooding –

The algorithm for Simple Flooding starts with a source node broadcasting a packet to all neighbors. Each of those neighbors in turn rebroadcast the packet exactly one time and this continues until all reachable network nodes have received the packet. Flooding as a scheme to achieve reliable broadcast and multicast in highly dynamic networks.

1.2 Probability Based Method - The Probabilistic scheme from is similar to Flooding, except that nodes only rebroadcast with a predetermined probability. In dense networks multiple nodes share similar transmission coverages. Thus, randomly having some nodes not rebroadcast saves node and network resources without harming delivery effectiveness. In sparse networks, there is much less shared coverage; thus, nodes won't receive all the broadcast packets with the Probabilistic scheme unless the probability parameter is high. When the probability is 100%, this scheme is identical to Flooding.

1.3 Area Based Method - In the area based method, the packet is re-broadcasted only if the node covers a significant amount of area than the sender who sent the packet. Suppose a node receives a packet from a sender that is located very close to it. If the receiving node rebroadcasts, the additional area covered by the retransmission is low. If the receiving node is located at the boundary of the sender node's transmission distance, then a rebroadcast would reach significant additional area.,

1.4 Distance-Based Method - A node using the Distance-Based Scheme compares the distance between itself and each neighbor node that has previously rebroadcast a given packet. Upon reception of a previously unseen packet, a RAD (Random Assessment Delay) is initiated and redundant packets are cached. When the RAD expires, source node location is examined to see if any node is closer than a threshold distance value. If true, the node doesn't rebroadcast.

1.5Neighbor knowledge method - In this method each node will have knowledge of its neighbors and maintains neighbors list. A node that receives a broadcast packet compares its neighbor list to the sender's neighbor list. If the receiving node would not reach any additional nodes then it will not re-broadcast. Otherwise the node rebroadcasts the packet. This is called as self-pruning.

The proposed multi source broadcasting algorithm allows multiple sources broadcast the messages to all the nodes in the network. It combines area based technique and neighbor based technique. Each node will have knowledge of its neighbours and maintains neighbours list. The algorithm calculates the relative position of the nodes with respect to the broadcasting source node. The nodes that are farthest from the source node rebroadcasts next. The algorithm tries to minimize the number of rebroadcasts made by the intermediate nodes and thus reduces latency.

The rest of the paper is organized as follows. The proposed system is described in Section 2. Concluding remarks and future works are described in Section 3.

2. Proposed System

The proposed system is multi source reliable broadcasting which can broadcast the messages reliably from different sources to all the nodes in the network. The solution does not require the nodes to know the network size, its diameter and number of nodes in the network. The nodes have its identity and its position. The source node broadcast the message to their subset of nods. The subset of nodes transmits and they transmit only once to achieve reliable broadcasting. The algorithm calculates the relative position of the nodes with respect to the broadcasting source node. It propagates the message as far as possible to minimize the delay. The nodes that are farthest from the source node are scheduled to transmit first. The algorithm minimizes the number of transmissions made by the participating nodes. If a node that is scheduled to transmit a message in a round realizes that its transmission cannot propagate the message to any new node, it cancels its scheduled transmission. This minimizes the number of rebroadcasts made by the intermediate nodes and reduces the delay latency.

MANET is represented as a grid based graph where a vertex of the graph represents a node and there is directed edge from node i to node j if node j is in the ange of node i. Nodes are located at grid points and they now their own position . A node that has received the broadcast message is called a covered node and a node that has not yet received the broadcast message is called an uncovered node. Each node is equipped with a GPS receiver to know its own location.

Global Positioning System (GPS) is a constellation of 27 Earth-orbiting satellites. The GPS receiver JP3 is shown in the Figure 1. It continuously tracks all the satellites in view, and provides accurate satellite position data. It locates four or more of these satellites, calculates the distance to each, and uses this Information to detect its own location. Initially, only the source node is covered. Messages can be directly transmitted by a node to other nodes that are no more than *R* grid distance away, where R > 1 is the maximum communication range of each node.

Figure 1: GPS Receiver JP3

Time is divided into synchronous rounds. It takes one round for a node to move from one grid point to a neighboring grid point. Each round consists of multiple time-slots, of which the first time-slot is referred to as the control slot. During the control slot nodes only exchange control information with other nodes within a certain distance. The remaining slots of a round are referred to as application slots. During the application slots, nodes can transmit the broadcast message. Nodes very close to each other are considered to be collocated at a point. Maximum of k nodes can be collocated at a grid point.

2.1 Broadcasting

In order to reliably broadcast a message to all the nodes of the network, the scheduling algorithm considers the relative position of the nodes with respect to the broadcast source. In every round, the covered node that is farthest from the source transmits. Algorithm also minimizes the number of transmissions by the Participating nodes. If a node that is scheduled to transmit a message in a round realizes that its transmission cannot propagate the message to any new node, it will cancel its scheduled transmission.

2.2 Scheduling Algorithm

The scheduling algorithm considers the relative position of the nodes with respect to the broadcast source, In order to reliably broadcast a message to all the nodes of the network. In every round, the covered node that is farthest from the source transmits. The algorithm minimizes the number of rebroadcasts made by the participating nodes. If a node that is scheduled to transmit a message in a round realizes that its transmission cannot propagate the message to any new node, it will cancel its scheduled transmission.

2.3. Execution of the Algorithm for Static Nodes

Execution of the reliable broadcasting algorithm when the nodes are static is shown in the Figure 2. An unhanded circle represents an uncovered node and a shaded circle represents a covered node. A node with the thick circle is the one that transmits in that slot. If there are multiple nodes collocated at the same point and more then one of them are scheduled to transmit in the same slot, then only one of them transmits. All the collocated

Nodes would be aware of each other following Communication in the control slot. By using node IDs, nodes are totally ordered and node with the smallest ID will transmit first. If there are multiple nodes in a grid segment and more than one of them are scheduled to transmit in the same slot, then only one of them transmits. If the segment number is positive then the right most nodes in that grid segment transmits. If the segment number is negative then the left most nodes in that grid segment transmits. So, to the right of the point of origin of the broadcast, the right most nodes transmit and in the direction the left most nodes transmits. After its initial transmission a source node just acts like an ordinary node and is allowed to move freely.

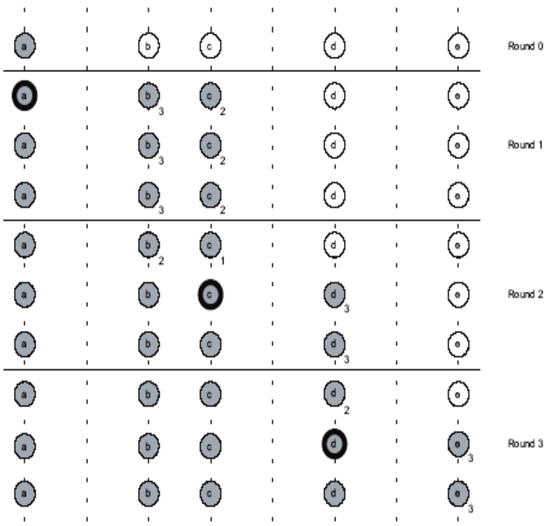

Figure 2. Execution of the algorithm when the nodes are static

In multi source reliable broadcasting algorithm, multiple sources can initiate the broadcasts at a time. The algorithm takes into consideration node mobility and multiple nodes co-located at the same point.

This algorithm delivers the messages within a bounded time. It minimizes the number of re-broadcasts made by the intermediate nodes. The algorithm reduces routing overhead by minimizing end to end delay.

2.4. Simulation

The performances of flooding, probability based broadcasting and reliable broadcasting for single and multi sources are analyzed. The simulations are performed using ns2. The NAM (Network Animators) instances of initial and final phases of Single and Multi source reliable broadcasting algorithms are shown in the Figures 3,4. The Gold nodes are the source nodes which initiate the broadcasting. Red nodes receive the broadcast message and forward it to the neighboring nodes. Blue nodes receive the message but will not forward it.

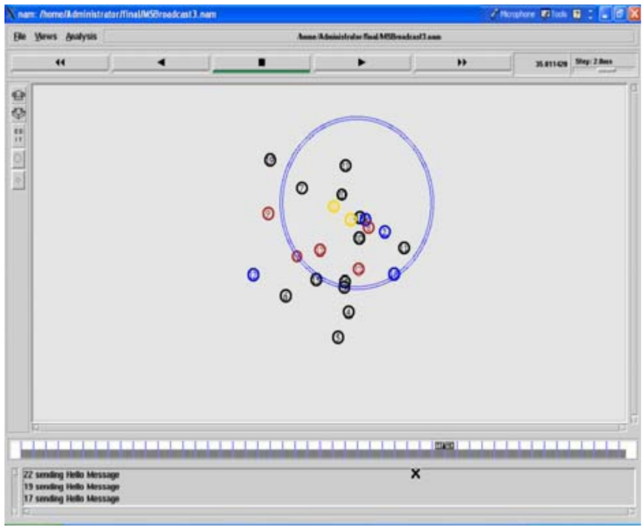

Figure 3: Initial Phase of Multi Source Reliable Broadcasting Algorithm

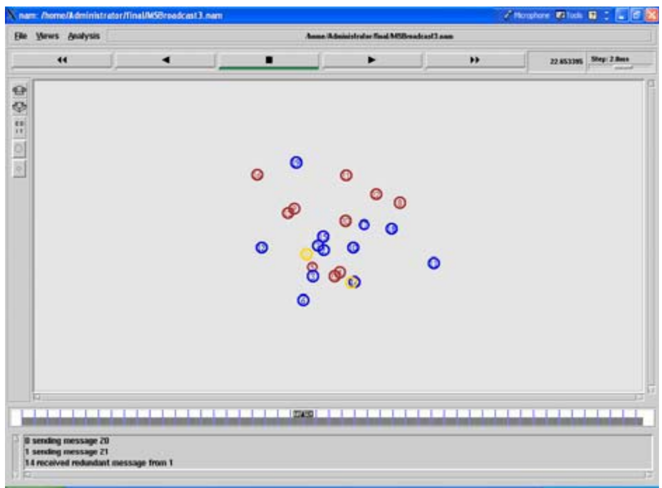

Figure 4: Final Phase of Multi Source Reliable Broadcasting Algorithm

The performance metrics to be observed are:

Packet delivery ratio is the number of data packets received by the destination nodes divided by the number of data packets transmitted by the source nodes.

Normalized routing load is the ratio between the number of routing packets sent by all the nodes for route maintenance and discovery and the number of data packets delivered to the destination nodes. Figure 4: Initial Phase of Multi Source Reliable Broadcasting Algorithm

Xgraphs are generated to compare various Broadcasting algorithms based on the above two metrics. Each point in the plot is an average of over ten simulation runs. Simulation results based on different threshold values are presented to verify and compare the effectiveness of these algorithms.

The comparisons of packet delivery ratio for various single and multi source broadcasting algorithms are shown in the Figures 5 and 6. In general, data packet delivery ratio will decrease with increase in node speed because it is very difficult to find a stable route to the destination. When compared with other broadcasting algorithms reliable broadcasting algorithm maximizes the packet delivery ratio because number of re-broadcasts made by the intermediate nodes is very less.

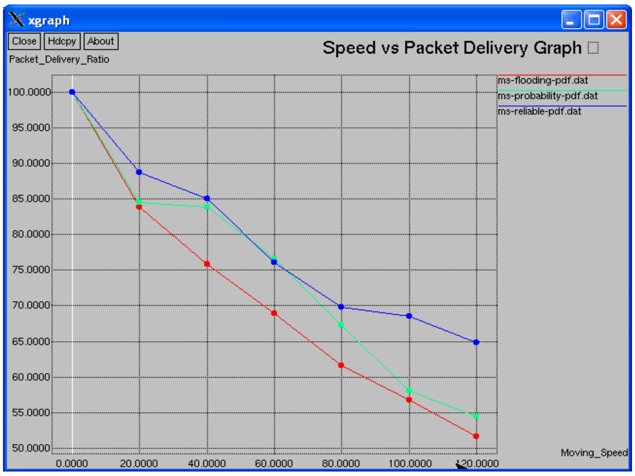

Figure 5: Speed vs. Packet Delivery Ratio for various Multi Source Broadcasting Algorithms

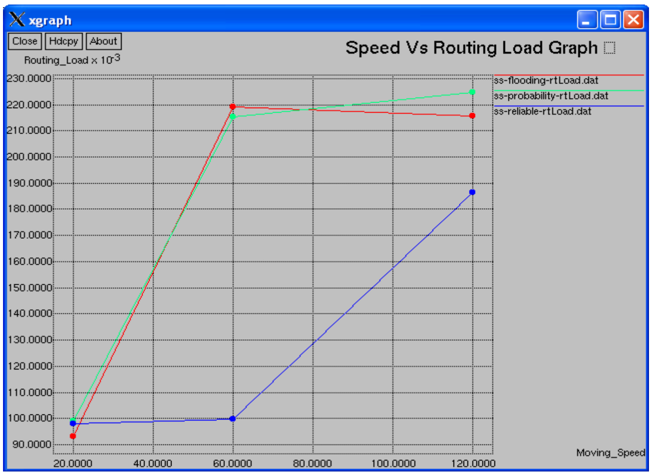

Figure 6: Speed vs. Normalized Routing Load for various Single Source broadcasting algorithm

3. CONCLUSION AND FUTURE WORK

Broadcasting plays a vital role in wireless mesh networks networks. So this work provides reliable broadcasting by reducing the unnecessary retransmissions. The algorithm takes into consideration node mobility and multiple nodes located at the same point. The algorithm is energy efficient, has low latency, has minimum number of retransmission and is collision free. CSMA/DCR protocol was used to resolve conflict between collocated nodes.

This algorithm delivers the messages within a bounded time. Flooding, Probability based broadcasting and Reliable Broadcasting algorithms for multiple sources are compared. The metrics Packet Delivery Ratio and Normalized Routing Load are used to evaluate these algorithms. Simulation results based on different threshold values are presented to verify and compare the effectiveness of these algorithms. As compared to the basic flooding approach and probability based broadcasting approach, reliable broadcasting algorithm eliminates many redundant rebroadcasts and reduces delay latencies.

For future work, the algorithm can be extended to work under error-prone conditions, i.e., location errors, imperfect time synchronization, and message losses.

REFERENCES

[1] L. Briesemeister, L. Sch¨afers, and G. Hommel, "Disseminating messages among highly mobile hosts based on inter-vehicle communication," in *IEEE Intelligent Vehicle Symposium*, Oct. 2000, pp. 522–527.

[2] W.-H. Liao, J.-P. Sheu, and Y.-C. Tseng, "GRID: A fully location aware routing protocol for mobile ad hoc networks," Telecommunication Systems, vol. 18, no. 1–3, pp. 37–60, 2001.

[3] F. L. V. Scoy and J. A. Brooks, "Broadcasting multiple messages in a grid," Discrete Applied Mathematics, vol. 53, no. 1–3, pp. 321–336, 1994.

[4] G. Korkmaz, E. Ekici, F. ¨ Ozg¨uner, and U. ¨ Ozg¨uner, "Urban multihop broadcast protocol for inter-vehicle communication systems," in VANET '04: Proceedings of the first ACM workshop on Vehicular Ad Hoc Networks, Oct. 2004, pp. 76–85.

[5] X. Yang, J. Liu, F. Zhao, and N. H. Vaidya, "A vehicle-tovehicle communication protocol for cooperative collision warning," in Proceedings of the First Annual International Conference on Mobile and Ubiquitous Systems: Networking and Services (MobiQuitous'04), Aug. 2004, pp. 114–423.

[6] H. Wu, R. Fujimoto, R. Guensler, and M. Hunter, "MDDV: A mobility centric data dissemination algorithm for vehicular networks," in VANET '04: Proceedings of the first ACM workshop on Vehicular Ad Hoc Networks, 47–56, Oct. 2004.

[7] E. Kranakis, D. Krizanc, and A. Pelc, "Fault-tolerant broadcasting in radio networks," Journal of Algorithms, vol. 39, pp. 47–67, 2001.

[8] F. L. V. Scoy and J. A. Brooks, "Broadcasting multiple messages in a grid," Discrete Applied Mathematics, vol. 53, no. 1–3, pp. 321–336, 1994.

[9] A. Sen and M. L. Huson, "A new model for scheduling packet radio networks," in Proceedings of the 15th Annual Joint Conference of the IEEE Computer and Communication Societies (IEEE INFOCOM'96), vol. 3, Mar. 1996, pp. 1116–1124