

CROSS LAYER ANALYSIS OF ENERGY EFFICIENCY USING DIRECTIONAL BROADCAST FLOODING BASED ROUTING PROTOCOL IN MOBILE ADHOC NETWORK

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Abstract: Many advancements have been made in adhoc networks to provide a reliable and efficient means of communication. Cross layer networks provide greatest security between the other layers. Adhoc networks are unique in their size, memory, rate of failure and their computational ability. The energy consumption of a network increases due to control packet overhead and delivery ratio degradation. The main aim of this project is using directional broadcast flooding technique. The directional broadcast flooding allows the packet to flow in correct direction hence reducing the energy consumption of nodes. The directional broadcast flooding based routing protocol complements the reliability by means of packet flooding method. Simulation results were taken by the network simulator. It is shown from the simulation results that the average number of packets that are transmitted can be significantly reduced compared to other existing algorithms. From the simulation results end to end delay, throughput, residual energy, packet delivery ratio and packet loss ratio of this system are analysed theoretically and a new technique for improving the delay distribution of directional flooding is proposed. The simulation results has been performed by the network simulator shows that the directional broadcast flooding technique gives the better performance compared to other existing techniques.

Keywords: Directional broadcast flooding, Adhoc networks, wireless sensor networks, cross layer, energy efficient.

1. Introduction

Adhoc networks are generally referred to as an infrastructureless networks and each and every node in the network can act as a router. Adhoc networks can transfer the data without the help or use of an infrastructure network. Wireless Adhoc network plays an

important role in energy saving technique. Adhoc networks are used in places where there is no management of infrastructure includes defence, disaster relief [7][10] etc. For a network to be an infrastructure less network it is very important to know about the location of every node while it is in random motion. In wireless sensor networks the energy utilization are very important to notice the lifetime of the nodes. Wireless sensor networks consume more energy since they are battery operated networks [4][12][15]. During transmission mobility can affect the MAC protocol [8]. Generally normal routing techniques broadcast the packets in random order called the flooding technique which can lead to packet drop and energy consumption [6] is high whereas the redundancy also becomes high and there occurs collision in some cases [2]. In the existing system traditional flooding techniques were used. Routing tables are required in flooding techniques. Energy efficient routing algorithm in previous paper calculated the multipath delay and even when the node goes to sleep state also the node will reach its destination [14]. Multicast routing protocols are used to improve the performance

[5]. A transmission medium that is controlled and accessed by a protocol called MAC protocol. MAC layer is responsible for reliability and efficiency of a network. MAC is responsible for the signals that are sent to reach the destination that does not collide with the other nodes. Several control mechanisms provided by MAC layer. Communication with different layers is provided by cross layer. Cross layer design is used to improve the quality of service [1]. Coordination among the physical layer, network layer and the application layer is important in cross layer design [3]. Cross layer protocol is responsible for broadcasting the nodes from source to destination which is a location based service [11]. Initially a route request is sent which consists of the information's such as nodes identification number, sequence number,

destination location and in this location of each and every node is provided. In the existing papers several nodes consume more energy and every node will be made as cell manager for a certain amount of time so the other nodes will rest in the network as unused [10]. Once the nodes receive the request message then the destination node sends the route reply message about its location therefore routing becomes easier to reach the destination.

There is a greater impact of wireless sensor networks nowadays which includes mobility and localization of nodes [16]. When a network is said to be in mobility then the sensor nodes are also moving in a network or said to be in random then it may affect the network topology, hence the networks topology changes [8]. Generally in Adhoc networks the nodes participating in generating a network. Communication protocols are developed by different layers [9]. Wireless sensor network can even monitor several environmental conditions since it consists of thousands of sensor nodes in a network. Wireless medium can be managed by MAC layer. Neighbouring nodes provide information about the sensor nodes that broadcast the packet from data link layer to its upper layer. In Adhoc networks the availability of power consumption is the main limitation [13].

2. Directional Flooding Based Routing Protocol

Several approaches have been made in the previous studies in order to reduce the energy efficiency of the nodes that consume more energy when the nodes reach the destination.. Energy efficient techniques can be obtained by combining both the normal flooding and directional flooding. In the existing approach normal flooding technique is used which leads to link failure and the messages in the normal flooding technique can become duplicated and it leads to wastage of energy. In directional flooding the nodes are allowed to flow in the correct direction. This technique ignores the least energy nodes and makes it go to sleep state.

With every packet hop counts are included such that the nodes are allowed to flood the packets in the correct direction to reach its destination. Destination node announces its location to all the nodes present in the network. Once this announcement is received by the other nodes in the network it starts to calculate its hop count with the other nodes. When a sensor node floods its packet to reach the destination node it starts calculating its minimum hop count. The neighboring nodes receiving the packets will forward the packet only if it has least hop count or else it simply ignores the packet. At least one node can transmit its packet to the destination is the problem that is rectified by this approach but this can still exist if the transmitting node cannot find a hop closer to

the destination node as it is impossible to retransmit the data packet as a reverse process.

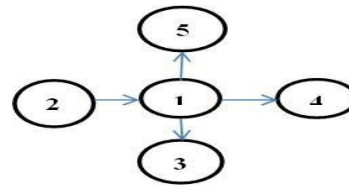


Figure 1. Normal flooding Approach

The Fig. 1 shows the normal flooding technique in which the data has been transmitted in all directions to reach its destination. In this Fig. 1 there are totally five nodes. From all the sides the data has been transmitted. Fig. 2 shows the steps involved in directional broadcast flooding

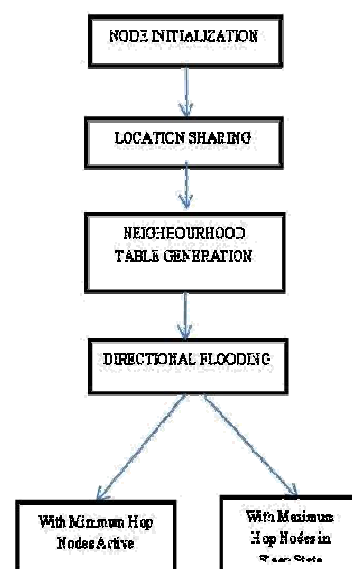


Figure 2. Steps involved in Directional Broadcast flooding

A. Node Initialization

The first step of directional broadcast flooding algorithm is node initialization. Initialization of nodes in the network says about how many number of nodes are preset in the network and creating topology among these nodes and describing the parameters required for initialization of nodes.

B. Location sharing

Second step involves location sharing. When a node is transmitted from source to destination, then each node shares its location to neighboring nodes to reach the destination without any packet loss or packet drop.

C. Neighborhood Table Generation

Third step for directional broadcast flooding is table generation. Generally a network is said to be a random network or a flat surface network such that when a node has to be sent to the destination it is flooded in all direction. Therefore while transmitting every node in the network generates table which consists of sequence number, destination location, nodes location etc.

D. Directional Flooding

Final step of this technique involves transmitting the packet to the destination in a correct direction. Once the table has been created the nodes look for minimum hop count to reach the destination. With minimum hop count the nodes are in active state. If the nodes are of maximum hop count then the nodes enter into sleep state.

3. Simulation Results

Simulation results show the difference between normal flooding technique and directional flooding technique. The first step of simulation is the initialization steps, generating object files, generation of nodes. The output results are taken from the network simulator. Directional broadcast flooding rectifies the problem of existing normal flooding technique. Directional flooding in this paper is done with 50 nodes. The output result consists of six parameters. The simulation results here shown are generation of routing protocol with 50 nodes and the X graph plot which indicates the end to end delay, packet loss ratio, throughput, packet delivery ratio and the residual energy. Therefore from these results it is well understood that directional flooding gives better performance compared to normal flooding techniques. Energy utilization in directional flooding is less compared to other existing techniques.

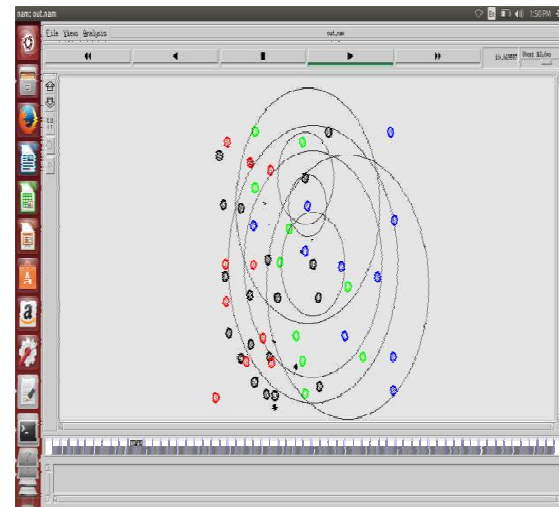


Figure 3. Generation of 50 nodes

The Fig. 3 shows the generation of 50 nodes and the maximum coverage region among the 50 nodes. Node has been coloured in order to differentiate them from the other nodes. In this work one to ten nodes are given red colour in similar way the remaining nodes are given different colours.

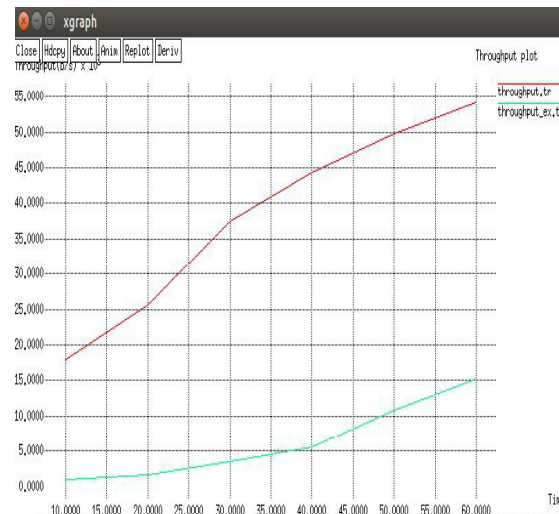


Figure 4. Throughput graph

The Fig. 4 shows the throughput graph which is the number of successful packets that are received. Throughput produces energy and process the trace file. Red line in the graph indicates the directional flooding and the green line indicates normal flooding in the graph using Xgraph plotter. In the x axis time is mentioned in seconds and in y axis throughput is mentioned.

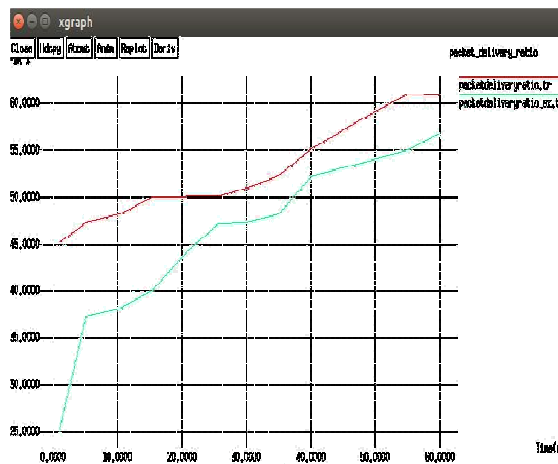


Figure 5. Packet Delivery Ratio graph

The Fig. 5 shows the packet delivery ratio graph. The packets that are delivered successfully to the destination is the packet delivery ratio. Red line in the graph indicates the directional flooding and the green line indicates normal flooding in the graph. In the x axis time is mentioned in seconds and in y axis packet delivery ratio (PDR) is mentioned.



Figure 6. End to End Delay graph

The Fig. 6 shows the end to end delay graph. End to end delay is defined as the difference between the sums of the received packets to the sum of transmitted packets to the sum of number of connections. In the x axis time is mentioned in seconds and in y axis delay (ms) is mentioned.

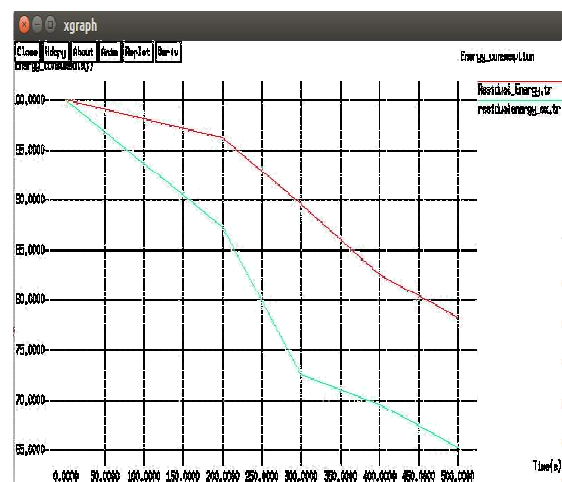


Figure 7. Residual Energy graph

The Fig. 7 shows the residual energy graph. Residual energy is defined as the transmitting packets or after receiving the packets the actual value of energy that is present in a node. In the x axis time is mentioned in seconds and in y axis Energy consumed is mentioned.

The Fig. 8 shows the packet loss ratio. Packet loss occurs when a packet fails to reach the destination. Packet loss ratio is defined as the number of packets that are lost during the transmission. In the x axis time is mentioned in seconds and in y axis packet loss ratio (PLR) is mentioned.

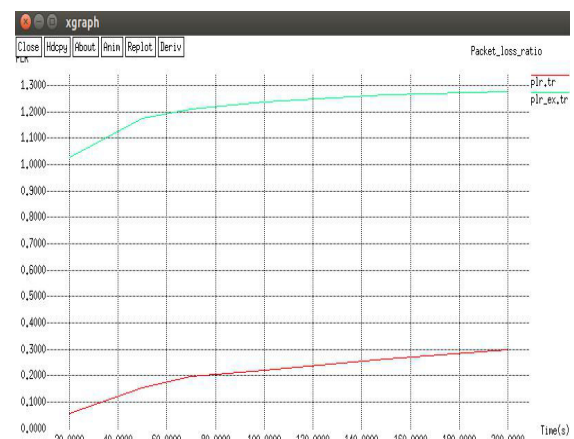


Figure 8. Packet Loss Ratio graph

From this chapter it has been noted that comparing to other techniques this directional flooding gives better performance compare to other flooding techniques. From these results the model parameters such as end to end delay, throughput, packet delivery ratio and packet loss ratio as well as the residual energy has been calculated effectively and these output show that directional flooding gives better quality of service than normal flooding.

4. Conclusion

In the existing papers nodes are placed in a flat surface network or in a random manner and this normal flooding technique allows the node to flow in random direction whereas in this paper directional flooding technique is used which makes the node to flow in one particular direction to reach the destination. Performance evaluation clearly shows that the average number of packets transmitted and the energy consumption in directional broadcast flooding gives better performance compared to normal flooding approaches. The end to end delay, throughput, residual energy, packet loss ratio and packet delivery ratio of the system were also analysed theoretically. Therefore the future scope of this project is heuristic approach in which the nodes movement and the speed of each node reaching the destination can be calculated by merging these two information's the active route lifetime can be calculated.

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