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Implementation of Energy Efficient AODV Routing Protocol with Increasing Network Lifetime

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Abstract: ***A Mobile Ad Hoc Network (MANET) consists of a set of self arranging remote portable hubs conveyed without brought together foundation. Hubs speak with each other with a constrained battery supply. Versatile or Mobile Ad-Hoc Network (MANET) is to expand organize lifetime by limiting hubs vitality utilization, since hubs are regularly battery fuelled. In MANET, all hubs are portable in nature and having restricted battery charge. Persistent change in position and association debases the battery charge of the hubs; consequently it is important to spare battery of those hubs which are having low battery so that the network lifetime can be long lasting. In order to enhance the lifetime of network by using energy efficient AODV routing protocol with willingness parameter. This work aims at increasing the network life time while reducing the energy consumption, minimizing the end to end delay. The NS2 simulator is used for simulation and the results are compared with existing Ad Hoc on Demand Distance vector (AODV) protocol.***

Keywords: Mobile Ad-hoc networks (MANETs), Ad-hoc On Demand Distance Vector (AODV), Energy Efficiency and Willingness

1. Introduction

Ad hoc Networks are unplanned or spontaneous networks which do not have a pre existing infrastructure or base station. Directing route to be more effective with the goal that information and hub won't be influenced by assailants. The hubs in the MANETs are self designing systems. Because of the absence of foundation, the hubs in the MANETs demonstration both as a switch and also a host. As MANETs are self creating and very powerful, some unique specially appointed steering conventions have been produced. Impromptu directing conventions ought to have the properties like Distributed Operation, circle free, request based and unidirectional connection bolster. The basic diagram of Ad-Hoc network as shown below Fig.1.

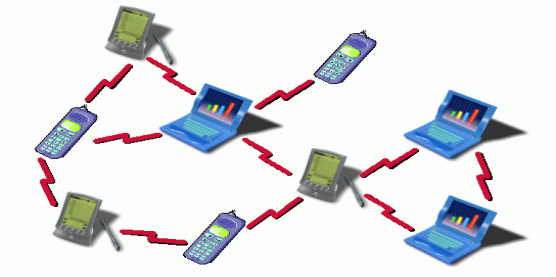

Figure 1: Ad-hoc Networks

A Mobile Ad-Hoc Network (MANET) is a collection of mobile nodes which communicate with each other via wireless link either directly or relying on other nodes as routers. Since the nodes are movable from one network to another they are known as mobile ad hoc networks or MANETs. Network nodes in MANETs are free to move randomly. Network topology of MANET may change dynamically without turning to any existing centralized administration because of the mobility of nodes.

2. Previous Work

In this [1], consider AODV protocol in MANET applications in expressions of bringing down the control bundle overhead, diminishing the occasional HELLO messages for the length of course conservation and bringing down the enthusiastic connection disappointments in view of hub versatility. In cell WSN programs, predominantly centred around lessening the vitality utilization as the sensor hubs are compelled in expressions of vitality. Never again a considerable measure of examinations are done inside the area of hyperlink breakage openings and it's after results, in light of hub movement in cell WSNs. The congruity of information Transmission is obstructed by method for the basic connection breaks.

A Mobile Ad-hoc Network [4] is a system produced using cell gadgets that are equipped for pass openly haphazardly. The client hubs and the framework itself are persistently changing over. This sort of network is thought to be a self-coordinated gadget of cell hubs, it might keep running in disengagement or may interface with a changeless network by means of an entryway. The self-setup and recovery of sensor hubs in advert hoc systems are troublesome task[5]. To full fill the necessities of this kind of systems there is expected to outline new proficient directing conventions. The current directing conventions inside the cell specially appointed system are AODV and DSR. It's far difficult to break down the steering issues, for instance, PDR underneath unmistakable parameters continuously environment. The directing conventions productivity depends at the scope of bundles effectually secure on goal. Vitality utilization is one of the constraints in WSN [6]. The directing of the convention are the present districts to improve great of transporter, network lifetime, parcel overhead and quality utilization. There is no such sort of convention which evacuates the vitality utilization best rebate in control utilization is reasonable. There are

numerous routing protocol to improve the throughput of the general place.

3. Proposed Method

Mobile Ad-hoc networks suffer many challenges during the routing. Energy efficiency is the biggest challenge of a Mobile Ad-hoc network. Energy efficiency can be estimated as the measure of time over which the system can keep up a specific execution level, which is generally known as the system lifetime. In versatile Ad-hoc organizes, portable hubs depend on batteries for control, which are constrained wellsprings of vitality for them, besides in numerous kind of conditions, it turns out to be a significant chaotic undertaking to supplant or energize them. Correspondence is one of the fundamental wellsprings of vitality utilization. Some measure of vitality is lost notwithstanding when a hub is out of gear mode. Hence, Energy effective correspondence is basic for expanding the life of intensity restricted remote Ad-hoc Networks. A directing convention should endeavour to limit the control activity happening, for ex. the intermittent refresh messages to enhance the lifetime of the hubs and system thus that the vitality of the hubs and system can be managed effectively. Energy Management is defined as the process of managing the sources and consumers of energy in a node or in a network as a whole for enhancing the lifetime of the network. The main observations are that in dynamic and random mobility scenarios are consider in this work. Willingness AODV routing protocol leads to an increases (20%) in network lifetime compared to standard protocol and slightly better performance in terms of Packet Delivery Ratio (PDR).

4. Energy Efficient Routing Protocol

Efficient routing objectives to reduce the power required to transmit or obtain packets i.e., Energetic communication electricity. It also tries to lower the energy fed on cell node stays idle but listens to the wireless medium for any visible conversation requests from other nodes i.e., inactive electricity. Transmission power manage approach and load distribution method minimizes lively communication power and sleep mode approach minimizes inactive electricity. Every protocol has specific risks and is well perfect for sure situations and it is not clean any specific set of rules or a class of algorithms is the best for all scenarios. Willingness AODV achieved by maintaining the network connectivity to lead to a longer battery life of the terminals. In contrast to AODV which optimizes routing for lowest delay, the energy efficient protocols ensure the survivability of the network which is to ensure that all nodes equally deplete their battery power. There are several ways of implementing routing such as Minimum Total Transmission Power Routing, Minimum Battery Cost Routing etc. In case of wireless networks it is more reducing the energy consumption and increasing the lifetime of the nodes.

5. Implementation

The flowchart of the algorithm of the modified AODV is shown in Figure 2.

Proposed Algorithm*:*

The following steps describe the proposed algorithm:

Step 1: When a source node finds no route to destination node, it starts the route discovery phase to the destination node.

Step 2: The source node then, checks the neighbor nodes list to find the route to the destination node .

Step 3: If the source node is found in the neighbor nodes list. Then, this intermediate node sends RREP control packet to the source node from which it received the RREQ packet. This RREP packet follows the same reverse path traversed by the RREQ packet until it reaches the source. This ends the route discovery phase and the route is established.

Step 4: According to willingness, the intermediate nodes are found.

$$willingness = \frac{\text{Residual energy}}{\text{initial energy}}$$

Where, initial energy = 50J and remaining energy are calculated and save in fie.

Step 5: Finally, the packets are transmitted between source and destination nodes via intermediate nodes.

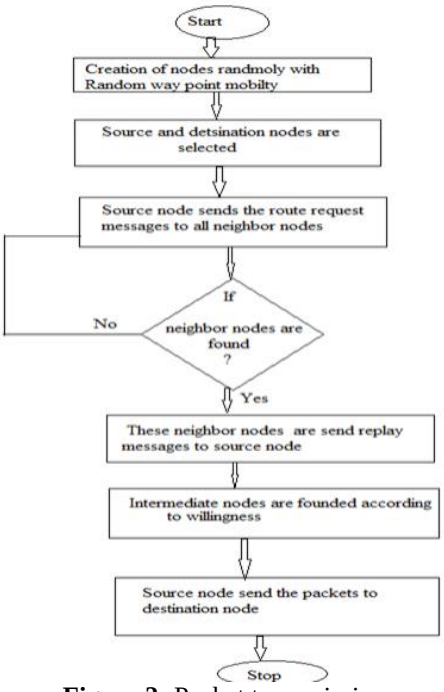

Figure 2: Packet transmission

6. Results and Discussion

The network area of 1500 × 1500 has been consider in our simulation, where 100 nodes are randomly deployed to move freely with the random way point movement model in the network environment and out of which 10 source nodes generate data packets at constant bit rate (CBR). AODV with willingness parameter are selects a route having good link quality and maintains its data transfer consistency using the data buffering capability of the intermediate nodes. The source-destination pairs are randomly chosen and they exchange data packets over UDP connections. IEEE 802.11 has been used as the underlying medium access control protocol.

a) Residual Energy

Compared to existing system more than 20% are energy saved in our implemented AODV routing protocol with

willingness. Energy Consumed per Packet Delivered ,It is defined as the ratio of total network energy consumption to the number of data packets successfully received by the source these to increasing a network life. The network energy consumption includes all the energy consumptions except MAC layer controls. Energy consumption is formulated as the difference between the initial energy of the node and the remaining energy of the node at the end of simulation. A less value of this metric means that most of the packets being received with less energy and this is to achievement for an energy efficient protocol to increasing network life.

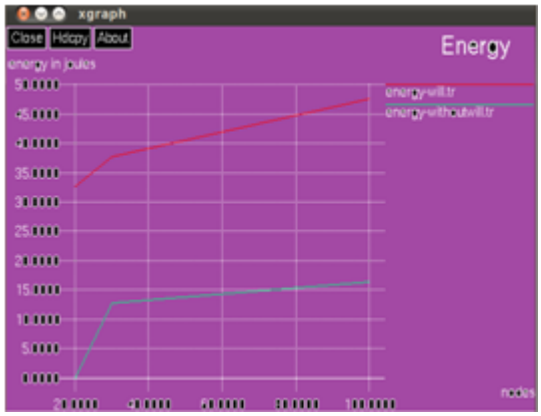

Figure 3: Number of node Vs. Remaining Energy

The Figure 3 shows the performance of the protocol based on energy. It shows that with willingness AODV and without willingness AODV achieve comparable performance. Compared of these two ,the energy is 47.66% With willingness AODV protocol and 16.38%. for without willingness AODV protocol.

b) Packet delivery ratio

In this consider number of nodes should be 100.therfore how many packets are deliver to destination node. Packet delivery ratio= (Total packets received by the destination node / Total packets send to destination node) X 100.

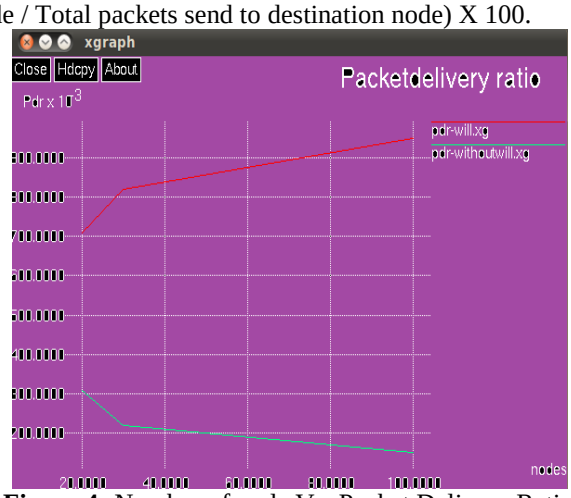

Figure 4: Number of node Vs. Packet Delivery Ratio

The Fig. 4 shows the packet delivery ratio better in AODV with willingness parameter compared from AODV without willingness. In this 0.95% for with willingness AODV and 0.15% in without willingness AODV protocol. It is defined as the ratio of total number of packets successfully received by the destination nodes to the number of packets sent by the source nodes. PDF is very important metric as it describes the loss rate i.e. it gives the maximum throughput that the network can support. There may be many reasons due to which packets may not be delivered to the destination such as packet collisions may occur in the layer, network partitions, routing loop, interface queue drop etc. A high value of PDF indicate that most of the packets sent are being delivered to the higher layers and is a positive sign of the protocol performance.

c) Throughput

Throughput measure how fast the network can continuously send/receive data to the sink. Throughput is the number of packet received from the sink per millisecond. It is defined as total packets received divided by duration of last packet received by destination node. It is calculated in bps “bits per second”.

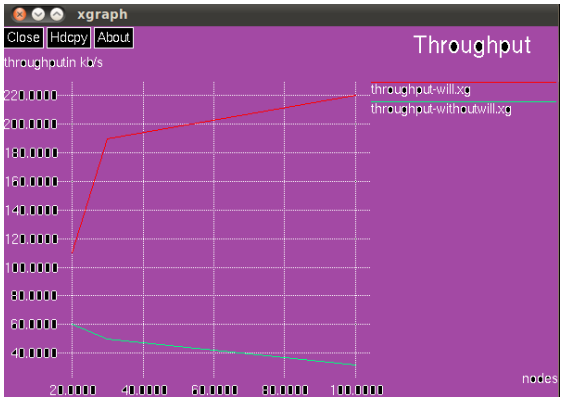

Figure 5: Number of node Vs. Throughput

In this Fig. 5 as shows the how many packets are received at destination. Better throughput in AODV with willingness compared from without willingness AODV protocol. In this consider 220 kbps Packets are transmitted with willingness AODV and 60 Kbps Packets are transmitted in without willingness AODV protocol.

d) Delay

The number of nodes can be increased then the delay should be decreases. Therefore delay is less automatically to save time in transmission of packets between source and destination.

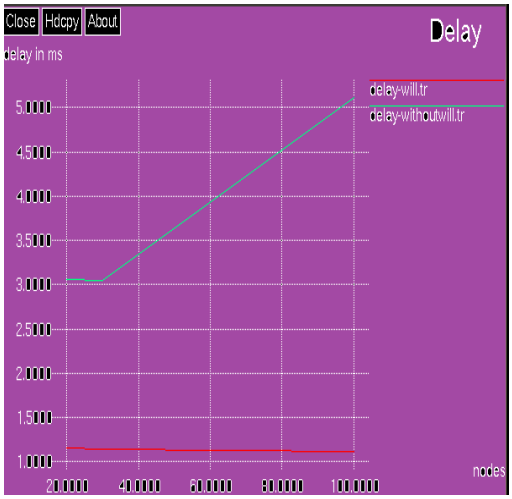

Figure 6: Number of node Vs. Delay

Delay is the most important parameter in network. Therefore delay is less than the packet transmission between source and destination will be fast and increasing a network lifetime. As Fig. 6 shows the better in AODV with willingness parameter.

e) Bit error rate

Bit error rate defined as the number of received bits divided by the number of transferred bits. In the MANET AODV protocol route are shortest then the bit error will be less, as shown Fig.7 with and without willingness parameter in AODV protocol.

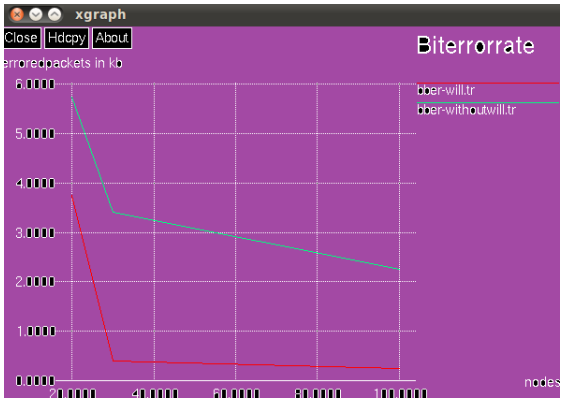

Figure 7: Number of node Vs. Bit error rate

7. Conclusion and Future Work

An ad hoc mobile network is a collection of nodes which move free in an arbitrarily way with different speeds, causing continuous changes in topology of the network. The Ad hoc On-Demand Distance Vector (AODV) routing protocol with willingness parameter are used to increasing a network lifetime. It is one of the most popular routing protocols for MANETs. On-demand is a major characteristic of AODV, which means that routes are established only when they are needed by a source node. Due to the nature of the ad hoc networks, links between nodes may be broken frequently. The source node sends the packets to destination node by using Intermediates nodes. These intermediates nodes are calculated by using two levels of neighbors nodes. Willingness AODV protocol is used to presented in this work to save more energy compared with the without willingness AODV protocol.

As a further enhancement, the algorithm can be made energy efficient by consolidating energy efficient protocols with this algorithm. This algorithm can be further applied to a network with created multiple short paths for packet transmission between source and destination and become save more energy, along with to avoid link breakages at the transmission time.

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