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Minimum Energy Conservation Routing Protocol for MANET

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Abstract— In early years energy consumption is the most important problem in Mobile Adhoc Network. This paper also proposes an attempt to obtain maximum Energy efficiency in MANET nodes using all the three possible approaches namely Energy efficient routing, Power save protocol and Transmission power control. By doing so the advantages of each of these layers add together to result in a more efficient way. Our work in this is to modify the protocols in each of these layers, so that they are compatible with each other and can work in synchronization. There are several techniques such as power save method, power control method and minimum energy routing. The simulation results are shown by using NS-2 simulator where the energy consumption per node and the lifetime of the network is increased.

Index Terms— AODV, Connection Dominating Set (CDS), DSR, Initiator Election,Path selection ,Route Discovery,Route Maintenance, Routing Table.

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1 Introduction

The wireless communication technology provides low-cost and powerful wireless transceivers which are widely used in mobile applications. Mobile networks have involved significant interests in recent years because of their improved flexibility and minimum costs. Compared to wired networks, mobile networks have unique characteristics. In difference to the stable link capacity of wired networks, wireless link capacity frequently varies because of the impacts from conduction power, recipient sensitivity, noise, fading and interference. In addition, wireless mobile networks contain a elevated error rate, power and bandwidth limitation.

Mobile networks can be classified into infrastructure networks and mobile ad hoc networks (MANET) according to their dependence on fixed infrastructures. In an communication mobile network, mobile nodes have wired access points (or base stations) within their transmission range[1]. furthermore, nodes in a mobile ad hoc network normally have restricted transmission ranges, some nodes cannot communicate straight with each other.

Hence, routing path in mobile ad hoc networks potentially enclose several hops, and each node in mobile ad hoc networks has the responsibility to act as a router.

2 Related Works

Number of initiators are elected randomly and then it use timers to construct the minimum path. For this it needs two types of initiators namely Single Initiator(SI) and Multi Initiator(MI)[1]. SI has Mobility handling capability but it does not remove single point failure.

In order to overcome that we use Multi Initiators to remove single point failure. The uncovered state is converted into converted state either by using dominatee state or dominator state[1]. The node that possess less number of neighbours are covered first and the nodes with maximum number of neighbours are covered last.

Timers based CDS protocol consists of 3 phases namely,

- Initiator election
- Tree construction
- Tree connection

Two types of timer-based CDS protocols namely SI and MI, that not only create CDS of competitive size with low over-heads but also address the shortcomings of the previous work. SI utilizes timers to distributively construct and maintain CDS in the presence of changes of network topology. Since both protocols use timers to construct the CDS, the convergence time is increased in Timer based CDS protocol.

Connected Dominating Set (CDS), C, is a dominating set of G which induces a connected sub graph of G. One approach to construct a CDS is to find an Minimum Independent Set (MIS), and then add additional vertices as needed to connect the nodes in the MIS[3]. An MIS is nothing but an independent set in that adding any vertex not in the set breaks the independence property of the set. It plays a very important role in power management by increasing the number of nodes to go to sleep mode when they are not utilized.

Actually many works seek a minimum connected dominating set (MCDS) in unit-disk graphs as their major design goal. Thus performance bounds is their primary design parameter. The rationale of this problem formulation can be reasonable as follows. The foot print of an ad hoc network with fixed transmission range for each host can be modelled by a unit-disk graph. And minimizing the cardinality of the computed CDS can help to decrease the control overhead since broadcasting for route discovery and topology update is restricted to a small subset of nodes[3]. Therefore broadcast storm problem inherent to global flooding can be greatly decreased.

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For efficiency reasons, many of these protocols first organize the network through the construction of dominating sets. These protocols address media access, routing, power managing and topology control. At the Link Layer, clustering can increase spatial reuse of the spectrum, minimize collisions and provide Quality of Service (QoS) guarantees. A CDS is also useful for location-based routing. In location-based routing, datas or packets are forwarded based on the geographical coordinates of the hosts, rather than topological connectivity[5]. In-between nodes are selected based on their proximity to the message's destination.

In wireless networks, CDS problems have been formulated in a number of ways, depending on the needs of the par-ticular application. These formulations can be classified into Weekly Connected Dominating Set(WCDS), Non-localized CDS, Localized CDS and Stable CDS with nodal mobility. Distributed CDS algorithms designed for use in a variety of wireless applications[7]. This evolution has been driven by both improvements in efficiency and stability and by the design requirements of the consumer applications.

Routing based on a connected dominating set is a potential approach, where the search space for a route is reduced to nodes in the set. To increase the life span of each node and the network by balancing the energy consumption in the network, nodes should be alternated form a connected dominating set[10]. One simple way to increase the lifetime of each host is to evenly distribute packet-relaying loads to each node to prevent nodes from being over used. The au-thors proposed some rules for selective removal. One is based on node degree and the other is based on energy level associated with individual node. The main goals of these two extensions are different: the node-degree-based approach aims at reducing the size of the connected dominating set while the energy-level-based approach tries to increase the average life span of each node. The additional cost associated with extended rules is insignificant both in terms of communication and computation. Further information that needs to be collected from neighbors are energy levels which can be piggybacked with the neighbor-hood information.

3 PROPOSED METHOD

IEEE 802.11 ad-hoc power saving mode uses periodic beacons to synchronize nodes in the network. Beacon packet contain timestamps that synchronize nodes clock. A node that receives and acknowledges an advertisement for unicast or broadcast traffic directed to itself for the rest of the beacon period. Apart from decreased channel capacity , 802.11 power saving mode also suffers from long packet delivery latency. The MAC layer use header of each packet including RTS packet by this neighbor table is likely to be corrected. Datalink layer uses CDS technique to determine the clusters and assign the clusters by giving highest priority. In the network layer AODV protocol is used which is a on-demand protocol which is Improved over DSDV algorithm (minimize the number of required broadcast by creating routes on a demand basis; maintain a complete list of routes as in the DSDV algorithm).Nodes (not on a selected path) don't maintain routing information or participate in routing table exchanges. Instead of source routing, AODV relies on dynamically establishing route table entries at intermediate node. AODV use the concept of destination sequence number from DSDV.

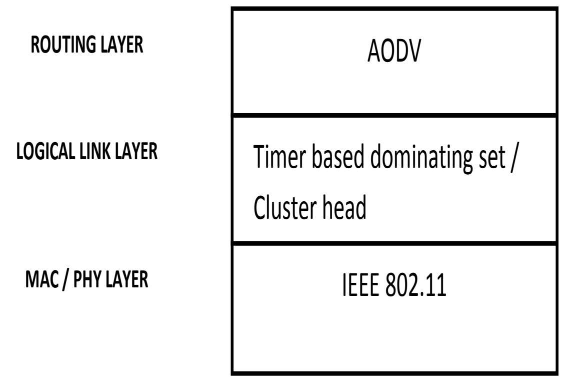

Figure 1 Proposed model

3.1 PROACTIVE ROUTING PROTOCOLS

A Proactive Routing Protocol is also called "table driven" routing protocol. Using a table driven routing protocol, nodes in a mobile ad hoc network incessantly evaluate routes to all reachable nodes and attempt to keep up reliable, up-to-date routing information. For that reason, a source node can catch a routing path instantly if it needs one. Inside proactive routing protocols, all nodes need to maintain a regular view of the network topology. When a network topology change occurs, relevant updates must be propagate throughout the network to report the change. The majority proactive routing protocols proposed for mobile ad hoc networks have inherited properties from algorithms used in wired networks. To get used to the dynamic features of mobile ad hoc networks, essential modifications have been completed on traditional wired network routing protocols. By means of proactive routing algorithms, mobile nodes update network state and maintain a route regardless of whether data traffic exists or not, the overhead to sustain up-to-date network topology information is high.

3.2 REACTIVE ROUTING PROTOCOLS

Reactive Routing Protocols for mobile ad hoc networks are also called "on-demand" routing protocols. Here a reactive routing protocol, routing paths are found only when needed. A route discovery process invokes a route-determination procedure. The discovery procedure discards either a route has been determined or no route available after examination for all route permutations.

3.2.1 ADHOC ON-DEMAND DISTANCE VECTOR (AODV)

The Ad Hoc On-demand Distance Vector Routing (AODV) protocol is a reactive unicast routing protocol for mobile ad hoc networks. As a reactive routing protocol, AODV solitary needs to keep the routing information about the active

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paths. In AODV, routing information is maintain in routtables at nodes. All mobile node keeps a next-hop routing table, which includes the destinations to which it currently has a route. A routing table ingress expires if it has not been used or reactivated for a pre-specified expiration time. Furthermore, AODV adopts the destination sequence number technique used by DSDV in an on-demand way. In the route discovery operation, the source broadcasts route request (RREQ) packets. A RREQ contains the addresses of the source and the destination, the transmit ID, which is used as its identifier, the most recent sequence number of the destination as well as the source node's sequence number. Sequence numbers are important to guarantee loop-free and up-to-date routes. To diminish the flooding overhead, a node rejects RREQs that it has seen before and the expanding ring search algorithm is used in route discovery operation. The RREQ starts with a small TTL (Time-To-Live) value. If the destination is not establish, the TTL is increased in following RREQs.In AODV, each node maintains a cache to keep track of RREQs it has received. The cache also backup the path back to each RREQ originator. When the target or a node that has a route to the destination receives the RREQ, it verify the destination sequence numbers it currently knows and the one specified in the RREQ. To agreement the freshness of the routing information, a route reply (RREP) packet is created and forwarded back to the source only if the destination sequence number is equal to or greater than the one specified in RREQ. AODV uses only symmetric associations and a RREP follows the reverse path of the respective RREP. In the lead receiving the RREP packet, each in-between node along the route updates its next-hop table entries with respect to the destination node. The superfluous RREP packets or RREP packets with lower destination sequence number will be dropped.

In AODV, a node uses hello messages to notify its existence to its neighbors. For that reason, the link status to the next hop in an active route can be monitored. After that a node discovers a link disconnection, it broadcasts a route error (RERR) packet to its neighbors, which in rotate propagates the RERR packet towards nodes whose routes may be affected by the disconnected link. Then, the affected source can re-establish a route discovery operation if the route is still needed.

4 Performance Evaluation

To evaluate the performance of our protocol in ns-2. To assess the performance of different CDS protocols five metrics are used including the size of CDS, the number of extra messages, the average traffic, the convergence time and the percentage of time CDS is alive. To assess the per-formance of routing with CDS protocols three metrics are used including delivery rate, end-to-end delay and the number of RREQ packets. The performance of on network that can be evaluated in the following tabulation.

TABLE 1
Performance Evaluation

No. of NODES	Control Overhead		Delay in ms		Throughput		Over all Consumption Energy in μJ	
	AODV	DSR	AODV	DSR	AODV	DSR	AODV	DSR
40	520	640	0.00785189	0.0086	99	99	39	39
75	975	1055	0.00860715	0.0088	97	95	74	83
100	2000	2090	0.0626845	0.0832	94	92	97	99

The performance parametes that can be also ploted in the graph given below.

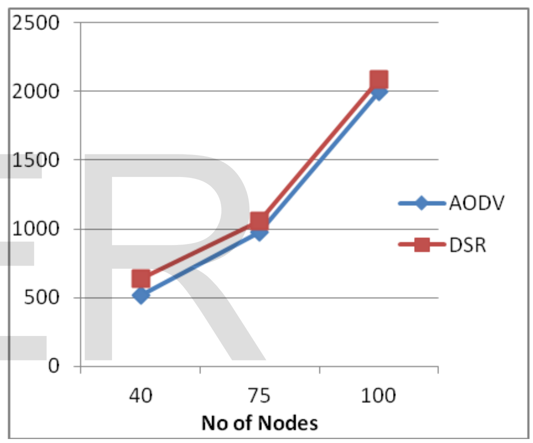

Figure 2 Control overhead

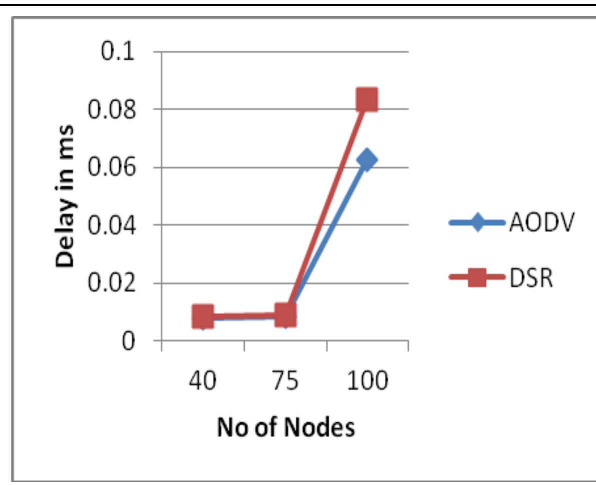

Figure 3 Delay

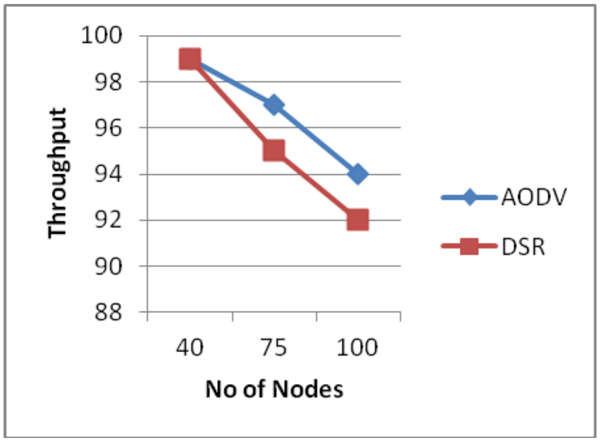

Figure 4 Throughput

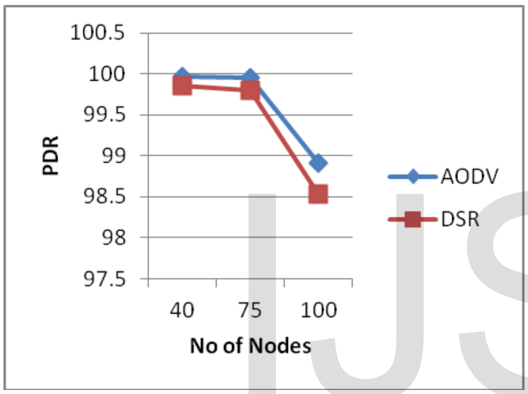

Figure 5 Packet Delivery Ratio

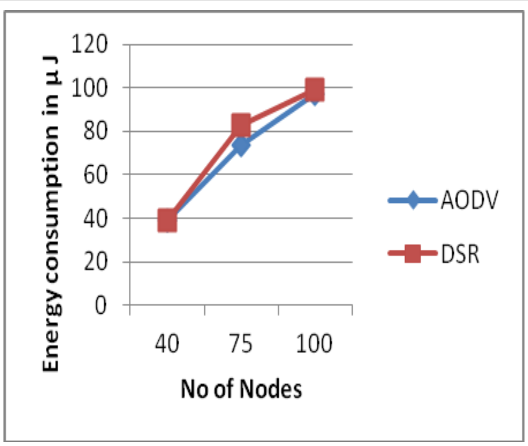

Figure 6 Energy Consumption

5 Conlusion

By using CDS the AODV protocols achieves the energy consumption of the wireless network. This is done by using NS 2 simulator and the output result is gathered in the awk file and can generate the graph file using NS-2 sh graph.sh command or MS Excel.

In the future the approach is extended to reduce the energy by modifying all the layers and minimizing the energy consumed for the routing process which plays a predominant role. There are several techniques such as power save method, power control method and minimum energy routing.With these changes the energy consumed .

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