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Implementation of Energy Efficient Routing Protocol for WireLess Network

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Abstract: ***Network are classified into two main types base connectivity i.e. wired and Wireless network. Energy efficiency is an important issue in wireless network where nodes rely on limited power and computational resource. So to control the network wide broadcast of the RREQs(routing request) the source node uses some technique. For extending the lifetime of the nodes in wireless network many energy efficient protocols have been design such as AODV, DSR,DSDV. We propose an energy efficient route discovery process for AODV HPR Protocol using NS2. Our approach saves energy of the nodes by avoiding the redundant rebroadcasting of the route request packets. The relaying status of the node is decided based on the broadcasting of its RREQ packets by its neighbour and it helps in reducing routing overhead incurred during the route discovery process.***.

Keywords: Ad-hoc On-Demand Distance Vector Routing Protocol, AODV HPR, RREQ(Routing Request), RREP(Routing Reply), Route Discovery**.**

1. Introduction

Networks are classified into two main types based on connectivity, wired and wireless networks. A wireless network provides flexibility over standard wired networks. Only with the help of wireless networks, the users can retrieve information and get services even when they travel from place to place[1]. The single-hop and multi-hop Networks are the two major classifications of wireless networks. Base stations are used in single-hop networks to accomplish communication between nodes. The communication between nodes is accomplished via other nodes which are called Intermediate or forwarding nodes. So there is a need of routing procedure between Nodes. And hence routing protocol plays a major role in wireless network. The routing protocols in wireless network are mainly classified using their routing strategy and network structure. Flat routing, hierarchical routing and geographic position assisted routing are the three major classification of routing protocols based on the network.

Based on routing strategy, the routing protocols are grouped as Table-driven and source initiated on-demand. Table-driven protocols usually find routes constantly and maintain in routing table for all source-destination pairs at the expense of high routing overhead. On-demand protocols such as AODV and DSR incur less routing overhead by finding path between a source destination pair only when it is necessary[2]. Compared to table driven protocols, on-demand protocols utilize less bandwidth and energy consumption.Ad-Hoc on Demand Distance Vector

Routing Protocol (AODV) find route between nodes only when it is necessary. It does not maintain topology information about all other nodes in the network.In AODV, each time the node initiates the route discovery for some destination using simple flooding for broadcasting the Route Request (RREQ) across the network [3]. Energy efficiency is an important issue in wireless network where nodes rely on limited power and computational resource, yet are required to cooperate in all sorts of fundamental network activities including routing.This work propose a modified version of AODV termed as AODV HPR where certain nodes are assumed to be high energy transmission nodes known as High Power Routing (HPR) nodes utilized for routing. The route is established only through HPR nodes which are capable of communicating to long distance [4].

2. Literature Review

It is difficult for the quantitative comparison of the most of the adhoc routing protocols due to the fact that simulation have been done independent of one another using different metrics and using different simulators. S. Preeti, B Ramachandran[1] propose an energy efficient route discovery process for AODV based on ERS and the approach saves energy of the nodes by avoiding the redundant rebroadcasting of the route request packets. The relaying status of the node is decided based on the broadcasting of its RREQ packets by its neighbours. Energy efficient AODV provides efficient energy consuming routing protocol with reduced routing overhead.

Energy efficient routing protocols in mobile ad-hoc network by Tanu Preet singh, Shivani Dua and Vikrant Das[2] does the realistic comparison of three routing protocols DSDV, AODV and DSR. As Expected reactive routing protocol AODV performance is the best considering its ability to maintain connection by periodic exchange of information which is required for TCP based traffic.

Ruchita A. Kalamkar, Prof. Amit M. Sahu[3] propose a method which will reduce the flooding as well as routing overhead in both route discovery and route maintenance by reducing the flooding in route discovery process and to avoid broadcast storm problem.

Janani A.P, Sakthivel M, Saravanan M[4] proposed AODV HPR provided significant improvement in throughput, PDF and significant reduction in dropped packets and end to end

delay. AODV HPR outperforms the conventional AODV by showing significant reduction in network overhead, MAC load and routing load. In our proposed system we use the AODV HPR protocol for the minimum energy consumption, minimum packet drop, maximum throughput.

A. AODV

AODV utilizes routing tables to store routing information[1]

- A routing table for unicast routes
- A routing table for multicast routes

The AODV routing protocol is a reactive routing protocol; therefore, routes are determined only when needed. Hello messages may be used to detect and monitor links to neighbors.If Hello messages are used to detect and monitor links to neighbors.If Hello messages are used, each active node periodically broadcasts a Hello message that all its neighbors receive. Because nodes periodically send Hello messages, if a node fails to receive several Hello messages from a neighbor, a link break is detected. When a source has data to transmit to an unknown destination, it broadcasts a Route Request (RREQ) for that destination. At each intermediate node, when a RREQ is received a route to the source is created. If the receiving node has not received this RREQ before, is not the destination and does not have a current route to the destination, it generates a Route Reply (RREP).[2] The RREP is unicast in a hop-by-hop fashion to the source.

As the RREP propagates, each intermediate node creates a route to the destination. When the source receives the RREP, it records the route to the destination and can begin sending data.If multiple RREPs are received by the source, the route with the shortest hop count is chosen. As data flows from the source to the destination, each node along the route updates the timers associated with the routes to the source and destination, maintaining the routes in the routing table. If a route is not used for some period of time, a node cannot be sure whether the route is still valid; consequently, the node removes the route from its routing table. If data is flowing and a link break is detected, a Route Error (RERR) is sent to the source of the data in a hop-by-hop fashion. As the RERR propagates towards the source, each intermediate node invalidates routes to any unreachable destinations. When the source of the data receives the RERR, it invalidates the route and reinitiates route discovery if necessary.

B. Route Discovery

When a node wishes to send a packet to some destination it checks its routing table to determine if it has a current route to the destination. If yes, forward the packet to the next hop node. If no, it initiates a route discovery process. Route discovery process begins with the creation of a Route Request(RREQ) packets source node creates it[1]. The packet contains source nodes, IP address,source node current sequence number, destination IP address, destination sequence number[2]. Packet also contains broadcast ID number. Broadcast ID gets increamented each time a source node uses RREQ. Broadcast ID and source IP address form a unique identifier for the RREQ.

3. Related Work

Our work propose a modified version of AODV termed as AODV HPR where certain nodes are assumed to be high energy transmission nodes known as High Power Routing(HPR) nodes utilized for routing. The route is established only through HPR nodes which are capable of communicating to a long distance. The simulation is performed in NS2 results are compared with DSR and AODV. The proposed AODV HPR provided significant improvement in throughput, and packet delivery ratio and reduction in dropped packets, energy consumption and overhead.

HPR nodes can be assumed as higher capability nodes which are having sufficient battery power and the may be deployed as HPR nodes during the entire life of the network. Here a HPR node can transmit or allowed to transmit to higher distance than normal node. HPR nodes can also be a source or destination node but a route can be established only through HPR nodes. Since there is no routing overhead for the normal nodes in the network. A route can not be established through any arbitrary node in the network . In a typical MANET mobility causes link failures and results in increased overhead and reduced performance.

In the proposed AODV HPR, the HPR nodes uses little bit of higher energy. So that it is resistant to mobility to some extent. Since the HPR nodes are capable of communicating to high distance little bit of mobility in individual nodes will not cause frequent link failures. Since the route is established only through HPR nodes the other nearby normal nodes which will receive the routing packets will not process those request and reduce the message overhead in a typical on demand routing protocol.

Consider a normal AODV route discovery process for example if the node S starts a route discovery process by broadcasting a RREQ message then all the neighbors of S will receive the request and process the request. If neighboring node knows the route, then it will send a reply otherwise, it will forward the RREQ message by rebroadcasting it again. In fact all the node in the network will receive that RREQ message. If the message will reach the destination D, then D will send a RREP message. Let us assume that the grey nodes are the normal nodes and the blue nodes are the HPR nodes.

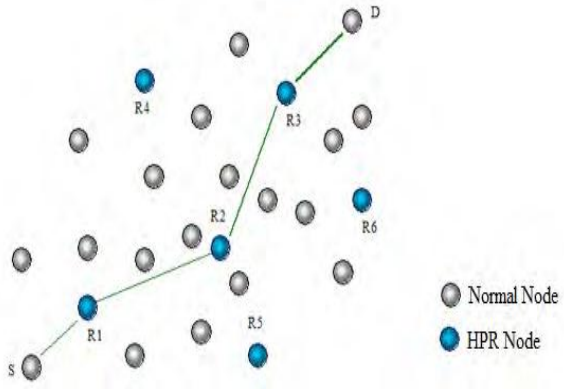

Figure 1: HPR Nodes Routing

In our proposed routing scheme as shown in Fig.1, the HPR nodes only will be allowed to forward the RREP and RREQ message. In other words, between S and D, a route can be established only through HPR nodes. Since the normal nodes will not rebroadcast the RREQ or forward RREP messages, it will reduce a lot of overhead as well as transmission power.
Since the HPR nodes are capable of passing message to longer distances, it will reduce the overall path length. The reduction in path length will reduce the end to end delay. Further, the normal nodes will only need to transmit up to the next nearest HPR node where the transmission power is reduced according to that distance, which reflects in the overall power consumption.

Advantages

- There is no routing overhead for the normal nodes in the network.
- A route can not be established through any arbitrary node in the network. Hence security in communication increases.
- Since the HPR nodes are capable of communicating to high distance. Little bit of mobility in individual nodes will not cause frequent link failure.

3. Simulation Results

A. Average Energy consumption

In AODV HPR energy consumption is low as compared to DSR and AODV. From Fig.2 we can see that the energy consumption level is 130 to 150 but in DSR and AODV it is at the level 200 at starting and it falls upto 170. Means DSR and AODV will consume lots of energy as compared to AODV HPR. The HPR nodes only will participate in route discovery and routing in general. The other normal nodes will preserve power by avoiding the routing of messages. The slight increase in transmission power increase the communication range and hence end to end link failures rate are reduced. The increase in transmission avoids lot of rebroadcasting and resend of messages. So, little increase in transmission power in a portion of nodes in a network reduces the overall energy consumption of the network.

Table 1: Simulation Parameters

Parameters	*Values*
Terrain Size	1200-1100sqm
Simulation Time	30000msec
Number of Nodes	49
Node Placement	Uniform
Transmission Range	280m
Bandwidth	2MHz
Propagations Model	Two Ray Ground
Minimum Speed	0 sec
Maximum Speed	0,10,20,30
MAC Protocol	802.11
Network Protocol	IP
Routing Protocol	AODV,AODV HPR
Transport Protocol	TCP
Application	CBR

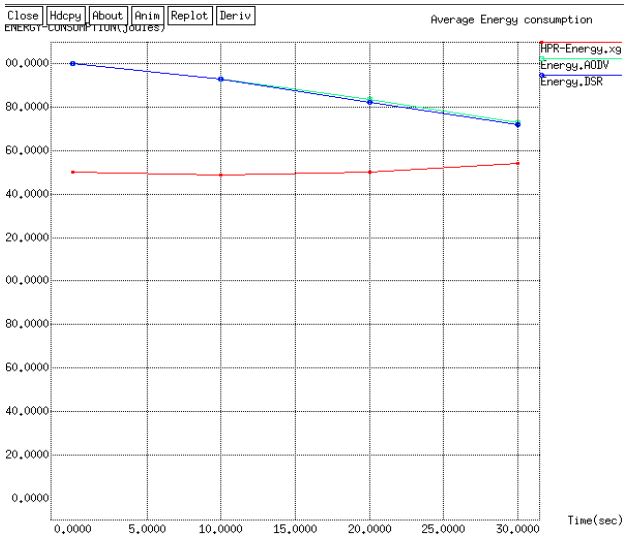

Figure 2: Average energy consumption

B. Packet Delivery Ratio

From Fig.3 we conclude that the ratio of packet that are successfully delivered to a destination to the number of packets that have been send by the sender is a packet delivery ratio. It is high in AODV HPR than DSR and AODV. As in DSR and AODV at time level 17.0000 some packets are dropped down but in AODV HPR packets are send successfully to the destination.

C. Throughput

From Fig.4 we can conclude that in AODV HPR the rate of successful packet delivery is better than AODV and DSR. In AODV HPR the throuhput is increase at time level 13.0000sec and in AODV it increase at time level of 17.0000 sec and in DSR is at 21.0000 sec. so that we can say that AODV HPR gives the better throughput as compared to AODV and DSR.

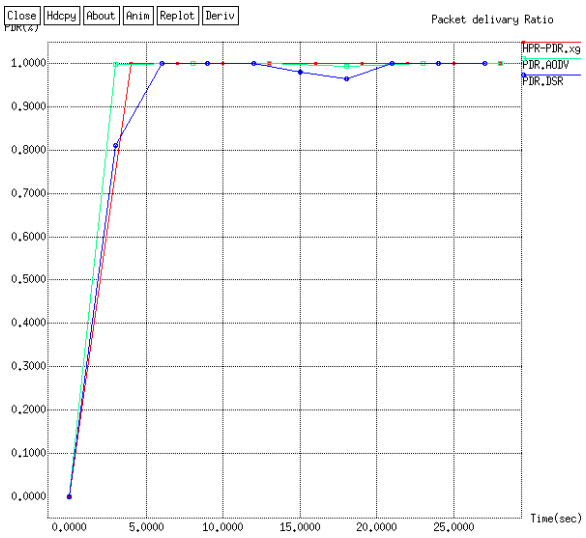

Figure 3: Packet Delivery Ratio

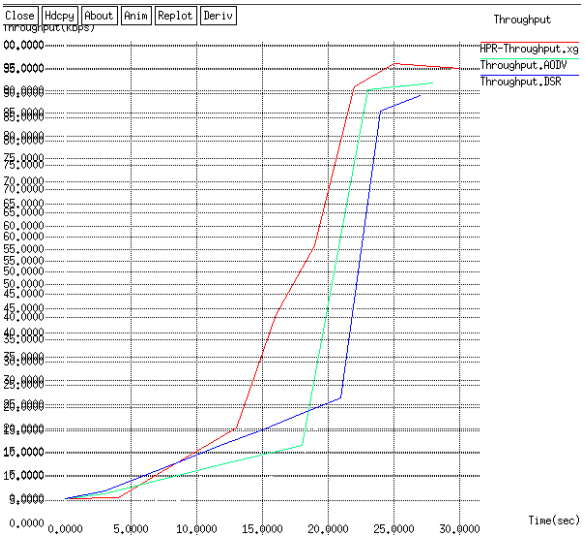

Figure 4: Throughput

D.Packet Drop

From Fig.5 we can conclude that the packet drop in AODV HPR is negligible as compared to DSR and AODV. If we are sending 30 packets at a time then in DSR 20 packets will drop after 4.0000 sec and in AODV 9 packets will drop after 4.0000 sec.

Conclusion and Future Scope

The simulation results shows that the proposed AODV HPR perform better with parameter like throughput, packet delivery ratio, energy consumption and packet drop. A HPR node can transmit or allowed to transmit to higher distance than normal nodes. HPR nodes can also be a source or destination node but, a route can be established only through HPR nodes. In future the proposed system can be extended to add security feature.

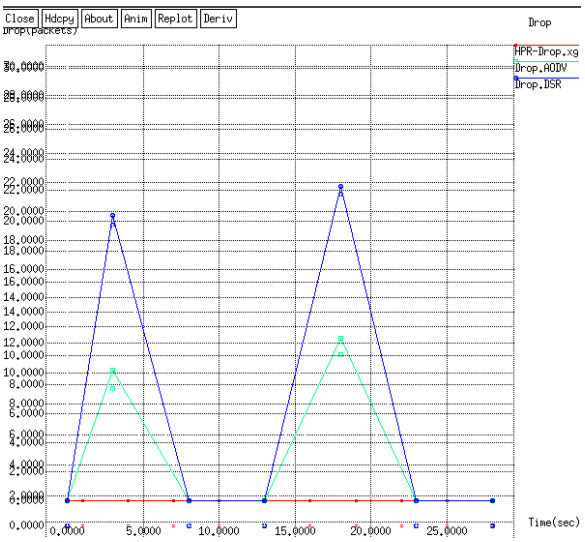

Figure 5: Packet drop

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