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Power Optimization Using EPAR Protocol In MANET

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Abstract

Now adays lot of important tasks are performed using MANET. To improve the communication energy efficiency at individual nodes power aware is an important issue. Here we propose an efficient Power Aware Routing (EPAR), a new power aware routing protocol that increases the MANET lifetime . Comparing to conventional power aware algorithms, EPAR identifies the node capacity not just by its battery power, but also by the energy lost in reliably forwarding data packets over a specific link. This is by a mini-max formulation, EPAR selects the path that has maximum packet capacity at the lowest residual packet transmission capacity. In addition to EPAR we consider the traffic density factor to improve the packet delivery ratio. Thus to find the optimal path we are considering the node with maximum power and maximum number of neighbouring nodes to it. our proposed scheme thus reduces the total energy consumption and decreases the mean delay especially for high load networks while achieving a good packet delivery ratio.

Keywords: *EPAR, AODV, DSR.*

1. Introduction

Wireless network has become increasingly popular during the past decades. There are two variations of wireless networks- infrastructured and infrastructureless networks. In infrastructured networks communications among terminals are established and maintained through centric controllers. Infrastructureless network is commonly referred to as wireless adhoc network. Such a network is organized in an adhoc manner, where terminals are capable of establishing connections by themselves and communicate with each other in a multi-hop manner. MANET is group of mobile nodes that form a network independently of any centralized administration .each moving nodes act as a host and router and forward packets for other nodes. The moving nodes in this network continously changes its network topology and allows biedirectional and unidirectional link.

MANET have many applications ,they are applied in Military Scenarios ,Rescue Operations , Data Networks ,Free Internet Connection Sharing , Sensor Network etc .All mobile nodes are battery operated. They are suffering from limited energy level problems and the battery lifetime extention is very important aim. Some nodes get down due to power exaustion and thus often reduces the lifetime of manet. Nowadays researchers are trying to develop efficient energy routing protocols. Although there are other types of protocols like DSR ,DSDV, AODV etc these protocols makes routing based on the smallest distance routing algorithm and never consider the factor power. But in an energy efficient routing protocol the main considering factor is power.

2. Motivation

There are lot of related works regarding power optimization in manet. In [1] we use a new power aware routing protocol called (EPAR) which can increase the MANET lifetime. In [2] they are discussing about power consumption aspect of the MANET routing protocols. A performance comparison of Dynamic Source Routing (DSR) and Ad hoc On-Demand Distance Vector (AODV) routingprotocols with respect to average energy consumption and routing energy consumption are explained. In [3] they considers energy constrained routing protocols and workload balancing techniques for improving MANET routing protocols and energy efficiency and also give new routing protocol that employs adaptive load balancing technique to

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the MANET routing protocols with node caching enhancement. Also, we show new application of energy efficiency metrics to MANET routing protocols for energy efficiency evaluation of the protocols with limited power supply. In[4] they first introduce anenergy consumption model to calculate the energy-factor[1] of the nodes and then propose a trust based protocol forenergy-efficient routing. Here they also adopt a trust module to track the value of routing metric. In [5] they presents E2DYMO, an improvement to the well-known DYMO protocol that offers energy efficiency and fairness in routingfor mobile wireless ad hoc networks.In [6] they discuss about the power consumption aspect of the MANET routing protocols(DSR) and (AODV), performance comparison of Dynamic Source Routing (DSR) and Ad hoc On-Demand Distance Vector (AODV) routing protocols with respect to average energy consumption ,routing energy consumption . In [7] they presents Energy Entropy-based multicast routing protocol in MAODV (EEMAODV). The key idea of the protocol is to find the minimal nodal residual energy of each route in the process of selecting path by descending nodal residual energy. It can balance individual nodes battery power utilization and hence prolong the entire networks lifetime.

3. EPAR Protocol

Here it proposes EPAR protocol for power optimization .To conserve energy, we should minimize the amount of energy consumed by all packets traversing from source node to destination node.we want to know the total amount of energy the packets consumed.The energy consumed for one packet is calculated by

$$E_c = \sum_{i=1}^{k} T\ n_i, n_{i+1}$$

Where, ni to nk are nodes in the route ,T denotes the energy consumed in transmitting and receiving a packet over one hop. Then we find the minimum Ec for all packets. The main objective of EPAR is to minimize the variance in the remaining energies of all the nodes and there by prolong the network lifetime.

3.1 Route discovery and Maintenance in EPAR

For EPAR, however, the path is chosen based on energy. First, we calculate the battery power for each path, that is, the lowest hop energy of the path. The path is then selected by choosing the path with the maximum lowest hop energy.

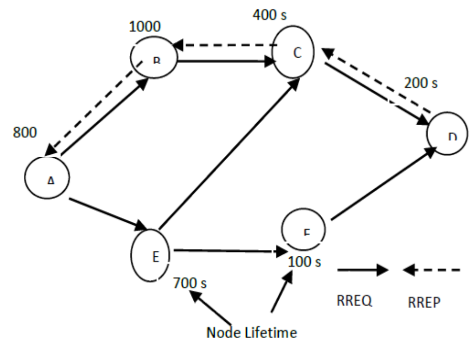

Figure 1: Route discovery and maintenance process in EPAR [1]

Using a mini-max formulation EPAR selects the routing path . Here in figure 1 there are three applying EPAR protocol we first select the minimum hope energy for each path. For the path ABCD the minimum hope energy is min(800,1000,400,200)= 200. For the path AECD the minimum hope energy is min(800,700,400,200)=200. For the path AEFD the minimum hope energy is min(800,700,100,200)=100. Then taking the maximum of the minimum hope energy ,we will take max(200,200,100)=200. Thus our method is dynamic distributed load balancing method that chooses the lightly loaded paths and avoids the power congested nodes. This will help the EPAR protocol to minimize the variance in energy levels of various nodes in the network and helps to increase network lifetime .

3.2 Data packet format for EPAR:

IP Header	DSR fixed Header	DSR Source Header	DSR source Route Address [1..N]	EPAR Source Route MTP [1…N]	Link Flag	DATA

Fig 2: EPAR packet format [1]

The *Pt* value is power that the packet is actually transmitted on the link. If a node chooses to change the transmit power for hop i, then it must set the *Pt* value in minimum transmission power (***MTP[i])*** to the actual transmit power. If the new power differs by more than ***Mthresh***then the ***Link Flag*** is set.

3.3 For improving the packet delivery ratio

At the time when a route node becomes out of range the packet could not be delivered properly.The proposed system also decided to consider the traffic density to improve the packet delivery ratio. Thus for better routing we are considering the node with maximum power and maximum traffic density which will improve both the life time and packet delivery ratio of manet.

3.4 Parameter used for verification:

Transmit power: power needed for packet transmission.

Packet Delivery Ratio:The **ratio** of **packet**s that are successfully delivered to a destination compared to the number of **packet**s that have been sent out by the sender

Battery power: Battery power is considered as the metric to analyze the performance of the protocols in terms of power.

End to end delay: End-to-end delay refers to the time taken for a packet to be transmitted across a network from source to destination

Moving speed of nodes: node speed movement is considered

4. System description

. The proposed system has mainly four steps:

- Node Deployment
- RREQ and RREP implementation
- RREP processing based on power and traffic density
- Packet forwarding and receiving acknowledgement

4.1 Node Deployment:

Implementing Node properties , the node properties may include the name, location,speed, number of neighbours etc. Creating base Simulator for wireless networks with all properties including data sending, receiving etc.

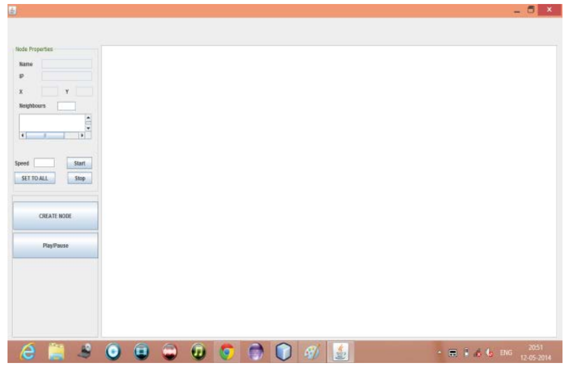

Fig:3 simulator enviornment

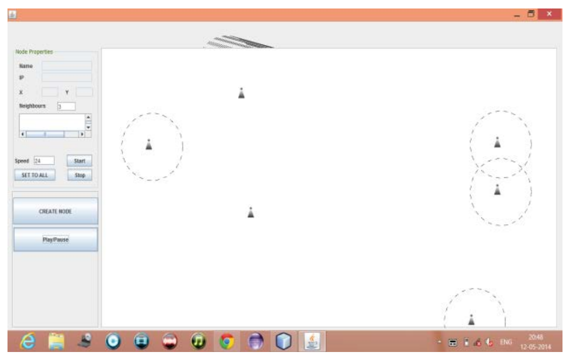

Fig: 4 moving manets in the simulator

RREQ and RREP implementation: RREQ is broadcasted to every node and RREP is unicasted to source node.

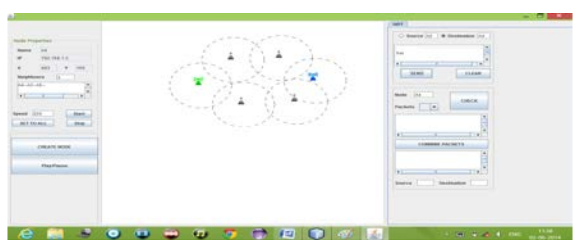

Fig :5 broadcasting request

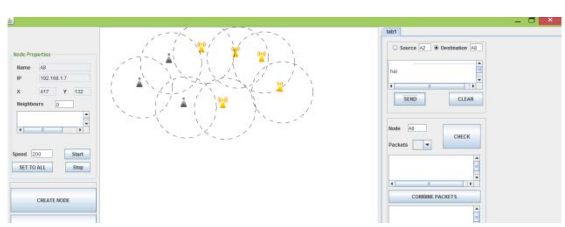

Fig: 6 unicasting reply

4.2 RREP processing : Here RREP packet is processed and choose the optimal path for data forwarding , this is by calculating the maximum power path. Ie summing up the power of each node and calculate the average power for each path. Thus maximum power path is selected for packet forwarding.

4.3Packet forwarding and receiving acknowledgment:

After finding the maximum power path data is send through these path and acknowledgment is received.

4.4Enhancement: we are adding an extra feature for improving the packet delivery ratio. We consider the traffic density along with power and find the optimal path. For considering the traffic density we consider the neighbouring nodes for each node. And we consider the node with maximum number of neighbouring nodes. This is because when a node become outoff range , the packet delivery cannot be properly maintained. For continuing the packet delivery,we are considering the neighbor of that node and finding the path through it.

Result: The experimental results are shown below. Thus the proposed system increases the power efficiency, thus increasing the network life time of manet. Here it also considers the traffic density to improve the packet delivery ratio. Here we considered both power and traffic density to improve maximum power and packet delivery ratio. Actually here we are comparing 3 types of different protocol AODV, EPAR and enhanced EPAR . Comparing the three protocols we can find the proposed system is more efficient.

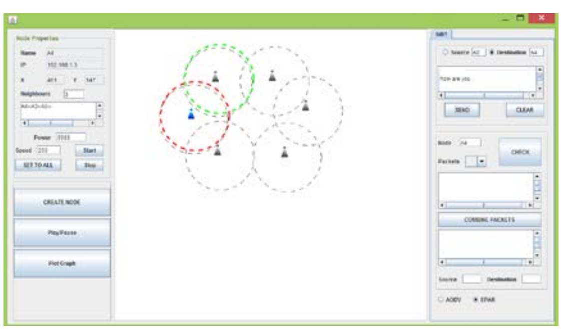

Fig:7 path choosen for each protocol

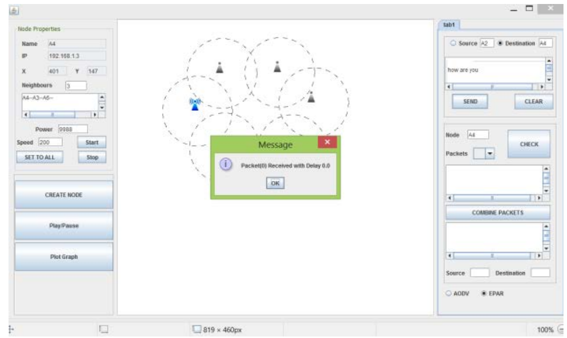

Fig: 8 messege sent for each protocol

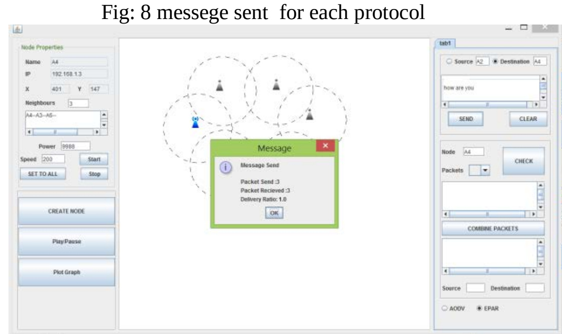

Fig:9 acknowledgment received

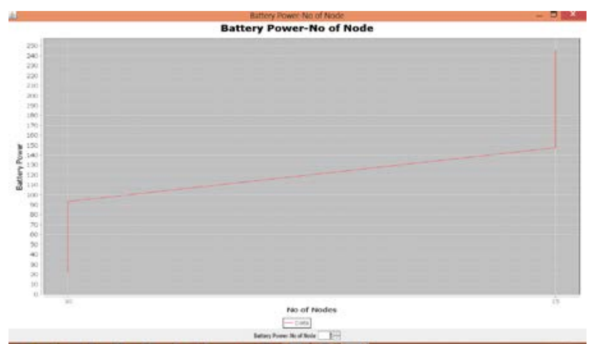

Fig:10 graph for battery power versus no of node

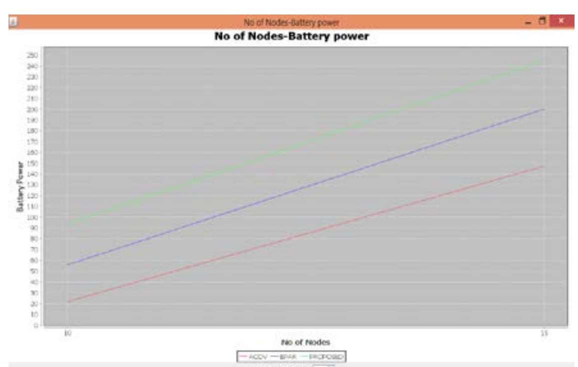

Fig:11 comparison graph for no of node versus battery power for AODV,EPAR and Proposed

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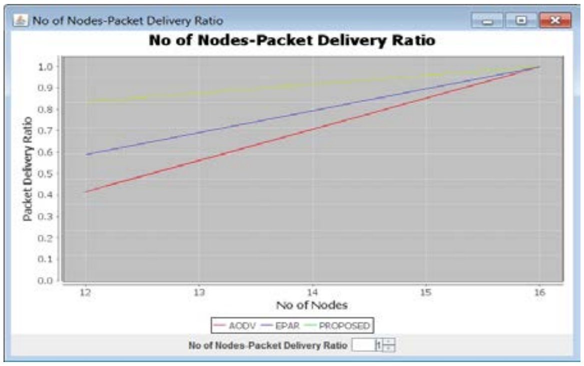

Fig:12 comparison graph for no of node versus packet delivery ratio for AODV, EPAR and Proposed

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