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A NOVEL ENERGY PROFICIENT COMMUNICATION PROTOCOL FOR WSN

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Abstract

The main aim of energy efficient routing is to minimize the energy required to transmit or receive packets also called as active communication energy. Inactive energy is the energy which not only tries to reduce the energy consumed when a mobile node stays idle but also listens to the wireless medium for any possible communication requests from other nodes. In this paper, we propose a energy proficient algorithm for routing.

Keywords: Energy efficient protocols, WSN, Adhoc Network.

1. Routing protocols

The basic routing functionality for mobile ad hoc networks is as follows[1-4]:

- **Path generation Mechanism:** which generates paths according to the assembled and distributed state information of the network and of the application; assembling and distributing network and user traffic state information,
- **Path selection Mechanism:** which selects appropriate paths based on network and application state information;
- **Data Forwarding Mechanism:** which forwards user traffic along the selected route forwarding user traffic along the selected route.
- **Path Maintenance Mechanism:** maintaining of the selected route.

There are more than 70 competing schemes for routing packets across mesh networks. Some of these include:

- AODV (Ad hoc On-Demand Distance Vector)
- B.A.T.M.A.N. (Better Approach To Mobile Adhoc Networking)
- Babel (protocol) (a distance-vector routing protocol for IPv6 and IPv4 with fast convergence properties)
- DNVR (Dynamic NIx-Vector Routing)
- DSDV (Destination-Sequenced Distance-Vector Routing)
- DSR (Dynamic Source Routing)
- HSLS (Hazy-Sighted Link State)
- HWMP (Hybrid Wireless Mesh Protocol)

2. Energy Proficient Routing

A network that can function as long as possible is an ideal network. In an ad- hoc system the main limitation is the availability of power. Power is consumed on resources such as running the onboard electronics, the number of processes running and overheads required to maintain connectivity[3]. The computing devices consist of mobile batteries in an adhoc network that communicates over the wireless medium. The memory space and the processing capacity of the nodes increase at a very quick speed, the battery method lags far behind. Hence, energy efficient protocols are derived to conserve

energy and to increase the network life time as well as increase the device and network operation time. In particular, energy efficient routing may be the most important design criterion for MANETs, as mobile nodes will be powered by batteries with limited capacity. Overall network lifetime decreases because of the power failure of a mobile node. Also the ability to forward packets on behalf of others decreases. For this reason, many research efforts have been applied to develop energy-aware routing protocols. Instead of average case the worst case i.e when a first node dies out is maximized[4].

The main aim of energy efficient routing is to minimize the energy required to transmit or receive packets also called as active communication energy. Inactive energy is the energy which not only tries to reduce the energy consumed when a mobile node stays idle but also listens to the wireless medium for any possible communication requests from other nodes. Transmission power control method and load distribution method are the two methods which decreases active communication energy. The sleep or power-down mode method decreases in-active energy. Both the protocol has specific benefits and drawbacks and therefore is applicable for certain situations. Thus it is not clear that which particular algorithm or a class of algorithms is the most excellent for all scenarios. To conserve energy, many energy efficient routing protocols have been proposed. Many re- searches are being made to carry out to develop energy aware routing protocols. Some are designed to search for the most energy efficient path from the source to the destination while some attempt to balance the remaining battery-power at each node when searching for the energy efficient path[2].

Some energy proficient routing protocol includes Local Energy- Aware Routing based on AODV (LEARAODV), Power-Aware Routing based on AODV (PAR-AODV), and Lifetime Prediction Routing based on AODV (LPR- AODV).

3. Literature Review

Power aware clustered time division multiple access (PACT) is a novel protocol with a clustered multi-hop topology [5]. PACT utilizes the concept of passive clustering where nodes are allowed to take turns as the communication backbone. PACT uses a passive cluster head election scheme. These cluster heads then form the communication system backbone nodes. PACT classifies nodes into four status categories: cluster head, gateway, and ordinary and low energy state node. In order to reduce energy consumption within a cluster, the role between cluster heads and gateway nodes is rotated. Furthermore, the duty cycle of each node is adapted to the traffic conditions in the network where the radios are turned off during inactive periods. PEGASIS [6] is a novel improved protocol where only one node is chosen a head node which sends the fused data to the BS per round. PEGASIS protocol requires formation of chain which is achieved in two steps: first, chain construction and gathering data. Leader of each round is selected randomly. Second, randomly selecting head node also provides benefit as it is more likely for nodes to die at random locations thus providing robust network. When a node dies chain is reconstructed to bypass the dead node [12]. Energy-aware routing has received attention in the recent few years, motivated by advances in wireless mobile devices. Since the overhead of maintaining the routing table for wireless mobile networks is very high, the stability of a route becomes of a major concern [7].

Al-Karaki et al. [8] is to find the tradeoff between computational accuracy and energy requirement of the algorithm on a single node. The purpose is to maximize the computational quality for a given energy constraint. Raghunathan et al. [9] is to break down the algorithm into multiple tasks and distribute the tasks among a group of nodes,

so that the energy consumption will be balanced among multiple nodes, and the overall lifetime will be prolonged. Wang and Chandrakasan [10] also investigate the energy efficiency by parallelizing computation among nodes.

4. Proposed Approach

The working of proposed algorithm is as follows:

Initialization parameters:

(1) Setup a network with N nodes and E edges

(2) Select a node S as the source node

(3) Select a set of nodes from N apart from S to act as target nodes.

(4) Setup the delay parameter in the channel.

(5) Initialize the type of the packet with parameters like hop count, energy and path.

(6) The edges E of network (connections) are unidirectional as per the assumptions. Therefore two distinct types of gates are taken for input and output

(7) Initial packets hop count set as 0 and also energy =0.0mW

For (each target node in the set)
{
Initiate from the source node
While(packet(path[ ]) isnotnull)
If(node==target node)
Accumulate packet parameters for further calculation
else
{
Int gaterange= count for the no of out gates for the node
Copy the Route Request (RREQ) message packets
Packet(hop_count) = packet(hop_count) + 1
Determine energy En with the following formula
En = (packet(hop_count) * delay) + (x * packet_size) + const
(here x required for calculation will be that of the sending as well as of the intermediate nodes.)
Packet(energy) = En

For(eachgate <= gaterange)
{
Get node connected to gate
If(packet(path)does not contain node)
{
Add node to packet(path)
Send packets to node through gate
}
}
}
Get next node from packet−>path }

Hop[i]= least hop count from the collected data

Energy[i]= least energy loss from the accumulated data

i=i+1

Pick another node from the set as destination node }

Calculate average of hop[] and energy[] values and plot them.

This process was reiterated for all the network of different dimension or no of nodes. This algorithm provides the best path for transmission between the source and destination pair as it takes into account both the node energy as well as the delay and hop counts. Hence the network life is automatically increased with effective path calculation.

5. Experimental Evaluation

We have taken the simulation environment as omnet++. This simulation IDE is freely available for academic purposes.

We created the network of 60 nodes. The simulation returns the average minimum hop count and energy loss as shown below:

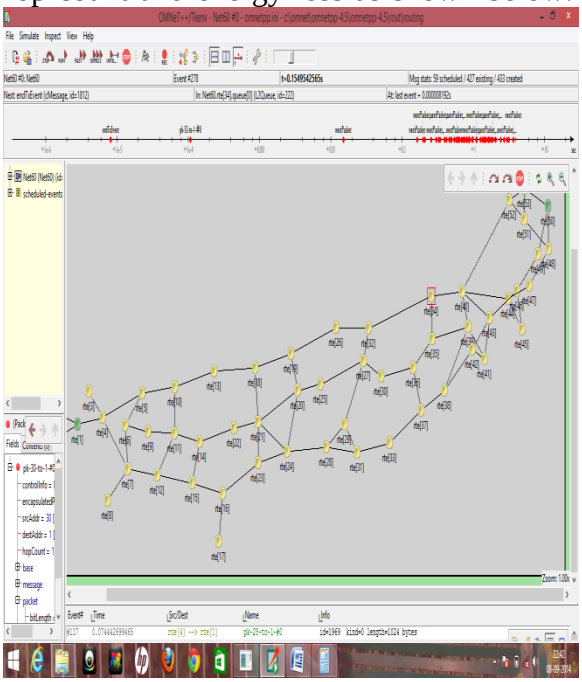

Figure 1: Network simulation

6. Conclusion

In this research we proposed a routing approach with the aim to minimize the energy required to transmit or receive packets also called as active communication energy. Inactive energy is the energy which not only tries to reduce the energy consumed when a mobile node stays idle but also listens to the wireless medium for any possible communication requests from other nodes.

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