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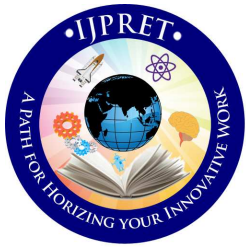

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A PATH FOR HORIZING YOUR INNOVATIVE WORK

A NOVEL APPROACH FOR ENERGY EFFICIENT ROUTING ALGORITHM FOR AD-HOC NETWORK

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Abstract

Routing is one of the important issues in mobile ad hoc network. In MANET, the nodes having limited battery capacity may cause network partition. If network is partitioned, the nodes have to recollect the routing information which again consumes available energy of the nodes. To avoid such problems, it is necessary to use the nodes energy efficiently. In this paper we discuss some techniques that can be added into existing energy efficient routing algorithm so that the network time may be increased to some extent.

INTRODUCTION:

A Network is a collection of nodes which are highly interconnected. This interconnection can be wired, wireless or wired cum wireless. Mobile devices coupled with wireless network interfaces is an essential part of computing environment that consist of infra- structuredand infrastructure-less mobile networks [1]. Wireless Local Area Network (WLAN) is the most prevalent infra-structured mobile network which is based on IEEE 802.11 standard, where a mobile node communicates with a fixed base station, and thus a wireless link is limited to one hop between the node and the base station. Mobile Ad hoc Network

(MANET) is an infrastructure-less multihop network where each node communicates with each other either directly or indirectly through intermediate nodes [1].

The nodes which comprise MANET have routing capabilities and forward traffic for other communicating parties that are not within each other's transmission range.

They are characterized by lower computing and energy resources. Therefore, ad hoc routing is challenged by power and bandwidth constraints, as well as by frequent changes in topology, to which it must adapt and converge quickly

[2]. Conventional routing protocols for wired networks cannot be employed in such an environment due to the factors described above. This fact has given rise to the design of ad hoc-specific routing protocols.

The main challenges in mobile ad-hoc networks are as follows [3,10]:

- Limited Power Supply
- Dynamically Changing Topology
- Limited Bandwidth
- Security
- Mobility-induced route changes
- Mobility-induced packet losses
- Battery constraints

A brief description of challenges in ad hoc network is given in [11,13]. How routing information is acquired and maintained by mobile nodes is one of the most popular methods which is used to distinguish mobile ad hoc network routing protocols. Using this method, mobile ad hoc network routing protocols can be divided into proactive routing, reactive routing, hybrid routing and location based routing [5]. Aswe know the fact that future devices are getting smaller and more efficient, advances in battery

technology yet not reached the stage where a mobile computer can operate for days without recharging the battery. So as of one important aspect of ad-hoc networks is energy efficiency since only a simple battery provides nodes autonomy. Thus, minimizing energy consumption is a major challenge in these networks. The main reasons for energy conservation in ad hoc networks are limited energy reserve, difficulties in replacing the batteries, lack of central coordination, constraints on the battery source, selection of optimal transmission power etc [13]

Recent studies in battery technology have helped us better understand battery behavior. Unlike what we used to know, the energy consumed from a battery is not equivalent to the energy dissipated in the device [14]. When discharging, batteries tend to consume more power than needed and to reimburse the over consumed power later if they have sufficient recovery, where "recovery" means that the battery is disconnected from its load. The process of reimbursement is often referred to as battery recovery. The over consumed power is referred to as the discharging loss. A "fatigue" battery is a battery with a high discharging loss, whereas a "well-recovered" battery is a battery with a low discharging loss.

2. ENERGY EFFICIENT ROUTING:

2.1 Sources of power consumption:

The sources of power consumption, with regard to network operations, can beclassified into two types: Communicationrelatedand computation related [6].Communication involves usage of the transceiver at the source, intermediate (in the case of ad hoc networks), and destination nodes. The computation is chiefly concerned with protocol processing aspects. It mainly involves the CPU usage and main memory, the disk or operations of other components, data compression techniques etc. There exists a potential tradeoff between computation and communication costs. Techniques that strive to achieve lower communication costs may result in higher computation needs, and vice-versa. RandomCast [14] is an energy efficient communication scheme used. Hence, protocols that are developed with energy efficiency goals should attempt to strike a

balance between the two costs.

Energy efficient routing mechanisms proposed for MANETs can be broadly categorized based on when the energy optimization is performed [1]. A mobile node consumes its battery energy for performing various operations in active as well as in idle mode. Thus, energy efficient routing protocols minimize either the active communication energy required to transmit and receive data packets or the energy during inactive periods.

Transmission power control and load distribution belong to the former category,and sleep/power-down mode approach belongs to the latter category. Another important approach to optimizing active communication energy is load distributionapproach. While the primary focus of theabove two approaches is to reduce energy utilization of individual nodes, the main goal of the load distribution approach is to balance the use of energy among the nodes and to increase the network lifetime by avoiding over-utilized nodes when selecting a routing path.

In the scientific papers reviewed, the lifetime of a network is usually defined according to the following criteria [2]:

- The time until the first node burns out its entire battery budget;
- The time until a certain proportion of the nodes fails; and
- The time until network partitioning occurs.

Energy-related metrics that may be used todetermine energy efficient routing path instead of the shortest one are [1, 6, 11, 13]

- Minimize energy consumed/packet,
- Maximize time to network partition,
- Minimize variance in node power levels,
- Minimize cost/packet, and
- Minimize maximum node cost.

2.2 Energy Efficient Ad Hoc Routing Protocols

Different energy-related routing metrics have been suggested in order to achieve energy conservation and increase the

lifetime of the network. Energy-related metrics used by these energy aware routing protocols can be broadly classified into four categories: transmission power,remaining energy capacity, estimated node lifetime, and combined energy metrics [4].

Power/energy efficient routing protocols can be classified into these four categories based on their path selection scheme as follows:

1. The first set of protocols use the energy cost for transmission as the cost metric and aim to save energy consumption per packet. However, such protocols do not take the nodes' energy capacity into account. Thus, the energy consumption is not fair among nodes in the network. MinimumTotal Transmission Power Routing (MTPR) is an example protocol for this category.

2. The second set of protocols use the remaining energy capacity as the cost metric, which means that the fairness of energy consumption becomes the main focus. But, theseprotocols cannot guarantee the energy consumption is minimized.

3. The third set of protocols is similar to the second set, but use estimated node lifetime instead of node energy capacity as the route selection criteria. Therefore, these protocols still aim to fairly distribute energy consumption.

4. In order to both conserve energy consumption and achieve consumption fairness, ConditionalMax-Min Battery Capacity Routing (CMMBCR) has been proposed to combine these two metrics. CMMBCR is an example of the fourth category of protocols, which use combined metrics to represent energy cost.

3. AREAS TO BE CON`SIDERED IN ENERGY EFFICIENT ROUTING APPROACHES

The transmission power control is an effective approach to reduce energy consumption in a MANET. However, it has to deal with Link error and retransmission overhead and also required Directionality. Transmission control protocols provide an opportunity to save energy by utilizing intermediate nodes between two distant nodes. However, the

resultant path with many short-range links may perform worse than a path with fewer long-range links in terms of latency as well as energy consumption [1]. This is because the path with many short range links would cause more link errors that would result in more retransmissions. To deliver packets with minimum energy, the transmission power control approach adjusts each node's radio power and allows different transmission power levels at different nodes. However, in order for the link-level connectivity of a MANET to work correctly, any pair of communicating nodes must share a bidirectional link.

Although the main objective of load balancing routing is the efficient utilization of network resources, none of the studies reviewed above takes energy-wise metrics into account. Because of heterogeneous requirements and availability of energy levels at each node, it is not possible to select same possible load balancing constraints for all nodes to distribute the load evenly in the network. There is no doubt that a better distribution of load leads to the more efficient use of bandwidth, which means that there is less contention and consequently less energy is consumed, but it is not self contained for achieving complete energy efficiency. Since none of the studies applies load balancing for achieving energy efficient consumption, the relevant literature does not contain an energy performance evaluation of load balancing routing protocols.

So we can conclude that all the protocols used for energy efficient routing may have their own advantages and limitations. We can try to use the basic properties of each protocol to increase energy efficiency like

1. like PEN, it should power down the radio device when it is idle.
2. as in LEAR, nodes decides whether to forward route request message or not. Depending on residual battery power so that destination node receives route request message only when all immediate nodes along route have good battery level.
3. we can decide threshold for given grid (geographical area as in CMMBCR.
4. as in PLR, we can assume that source node has location information of its neighbors and destination. This is not

optimal path but source selects next hop through which overall transmission power to destination is minimized. Power consumption of indirect link is less than direct link due to super-linear relationship between transmission energy and distance. try to minimize sum of link costs along the path. As mentioned in FAR, link requiring less transmission is preferred.

5. we can also used mobile node's page rank which is used in PR-RAM , which means how many routing paths are included to this node. Thus higher rank of node is more important than the value of lower rank of node. So higher rank of node should get the more chance to transmit the data to next-hop node than the lower rank of node.

But it is not possible to add all properties in one protocol. So we studied working of ZRP routing protocol which is hybrid protocol and try to change some of its parameter as explained above to make a novel approach for adhoc routing. From the study of ZRP routing protocol which is a hybrid protocol we can said that nodes consume some power even if they are in idle mode. We can mention here a novel approach which combine transmission power control and sleep/power down approach. Here we can maintain a master node which can monitor working of all nodes and put them in sleep mode periodically. We impose some scheduling algorithm which is used to made nodes to go in sleep mode periodically. The master nodes checks whether there is any message intended to node which is in sleep mode. If there is message, the master node saves this message on behalf of sleep node, and forwards this message when node is awake.

CONCLUSION:

In order to facilitate communication within a MANET, an efficient routing protocol is required to discover routes between mobile nodes. Energy efficiency is one of the main problems in a MANET, especially in designing a routing protocol. In this paper, we have surveyed and classified a number of energy aware routing schemes. In many cases, it is difficult to compare them directly since each method has a different goal with different assumptions and employs different means to achieve the goal. Therefore, more research is needed to combine and integrate some of the

protocols presented in this paper to keep MANETs functioning for a longer duration. By using this survey we conclude that there is not a single protocol which can be selected for its best performance in ad-hoc network. Performance of the protocol varies according to the changes in the network parameters. Sometimes the mobility of the node of the network is high sometimes energy of the node is of prime concern. The comparisons of these energy efficient protocols have been discussed in this survey paper. We have tried to present almost all possible approaches of energy efficient protocols.

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