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Review Paper on Energy Optimal Method to Maximize Network Lifetime of Wireless Ad Hoc Networks

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Abstract -*In wireless ad hoc networks, energy efficiency plays important role to improve the lifetime of network. Nodes in wireless ad hoc network are limited battery powered. Therefore, energy efficiency is of vital important in the wireless ad hoc network. Hence there is challenge to maximize the network lifetime. This paper presents a brief overview of wireless ad hoc network, causes of energy loss and some energy conservation schemes based on existing techniques.*

Keywords: Ad Hoc network, Energy Efficiency, Network lifetime.

1. INTRODUCTION

Nowadays wireless network plays important role in communication. Wireless networks are being increasingly used in communication between different types of devices. User mobility, flexibility and ease of use are some reasons make them appealing to new applications. In this work I am considering wireless ad hoc networks. In wireless ad hoc network, wireless devices are directly communicated with each other. In ad hoc network all wireless devices within range of each other to discover and communicate in peer to peer mode. An ad hoc network is made up of multiple nodes connected by links. The network must allow any two nodes to communicate by relaying the information via other nodes. A path is a series of links that connects two nodes. In wireless ad hoc and network, nodes are working only with battery power. Wireless ad hoc network is working on limited power. Also has limited availability of energy resources. It will die after battery exhaustion. It is impossible to recharge or replace the batteries during process. Thus the network has a limited lifetime. Hence there is challenge to maximize the network lifetime.

The communication between two nodes can be either in a single hop transmission or in multi hop transmission. In single hop transmission two nodes are within the transmission ranges of each other. In a multi hop transmission where the message is relayed by intermediate nodes. Since wireless communications consume limited amounts of battery power, therefore, the limited battery lifetime imposes a severe constraint on the network performance. Energy efficient operations are critical to enhance the network lifetime. Therefore, energy efficiency is of vital important in the wireless ad hoc network. Since the Nodes are battery-powered; thus energy is a precious resource, which has to be carefully used by the nodes in order to avoid an early termination of their activity. Hence the study and implementation of energy-efficient algorithms for wireless networks is required.

1.1 Reasons of energy consumption in network

In wireless ad hoc network, nodes dissipate energy in processing, transmitting and receiving messages. Some amount of energy waste in state such as:

a) Idle listening: Node does not know when it will receive message hence it will permanently listen to medium and remains in idle state.

b) Overhearing: During transmission of packets all neighbors receives packet even if they are not as destination. Thus energy dissipation is occurs for overhearing.

c) Collision: Due to collision packets are discarded and retransmitted .Hence energy is dissipated for retransmission of packets.

Thus wireless ad hoc network requires the use of energy efficient technique to minimize the energy waste and so to increase the network lifetime.

2. LITERATURE REVIEW

There were so many routing algorithms have been proposed. Some algorithms consider the reliability of links to find more reliable routes. R Morris et al.[1] introduce ETX (expected transmission count) to find reliable routes. These reliable routes consists of links whichrequiring less number of retransmission for lost packet recovery. If any reliable route has higher priority, then those nodes are overused. Also reliable links will frequently used to forward the packet which results in fail of nodes with reliable links. Some algorithms find energy efficient rout.[2] [3] [4] [5] , These algorithms do not consider the remaining battery energy of nodes. Also do not consider the actual energy consumption of

nodes to discover energy efficient rout. Some algorithms try to maximize network lifetime. [6] [7] [8] [9] [10] [11]. They find routes which consistnodes with high level of battery energy. They only increase network lie time;they do not give energy efficiency and reliability of routes. Energy efficient algorithms [20] [21] [22] are surveyed and categorizes on the basis of metric used for energy efficient routing. It describes many routing protocols. Routing protocols can be classified into three main groups.

1) Proactive routing protocols: these protocols are based on table driven routing. Each node maintains routing table which contains latest information of routes to its neighbor node in network. This group contains protocols such as DSDV (destination sequenced distance vector), LSR(link state routing).

2) Reactive routing protocols: also called as on demand routing protocols. Nodes initiates route discovery process only when route to destination is required. This group contains protocols such as AODV (ad hoc on demand distance vector)

Hybrid routing protocols: initially routing is established with proactive routing protocol then through reactive flooding. Examples of hybrid routing protocols are "Hybrid Routing protocol for Large Scale Mobile Ad Hoc Networks"(HRPLS), "Hybrid Wireless Mesh Protocol" (HWMP) and "Zone Routing Protocol" (ZPR).

Tiankui Zhang et al propose network models which consider the battery energy of wireless nodes, multi hop transmission distance and geographic distance between wireless nodes. [24] They propose new energy efficiency metric which consider energy efficiency of wireless link and impact of wireless node on the entire network. Hanan Shpungin [29] Studies the bottleneck link capacity under the Gaussian channel model in strongly connected wireless ad hoc network in which n nodes independently and uniformly distributed in a unit square. They assume that each node is equipped with two transceivers and allowed all nodes to transmit simultaneously. Then draw lower and upper bounds in terms of bottleneck link capacity and propose an energy efficient power assignment algorithm.

Maggie X. Cheng et all focus on energy efficiency and maintaining the network connectivity. They considered the power assignment of nodes such that they form a topology which consumes minimum energy.[13].They consider energy consumption model in which each node transmits data to only its direct neighbors periodically. The state information of each node is integrated by neighbor nodes and transmitted to other nodes in the network.

TommasoMelodia et al proposed the framework in this paper gives the relationship between energy efficiency of routing task and the extension of range of topology knowledge for each node .they describe that limited topology knowledge is sufficient to make energy efficient forwarding decisions. They introduce an analytical framework to evaluate the energy consumption of geographical routing algorithm for power constrained large scale ad hoc network.[26]

Chi Ma et al introduce battery aware routing scheme for wireless ad hoc network to achieve energy efficiency. In this battery aware routing scheme choose the devices with well recovered batteries and leave the previously used batteries for recovery. Battery aware routing scheme can recover the device's battery capacity to achieve energy efficiency. In this scheme routing protocol select well recovered nodes. [19]

Xiangying Yang et al propose the design of ad hoc network which supports hop by hop relaying on different spatial scales. Using various transmission ranges, nodes relay beyond the nearest neighbor. Hence number of hopes between source and destination are reduced. Also propose multi-scale MAC clustering and power control mechanism.[27].

Liang Zhou et al propose energy spectrum aware scheduling scheme with dynamic transmission range.[30] when node mobility is high enough it is possible to achieve constant energy efficiency and spectrum efficiency as the number of nodes increases. PinyiRen et al propose channel aggregation diversity (CAD) [31] through which each node can utilize multiple channels simultaneously to improve spectrum and energy efficiency. Jalal Habibi et al presented mixed integer optimization framework which provide optimal transmission policy for minimum energy routing.[32]

YuHua Yuan et al [33] proposed an optimizing routing protocol based on AOMDV .this protocol solves route cutoff problem. It finds more reserved paths so that they route discovery frequency can be decreased and network performance will be increased. Syed Ali RazaZaidi et al presents analytical approach to determine energy efficiency [35] J.-E. Garcia et al describes energy efficient mechanism to prevent nodes from sharp drop of battery power.[36] They apply this mechanism to dynamic source routing (DSR) protocol. They describe the power aware rout discovery algorithm. They have used Dynamic Source Routing (DSR) based algorithm called Energy Dependent DSR. In this EDDSR mechanism nodes with small lifetime are not participating in route discovery process. This mechanism also modifies the route maintenance process of DSR protocol.

Nishant Gupta et al says that in On demand routing protocol nodes discovers and maintains route when required. They make this protocol energy aware in order to increase operational lifetime of network.Techniques uses a new routing cost metric which is a function of the remaining battery level in each node on a route and the number of neighbors of this node.[37]

AlexandreMassayuki et al designed a protocol to use metrics as heuristic information to support routing decisions according to the network needs, such as distance, latency, residual energy, and/or signal strength.[38] Their approach aims at using residual energy as a metric in ADHOP to distribute the network traffic load, thus balancing the energy consumption among nodes without compromising communication.Such method also allows us to achieve a routing algorithm powerful enough to reduce the energy consumption per delivered data in high data loss scenarios.

Rajgopal et al discusses the performance and comparison of different routing protocols of Mobile ad hoc networks based on the energy level. To reduce the energy consumption in AODV, DSR, they proposed enhanced AODV and enhanced DSR.[39].

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