Research Paper

ASTOUNDING IMPACT OF OVERHEARING ON ENERGY MANAGEMENT IN MANET

A. Karmel[1] and Dr. C. Jayakumar[2]

Address for Correspondence

[1]Assistant Professor (Sr), School of Computing Science & Engineering, VIT University, Chennai, Tamil Nadu, India. & Research Scholar, Anna University of Technology, Chennai 600 025, Tamil Nadu, India.

[2]Professor, Department of Computer Science and Engineering, RMK Engineering College, Kavaraipettai 601 206, Tamil Nadu, India.

ABSTRACT

In Mobile Ad hoc networks, though Overhearing improves the network performance by allowing nodes to collect route information, it takes the situation worst by wasting the available limited energy by overhearing the packets that are intended to a specific destination. The energy wasted by the neighboring nodes by receiving the packets from source that are not meant for it results complete energy drain out and poor network performance. Overhearing means a node receives a packet not addressed to it and these overhearing transmission produces unnecessary energy consumption. Overhearing avoidance approaches are designed only for unicast messages. New approaches for avoiding overhearing for broadcast /multicast messages in a dense network environment are still an open challenge. This article presents the impact of overhearing that result in poor energy conservation in high mobility and dense networks.

KEYWORDS - Battery power, Drain Rate, Energy Consumption, Mobile ad hoc network, Overhearing.

1. INTRODUCTION

In Mobile Ad hoc Network, the nodes are mobile devices that communicate dynamically in a random way. Mobile ad hoc networks Mobile Ad hoc network is a de-centralized multi-hop wireless network infrastructure, which can be setup anytime, anywhere [1]. MANETs can operate in several environments where conventional networks fail. Such superficial benefits bring forth the attention that these networks are suitable for many different applications like military, commercial, disaster management, rescue operations and defense applications. Mobile Ad hoc networks that operates on either rechargeable or replaceable batteries has same richness like usage, battery power consumption with respect to transmission range, type of application running on each device, location etc, all make energy conservation as a standard factor that indicate the overall network lifetime.

Even though it must works with respect to the absence of infrastructure that come from the type of applications which make the construction of this kind of network an important issue [2]. Overall the Energy Conservation plays a vital role in MANET due to the limited lifetime of mobile nodes and all mobile nodes depend on the limited battery power supply. In this situation, there is a necessity to avoid the energy consumed by the nodes that are not participating in the communication in a dense network. This paper presents a survey on the impact of overhearing that occurs in a mobile network environment.

2. SURVEY

2.1 Minimum Drain Rate Mechanism [MDR].

Dongkyum Kim et al proposed a Minimum Drain Rate (MDR) Mechanism [3] in which drain rate is used as a routing metric to predict the node lifetime. This mechanism also considers the energy consumed by the neighboring nodes by overhearing the transmitted packets. The energy Consumed by overhearing the packet transmission is equal to the energy consumed during transmission. The energy consumed by a node depends on the energy consumed during transmission, reception and overhearing of a packet by that node. In a dense network overhearing of packets results in maximum energy consumption that takes the network to a worst condition. New techniques should be proposed to minimize the energy consumption by switching the network interface cards into sleep state.

2.2 Reduction of Overhearing and Rebroadcasting [R-ROR]

Bhanumathi, V., and Dhanasekaran, R., proposed a Receiver based Signal Strength (RSS) [4][15] based Reduction of Overhearing and Rebroadcasting (R-ROR) mechanism to reduce unconditional and conditional overhearing which is a main criterion for energy consumption and control the rebroadcasting of RREQ that in turn minimizes the energy consumption and overhead in MANET. Overhearing Reduction Probability value is determined not to overhear unicast message. RSS value determines the distance of a node from the sender. If RSS value is small, the nodes are far away from the sender due to mobility. Experimental results proved that R-ROR mechanism achieves 30 joules of lesser energy compared to RandomCast and 3.2% improvement in Packet Delivery Ratio. Overall R-ROR is proved to be a better energy efficient mechanism compared to 802.11PSM and RandomCast.

2.3 Efficient Demand Based Energy Allocation Topology (EDBAT) Mechanism

Kureti Maheswara Rao & Ravichandra, M.L., proposed an Efficient Demand Based Energy Allocation Topology (EDBAT) [5] mechanism to reduce the effect of overhearing. DSR gathers the path information through overhearing. Overhearing enhances the routing effectiveness in DSR by eavesdropping additional communications to gather course info but it spends a significant amount of energy.

2.4 Power Aware Routing Optimization Model (PARO)

Javier Gomez et al proposed a Power Aware Routing Optimization Model (PARO) [8] to optimize the energy consumed during transmission. The model comprises of three algorithms namely, overhearing algorithm, redirecting algorithm and Route Maintenance algorithm. The overhearing algorithm creates an overhead table where the information about the current range of neighbor nodes are maintained. The redirecting algorithm computes

whether the route optimization through the any one of the intermediate node to achieve power saving. The overheard packets are then passed to packet classifier to take appropriate decision. The route maintenance algorithm ensures minimum flow of packets to maintain the route when there is no more packets at the sender. Authors also proved that PARO model consumes less energy to determine power efficient routes.

2.5 Waste Energy Cost Metric (WECM)Mechanism

K.S.Gupta et al proposed a self-managing, energy-efficient multicast routing suite based on the self-stabilization paradigm. They designed a Waste Energy Cost Metric (WECM) [9] for energy-efficient route selection. The WECM considers the overhearing energy wasted. The wastage energy is minimized during self-stabilization. None of the protocols takes into consideration the possible energy wasted due to reception of unwanted broadcast/multicast packets at the non-intended neighbor nodes. Such overhearing energy has a very high impact on the overall energy efficiency in case of group communication such as multicast [10].

2.6 RandomCast protocol Mechanism

S.Gomathi et al proposed a RandomCast protocol [11], designed to improve energy consumption by controlling the level of overhearing. In RandomCast Protocol, the source node sends the data to the destination by specifying the randomized overhearing using the Ad hoc Traffic Indication Message (ATIM) window. The randomized overhearing is based on the neighbor nodes of source node and it's intermediate nodes. If the node random value is greater than the threshold, it will receive the data transmitted by the source. Simulation results proved that the randomized overhearing improves the routing efficiency, Packet delivery Ration and Energy conservation in mobile networks.

2.7 Probability based Overhearing Mechanism

N.Sumathi and Dr.C.P.Sumathi proposed a Probability based overhearing method [12], to minimize energy consumed on overhearing nodes. During broadcast/Unicast transmission, the sender node determines the route considering probability overhearing, no overhearing, and unconditional overhearing specified in ATIM frame control. A node can overhear if it satisfies the probability based condition. A node is not allowed to overhear should go to low power sleep state. In unconditional overhearing, only one hop neighbor node can overhear. This method improves the available bandwidth and reduces energy consumed by overhearing nodes so that as much as possible bandwidth is available for actual data transmission.

2.7 Hibernation Mechanism

A hibernation mechanism [13,14] was proposed, to eliminate the power consumption during idle listening and overhearing mode. Every node that receives N beacon intervals, forms a cycle and enter the listen mode only once per cycle. Which is determined by the Hibernation Overhearing can be avoided by using the sequence of four operations RTS/CTS/DATA/ACK. The Network Allocation Vector can avoid the overhearing and save the power. This mechanism saves up to 70% of power consumption.

2.8 Impact of Overhearing on Proactive and Reactive Protocols

The overhearing activity drastically affects the performance since all the neighboring nodes of a sender node consume its own energy. To avoid overhearing problem at the data link layer, effective retransmission request schemes and switching off the non-participating nodes may be implemented to avoid overhearing. In the network layer, overhearing activity may be avoided by modifying the routing metrics to choose the routes that require less transmission power. Simulation results show the number of nodes died over time to lack of battery when considering the effect the overhearing. They also proved that the amount of energy wasted in overhearing is greater than 90% for DSR and OLSR protocols [7]. They concluded that the idle power and overhearing effects dominates the energy consumption especially in dense network environment.

2.9 Zero Overhearing

The energy consumption saved for overhearing the broadcast messages may be greater than the energy consumed for retransmissions in a lossy network [6]. The packet reception and packet overhearing consumes different energy levels. If a node overhears the whole data packet, it may consume a comparable amount of energy to reception, If a node overhears only the preamble, it may consume much less energy. In a slotted system, overhearing may be avoided by switching the node to idle state. But, switching between idle and active state consumes energy. Yuxi Li et al proposed a simplistic approach to model the overhearing energy consumption, which becomes 0 if no overhearing. The results proved that, with an Omni-directional antenna, overhearing is an important factor for energy efficiency.

2.10 AODV-Energy Based Routing Protocol [AODV-EBR]

AODV-Energy Based Routing [EBR] was proposed [16] especially for energy constrained mobile ad hoc networks. Due to the limited battery power, drain out of energy from the nodes may occur frequently by overhearing the message even if the node is in idle mode. AODV-EBR protocol determines a new active route to manage the node with minimum energy to avoid partitioning of network and to deliver the data packets with minimum packet drop. In AODV-EBR, each node along with the HELLO packets reports their energy level to the neighboring nodes. The active route is determined based on the energy level of the nodes.

3. CONCLUSION

The study on the impact of overhearing when estimating the energy consumption arise the necessity for developing an optimized algorithm that consider overhearing as one of the mandatory metric to evaluate the energy consumption in mobile ad hoc networks. The impact of overhearing results in energy consumption by the nodes as shown in Figure 1. Thus we conclude that the optimization

algorithm must be designed in such a way that the quantity of overhearing must be minimized when transmitting unicast, broadcast and multicast messages.

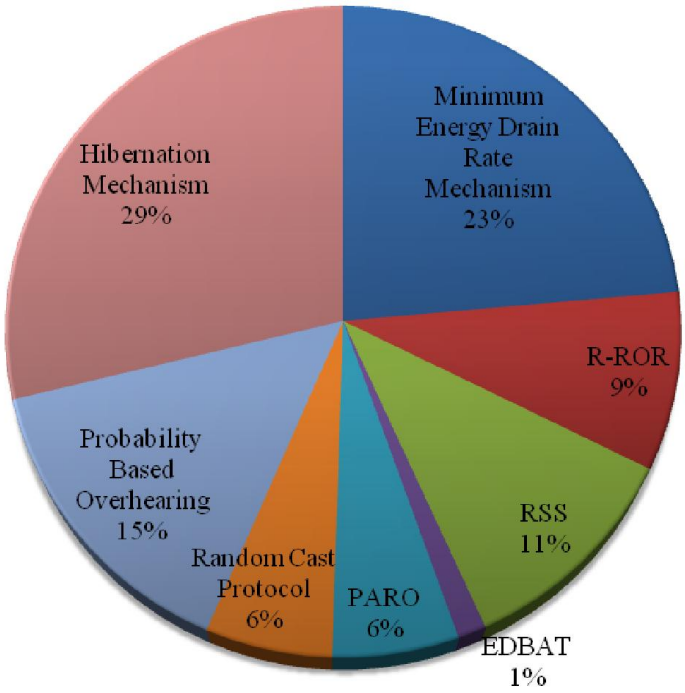

Figure 1.Energy Consumption (%) in Various Energy Efficient Mechanisms

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