A STUDY ON EFFICIENT ENERGY MANAGEMENT SYSTEM IN ADHOC WIRELESS NETWORKS

A . Emmanuel Peo Mariadas
Research Scholar,
Department of Computer Science and Engineering,
Annamalai University, Tamil Nadu , India.
emmanuelpeo@gmail.com

Dr. R .Madhanmohan
Assistant Professor,
Department of Computer Science and Engineering,
Annamalai University, Tamil Nadu , India.
madhanmohan_mithu@yahoo.com.

ABSTRACT

A Mobile Ad-hoc Network (MANET) is a self-configuring network composed of mobile nodes without any fixed infrastructure. Wireless adhoc networks can be used to manage services anywhere and anytime. Ad hoc networks enable users to spontaneously construct a dynamic communication system. They do users to retrieve the services offered by the fixed network over multihop communications, without requiring infrastructure in the user immediacy. Wireless networks are come at from all sides by demand of communication bandwidth and correctly a key issue is to become user requests with minimum service delay. Network nodes have limited energy resources; the energy expended for transferring information across the network has anticipated minimized. Adhoc wireless networks are constrained by restrictive battery power, which makes energy management an important issue. Adhoc Networks are more active to these issues where each mobile device is act like a router and consequently, routing delay adds considerably to everywhere end-to end delay. In this paper , focus on energy management schemes, energy efficient routing Protocol which tries to approach the challenge of using battery power efficiently.

Keywords: Adhoc Networks, Energy Management, Routing Protocols.

I.INTRODUCTION

An Efficient battery management and transmission power management hugely deals with Energy management. In few years, there has been an explosive growth of interest in mobile computing [11], as well as in delivering World Wide Web content and streaming traffic to radio devices. There is a huge potential market for providing personal communication systems with access to airline schedules, weather forecasts, or location-dependent information. However, to offer high-quality and low-cost services to ad hoc network nodes, several technical challenges still need to be addressed. Mobile ad-hoc networks can turn the vision of getting connected "anywhere and at any time" into reality. Recent advancements such as Bluetooth introduced a new type of wireless systems known as mobile ad-hocnetworks. Mobile ad-hoc networks or "short live" networks operate in the absence of fixed infrastructure. Nodes in mobile ad hoc networks are constrained by limited battery power for their operation. Hence, energy efficiency is an important issue in adhoc networks.

The characteristics of mobile networks are summarized as follows:
• Communication via wireless means.
• Performance of nodes can be the roles of both hosts and routers.
• No centralized controller and infrastructure.
• Dynamic network topology.
• Frequent routing updates.
• Autonomous, no infrastructure needed.
• Can be set up anywhere.
• Energy constraintsand Limited security.

A. Why Energy Management isneededin Ad hoc Networks

In adhoc wirelessnetworks,mobile computation devices are usually battery powered. A limited energy budget constrains the computation and communication capacity of each device. Energy resources and computation workloads have different distributions within the network. Devices that expend all their energy can only be recharged when they leave the network. In wireless networks, the ratio of computation energy consumption to communication energy consumption varies in a wide range, depending on application type.

In some applications like micro sensor networks, communication dominates energy   consumption. In other application domains and applications like simulation, artificial intelligence, target detection, handwriting recognition, and voice recognition computation energy consumption generally dominates communication energy consumption.

B. Reasons for energy management in Ad hoc networks

1) Limited energy reserve:
The ad hoc networks have limited energy reserve. The improvement in battery technologies is very slow as compared to the advances in the field of mobile computing and communication.

2) Difficulties in replacing the batteries:
In situations like battlefields, natural disasters such as earthquakes, and so forth, it is very difficult to replace and recharge the batteries.Thus, in such situations, the conservation of energy is very important.

3) Lack of central coordination:
Because an ad hoc network is a distributed network and there is no central coordinator, some of the nodes in the multihop routing should act as a relay node. If there is highest relay traffic, this leads to preferably power consumption at the respective relay node.

4) Constraints on the battery source:
The weight of the nodes may increase with the weight of the battery at that node. If the weight of the battery is decreased, that in turn will lead to less power of the battery and thus decrease the life span of the battery. Thus, energy management techniques must deal with this issue; in addition to reducing the size of the battery, they must utilize the energy resources in the best possible way.

5) Selection of optimal transmission power:
The increase in the transmission power increases the consumption of the battery charge. Because the transmission power

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decides the reachability of the nodes, an optimal transmission power decreases the interference between nodes, and that in turn increases the number of simultaneous transmissions [17].

II.CLASSIFICATION OF ENERGY MANAGEMENTSCHEMES

A better understanding of the capabilities and limitations of the energy resources of the nodes is maintained to improve the life of an ad hoc wireless network. A longer lifetime of the node can be achieved by increasing the battery capacity. Increasing the capacity of the battery at the nodes can be achieved by either battery management, which concerns the internal characteristics of the battery, or power management, which deals with utilizing the battery capacity to the maximum possible extent. The Figure (a) shows an overview of Energy management system.

The main three categories of Energy management system can be divided into:
- **Battery management system**
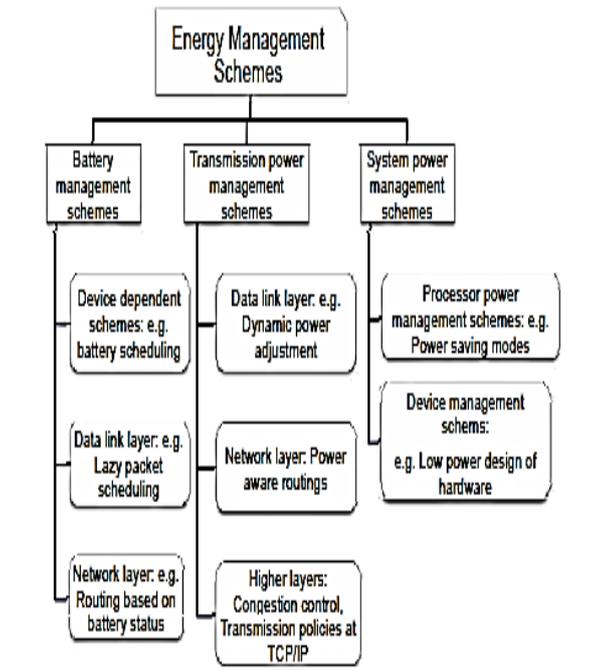- **Transmission power management**
- **System power management**

Figure (a) : Classification of Energy Management System

III.POWER MANAGEMENT OF ADHOC NETWORKS

The equipment in ad hoc networks permanently uses exhaustible energy as their power supply such as batteries .[16][17].
The genuine fact that mobile computing is evolving rapidly with advances in wireless communications and devices getting smaller and more efficient, advances in battery technology have not yet reached the stage where a mobile computer can operate for days without recharging[18].
Therefore, advancedpower conservation techniques are necessary. A variety oftechniques can be used to cope with power scarcity.

The Table1 shows the power management at various protocol layers.

Protocol Layer	Power Conservation Techniques
Data-Link Layer	Avoid unnecessary retransmission. Avoid collision in channel access whenever possible. Put receive in standby mode wheneverpossible. Use or allocate contiguous slots for transmission and reception whenever possible.Turn radio off (sleep) when not transmitting orreceiving.
Network Layer	Consider route relaying load.Consider battery life in route selection. Reduce frequency of sending control message. Optimize size of control headers. Efficient routereconfiguration techniques.
Transport Layer.	Avoid repeated retransmissions. Handle packetloss in a localized manner. Use power-efficienterror control schemes.
Application Layer	Adopt an adaptive mobile quality of service (QoS) framework. Move power-intensive computation from a mobile host to the basestation. Use proxies for mobile clients. Proxiescan be designed to make applications adapt topower or bandwidth constraints. Proxiescanintelligently cachefrequently used information, suppress video transmission and allow audio, and employ a variety of method to conservepower.

Table 1: Power Management at Various Layers

IV.ENERGY MANAGEMENTIN AD HOC NETWORKS

A very important aspect of the overall management of ad hoc networks is the energy management [2]. The mobile wireless sensor nodes in the field need to conserve energy and use it optimally in order to play the assigned role in an ad hoc network for a longer period of time.A various levels of Energy management are: Component level ,System level and Network level.

1. Component Level Energy Management
Component level energy management (CEM) [3] gives an opportunity to control the energy utilization by various components of a system. There are several components that are part of a system that get used during initialization, and other components that get used at irregular intervals. By a suitable design, if the energy consumed by these components during idle time can be reduced close to zero, the main operation of the system can be better sustained.

2. System Level Energy Management
Adhoc wireless networks carrying different kinds of traffic. A node in such a network is the system under consideration and considers a scenario in which multiple tasks handle traffic of different kinds. If we use the available energy in appropriateway it may be better to trade-off low priority traffic so as to be able to handle high priority traffic [10].

3. Network Level Energy Management
The issues related to energy management are deled at Network level. The objective is to conserve energy at network level by cooperating loading of neighboring nodes.

V. ENERGY EFFICIENT PROTOCOL

The major challenge in wireless networks is obviously Energy efficiency. To facilitatecommunication, most wireless

network devices are portable and battery-powered, and thus operate on an extremely constrained energy budget. However, progress in battery technology shows that only small improvements in battery capacity can be expected in the near future.Likewise recharging or replacing batteries is expensive or, under some situation, impossible, it is appropriate to keep the energy dissipation level of devices low.

An Adhoc network is a collection of two or more nodes equipped with wireless communications and networking capabilities without central network control, namely, an infrastructure less mobile network.

The important and challenging networks is Energy-efficient design in ad hoc networks is preferably than with other wireless networks. First, due to the absence of an infrastructure, nodes in an ad hoc network must act as routers and join in the process of forwarding packets. Therefore, traffic loads in ad hoc network are heavier than in other wireless networks with fixed access points or base stations, and thus ad hoc network have more energy consumption.

Second, the trade-offs between different network performance criteria is needs directs to energy-efficient design.

Third, no centralized control implies that energy-efficient managementmust be done in a distributed and cooperative manner, whichis difficult to achieve [5] [7]. In the wireless interface, energyconsumption in idle mode is only slightly less than in transmitmode and almost equal to that of receive mode. Therefore, anetwork protocol is needed to maximize the time a device is insleep mode and also maximizes the number of wirelessdevices that can be in sleep mode. Many protocols have beenproposed to deal with this challenge. Here we are discussingabout the Energy Efficient Medium Access Control Protocol.

A.   Energy-Efficient Medium Access Control (EE-MAC)Protocol

The Energy-Efficient Medium Access Control (EE-MAC) Protocol is based on the circumstance that most applications of ad hoc networks are data driven, which approach that the sole purpose of forming an ad hoc network is to make and resolve data.Hence, keeping all network nodes awake is costly andunnecessary when some nodes do not have traffic to carry [7].The protocol conserves energy by turning on and off theradios of specific nodes in the network. The goal is to reduceenergy consumption without significantly reducing networkperformance. The key idea of EE-MAC is to select masternodes from all nodes in the network. Master nodes stay awakeall the time and act as a virtual backbone to route packets inthe ad hoc network. Other nodes, called "slave nodes," remainin an energy efficient mode and wake up periodically onlyduring signal intervals to check whether they have packets toreceive [5].

B.   Features of EE-MAC Protocol:

In EE-MAC the mastersdon't operate in power saving mode and forward packets allthe time, the packet delivery ratio and packet delay can beimproved.

The features of EE-MAC are
- Entering Sleep Mode Earlier
- Priority processing of packets to slaves
- Prolonging the sleep period for slaves

Performance:

Our main concern is energy efficiency; energylevel is given higher weight than connectivity. considersome metrics to evaluate the network performance which willdiffer from those used by others.
- Data Packet Delivery Ratio.
- End-to-end delay.
- Energy efficiency.

VI.   CONCLUSION

In this paper, the study of energy consumption behaviour of various routing protocols is being analysed and discussed how to perform energy efficiently in wireless ad hoc networks. Because the nodes are mobile and can be used for emergency purposes like military or natural disasters, each node should employ its battery efficiently. Some of the problems which are faced meanwhile managing energy and are limited energy reserve, difficulties in replacing batteries, demand of central coordination, and constraints on the battery source. Furthermore, energy management in Ad hoc Networks at various levels like Component, System and Network, as well as the energy management schemes, power management in Ad hoc Networks. The challenge is not to grant each node with higher battery power but to handle the available battery power in a very efficient manner. We dealt with Energy-Efficient Medium Access Control (EE-MAC) Protocol which tries to approach the challenge of using battery power efficiently.

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