IJRD International Journal of Research & Development Organisation
ISSN-4567-7860
Journal Of Electrical And Electronics Engineering

Study Of Different Routing Protocols for Mobile Ad Hoc Network for Energy Conservation

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Abstract - Recent advances in wireless sensor networks have led to many new protocols specifically designed for sensor networks where energy awareness is an essential consideration. Although establishing correct and efficient routes is an important design issue in mobile ad hoc networks (MANETs), a more challenging goal is to provide energy efficient routes because mobile nodes' operation time is the most critical limiting factor.

A WSN is a specialized wireless network made up of a large number of sensors and at least one base station. The foremost difference between the WSN and the traditional wireless networks is that sensors are extremely sensitive to energy consumption. Energy saving is the crucial issue in designing the wireless sensor networksThis paper surveys recent routing protocols for sensor networks and presents a classification for the various approaches pursued also a review on network structure based routing protocol in WSNs is carried out.Energy consumption and network life time has been considered as the major issues . The purpose of this paper is to facilitate the research efforts in combining the existing solutions to offer a more energy efficient routing mechanism.

Keywords— wireless sensor networks; routing protocols; Energy consumption; energy efficient routing.

I. INTRODUCTION

Mobile devices coupled with wireless network interfaces will become an essential part of future computing environment consisting of *infra-structured* and *infrastructure-less* mobile networks [1]. Wireless local area network based on IEEE 802.11 technology is the most prevalent infra-structured mobile network, 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 multi hop network where each node communicates with other nodes directly or indirectly through intermediate nodes. Thus, all nodes in a MANET basically function as mobile routers participating in some routing protocol required for deciding and maintaining the routes. Since MANETs are infrastructure-less, self-organizing, rapidly deployable wireless networks, they are highly suitable for applications involving special outdoor events, communications in regions with no wireless infrastructure, emergencies and natural disasters, and military operations [2,3].

A WSN is a specialized wireless network made up of a large number of sensors and at least one base station. The sensor nodes are small devices that consists of four basic components 1) sensing subsystem , 2) processing subsystem, 3) wireless communication subsystem 4) energy supply subsystem. The sensor nodes have limited battery power, communication range and memory etc. In most cases, the sensors forming these networks are deployed randomly and left unattended to and are expected to perform their mission properly and efficiently. Sensor networks are also energy constrained since the individual sensors are extremely energy constrained .

Recent advances in micro-electro-mechanical systems (MEMS) and low power and highly integrated digital electronics have led to the development of micro sensors [4][5][6][7][8]. Such sensors are generally equipped with data processing and communication capabilities. The sensing circuitry measures ambient conditions related to the environment surrounding the sensor and transforms them into an electric signal. Processing such a signal reveals some properties about objects located and/or events happening in the vicinity of the sensor. The sensor sends such collected data, usually via radio transmitter, to a command center (sink) either directly or through a data concentration center (a gateway). The decrease in the size and cost of sensors, resulting from such technological advances, has fueled interest in the possible use of large set of disposable unattended sensors. Such interest has motivated intensive research in the past few years addressing the potential of collaboration among sensors in data gathering and processing and the coordination and management of the sensing activity and data flow to the sink. A natural architecture for such collaborative distributed sensors is a network with wireless links that can be formed among the sensors in an ad hoc manner.

II. LITURETURE REVIEW

A. Routing Protocols for Mobile Ad Hoc Networks

The routing protocols proposed for MANETs are generally categorized as *table-driven* and *ondemand driven* based on the timing of when the routes are updated. With table-driven routing protocols, each node attempts to maintain consistent, up-to-date routing information to every other node in the network. This is done in response to changes in the network by having each node update its routing table and propagate the updates to its neighboring nodes. Thus, it is *proactive* in the sense that when a packet needs to be forwarded the route is already known and can be immediately used. As is the case for wired networks, the routing table is constructed using either *link-state* or *distance vector* algorithms containing a list of all the destinations, the next hop, and the number of hops to each destination. Many routing protocols including *Destination-Sequenced Distance Vector (DSDV)* [9] and *Fisheye State Routing (FSR)* protocol [10] belong to this category, and they differ in the number.

B. Energy Efficient MANET Routing

In contrast to simply establishing correct and efficient routes between pair of nodes, one important goal of a routing protocol is to keep the network functioning as long as possible. As discussed in the Introduction, this goal can be accomplished by minimizing mobile nodes' energy not only during active communication but also when they are inactive. *Transmission power control* and *load distribution* are two approaches to minimize the active communication energy, and *sleep/power-down mode* is used to minimize energy during inactivity. Before presenting protocols that belong to each of the *energy-related metrics* that have been used to determine energy efficient routing path instead of the shortest one are discussed. They are [11]

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

The first metric is useful to provide the *minpower path* through which the overall energy consumption for delivering a packet is minimized. Here, each wireless link is annotated with the link cost in terms of transmission energy over the link and the min-power path is the one that minimizes the sum of the link costs along the path. However, a routing algorithm using this metric may result in unbalanced energy spending among mobile nodes. When some particular mobile nodes are unfairly burdened to support many packet-relaying functions, they consume more battery energy and stop running earlier than other nodes disrupting the overall functionality of the ad hoc network.

A WSN can have network structure based or protocol operation based routing protocol. Routing protocols in WSNs might differ depending on the application (Protocol-Operation-based) and network architecture (Network-Structure-based). Based on the underlying network there are three protocol categories:

a. Flat Routing Each node plays the same role and sensor nodes collaborate to perform the sensing task.

b. Hierarchical Routing Higher-energy nodes are used to process and send the information, while low-energy nodes are used to perform the sensing in the proximity of the target. The creation of clusters and assigning special tasks to cluster heads can greatly contribute to overall system scalability, lifetime, and energy efficiency. Hierarchical routing is an efficient way to lower energy consumption within a cluster, performing data aggregation and fusion in order to decrease the number of transmitted messages to the sink node.

c. Location-based sensor nodes are addressed by means of their locations. The distance between neighboring nodes can be estimated on the basis of incoming signal strengths. Relative coordinates of neighboring nodes can be obtained by exchanging such information between neighbors or by communicating with a satellite using GPS. To save energy, some locationbased schemes demand that nodes should go to sleep if there is no activity. Depending on the ***Protocol Operation*** we can divide routing protocols in: ***Multipath-based.*** They use multiple paths rather than a single path in order to enhance network performance. For instance the fault tolerance can be increased by maintaining multiple paths between the source and destination at the expense of increased energy consumption and traffic generation. *Query-based* The destination nodes propagate a query for data from a node through the network, a node with this data sends the data that matches the query back to the node that initiated it. *Negotiation-based* Use negotiation in order to eliminate redundant data transmissions. Communication decisions are also made based on the resources available.

QoS-based When delivering data, the network balances between energy consumption and data quality through certain QoS metrics as delay, energy or bandwidth.

Coherent-based The entity of local data processing on the nodes distinguish between coherent (minimum processing) and non-coherent (full processing) routing protocols.

III. CONCLUSION

One of the main challenges in the design of routing protocols for WSNs is energy efficiency due to the scarce energy resources of sensors. The energy consumption of the sensors is dominated by data transmission and reception. Therefore, routing protocols designed for WSNs should be as energy efficient as possible to prolong the lifetime of individual sensors, and hence the network lifetime. The protocols discussed have individual advantages and pitfalls. Based on the topology, the protocol and routing strategies can be applied. For realization of sensor networks, it is needed to satisfy the constraints introduced by factors such as fault tolerance, scalability, cost, topology change, environment, and power consumption.

Routing in sensor networks has attracted a lot of attention in the recent years and introduced unique challenges compared to traditional data routing in wired networks. In this paper, we have summarized recent research results on data routing in sensor networks and classified the approaches into three main categories, namely data-centric, hierarchical and location-based. Few other protocols followed the traditional network flow and QoS modeling methodology.

A mobile ad hoc network (MANET) consists of autonomous, self-organizing and self-operating nodes, each of which communicates directly with the nodes within its wireless range or indirectly with other nodes via a dynamically computed, multi-hop route. Due to its many advantages and different application areas, the field of MANETs is rapidly growing and changing. While there are still many challenges that need to be met, it is likely thatMANETs will see widespread use within the next few years.

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