

Chapter 6

Energy Aware Optimized Routing Protocols for Wireless Ad Hoc Sensor Network

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ABSTRACT

Advancement in wireless technology made human life become simple and easy going. Wireless Ad Hoc Sensor Network (WASN) is one of the friendly wireless networks used to monitor the most unfriendly and ever changing dynamic environment that restricts continuous human attention. WASN has drawn significant attentions due to its unique capabilities to deal with complex network operation in highly resource constrained network construct. This ad hoc and unstructured deployment of tiny sensor nodes operate with controlled transmission range, processing capabilities, as well as very limited battery backup. The severe power depletion affects the existence of active nodes. Hence, data forwarding and reliable packet routing in such phenomenon oriented network becoming a challenge. In this chapter the clustering and hierarchical routing approaches for WASN environment has been briefly presented followed by some optimization strategies applicable to cluster routing process. This chapter can help researchers to think fresh dimensions of ongoing research in WASN cluster routing.

INTRODUCTION

Routing is the act of moving data and information from a source point to a destination point via intermediate nodes, called multi hopping in packet routing. But, collecting and gathering data at some universal destination point is quite difficult as there is always a chance of unpredictable power depletion, resulting packet

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loss and network delay. That leads to early breakdown of the whole network structure. Ad hoc capability in real time network setting makes wireless routing critical due to ever changing routing path with respect to different instance of time. Active research in wireless ad hoc and mobile sensor kind of network is being carried out in the field of routing, resource management, power control, security etc. The consideration of energy for making routing process efficient is the best way to deal with any of these issues by extending network operation. There are several more considerations that make the designing of WASN protocol a tough task. Moreover, unpredictable node displacement causes frequent topology change and network partitioning. The short range and variable capability link makes the chance of packet loss higher. Additionally, mobility of sensor nodes draws more power and makes the routing process power hungry that, affects the sustainability of routing path prior to the packets reaches to its intended destination. Techniques like multicasting, broadcasting, flooding, clustering provides significant support in routing and continuously providing a base for further optimization in modeling new energy aware routing protocols.

Severe power depletion strongly affects the existence of active nodes and the network operation too. In order to prolong the network utilization, several power management approaches are available that efficiently reduce the energy consumption individually in each sensor as well as in the whole network. Several studies say, due to natural real time dynamic behaviors and complexities of ad hoc wireless nodes, the use of traditional methods for enhancing quality and durability in the process of routing become a challenging job. Optimization is very helpful in creating the appropriate trade-off between different conflicting parameters to get the best possible outcome. The potential paradigms of evolutionary computation and soft-computing based heuristics can be compatible with network setting to overwhelm the complexities. Two major issues in wireless sensor networks are energy efficiency and quality of service. Bio-inspired evolutionary meta-heuristics can be able to optimize current clustering and routing protocols to maximize quality of services and efficiency in terms of energy.

This chapter will give state of the art ideas and reviews on energy aware cluster routing schemes and discussed further enhancements and optimizations that has being carried out for smooth and prolonged network routing operation, followed by a brief conclusion.

BACKGROUND

Routing

Routing is the act of selecting best path or links in the network for transmitting data and information across the route from source to destination. The routing protocols are the part of the network layer which decides what should be the succeeding intermediate node for the packet based on certain metrics that evaluate quality and goodness of the travelling path. A metric is a measurement which can be path bandwidth, reliability, delay, current load on that path, energy usages, link quality etc. Routing protocols maintain routing tables with several parameters based information among which, destination or next hop ID through which the router will route the packets so that intended destination can be optimally achieved. Some of the routing protocols allow a router to have numerous “intermediate hop” for a single destination depending upon different metrics. It compares metrics depending on the objective of the routing protocol to find optimal routes. Routers maintain their routing tables by communicating variety of messages. For example, link-state advertisement informs other routers about the state of the sender’s links, so that optimal routes to destinations can be traced out. There are certain properties for routing protocols:

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