Chapter 8
Power Aware Routing in Wireless Mobile Ad Hoc Networks

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ABSTRACT

Wireless mobile ad hoc networks are gaining importance because of their flexibility, mobility, and ability to work with a limited infrastructure. If the battery of a node is drained out, then it cannot communicate with other nodes and the number of dead nodes makes the network partition. In order to overcome the network partition problem, this chapter presents different routing algorithms for wireless mobile ad hoc networks. Different routing algorithms use different metrics, namely transmission power, residual battery capacity and noncritical nodes to forward data packets from the source to destination. Minimum total transmission power routing uses the transmission power as metric to forward the packets but it cannot increase the lifetimes of the node and network. In conditional max-min battery capacity routing, it increases network lifetime and reduces power consumption over the network. Noncritical nodes with more residual battery capacity based routing models will increase the network lifetime and network throughput.

1. INTRODUCTION

A Mobile Ad hoc Network (MANET) is a wireless network that does not have a fixed infrastructure that is formed by an autonomous collection of mobile nodes, and communicates over wireless links. Because of node mobility, the topology will change rapidly and unpredictably over short periods of time. In the MANET, each mobile node acts as a router as well as host. This means that all the nodes participating in the network have to send and receive the data packets. Depending on the transmission range and current location of the node, the node can get in and out, forming a network in an arbitrary fashion. The network partition is a problem in MANET environments and inconsistency can prove to be very costly in mobile computation scenarios (De Moraes, Sadjadpour & Garcia-Luna-Aceves, 2006). Mobile nodes interact with other over wide spaces.

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Therefore, inconsistency can be propagated indefinitely, causing unrecoverable damage in all of the critical applications. Nodes with higher mobility have more link failures than more slowly moving nodes. It leads to the communication failures/ disconnections caused by the nodes moving out of the coverage area (Chao, Sheu & Chou, 2006). The conventional routing protocols of MANETs do not consider transmission power as a design constraint. Hence, these routing protocols work towards optimizing paths in terms of delay and host, which usually results in the shortest path. A higher degree of nodes die soon since they are being used in most of the cases. The problem of routing in MANETs is complicated by node mobility, which results in the transmission of frequent topology updates that are required to optimize the paths. The regular updates need greater bandwidth and power and take more message overhead. The basic structure of a MANET environment is shown in Figure 1. The types of mobile devices and their applications range from laptops, PDAs and notebooks to cell phones. Most of these devices currently perform all the tasks of traditional PCs with the advantage of portability. The MANET is a good alternative network in rural areas, where installing basic communication infrastructure is not feasible. Another interesting application of the MANET is ubiquitous computing. Here, the intelligent nodes are used for communications (Ma & Yang, 2005).

The difference between ad hoc networks and traditional wireless networks is the absence of a centralized base station. In the MANET, there are many routing protocols used to determine an optimal path from the source to the destination. The hop-count is used in various routing algorithms like Dynamic Source Routing (DSR), Destination Sequenced Distance Vector (DSDV), Temporally Ordered Routing(TORA), etc. The conventional models use delay and throughput as metrics to forward the packets from one node to another. The DSR protocol outperforms the AODV model in less stressful situations that have a reduced number of nodes, low load and low mobility. The AODV protocol outperforms the DSR model in more stressful situations by widening performance gaps and by increasing stress in the

Figure 1. Structure of MANET