Chapter 4

MULTICASTING IN AD HOC NETWORKS

Prasant Mohapatra, Jian Li, and Chao Gui
Department of Computer Science
University of California
Davis, CA 95616
prasant, lijian, guic@cs.ucdavis.edu

Abstract
The widespread use of mobile and handheld devices is likely to popularize ad hoc networks, which do not require any wired infrastructure for intercommunication. The nodes of mobile ad hoc networks (MANETs) operate as end hosts as well as routers. They intercommunicate through single-hop and multi-hop paths in a peer-to-peer fashion. Most applications of MANETs require efficient support for multicast communications in which a node can communicate with multiple other nodes exploiting the broadcast nature of wireless channels. In this chapter, we first provide a classification approach of the multicasting techniques in mobile ad hoc networks, followed by the description of the protocols. Overarching issues such as energy efficiency, reliability, quality of service, and security have been also addressed. Several intriguing issues have been identified for further investigation on this topic.

Keywords: Mobile ad hoc networks, Multicasting, Broadcasting, Energy-efficient routing, Quality of service.

4.1 Introduction
The wireless mobile networks and devices are becoming increasingly popular as they provide users access to information and communication anytime and anywhere. The conventional wireless mobile communication is usually supported by a wired fixed infrastructure (like ATM or Internet). The mobile devices use single-hop wireless radio communication to access a base station that connects it to the wired infrastructure. In contrast, the class of mobile ad hoc networks (MANETs) does not use any fixed infrastructure. The nodes of MANETs intercommunicate through single-hop and multi-hop paths in a peer-to-peer fashion. Intermediate nodes between a pair of communicating nodes act...
as routers. Thus the nodes in MANETs operate both as hosts as well as routers. The nodes are mobile, and so the creation of routing paths is affected by the addition and deletion of nodes. The topology of the network may change rapidly and unexpectedly. Figure 4.1 shows an example of a mobile ad hoc network.

![Figure 4.1. A mobile ad hoc network.](image)

MANETs are useful in many application environments and do not need any infrastructure support. Collaborative computing and communications in smaller areas (buildings, organizations, conferences, etc.) can be set up using MANETs. Communications in battlefields and disaster recovery areas are other examples of application environments. Similarly communications using a network of sensors, and inter-island communications using floats over water are other potential applications of MANETs. The increasing use of collaborative applications and wireless devices may further add to the needs and usages of MANETs. Many of these potential applications of MANETs involve point-to-multipoint communication, and thus would benefit from multicasting support in the network layer.

Intercommunication in MANETs differs from that of wired networks in the following aspects.

- The wireless communication medium has variable and unpredictable characteristics. The signal strength and propagation delay fluctuate with respect to time and environment.

- The bandwidth availability and battery power are limited in mobile ad hoc networks. Thus the algorithms and protocols need to conserve bandwidth as well as energy.

- The computing components (processors, memory, I/O devices) used in wireless devices usually have low capacity and limited processing power. Thus the protocols for communications need to be lightweight in terms of computational and storage needs.