

Chapter 3.15

Mobile Ad Hoc Network

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INTRODUCTION

A mobile ad hoc network (MANET) is a temporary, self-organizing network of wireless mobile nodes without the support of any existing infrastructure that may be readily available on conventional networks. It allows various devices to form a network in areas where no communication infrastructure exists. Although there are many problems and challenges that need to be solved before the large-scale deployment of an MANET, small and medium-sized MANETs can be easily deployed.

The motivation and development of MANET was mainly triggered by Department of Defense (DoD)-sponsored research work for military applications (Freebersyser and Leiner, 2002). In addition, ad hoc applications for mobile and dynamic environments are also driving the growth of these networks (Illyas, 2003; Perkins, 2002; Toh, 2002). As the number of applications of

wireless ad hoc networks grows, the size of the network varies greatly from a network of several mobile computers in a classroom to a network of hundreds of mobile units deployed in a battlefield, for example. The variability in the network size is also true for a particular network over the course of time; a network of a thousand nodes may be split into a number of smaller networks of a few hundred nodes or vice versa as the nodes dynamically move around a deployed area.

Ad hoc networks not only have the traditional problems of wireless communications like power management, security, and bandwidth optimization, but also the lack of any fixed infrastructure, and their multihop nature poses new research problems. For example, routing, topology maintenance, location management, and device discovery, to name a few, are important problems and are still active areas of research (Wu & Stojmenovic, 2004).

Characteristics of MANET

- **Mobile:** The nodes may not be static in space and time, resulting in a dynamic network topology.
- **Wireless:** MANET uses a wireless medium to transmit and receive data.
- **Distributed:** MANET has no centralized control.
- **Self-organizing:** It is self-organizing in nature.

A message from the source node to destination node goes through multiple nodes because of the limited transmission radius.

- **Scarce resources:** Bandwidth and energy are scarce resources.
- **Temporary:** MANET is temporary in nature.
- **Rapidly deployable:** MANET has no base station and, thus, is rapidly deployable.
- **Neighborhood awareness:** Host connections in MANET are based on geographical distance.

SOME BUSINESS AND COMMERCIAL APPLICATIONS OF MANET

An ad hoc application is a self-organizing application consisting of mobile devices forming a peer-to-peer network where communications are possible because of the proximity of the devices within a physical distance. MANET can be used to form the basic infrastructure for ad hoc applications.

Some typical applications are as follows:

- **Personal-area and home networking:** Ad hoc networks are quite suitable for home as well as personal-area networking (PAN) applications. Mobile devices with Bluetooth or

WLAN (wireless local-area network) cards can be easily configured to form an ad hoc network. With Internet connectivity at home, these devices can easily be connected to the Internet. Hence, the use of these kinds of ad hoc networks has practical applications and usability.

- **Emergency services:** When the existing network infrastructure ceases to operate or is damaged due to some kind of disaster, ad hoc networks enable one to build a network and they provide solutions to emergency services.
- **Military applications:** On the battlefield, MANET can be deployed for communications among the soldiers in the field. Different military units are expected to communicate and cooperate with each other within a specified area. In these kinds of low-mobility environments, MANET is used for communications where virtually no network infrastructure is available. For example, a mesh network is an ad hoc peer-to-peer, multihop network with no infrastructure. The important features are its low cost, and nodes that are mobile, self-organized, self-balancing, and self-healing. It is easy to scale. A good example is SLICE (soldier-level integrated communications environment), a research project sponsored by DARPA (Defense Advanced Research Projects Agency) in this area for this need. The idea is that every soldier is equipped with a mobile PC (personal computer) with a headset and a microphone. SLICE is supposed to create mesh networks that handle voice communications while mapping whereabouts of soldiers and their companions.
- **Ubiquitous and embedded computing applications:** With the emergence of new generations of intelligent, portable mobile devices, ubiquitous computing is becoming a reality. As predicted by some researchers (Weiser, 1993), ubiquitous computers will

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