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INTRODUCTORY APPROACH ON AD-HOC NETWORKS AND ITS PARADIGMS

Mehtab Singh Kahlon

Institute of Engineering & Technology, Bhaddal

Abstract: *An ad-hoc wireless network is a collection of wireless mobile nodes that self-configure to construct a network without the need for any established infrastructure or backbone. Ad hoc networks use mobile nodes to enable communication outside wireless transmission range. With the advancement in wireless communications, more and more wireless networks appear, e.g., Mobile Ad Hoc Network (MANET), Wireless Sensor Network (WSN), etc. So, in this paper we have discussed Ad Hoc Networks along with its energy issues, applications, QoS and challenges.*

Keywords: - Ad-Hoc Wireless Networks, Routing, MANET.

I. INTRODUCTION

Ad-Hoc is a decentralized wireless network. The network is ad hoc because it does not rely on a preexisting infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, and so the determination of which nodes forward data is made dynamically based on the network connectivity. A mobile ad hoc network, also called a mobile mesh network, is a self-configuring network of mobile devices connected by wireless links. Wireless networks can be classified into two types: Infrastructure based networks and Infrastructure less (Mobile Ad hoc) Networks. Infrastructure based network consists of a network with a fixed and wide gateways. Mobile hosts communicate with a bridge in the network (called base station) within its communication radius. A lack of infrastructure presents problems with centrally controlled security, for example access control, which is traditionally maintained by a central server. Also security Mechanisms involving trusted third parties may no longer be viable in ad hoc networks. Figure 1 shows the working of general Ad Hoc Network.

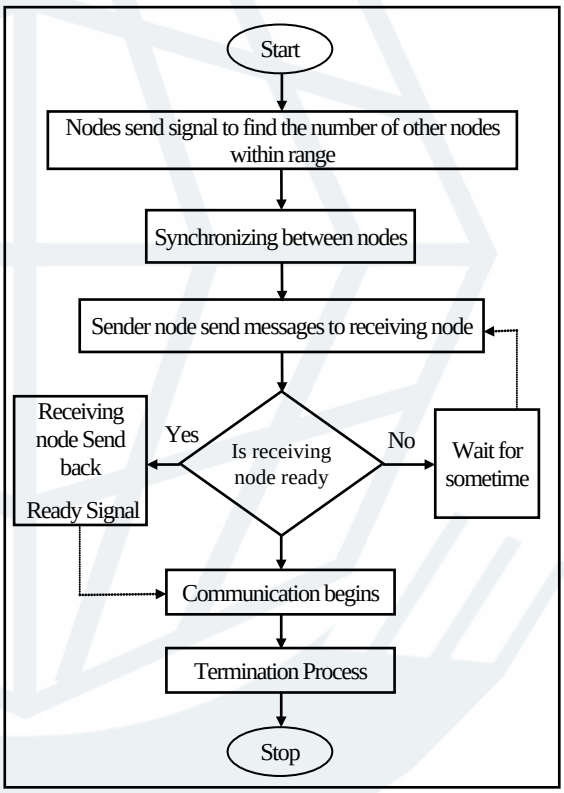

Fig.1: Working of Ad Hoc Network [1]

II. MOBILE AD HOC NETWORK (MANET)

With the advancement in wireless communications, more and more wireless networks appear, e.g., Mobile Ad Hoc Network (MANET), Wireless Sensor Network (WSN). Mobile adhoc network (MANET) is a temporary network setup for a specific purpose without help of any pre-existing infrastructure. The nodes in MANET are empowered to exchange packet using a radio channel. The nodes not in direct reach of each other uses their intermediate nodes to forward packets. Therefore threats exist to a mobile ad hoc network both from external nodes unauthorized to participate in the mobile ad hoc networks, and from internal nodes, which have the authorization credentials to participate in the mobile ad hoc network. Internal nodes giving rise to threats can be further divided according to their behavior - failed, badly failed, selfish and malicious nodes. Figure 2 shows the Mobile Ad Hoc Network.

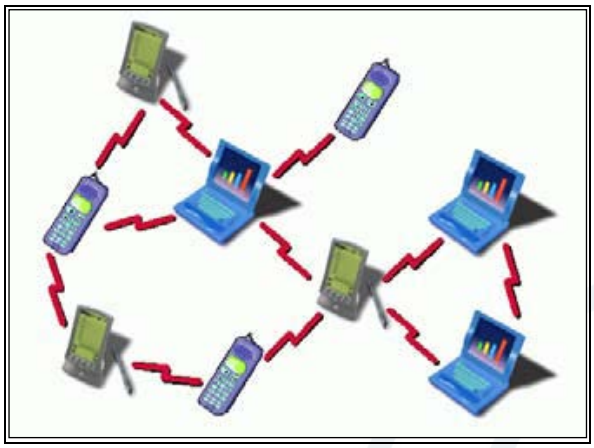

Fig.2: Mobile ad hoc network

III. QUALITY OF SERVICE (QOS)

Quality of Service (QoS) is not easily achieved in ad hoc networks. To provide QoS routing in Ad hoc networks, it is not just sufficient to provide a basic routing functionality where only a feasible route is found, other aspects like the bandwidth constraints due to shared media, dynamic topology due to continuously changing topology and the power consumption due to limited battery powers must also be considered. The nodes in the Ad hoc network move randomly, hence, the topology changes continuously resulting in route breakage. Thus, the route breakage must first be detected and a new route should be found to the destination in advance. The quality-of-service (QoS) routing in an ad hoc network is difficult because the network topology may change constantly, and the available state information for routing is inherently imprecise [3, 4].

IV. LOCATION-AIDED ROUTING (LAR)

The LAR protocols use location information (which may be out of date, by the time it is used) to reduce the search space for a desired route. Limiting the search space results in fewer route discovery messages. Location information used in the LAR protocol may be provided by the Global Positioning System (GPS). With the availability of GPS, it is possible for a mobile host to know its physical location [3]. In reality, position information provided by GPS includes some amount of error, which is the difference between GPS-calculated coordinates and the real coordinates. For instance, NAVSTAR Global Positioning System has positional accuracy of about 50–100 m and Differential GPS offers accuracies of a few meters [5].

V. ENERGY RELATED ISSUE

In ad hoc networks, each device plays the role of a router and has limited battery energy. In addition, the network topology can constantly change. Thus, it is widely accepted that conventional routing protocols are not appropriate for mobile ad hoc networks and consequently, the design of routing protocols for such networks is a challenging issue, taking power consumption into consideration. One critical issue for all kinds of mobile nodes supported by battery powers is power saving. Without power, any mobile node will become useless. Battery power being limited, extending the lifetime of batteries is an important issue, especially for Mobile Ad Hoc Networks (MANETs). To reduce the energy consumption in mobile devices, there have been efforts in physical and data link layers as well as in the network layer related to the routing protocol. The purpose of power-aware routing protocols is to maximize the network lifetime [2].

VI. APPLICATIONS OF AD HOC NETWORKS

A. Conferencing

Perhaps the prototypical application requiring the establishment of an ad hoc network is mobile conferencing. When mobile computer users gather outside their normal office environment, the business network infrastructure is often missing. But the need for collaborative computing might be even more important here than in the everyday office environment. Indeed, the whole point of the meeting might be to make some further progress on a particular collaborative project. Given that today's project environments are heavily computerized, for projects in a very broad range of industries the need for being able to create an ad hoc network seems clear.

B. Home Networking

As another example, consider the scenario that will likely result if wireless computers become popular at home. These computers will probably be taken to and from the office work environment and on business trips. It is quite possible that such computers will not have topologically related IP addresses, especially if they are connected at the offices of each parent or at the children's school. Keeping in mind the convenience that an unchanging IP address affords to the user, it would be nice to allow the various mobile computers to operate an ad hoc network in the home, even if the home maintains its own subnet with more or less permanently situated network nodes.

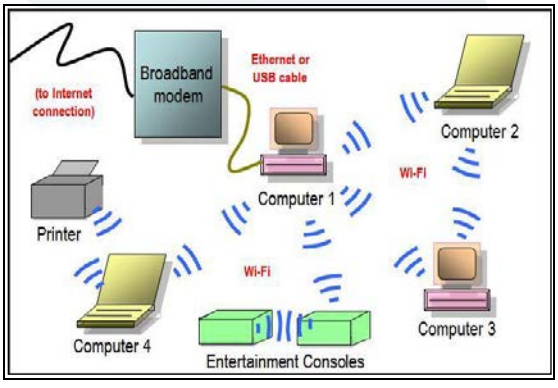

Fig.3: Home Networking

C. Emergency Services

Ad hoc networks can help to overcome network impairment during disaster emergencies. Mobile units will probably carry networking equipment in support of routine operations for the times when the internet is available and the infrastructure has not been impaired. With the techniques and protocols in this book, emergency mobile units can greatly extend the usefulness of their networking equipment during times of lost infrastructure support. For instance, police squad cars and firefighting equipment can remain in touch longer and provide information more quickly if they can cooperate to form an ad hoc network in places not otherwise offering connectivity to the global Internet.

D. Embedded Computing Applications

The world is full of machines that move, and future intelligent mobile machines will be able to process a great deal more information about the environment in which they operate. The "environment" itself will increasingly be a virtual one created by fixed and mobile computers. Some researchers [Weiser 1993] predict a world of ubiquitous computing, in which computers will be all around us, constantly performing mundane tasks to make our lives a little easier. These ubiquitous computers will often react to the changing environment in which they are situated and will themselves cause changes to the environment in ways that are, we hope, predictable and planned.

E. Personal Area Networks and Bluetooth

The idea of a personal area network (PAN) is to create much localized network populated by some network nodes that are closely associated with a single person. These nodes may be attached to the person's belt or carried in a purse. More exotic visions of the future include virtual reality devices attached around the head and other devices more oriented toward the sense of touch. These devices may or may not need to have an attachment to the wide area Internet, but they will almost certainly need to communicate with each other while they are associated with their users' activities. In this scenario, mobility is not the overriding consideration. Figure 4 shows the Global Wireless Standards of WAN, MAN, LAN, and PAN.

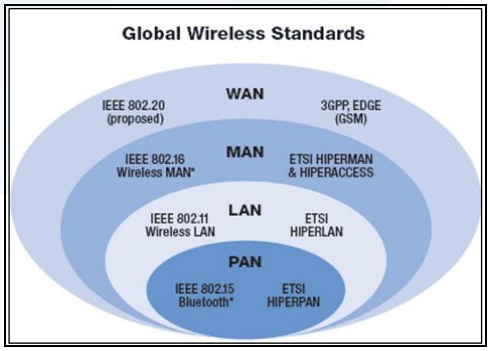

Fig.4: Global Wireless Standards

VII. CHALLENGES IN AD HOC NETWORKS

One of the biggest obstacles to the adoption of ad hoc networks may be reduced data rates—the same problem that slowed the adoption of wireless computing during the last decade. We can typically observe an order of magnitude difference in the speed of wired and wireless networks. For instance, while many enterprise users are accustomed to 100 Mbit/sec from the local Ethernet, wireless users must struggle to get a reliable 10 Mbit/sec over the air: 1 to 2 Mbit/sec is much more common.

VIII. CONCLUSION

In recent years, mobile computing has enjoyed a tremendous rise in popularity. The continued miniaturization of mobile computing devices and the extraordinary rise of processing power available in mobile laptop computers combine to put more and better computer-based applications into the hands of a growing segment of the population. At the same time, the markets for wireless telephones and communication devices are experiencing rapid growth. Projections have been made that, by the year 2002, there will be more than a billion wireless communication devices in use, and more than 200 million wireless telephone handsets will be purchased annually. So, in this paper we have discussed Ad Hoc Networks along with its energy issues, applications, QoS and challenges.

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