A Review on Mobile Ad Hoc Network and its Routing Protocols

Raj Kumar Mohanta, Binapani Sethi

Abstract- Mobile Ad-Hoc Networks (MANETs) are wireless networking in which mobile nodes are associated with ad hoc basis means the network can be established for a particular purpose as necessary. MANETs are both self-forming and self-healing enabling communication between mobile nodes without centralized or fixed infrastructure, since setting up a fixed infrastructure is not always easier especially in disaster area or in war zone. This paper aims at studying details about MANET and the different routing protocols used in MANET as well as how it differs from a cellular network and also merits and demerits of the protocols.

Keywords- cellular network, MANET, P2P, Routing protocol, Wireless network.

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1. INTRODUCTION

Computer network is a collection of computers and other hardware devices that are linked together through communication channels to provide communication and sharing of resources among different users. Computer network can be wired or wireless, infrastructure based or infrastructure less etc. The wireless network can be classified into two types: Infrastructure based or Infrastructure less. In infrastructure based wireless networks, the mobile node can move while communicating, the base stations are fixed and as the node goes out of the range of a base station, it gets into the range of another base station. This can be shown in figure.
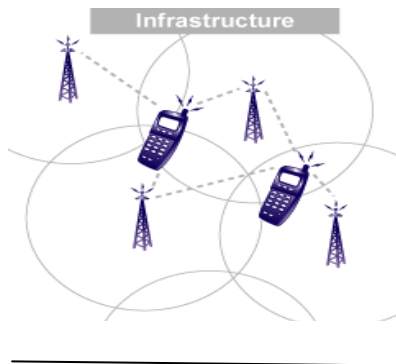
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Infrastructure mode is used when the wireless network requires a physical structure to support it. This means there should be a medium handling the network functions, creating an infrastructure around which the network sustains.

 It performs these typical functions:

- Providing access to other networks
- Forwarding
- Medium access control

In infrastructure-based wireless networks, the communication takes place between the wireless nodes (i.e. endpoints in the network such as your computer, your phone, etc.) and the access points (i.e., the router) only.

There can be more than one access point on the same network handling different wireless nodes. A typical example of an infrastructure network would be cellular phone networks. They have to have a set infrastructure (i.e., network towers) to function. When to use an infrastructure network:

- If you can easily add more access points to boost the range
- If you want to set up a more permanent network
- If you will need to bridge to other types of networks (e.g., you can connect to a wired network if required)

In Infrastructure less or Ad Hoc wireless network, the mobile node can move while communicating, there are no fixed base stations and all the nodes in the network act as routers. A mobile Ad Hoc network is one of them. A MANET, which is a collection of wireless mobile nodes forming a temporary/short-lived network without any fixed infrastructure where all nodes are free to move about arbitrarily and where all the nodes configure themselves. In MANET, each node acts both as a router

and as a host & even the topology of network may also change rapidly. A mobile ad hoc network (MANET) is a continuously self-configuring, infrastructure-less network of mobile devices connected wirelessly. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. MANET is self configuring that means that nodes that are to participate in a MANET should not need extensive knowledge of network parameters prior to joining the network. It includes automatic configuration of IP addresses.

1.1 Mobile Ad Hoc Network

A Mobile Ad Hoc Network is an autonomous network that can be formed without the need of any established infrastructure or centralized administration. MANET use portable devices such as mobile phones, laptops or personal digital assistants (PDAs) for spontaneous establishment of communication. A mobile ad hoc network is a group of nodes that are capable of changing their location dynamically but still they can communicate each other. In this type of network there is no need of centralized device in order to co-ordinate the other nodes. These nodes are able to perform routing also. So Ad-hoc network can install without the predefined infrastructure. Ad-hoc wireless networks do not require a set infrastructure to work. In ad-hoc networks, each node can communicate with other nodes, so no access point that provides access control is required. Whereas the routing in infrastructure networks is taken care of by the access point, in ad-hoc networks the nodes in the network take care of routing. Routing is to find the best possible path between the source and destination nodes to transfer data. A typical example of an ad-hoc network is connecting two or more laptops (or other supported devices) to each other directly without any central access point, either wirelessly or using a cable. When to use an ad-hoc network:

- If you want to quickly set up a peer-to-peer (P2P) network between two devices
- When creating a quick temporary network
- If there is no network infrastructure set up in the area (ad-hoc is the only network mode that can be used in areas like this)

The application of MANET includes disaster recovery, heavy constructions, mining, transportation, defense etc.

1.2 Characteristics of an AD-HOC network

The different characteristics are:

- Collection of mobile nodes forming a temporary network
- Network topology changes frequently and unpredictably
- No centralized administration or standard support services
- Each host is an independent router
- Hosts use wireless RF transceivers as network interface
- Number of nodes 10 to 100 or at most 1000

1.3 Comparison between cellular network and Ad-Hoc network

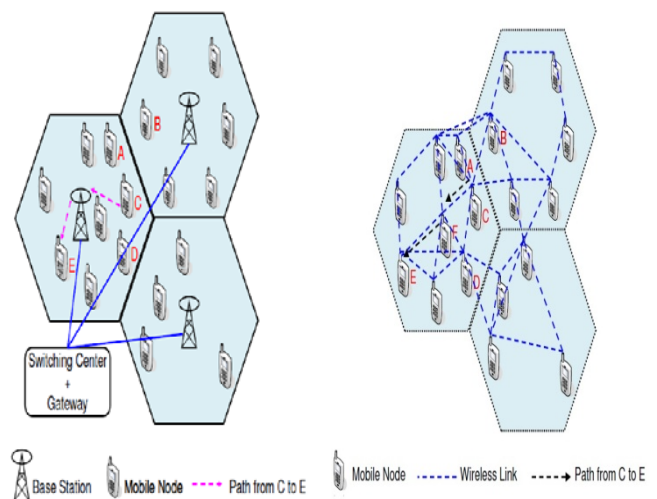| Cellular Network	Ad-Hoc Network
Fixed infrastructure based.	Infrastructure less.
Centralized routing.	Distributed routing.
High cost and time of deployment.	Quick and cost effective deployment.
Seamless connectivity.	Frequent path breaks due to mobility.
Reuse of frequency spectrum through geographical channel reuse.	Dynamic frequency reuse based on carrier sense mechanism.
Easier to employ bandwidth reservation.	Bandwidth reservation requires complex medium access control protocol.
Circuit switched.	Packet switched.
Static backbone network topology.	Dynamic backbone network topology.

Figure of cellular network   Figure of Ad-Hoc network

2. NETWORK PROTOCOLS

Network protocols are formal standards and policies comprised of rules, procedures and formats that define communication between two or more devices over a network. Rules of Network Protocol include guidelines that regulate the following characteristics of a network: access method, allowed physical topologies, types of cabling, and speed of data transfer. Network protocols govern the end-to-end processes of timely, secure and managed data or network communication.

2.1 Routing

Routing is the selection of path or a route in a network for forwarding packets. The objective of routing packets in a network is to determine the best possible path in terms of minimizing the number of hops, delays, packet loss, cost etc. MANETs are formed dynamically by connecting arbitrary wireless mobile nodes, without using existing infrastructure so routing in MANET is different from other traditional routing. Each node in MANET behaves like a host and a router. The nodes also take part in forwarding or receiving their own packets. The nodes also take part in forwarding other's node packet. Therefore MANET provides limited physical security as compared to the traditional network.
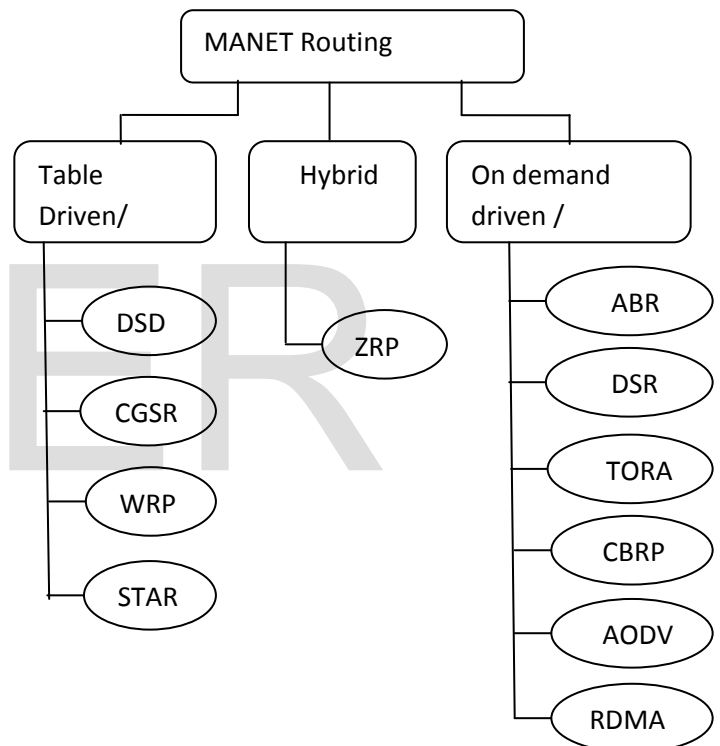
2.2 Network Routing Protocols

Routing protocols are special-purpose protocols designed specifically for use by network routers on the Internet. A routing protocol can identify other routers, manage the pathways (called *routes*) between sources and destinations of network messages, and make dynamic routing decisions. Common routing protocols include EIGRP, OSPF and BGP.

2.3 How to Implement Network Protocols

Modern operating systems contain built-in software services that implement support for some network protocols. Applications like Web browsers contain software libraries that support the high level protocols necessary for that application to function. For some lower level TCP/IP and routing protocols, support is implemented in directly hardware (silicon chipsets) for improved performance. Each packet transmitted and received over a network contains binary data (ones and zeros that encode the contents of each message). Most protocols add a small header at the beginning of each packet to store information about the message's sender and its intended destination. Some protocols also add footer at the end. Each network protocol has the ability to identify messages of its own kind and process the headers and footers as part of moving data among devices. A group of network protocols that work together at higher and lower levels are often called a protocol family.

Students of networking traditionally learn about the OSI model that conceptually organizes network protocol families into specific layers for teaching purposes. A routing protocol specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network. Routing algorithms determine the specific choice of route. Each router has a priori knowledge only of networks attached to it directly. A routing protocol uses software and routing algorithms to determine optimal network data transfer and communication paths between network nodes. Routing protocols facilitate router communication and overall network topology understanding. A routing protocol is also known as a routing policy.

2.4 Classification of MANET routing Protocols

Proactive routing protocols are also called as table driven routing protocols. In this each node maintain routing table which contains information about the network topology even without requiring it. The routing tables are updated periodically whenever the network topology changes. Proactive protocols are not appropriate for large networks as they need to maintain node entries for each and every node in the routing table of every node. The different types of proactive routing protocols are DSDV, CGSR, WRP, and STAR.

Reactive routing protocol is also known as on demand routing protocol. In this type of protocol, route is discovered whenever it is needed. Nodes initiate route discovery when demanded. A route is acquired by

the initiation of a route discovery process by the source node. There are various reactive routing protocols which are ABR, DSR, TORA, CBRP, AODV and RDMAR.

Hybrid Routing Protocol is a trade-off between proactive and reactive protocols. Proactive protocols have more overhead and less latency while reactive protocols have less overhead and more latency. Thus a Hybrid protocol is needed to overcome the shortcomings of both proactive and reactive routing protocols. This protocol is a combination of both proactive and reactive routing protocol. It uses the on demand mechanism of reactive protocol and the table maintenance mechanism of proactive protocol so as to avoid latency and overhead problems in the network. Hybrid protocol is appropriate for large networks where large numbers of nodes are present. In this, large network is divided into a set of zones where routing inside the zone is done by using proactive approach and outside the zone routing is done using reactive approach. It includes ZRP.

2.5 Comparison of protocols

Protocols	Advantages	Disadvantages
Proactive	Information is always available. Latency is reduced in the network.	Overhead is high, Routing information is flooded in the whole network.
Reactive	Path available when needed overhead is low and free from loops.	Latency is increased in the Network.
Hybrid	Suitable for large networks and up to date information available.	Complexity increases.

3. CONCLUSION

In this paper we study about MANET and how it differs from a Cellular network as well as different routing protocols associated with MANET. The routing in MANET is an important and difficult task due to the fact that MANET works on highly dynamic environment. In our future work we aim at studying more about routing protocols and their implementation along with different security issues associated with them and how to improve the performance of these protocols.

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