ISSN:0975-9646

Krunal N. Chandewar et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 3 (2) , 2012,3782-3786

Mobile Ad-Hoc Wireless Network

Krunal N. Chandewar, H.R. Deshmukha

Computer science Computer science ,Amravati university Amravati university
Satkar Nagar, Nagpur Road Bhandara, India

***Abstract*— An ad hoc mobile network is a collection of mobile nodes that are dynamically and arbitrarily located in such a manner that the interconnections between nodes are capable of changing on a continual basis. In order to facilitate communication within the network, a routing protocol is used to discover routes between nodes.**

A "mobile ad hoc network" (MANET) is an autonomous system of mobile routers (and associated hosts) connected by wireless links--the union of which form an arbitrary graph. The routers are free to move randomly and organize themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably. Such a network may operate in a standalone fashion, or may be connected to the larger Internet.

The primary goal of such an ad hoc network routing protocol is correct and efficient route establishment between a pair of nodes so that messages may be delivered in a timely manner. In a mobile ad hoc network the hierarchical addresses must be continuously changed to reflect movements. This article examines routing protocols for ad hoc networks and evaluates these protocols based on a given set of parameters, also provides an overview of different protocols by presenting their characteristic. A wireless Ad Hoc Network is created spontaneously by a collection of mobile nodes, interconnected by multihop wireless links in a peer to peer fashion. Each node may serve as a packet level router for its peer in the same network. In Latin, "ad hoc" literally means, "for this purpose only" It can be regarded as a "spontaneous network," i.e., that automatically "emerges" when nodes gather together. Thus it is a collection of wireless mobile nodes dynamically forming a temporary network without the use of any existing network infrastructure or centralized administration.

Keywords— PDA, wireless communication, ad-hoc network, distributed blackboard, icons.

I. INTRODUCTION

What is an ad hoc network? An ad hoc network is a collection of mobile nodes without the need of infrastructure support. The interesting feature of ad hoc networks is the absence of base stations. Conventionally, base stations act as repeaters, relaying signals from one mobile station to another. In ad hoc networks, however, each mobile station is specially designed with the capability to relay signals for peer-to-peer communication. Thus, virtual paths are established as the need arises [1]. Since no base station is needed, ad hoc networks can be employed easily and rapidly. This factor makes the concept attractive for communications in situations, where the infrastructure is not available. Consequently, the cost of implementation is greatly reduced. In addition, it is envisaged that the network capacity will increase on par with the rising demand for mobile communications [2]. This research aims at investigating the different aspects of networking. The teletraffic performance of the network will be examined through computer simulation.

A mobile ad-hoc network (MANET) is a collection of mobile nodes, which communicate over radio. These networks have an important advantage; they do not require any existing infrastructure or central administration as shown in figure 1.1. Therefore, mobile ad-hoc networks are suitable for temporary communication links. This flexibility, however, comes at a price: communication is difficult to organize due to frequent topology changes.

A. Why Multi Hop Ad Hoc Network ?

This is a very reasonable question to ask. After all, a large number of graduate students have dedicated their research efforts to providing solutions to the nontrivial problem of routing a mobile multi-hop wireless environment. Is it possible that we are solving a problem of only theoretical interest? That is, why not provide the spontaneity of ad hoc networking through single hop wireless networking (as in a giant 802.11 LAN) or deploy base station technology on a massive scale. Such solutions would obviate the need for complex multi-hop routing protocols for mobile nodes. The justification for continued intensive research of multi-hop mobile ad hoc network routing is based on three well-documented performance advantages that the multi-hop paradigm has over the single-hop solution. First, there is the feature of adaptability (or survivability), which is crucial for battlefield scenarios. By deploying a multi-hop datagram forwarding network, packets can be routed around obstructions or areas captured by enemy units. Second, there is the advantage of spatial reuse.

B. If between base stations there are a large number of nodes for which peer-to-peer communications are prevalent, then packet forwarding over multiple hops via small radii transmissions will exploit spatial reuse and maximize throughput. Third, depending on transceiver power specifications, packet forwarding via multiple small radii transmissions may require less energy than a single large radius transmission for peer-to-peer communications.

C. The energy savings afforded by multi-hop packet forwarding would help conserve battery resources of mobile nodes. Although there is currently little consumer demand for multi-hop ad hoc networking, these three advantages indicate that the multi-hop paradigm has the potential to greatly improve ad hoc networking performance. To exploit these advantages, however, research of mobile wireless communication systems and

mobile multi-hop ad hoc network routing protocols must continue to advance.

D. An Overview of MANET and Fixed Infrastructure Network.

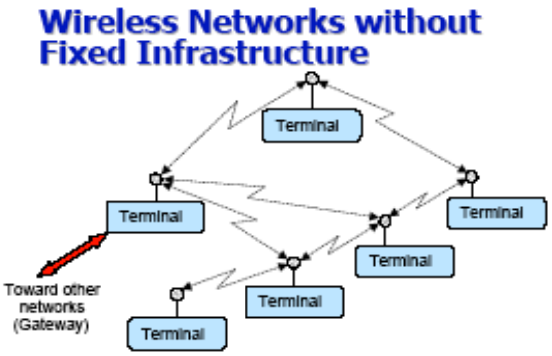

Fig 1.1 wireless network without fixed infrastructure

E. Fig 1.1 shows that Wireless Network without fixed infrastructure i.e. Communication of this type did not has a fixed path. So this wireless network can not require any kind of central administration because nodes or mobile co-operate to provide the services.

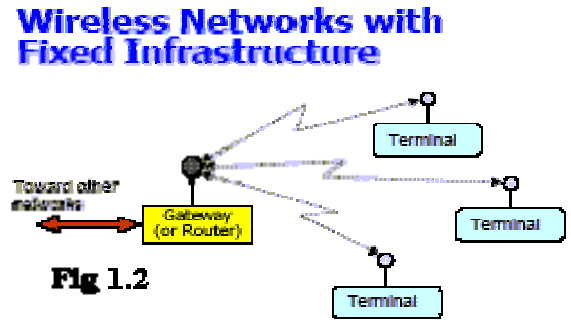

FIG 1.2 wireless network with fixed infrastructure

F. First Fig.1.2 shows Wireless Network with fixed infrastructure i.e. this type of communication have fixed path. If you make any kind of phone call with you cellular phone then that call given to a fixed administrator that is capable of handling your phone call, this path is fixed. Any node i.e. cellular phone want to communication it can be under the central administration. Fig. 1.2 shows the router or gateways, which is responsible for central administration. Because of this we can easily say that, it has a fixed infrastructure

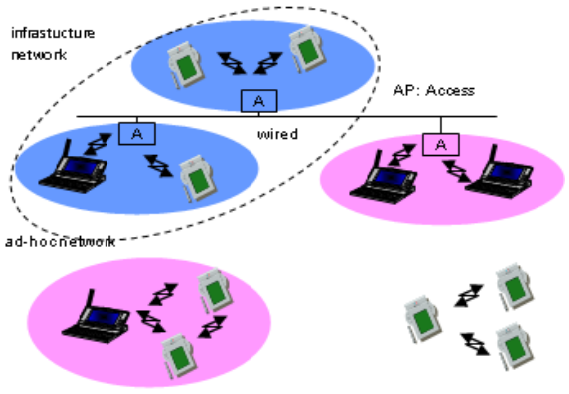

Figure 2 Different between with fixed infrastructure and without fixed infrastructure wireless network.

Figure 2 shows that different between with infrastructure and with fixed infrastructure wireless network. In without fixed infrastructure mobiles or nodes cooperate with each other for communication .So in this type of wireless network contains no central administration and fixed administration, so router or any type of gateway are not present in this type of network. Perhaps nodes of MANET are act as routers or gateways.

In fixed infrastructure there is no direct communication between nodes or cellular phones. They can be control with the help of central administration because they have fixed infrastructure

CHARACTERISTICS OF AD-HOC NETWORKS

We are able to come up with some characteristics of ad hoc networks that place it quite apart from the conventional wired fixed networks:

There are no centralized administrative servers in an ad hoc network so handling of addressing has to be done in a distributed manner.

Since there are no centralized systems, all the hosts have to support the network by acting as routers, passing along message packets that are not meant for that particular host.

The form of data transmission for mobile hosts is by broadcasting and here we are assuming that the hosts practice promiscuous receiving, accepting any signal they received.

Transmission between two hosts over a wireless network may not work equally well in both directions, i.e. the data communication is not bi-directional, unlike a fixed wired network.

The data transfers are less reliable as compared to wired networks.

There are several redundant links between the hosts.

There are dynamic topological changes in an ad hoc network as the hosts, which are also acting as routers can move in and out of a network and under a worse case; the network can become partitioned in the midst of a communication session.

Unlike wired networks, mobile hosts are more likely to have limited power sources, depending mainly on battery and hence there should be minimum redundant data transfers to conserve power.

ROUTING IN AD-HOC NETWORKS

Ad hoc networks allow several hosts equipped with wireless interfaces to communicate with one another. With this technology come several issues which must be resolved before it can truly become an efficient means of communication. The issues includes

· Addressing
· Session Maintenance
· Routing
· Security

These networks are very flexible and suitable for several types of applications, as they allow the establishment of temporary communication without any pre installed infrastructure. Due to the limited transmission range of wireless interfaces, in most cases communication has to be

relayed over intermediate nodes. Thus, in mobile multi-hop ad-hoc networks each node also has to be a router.

With continuing above discussion one question arises in the mind that is how communication can be possible without fixed infrastructure and central administration? How nodes cooperate with each other? Answer for above question is that MANET uses different routing protocol for better communication. To find a route between the communication end-points is a major problem in mobile multi hop ad-hoc networks. The problem is further aggravated through the node mobility. Many different approaches to handle this problem were proposed in recent years, but so far no routing algorithm has been suitable for all situations. Other aspects of mobile ad-hoc networks are also subject to current research, especially the dynamic address configuration of nodes.

The simplest form of ad hoc network is a peer to peer session between just two hosts, which are located close together. They may communicate either using wireless LANs, or more commonly for portable notebooks, Infrared (IrDA) Interface. No form of routing decision is necessary for this situation. The only condition for such communication is that the two hosts must be within transmission range of each other. However ad hoc networks also allow for two hosts that are not within transmission range of each other to communicate via a third host that is within the range of the first two hosts. a unique address so that any sender will know who and Figure 3 shows a situation whereby hosts A and B, although not within transmission range, can still communicate via host C by asking C to forward the packets to the destination. It is very difficult to obtain dynamical route for communication. In normal cellular phone there is no need of dynamic routing because it has a static fixed infrastructure [2].

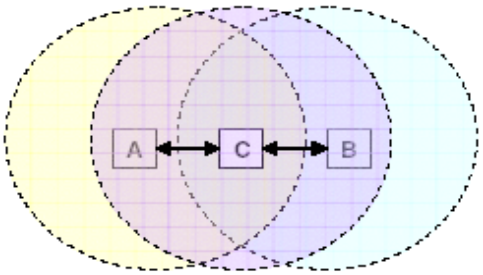

FIG 3 Two hosts A and B that communicates via C.

So with the help of above discussion we can say that routing in mobile ad-hoc network is very difficult because in MANET mobile nodes are itself act as a router. But normal cellular phone uses separate element called “Router” to finding the route. It is tuff task to achieve the good communication i.e. routing in MANET.

Addressing

Before we actually discuss the issues on routing in ad hoc networks, we will touch a little bit on addressing of mobile hosts in an ad hoc network. In all networks, fixed or mobile wireless, every host needs to be distinguished from one another. Hence each of them requires where to send the information to[1]. Imagine the chaos that will ensue if there are some hosts with duplicate addresses in the network.

In a fixed infrastructure network such as the Internet, network layer addressing is achieved via IP address, which is usually handed out by a server known as a DHCP server (Dynamic Host Configuration Protocol)[2]. There will be at least a DHCP server for an administrative domain and it is responsible for making sure that the IP addresses in its domain are unique and it does this by handling out to every host that connects to it, an IP address.

In an ad hoc wireless network however, there is no centralized administrative server that acts as the DHCP or controls the addresses that every host can take. Furthermore there is a restriction that ad hoc network addressing should follow closely to that of those used in wireless networks so that the entire ad hoc network can connect to the Internet if one of its hosts is Internet enabled.

Another challenge in addressing for ad hoc wireless networks is address duplication. A host, when joining a network, can obtain a unique address easily by generating an IP address and broadcasting it to the network to see if any other host is using it. If it is, the generation process is repeated again; otherwise the requesting host will adopt this address. The problem comes when two or more networks merge together to form one bigger ad hoc network. There might be several duplicated addresses in the merging networks and resolving all the duplication may prove to be arduous. There are now several proposals to resolve these addressing issues. [2] For the sake of completeness, we will just introduce one of the simplest schemes.

IP Address Configuration

This is a very simple addressing scheme. A host, when detecting network connectivity for the first time (i.e. joining a network) will first picks a random IP address in the range of 169.254.1.0 to 169.254.254.255. This range is possible as it is registered with the IANA (Internet Assigned Numbers Authority) for such purposes. Initially the host will assume a temporary address from the range 1 - 2047 of the network 169.254/16. The host will then broadcast a Route Request (RREQ) for that address. If there is no Route Reply (RREP) from other hosts within a certain timeout period, the broadcast of the request is repeated for a certain number of retries. If still no RREP are received, the requesting host will then assume that the address can be taken for its own [2]. Otherwise the node randomly picks another address and tries again. This scheme, although will encounter problems when two different networks merge, is sufficient for a moderate size ad hoc network and will not incur as much overhead as compared to IPv6 auto configuration when dealing with source routing protocols due to their (IPv6) long addresses.

Desirable properties

To be considered an efficient routing protocol, it must have certain desirable properties [2]. Below is a list of desirable qualitative properties that an ad hoc routing protocol should have:

Distributed operation - Since in an ad hoc network there is no centralized administration, any host or node can leave on enter the network as and when it pleases. Hence routing of messages cannot depend on a master or a small group of master hosts.

Loop free – This property is desired to avoid problems such as a small fraction of packets spinning around in the network for arbitrary time periods. Although there are other ways to solve the problem, having a better structured approach would improve performance .

Demand-based operation – Instead of continuous route maintenance, it is an added advantage to let the routing protocol adapt to the traffic pattern on a need-to basis. This can reduce network traffic and enables the utilization of bandwidth more efficiently.

Proactive operation – This is the opposite of demand-based operation. Although different, this property might be desirable in situations whereby the additional latency that the demandbased operation incurs may be unacceptable.

Unidirectional link support – An ad hoc network is different from a fixed infrastructure network as the direction of data flow may not be bi directional due to physical reasons . Hence the routing protocol must be able to work in situations where data can only be transmitted in one direction.

Security – As stated in the previous section, ad hoc networks are more vulnerable to security problems hence the routing protocol should have sufficient security protection to prevent the modification of protocol operation.

Sleep period operation – The mobile hosts in an ad hoc network are most likely to be running on battery and hence sometimes require to be inactive, or in 'sleep' mode. The routing protocol should be able to accommodate such modes where the hosts may stop transmitting or receiving data for a certain time.

Types of Routing Protocols

The routing protocols of ad hoc network are mainly divided into two categories depending on their operation. Figure 4.1 shows the categorization of ad hoc routing protocols. It is according to the way the mobile hosts exchange information

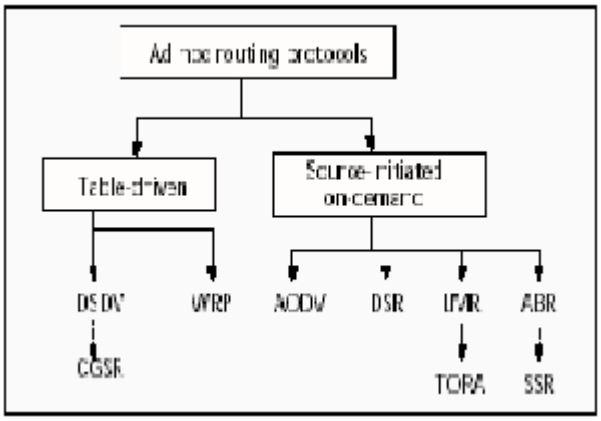

FIG 4 Categorization of ad hoc routing protocols.

Proactive (table-driven)

Table driven routing protocol keeps up-to-date routing information from each node to every other node in the network. These protocols require each node to maintain one or more tables to store the routing information, they also respond to changes in the network topology by propagating updates throughout the network in order to maintain the consistent network view [1]. There are some existing table driven ad hoc routing protocols.

List of Table-Driven protocols

1. DSDV: Destination Sequenced Distance Vector Routing
2. WAR: Wireless Anonymous Routing
3. CGSR: Cluster-Head Gateway Switch Routing

Reactive (On-demand)

The Source-Initiated On-Demand routing creates routes only when desired by the source node. When a node requires a route to a destination, it initiates a route discovery process within the network. This process is completed once a route is found or all possible route permutations have been examined. Once a route has been established, it is maintained by a route maintenance procedure until either the destination becomes inaccessible along every path from the source or until the route is no longer desired.

List of Demand-Driven Routing Protocols

1. AODV: Ad hoc On-Demand Distance-Vector routing
2. DSR: Dynamic Source Routing
3. TORA: Temporarily Ordered Routing Algorithm
4. ABR: Associativity Based Routing
5. SSR: Signal Stability Routing

Applications

List of Applications.

These are the five major application of Ad hoc mobile network.

1. Personal communications
   Ad-hoc mobile network can use or where distance matters there we can use this type of network. So this type of network can use for personal communication [1]. With the help of this type of network we can setup a small distance oriented network for our personal use without any fixed infrastructure.
2. Co-operative environment
   As mention above we can setup a mobile network for our privacy. It depends upon you to for which purpose you use that. Meeting room environments is one of the uses of ad hoc mobile network.
3. Emergency operations
   Policing and fire fighting is two the emergency operation under government. With the help MANET. Each area of our city has a police camp. So to communicate within that area or communication within city we can setup this type of network. So when there is emergency of any resources then it is useful.
4. Military operation
   This one of the important application under government.
5. Natural calamities
   If there is Natural calamities then there unfortunately no resources for communication. For example if there is earthquake then that part of earth is dead for communication then how we help the peoples from calamities? For that time how communication is achieve for helping the people. Solution is setting the temporary network with ad-hoc technique. With the help of ad-hoc network we can achieve the better communication in such situation.

Merits and Demerits of Ad-Hoc Network

Merits of Mobile Ad-hoc Network

1. No wires or cable with cheap installation
   In this mobile network there is no part of wire or cable so installation is cheap.
2. Autonomous network possible
   We can set this network for our private purpose.

3. Dynamic topology
   In mobile ad-hoc networking there is no static or fix structure for communication like in our normal mobile communication. So topology changes at every instant in ad-hoc networking [1]. Because nodes are cooperated to provide the connectivity. So they do not know which path they have follow for forwarding the message. So topology changing for different call.
4. Independent of infrastructure
   As there is no fixed structure for communication in Ad-hoc technology. So this type of network is independent of infrastructure.
5. Independent of central administration
   In mobile ad-hoc network nodes are cooperated to provide the connectivity. So there is no need of central administration for communication and services.
   There is no such element, which is used for normal mobile communication except mobile so we can say that this type of network is purely mobile based.

Demerits of Mobile Ad-hoc network

1. Need for 'cooperative network environment'
   In mobile Ad-hoc networking, there are nodes communicated with nodes with the help of themselves. So there is need of cooperativeness among them.
2. Network Traffic load
   For handling the network traffic there is no central administrator [2]. So node as the part of that network has a responsibility to handle the traffic.
3. Autonomous and spontaneous nature of node
   Distributed algorithms to support security Reliability and consistency of exchanged and stored information
4. Fluctuating link capacity and network resources
   Enhanced functionalities to improve link layer performance, QoS network support End-to-end efficiency.

CONCLUSION

Here we have introduced what an Ad Hoc Network is and its various characteristics. Mobile Ad-hoc Network growing up because of its flexibility. It can be connected to larger network. Main applications Ad-hoc network is in Military i.e. Battlefield and Natural calamities. It can be used privately also. As far as private is considered we can set our private network using MANET in our office or campus. Thus we have identified possible applications and challenges facing ad hoc mobile wirelessnetworks.

REFERENCES

[1].Computer Networks(Third Edition)- Andrew S Tanenbaum.
[2]. http://www.netcraftsmen.com/welcher (Dr.Peter J Welcher –Cisco Certified Instructor & consultant for Technical Papers).
[3]. http://en.wikipedia.org
[4]. Ad-Hoc Networks- Srikanth Krisnamurty