A Survey to MANET Techniques Research and Related Challenges

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ABSTRACT
In a last few decades there is advancement has done in the area of wireless communication. Depending upon the application and recent development a new field emerges in wireless technology which is infrastructure less. Ad-hoc network is a type of infrastructure less wireless network. Ad-hoc network is an example of distributed network in which mobile nodes connected together by means of wireless link. It is a temporary infrastructure less network. In this paper we are giving an overview of MANET history, MANET basics and current trend and future scope.

Keyword
MANET, Infrastructure less network, Ad-hoc Network, Distributed network.

1. INTRODUCTION TO AD-HOC NETWORK
Wireless communication provides the service whether the user is mobile or not. A computer network is an interconnected collection of independent computers which aids communication in numerous ways [1]. There are two major components are in modern day computer networks:-[1]
A. Distributed Application
B. Network Infrastructure

Wired Network: - In wired computer network data travels from one communication device/computer to another communication device/ computer as electrical signal via wires.

Wireless Network: - In wireless computer network data travels from one communication device or computer to another communication device or computer as electromagnetic waves through air.
Communication Network may be classified as [1]
  A. Wired Network
  B. Wireless Network
    a) Infrastructure Based Wireless Network
    b) Infrastructure less Wireless Network
      i) Mobile Ad-hoc Network (MANET)
      ii) Wireless Sensor Network (WSN)
      iii) Wireless Mesh Network (WMN)

Infrastructure based wireless Network: - Such type of wireless network consists of network with fixed and wired gate ways.
Example: Cellular Mobile Communication

Infrastructure less wireless Network (Ad-hoc Network):- Such types of wireless network do not need to establish the network at the time of communication.
Example- Ad-hoc Networks.
Ad-hoc is a Latin word which means "for this purpose". The term "Ad-hoc" tends to imply "can take different forms" and "can be mobile, stand alone, or networked."[2] Ad-hoc network may be also defined as: "An Ad-hoc network is a collection of two or more devices equipped with wireless communications and networking capability."[2] It network is an example of distributed network in which mobile nodes connected together by means of wireless link. It is a type of infrastructure less wireless network that having dynamic network topology and having lack of centralized control.

Table 1 Comparison of Cellular wireless and Ad-hoc networks [5]

Fixed, pre-located cell sites and base stations.	No fixed base stations, very rapid deployment
Static backbone network topology.	Highly dynamic network topologies with multi-hop.
Relatively benign environment and , stable connectivity	Hostile environment (losses, noise) and sporadic connectivity
Detailed planning before base stations can be installed.	Ad hoc network automatically forms and adapts to changes

2. SHORT HISTORY OF AD-HOC NETWORK
The idea of Ad-hoc networks were use in 500 B.C by Darius the king of Persia. Also the use of Ad-hoc voice communication was used in many ancient/tribal societies with a string of repeaters of drums, trumpets, or horns. [1] The concept of mobile ad hoc networking is not a new one and its origins can be traced back to the Defense Advanced Research Projects Agency (DARPA) Packet Radio Network project in 1972. [7] We may classify the history of Ad-hoc network in terms of different generations as First, second and third. [8, 11]. First generation of Ad-hoc networks goes back to 1972, at this time Ad-hoc network was known as packet radio network (PRNET) [21].
First generation of Ad-hoc networks were used for different military scenarios. PRNET uses the combination of Areal Location of Hazardous Atmospheres (ALOHA) and Carrier Sense Multiple Access (CSMA) for multiple access and distance vector routing [5, 17]
Second generation of Ad-hoc networks starts from 1980 to mid-1990. It was the advanced version of first generation. The main aim was same as for first generation i.e. aiding combat operation. Second generation was the enhancement of first generation PRNET [17] and it is known as Survival adaptive radio networks (SURAN) in second generation.
The third generation of Ad-hoc network systems is known as commercial Ad-hoc network system [17]. The main developments are Bluetooth technology, Ad-hoc sensor networks etc.

3. CONCEPTUTAL APPROACH TO MANET
Mobile Ad-hoc network is a collection of wireless nodes having wireless and networking capability. It is a type of Infrastructure less wireless mobile device. It is self-organizing, self-

configuring, self-maintaining and adaptive in nature. It means that each device in a MANET is free to move independently in any direction. Due to mobility of nodes the topology in MANET frequently changes. In MANET mobile nodes are connected by means of wireless link. MANET supports the dynamic network topology.

MANET may be divided in to two parts [4, 18]
A. VANET
B. IMANET

VANET: - VANET means Vehicular Ad-hoc network. It is a type of MANET which is used for communication among vehicles and between vehicles and roadside equipment. [4, 18]

IMANET: - IMANET means internet based mobile ad-hoc networks. It is a type of MANET which is used to link mobile nodes and fixed internet gateways. It enables an autonomous system of mobile node, which can be operating in isolation or be connected to the greater internet. [11]. It combines a wired network and a Mobile Ad-hoc network for developing a ubiquitous communication infrastructure. [12]

Advantages of MANET [2]
A. Free frequency spectrum (used in unlicensed spectrum i.e. ISM band.)
B. Easy to setup i.e. no infrastructure is required at the time of communication.
C. Scalable network

Disadvantage of MANET [2]
A. Lack of centralized control
B. Frequent changes in network topology
C. Physical security and limited resources.

Application of MANET
The mobile ad-hoc networks are used in following environments [13].
A. Tactical networks.
Military communications and operation
ii. Automated battle field
B. Emergency Services.
Search and rescue operation
ii. Disaster management
iii. Replacement of fixed infrastructure in case of environmental disasters.
C. Commercial and civilian environments.
E-commerce
ii. Sports stadium, trade fairs, shopping malls
iii. Networks of visitors at airports
iv. Vehicular services
D. Education.
University and campus setting
ii. Virtual classroom
iii. Ad-hoc communications during meeting and lectures.
E. Entertainment
i. Multi user game
ii. Robotics pets etc.
iii. Wireless P2P networking
F. Sensor network
i. Home applications
ii. Body area network

4. DESIGN ISSUES AND CHALLANEGES
As the Ad-hoc networks are used in various applications and the long history of mobile ad hoc network, but it faces some issues and design challenges that we have to overcome [6]. An ad hoc

wireless network faces the traditional problems of wireless communications and wireless networking [10].
The major issues and challenges in MANETs are following [2, 10]

C. Medium Access Scheme
The main responsibility of a MAC protocols in MANETs are the distributed adjustment for the shared channel for the transmission of packets. The performance of any wireless networks depends on the performance of MAC protocol, so for better utilization of sharing medium better selection of MAC protocols are necessary.

D. Routing
Routing is one of the important design issues in MANET as the bandwidth of the MANET is limited. It is a process of establishment of path and packet forwarding from source to destination node. The main responsibility of routing is find the feasible path to the destination based on the criteria such as hop length, minimum power required, utilization of minimum bandwidth etc.

E. Multicasting
Multicasting is very important technique used in the various applications of MANET such as, emergency services, search and rescue operations and in military communication. Multicasting is a type of one to many (group) type of communication. In such environments multicasting is very important issue because the arbitrary movement of nodes changes the topology dynamically. The mobility of nodes, with constraint of power source and bandwidth, makes multicasting a very important design issue.

F. Transport Layer Protocol
The main aim of transport layer protocol is to maintain end to end connections, provide reliable end to end packet delivery of data packet, and manage flow control and congestion control.
The main performance of transport layer protocols are degraded due to the frequent path breaks, presence of stale routing information, high channel error rate, and frequent network partitions.

E. Pricing Scheme
As we know that the Ad-hoc wireless network's function depends on the presence of the relaying of nodes and their willingness to rely other node's traffic. Ad-hoc wireless networks employed for special tasks such as military missions rescue operations etc.; do not require pricing scheme, whereas the successful commercial deployment of Ad-hoc wireless network requires billing and pricing scheme. [1].

F. Quality of Services
The quality of services is the performance level of services that are offered by a service provider or a network to the user. It often requires negotiation between the host and the network, resource reservation scheme etc. In mobile Ad-hoc networks there is a boundary between the service provider and the user is blurred. The lack of centralized control and limited resources are the problems to achieve desired quality of service in mobile Ad-hoc networks.

G. Self-organization
As we know that the Self-organization is the one of the most important property of Mobile Ad-hoc network. During the topology reorganization phase the Ad-hoc networks requires updating the topology information. The reorganization phase consists of two main activities.

First – The periodic or aperiodic exchange of topological information due to mobility of nodes.

Second – The Adaptivity.

Hence the Mobile Ad-hoc network should be able to perform self-organization quickly so that it is transparent to the user and the application.

H. Security

As we know that the Mobile Ad-hoc networks are mainly used for military purpose so it is very important that the communication should be secure. Due to lack of centralized control and shared wireless medium it is easy to attack than wired network.

5. NETWORK SIMULATORS USED IN MANET

Network simulator is a technique in which the behavior of a network is modeled based on the program either by the calculation of interaction between network entities using mathematics or based on the observations from a main network. It is widely used in the research area of Computer and communication network. Network Simulator is a software/hardware that predicts the behavior of a network without the presence of actual network. [14].

Some network Simulators used in MANET are following:

G. NS-2

H. GloMoSim

I. OPNET

NS-2: - Ns (simulator) is a name for series of discrete event network simulator specifically ns-1, ns-2 and ns-3. All of them are discrete event network simulator. [4]. It provides substantial simulation of TCP, routing and multicasting. It consists of two simulation tools. The network simulator (ns) contains all commonly used IP protocols. NAM (Network Animator) is used to visualize the simulation. NS-2 is an object oriented network simulator written in C++ and OTCL. It supports all class hierarchy in interpreter. [15].

GloMoSim:-

It is network protocol simulation software that simulates wireless and wired network system. GloMoSim is a scalable simulation environment for large wireless and wire line communication network [14]. It uses a parallel discrete event simulation capability provided by parsec [14].

OPNET:-

It is a commercial network simulator used for network modeling and simulation. It allows the users to design and study communication networks, devices, protocols and applications with flexibility and scalability [16]. It simulates the network graphically and its graphical editors mirror the structure of actual network and network component.

Table 2 Comparison of different simulators [14-16]

Simulator	Open Source	Availability	Programming Language
NS-2	Yes	Yes	C++, TCL
GloMoSim	Yes	Limited	Parsec
OPNET	No	No	C

6. CONCLUSIONS AND FUTURE SCOPE

As we know that MANET is an infrastructure less wireless network. There are several applications and design issues are related with MANET. But Security, Battery limitation, Routing, Qos are some important design concerns that are related with MANET. As we know that the nodes of the MANET consumes power during transmission and reception of message and since they are used in worst case scenario and it is very difficult to replace the batteries in this scenario. So it is necessary to reduce the consumption of power during active and in active mode. So energy management is very crucial design concern in MANET. Mobility of nodes makes frequent changes in the network topology. Also Hidden and expose terminal problem is also considerable during transmission of packet. So to minimize transmission loss and for reliable power consumption efficient routing is required. So routing protocols and routing techniques are considered during design. Also multicasting, security and Qos are important design concern.

So for proper operation of MANET and with the increase in commercial and military uses some improvement in the area of energy conservation, routing, security and problem of mobility of nodes etc. These issues lead to more future research in the field of MANET.

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