An Overview of MANET: History, Challenges and Applications

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Abstract

We have seen the advancement in the field of internet due to wireless networking technologies. It gives rise to many new applications. In the past of few decades, we have seen the advancement in wireless networks. The emerging capabilities of mobile devices have given a new direction to the internet, which decreases the cost and allow us to use infrastructure wireless networks and infrastructure less wireless networks (i.e. Mobile Ad Hoc Wireless Network).With so many applications that MANETs provides us, there are still some challenges that have to overcome. We present in this paper, the history of MANET, challenges (issues) involve in MANET and its some applications.

Keywords: **MANET; Tactical Networks; SURAN.**

1. Introduction

Opposed to the infrastructure wireless networks where each user directly communicates with an access point or base station, a mobile ad hoc network, or MANET is a kind of wireless ad hoc network [1]. It is a self configuring network of mobile routers connected by wireless links with no access point. Every mobile device in a network is autonomous. The mobile devices are free to move haphazardly and organize themselves arbitrarily. In other words, ad hoc network do not rely on any fixed infrastructure (i.e. the mobile ad hoc network is infrastructure less wireless network. The Communication in MANET is take place by using multi-hop paths. Nodes in the MANET share the wireless medium and the topology of the network changes erratically and dynamically. In MANET, breaking of communication link is very frequent, as nodes are free to move to anywhere. The density of nodes and the number of nodes are depends on the applications in which we are using MANET.

MANET have given rise to many applications like Tactical networks, Wireless Sensor Network, Data Networks, Device Networks, etc. With many applications there are still some design issues and challenges to overcome.

Mobile ad hoc network
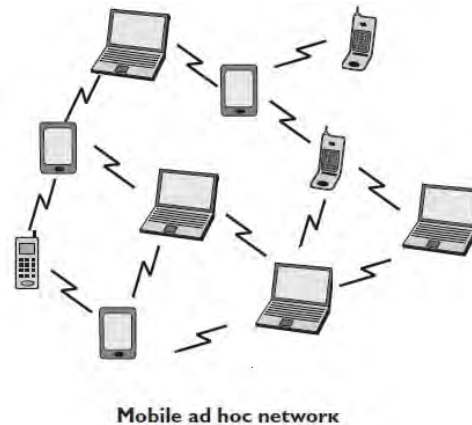
2. History

We can characterized the life cycle of mobile ad hoc network into first, second and third generation. Present ad hoc network are considered the third generation [2][3]. The first generation of ad hoc network can be traced back to 1970's. In 1970's, these are called Packet Radio Network (PRNET) [4]. The Defence Advanced Research Project Agency (DARPA) initiated research of using packet- switched radio communication to provide reliable communication between computers and urbanized PRNET. Basically 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][2][3].

The PRNET is then evolved into the Survivable Adaptive Radio Network (SURAN) in the early 1980's. SURAN provides some benefits by improving the radio performance (making them smaller, cheaper and power thrifty). This SURAN also provides resilience to electronic attacks.

Around the same time, United State Department of Defence (DOD) continued funding for programs such Globe Mobile Information System (GloMo) and Near Term Digital Radio (NTDR). GloMo make use of CSMA/CA and TDMA molds, and provides self-organizing and self-healing network (i.e. ATM over wireless, Satellite Communication Network). The NTDR make use of clustering and link state routing and organized an ad hoc network. NTDR is worn by US Army. This is the only "real" ad hoc network in use. By the growing interest in the ad hoc networks, a various other great developments takes place in 1990's.

The functioning group of MANET is born in Internet Engineering Task Force (IETF) who worked to standardized routing protocols for MANET and gives rise to the development of various mobile devices like PDA's , palmtops, notebooks, etc . Meanwhile the Development of Standard IEEE 802.11 (i.e. WLAN's) benefited the ad hoc network. Some other standards are also developed that provide benefits to the MANET like Bluetooth and HIPERLAN.

3. Manet Challenges

Regardless of the variety of applications and the long history of mobile ad hoc network, there are still some issues and design challenges that we have to overcome[6]. This is the reason MANET is one of the elementary research field. MANET is a wireless network of mobile nodes, its a self organized network. Every device can communicate with every other device i.e. it is also multi hop network.
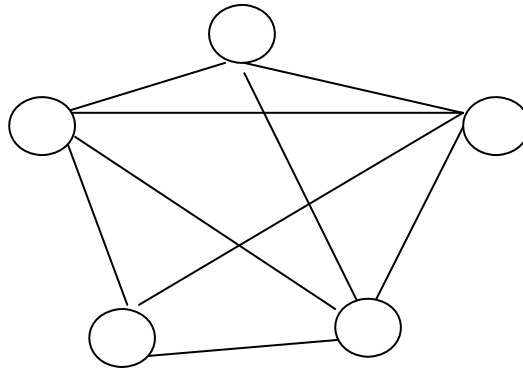
As it is a wireless network it inherits the traditional problem of wireless networking:

    3.1 The channel is unprotected from outside signal.
    3.2 The wireless media is unreliable as compared to the wired media.
    3.3 Hidden terminal and expose terminal phenomenon may occur.
    3.4 The channel has time varying and asymmetric propagation properties [6].

With these problems there are some other challenges and complexities:

- The scalability is required in MANET as it is used in military communications, because the network grows according to the need , so each mobile device must be capable to handle the intensification of network and to accomplish the task.
- MANET is a infrastructure less network, there is no central administration. Each device can communicate with every other device, hence it becomes difficult to detect and manage the faults. In MANET, the mobile devices can move randomly. The use of this dynamic topology results in route changes, frequent network partitions and possibly packet losses [1].
- Each node in the network is autonomous; hence have the equipment for radio interface with different transmission/ receiving capabilities these results in asymmetric links. MANET uses no router in between.
- In network every node acts as a router and can forward packets of data to other nodes to provide information partaking among the mobile nodes. Difficult chore to implement ad hoc addressing scheme, the MAC address of the device is used in the stand alone ad hoc network. However every application is based on TCP/IP and UDP/IP.

Table 1

Areas	Possible Scenarios
Military Scenarios	MANET supports tactical network for military communications and automated battle fields.
Rescue Operations	It provides Disaster recovery, means replacement of fixed infrastructure network in case of environmental disaster.
Data Networks	MANET provides support to the network for the exchange of data between mobile devices[7].
Device Networks	Device Networks supports the wireless connections between various mobile devices so that they can communicate.
Free Internet Connection Sharing	It also allow us to share the internet with other mobile devices.
Sensor Network	It consist of devices that have capability of sensing ,computation and wireless networking . Wireless sensor network combines the power of all three of them, like smoke detectors, electricity, gas and water meters[7].

4. Future Scope

We have seen a great development in the field of wireless networks (infrastructure based) and in the field of Mobile ad hoc network (infrastructure less network). The integrations of Wireless Networks and fixed infrastructure network with the Mobile ad hoc network may evolve the fourth generation communication support networks.From   the technological point of view, the realisation of this vision still requires a large number of challenges related to devices, protocols, applications and services, are to be dealt with. The succinct discussion in this paper shows that, In spite the large efforts of the MANET research community and the ample progress made during the last years, a lot of technical issues remain unanswered [8]. From an economical point of view, mobile ad-hoc networks open up new business opportunities for telecom operators and service providers. To this end, appropriate business scenarios, applications and economical models need to be identified, together with technological advances, making a transition of ad-hoc networks to the commercial world viable.

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