

Mobile Ad Hoc Network: Challenges and Suggestions to overcome



Engineering

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ABSTRACT

The advancement in networking field has given rise to many new wireless applications, one of which is the mobile ad hoc network. It is the collection of devices connected to each other via wireless networks provides necessary networks in absence of fixed infrastructure. With so many applications in Mobile Ad Hoc Networks, there are still some challenges that need to overcome. Due to lack of security of routing processes, Mobile Ad Hoc Networks is vulnerable to attacks resulting in degradation of its quality and questioning to the reliability of such a network. This paper discusses about some challenges to Mobile Ad Hoc Networks and also discusses about suggestions for solutions to overcome this technology which finds its place due to its ability to provide internet facility which is small and portable.

1. Introduction

Connection between two devices forms a network which helps in transfer of data packets from one node to another. A network facilitates interpersonal communications which allows people to communicate efficiently and easily via email, telephone, video telephone calls etc. The major feature of any networks is to provide access to information on shared storage devices also. A network allows sharing of network and computing resources.

Now the paradigm shift of the networks is towards mobile ad hoc network, which provides the easiest solution for interconnection of wireless on mobile units.

Mobile ad hoc networks provide a portable wireless network formed without any pre-established infrastructure. It is flexible and provides the independency to nodes to move in any directions and forms a random topology among mobiles. These nodes behave as routers that maintain the information and carry data packets.

The application set for Mobile Ad Hoc Networks includes from large-scale networks, mobiles, highly dynamic networks, to small and static networks.

Mobile Ad Hoc Networks technology has its applicability in an extremely flexible method for establishing communications for providing many operations such as education, entertainment, e-commerce, home applications, etc.

There are many approaches for establishing wireless mobile units, for communication such as:

Infrastructured network-

Cellular concept is the basic theme that derives Wireless mobile networks and relies on well developed infrastructure support. Mobile devices communicate with access points like base stations connected to the fixed network infrastructure like GSM, WLAN, etc.

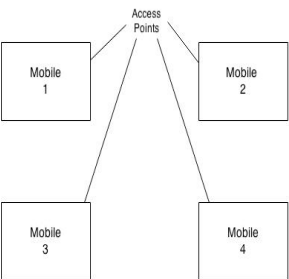


Figure 1: Infrastructure based wireless networks

Infrastructure less-

As to infrastructure networks , mobile wireless network also known as a Mobile Ad Hoc Network , where the information exchange between the mobile units does not rely on any fixed network infrastructure, but on fast configuration of a wireless connection.

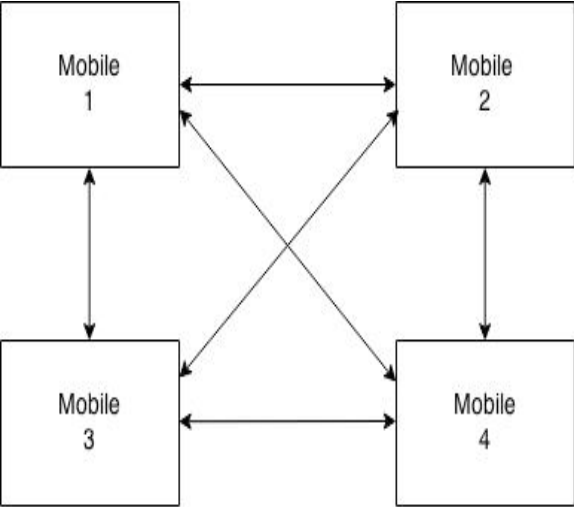


Figure 2 Infrastructureless ad hoc networks

The aim of this mobile ad hoc networking is to provide robust and efficient operation in mobile wireless networks. Such networks have no established infrastructure i.e. the networks do not rely on routers in wired networks but, each node participates in routing by forwarding data for other nodes. This is a self-governing network of mobile devices which is connected by wireless links.

Therefore, a mobile ad hoc network can dynamically be set up anywhere without any network infrastructure. Forming a system in which mobile nodes are connected through wireless links and are free to move in random directions and simultaneously act as routers too.

Mobile Ad Hoc Network Applications

Following are its application areas:

Application	Description
Tactical Networks	For Military communication- operations and, Automated battlefields.
Emergency services	For search, rescue operations in disaster discovery.
Commercial & civilian	For ecommerce-e-payments, vehicular services and sports stadiums.

Home & enterprise	For personal area networks at Home and offices.
Education	For universities- campus settings & virtual classrooms.
Entertainment	For multi user games, outdoor internet access, etc.

Table 1:- Applications of mobile ad hoc networks.**Literature review**

Erlend Larsen discussed on problems of TCP in Mobile Ad Hoc Networks and introduced to the challenges that TCP faced in Mobile Ad Hoc Networks and elaborated about how to adapt TCP to Mobile Ad Hoc Networks.

M. Scott Corson and Joseph P. Macker summarized the Mobile ad hoc networks related issues such as routing protocol, Power consumption analyses, its architecture and mobile IP interaction.

Alex Hinds et al stated about a variety of Mobile Ad Hoc Networks protocols that are developed but there still exists some routing and security challenges that Mobile Ad Hoc Networks is facing. Their study also focused on improving various Mobile Ad Hoc Networks routing protocols.

Jeroen Hoebeke et al emphasized on the applications and challenges of the mobile ad hoc networks with respect to technical problems in it like routing, service, resource discovery, internet connectivity and security.

4. Challenges and solutions

Regardless of all those useful applications Mobile ad hoc networks provides, there are still some challenges that are preventing Mobile ad hoc networks from wide commercial deployment and making it vulnerable.

Some of the major challenges and there suggested solutions are discussed below:

(i) Routing:

Since the network topology on mobiles changes constantly, the issue of routing packets between any pair of nodes becomes a challenging task. Most protocols should be based on reactive routing instead of being proactive.

Multicast routing is a major challenge because due to the random movement of nodes in the network the multicast tree is not static. Routes between nodes contain multiple hops, which makes it complex to the single hop communication.

As mobile ad hoc networks change frequently due to mobility, therefore to establish communication paths between nodes, efficient routing protocols are required which does not cause any sort of computational burden on the power constrained devices.

A large number of solutions are proposed, some of them are subject to standardization within the IETF. Many protocols are also available, like pro-active routing protocols which are modified versions of distance vector routing protocols adapted to the requirements of dynamic mobile ad hoc network environments.

Sometimes, when it is not possible to have an up-to-date route to all nodes, reactive routing protocols are set up to nodes for communication and are kept alive as long as they are desired to be used. Combinations of proactive and reactive routing protocols are called hybrid protocols in which the near-by routes are kept updated and far-away routes are set up reactively.

Another routing protocol as a solution is location based routing protocol in which transferring of packets is based on location of sender and receiver nodes. Location information services is used

which provides nodes with the location of receiver nodes so that is easier for the node to forward packet to its destination node without any obstacle of packet loss.

Ongoing research at Ghent University investigates the possibility of developing protocols capable of dynamically adapting to the network. Several studies have proved that performance of routing protocols in terms of throughput, packet loss, delay and control overhead rely on the network conditions such as traffic load, mobility, density, number of nodes etc.

(ii) Security and Reliability:

Along with the vulnerabilities of wireless networks, an ad hoc network has many security problems. The wireless links have many reliability problems, because of the limited wireless transmission range, data packet losses and transmission errors.

Wireless networks are prone and vulnerable to attacks which in turn deteriorate its reliability and raises question on its security too.

(iii) Quality of Service (QoS):

It seems to be a challenge for Mobile Ad Hoc Networks to provide different quality of service levels in the rapid changing environment.

An adaptive QoS is implemented to support the multimedia services. Maintaining the QoS in Mobile Ad Hoc Networks is another challenge to QoS framework.

The wire less networks provides less quality of service, because of fixed path between source and destination during the data transfer session. QoS model defines the type of services that any QoS model should provide. Also, it sets the system level goals like:-QoS signaling, QoS routing that any QoS framework should implement.

A lot of work is done to maintain the Quality of Service in internet. The dynamic topology challenges of Mobile Ad Hoc Networks are overcome by QoS for Mobile Ad Hoc Networks.

(iv) Internet working:

Internetworking between Mobile Ad Hoc Networks and fixed networks is expected in a mobile device, having many routing protocols is a big challenge today. To enable communication between nodes in an ad hoc network, each node requires an address of another node or a destination node or receiver node. So, a unique MAC address could be used to provide address to the nodes through which the mobile ad hoc networks will interact with the IP-based direction of the destination network or node. This will help in establishment of a better network between nodes and make data transfer more efficient.

Conclusion and future work

Although Mobile Ad Hoc Networks is viably getting more widely used, it requires huge efforts for its implementation. To resolve the performance issues we require new protocols for network control. Being a very essential and important technology, Mobile Ad Hoc Networks can be used in commercial, personal and wide area networks and in other fields too. Its applications are serving many fields but on the other hand the challenges which need to be resolved are still affecting the quality and other features of Mobile Ad Hoc Networks. This paper discusses some of the Mobile Ad Hoc Networks challenges and its solutions.

The concise discussion in this paper shows that despite of all the challenges discussed, Mobile being handy, and providing internet facility through Mobile ad hoc networks is a boom in technical field and will make ad hoc networks commercially visible and potentially strong and reliable if the issues are resolved and routing protocols are improved.

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