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An Overview of MANET: Features, Challenges and Applications

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ABSTRACT

Advancement in the field of internet due to wireless networking technologies gives rise to many new applications. Mobile ad-hoc network (MANET) is one of the most promising fields for research and development of wireless network. As the popularity of mobile device and wireless networks significantly increased over the past years, wireless ad-hoc networks has now become one of the most vibrant and active field of Communication and networks. A mobile ad hoc network is an autonomous collection of mobile devices (laptops, smart phones, sensors, etc.) that communicate with each other over wireless links and cooperate in a distributed manner in order to provide the necessary network functionality in the absence of a fixed infrastructure. This type of network, operating as a stand-alone network or with one or multiple points of attachment to cellular networks or the Internet, paves the way for numerous new and exciting applications. This paper provides insight into the potential applications of ad hoc networks, various attacks and discusses the technological challenges that protocol designers and network developers are faced with.

Keywords : MANETS;Features;Applications;Challenges

I. INTRODUCTION

MANETS are the category of wireless networks which do not stand in need of any infrastructure to function that is in MANETS there is no central authority and therefore for the purpose of communication all the nodes both acts as transmitters as well as receivers. The communication is achieved as follows: when the destination is easily reachable from the source that is the destination lies within the transmission range of the source, they communicate directly and when they are far apart the take help of neighbor nodes. This blatantly implies that every node behaves like a router in MANETS [1]. All the links in MANETS are bidirectional. The biggest advantage of wireless networks is their tendency to allow different nodes to communicate while maintaining their mobility at the same time. Since MANETS do not rely on any infrastructure, all the nodes are independent and can move freely. The transmission range of MANETS node is limited which means that the direct communication between source and destination is not possible when they are outside their zones of transmission, for that intermediate nodes take part in communication and hence communication in MANETS is divided among two types: “Single Hop Communication” and “Multiple Hop Communication”. In the former, the nodes which lie in the radio range of each other communicate directly while as in multi-hop communication when the destination node is beyond source nodes radio range, intermediate nodes help to relay the messages to their destinations.

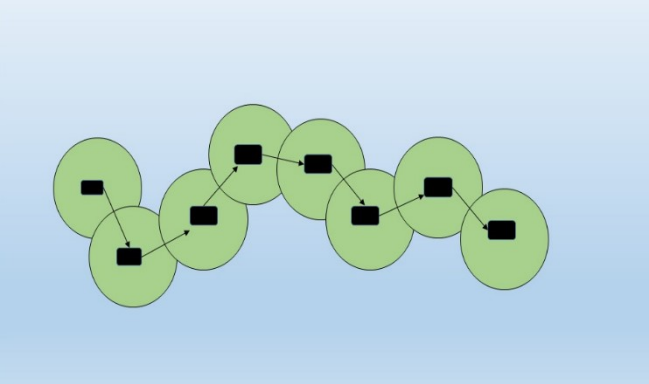

Figure 1. MANET Single Hop and Multi-Hop Communication

These networks can function in a way such that they did not depend on anything else or they will connect to a larger network, e.g. Internet. These networks contains a set of using wireless links in which MHs uses to communicate among them, without using any other support of communication. These can be called as multi- hop wireless networks or mobile radio networks. When two or more MHs are in the range of each other if one mobile host can receive other mobile hosts transmission [2].

II. CHARACTERISTICS OF MANETS

MANETs are the systems which are known for their dynamism, the medium of communication in MANET is air, and therefore the entire communication is vulnerable to interference and attacks. The dynamism is brought by the nodes which are mobile -they give rise to frequent changes in the topology. Owing to these frequent topology changes and absence of centralised authority (infrastructure).MANET operation calls for two fundamental requirements.

1. Similar management capabilities for all nodes in MANET
2. Every operation of network as dataflow, routing, locating etc. need to be infrastructure less (decentralised)[3].

Several Characteristic features of MANETS are listed below:

(a) Self-configuring networks: MANETs have the ability to form self-configuring and self- maintaining networks. They tend to be self-configuring and self-maintaining since no central administration is present to do this job for them. This means MANETs do not need any static infrastructure to perform a particular jobs well (applications where infrastructure based networks are hard to be deployed).

(b) Mobility: Nodes in MANET move freely while carrying information. This feature may help in dispersion, mixture and aggregation of information.

(c) Broadcast Communication: The communication in MANETs is broad cast based. So if 10 n1odes lie in the range of the source all of them receive the information. These nodes then move the message forward by relaying on to their transmission range. Therefore, every time source node talks to its neighbours the gossip reaches to all the other nodes in its vicinity at no extra cost [4].

(d) Data centric routing: Unlike traditional MANETs that use point to point addressing centric model. Some MANETs use data centric communication model in routing. In data centric communication model, the priority is given to type of data rather than the sources identity. This model supports data aggregation which is performed in networks. It also puts restrictions on the way in which storage and routing tasks are executed in the network.

(e) Limited Resources: The nodes in MANETs are relatively small in size – hence they have limited power, processing ability and memory.

(f) Costly Routing: Since there are no access points, no fixed infrastructure, every node in MANETs need to perform the function of routing which becomes expensive. Furthermore, when the destination is far

away, the routing cost increases even more. Therefore in MANETs, neighbour communication is favoured.

(g) Unreliable links: The links established in MANETS are unreliable because the topology changes rapidly owing to mobility, plus there are environmental factors and interference of other elements. Also collisions cannot be detected in wireless networks like their wired counterparts. As a result the percentage of message losses is high in MANETS [5].

III. MANET CHALLENGES

Today MANETs are considered to be one of the best emerging technologies for mobile computing. MANETS is the fastest growing of networks because of the increase in affordable, powerful and portable devices. Unlike their wired counterparts, MANETs displays some unique characteristics which ultimately pose numerous challenges related to security and routing. Also the medium of communication is shared which means that not only the legitimate user gets the access, illegitimate users also can access the medium easily therefore breach of security. This clearly implies that in MANETs there is no clear line of defence as we have in wired networks. In wired networks there are fixed routes but in MANETs every node can be treated as router. Thus, securing such a network is in itself a challenge because the attacker field/range is vast. Other non-trivial challenges are the server resource bondage, hugely dynamic topology of network etc [6]. MANETs offer alluring applications because of their features discussed in preceding sections, but before they can be expected to be deployed on commercial scale, some of the typical challenges and thought provoking problems require to be solved. These include:

(a) Changing Topologies: MANET nodes are highly dynamic, independent in motion, frequently fuse with or dispense the network, stray around the network at their own drive. Bringing security along with such dynamism is in itself a challenge because no doubt, that nodes roam easily in the network, they request for security at anywhere and anytime.

(b)Routing: Owing to the dynamism of the topology, problems stack up in routing also. Since the nodes are straying continuously, table driven routing protocol can be used, therefore only the reactive routing protocol can be used. Again Multicast routing becomes a challenge here because the nodes move freely and multi-cast tree is no more static. Also it is not necessary that the source and destination lie within each other's radio range, therefore multi-hop communication is needed which is complex than single hop.

(c) Device discovery: Recognizing the honest nodes which enter into the network and informing about their entries require dynamic updates to ensure optimal route selection automatically. This require authenticating the nodes.

(d) Constraint Resources: The capacity of wireless links is limited and variable which pose numerous challenges. Moreover, almost all the MANET nodes run on exhaustible energy sources to gain energy. Therefore design of mobile nodes require considering energy conservation seriously. The consumption of power should be lean, energy conserving routing protocols need to be proposed which are secure also.

(e) Reliability Challenge: Numerous reliability issues creep in among MANETs like constant wireless transmission range, hidden terminal problem, packet losses because of mobility and data transmission errors etc.

(f) Quality of service: To arrange distant QOS levels for devices in an environment which is hugely dynamic as in MANET is a challenge and that too not trivial one. The communication in MANET is stochastic in nature and therefore stable QOS cannot be guaranteed. There is a straight need for adaptive QOS to be implemented.

(g) Inter-Networking: Sometimes MANETs need to interact with fixed networks. In that case mobile devices should have the co-existing routing protocols. This co-existence is a challenge for management of mobility.

IV. APPLICATIONS

With the expansion of versatile gadgets and in addition advance in remote correspondence, adhoc organizing is picking up significance with the expanding number of far reaching applications in the business, Military and private parts. Portable Ad-Hoc Networks enable clients to get to

What's more, trade data paying little heed to their geographic position or nearness to foundation. As opposed to the foundation organizes, all hubs in MANETs are versatile and their associations are dynamic. Not at all like other versatile systems, do MANETS require a settled foundation. This offers a worthwhile decentralized character to the system. Decentralization makes the arrangement more adaptable and more robust [7]. The application of MANETS can be seen in various fields including:

(a) Military combat zone: Military gear now routinely contains some kind of PC equipment. Through specially appointed systems administration, the military could take the upside of typical organize innovation to keep up a data arrange among the vehicles, fighters and military headquarters. Fundamentally the strategies of specially appointed systems originated from this field.

(b) Commercial segment: Ad hoc can be utilized as a part of crisis/safeguard operations for regular cataclysms alleviation endeavors, e.g. in flame, surge, or seismic tremor. Protect operations must occur where non-existing or harmed interchanges framework and quick sending of a correspondence system is required. Data is conveyed starting with one protect colleague then onto the next.

(c) Local level: Adhoc systems can self-ruling, connect a moment and transitory mixed media arrange utilizing scratch pad PCs or palmtop PCs to spread and share data among members at a meeting. Another fitting nearby level application may be in home systems where gadgets can impart specifically to trade data

(d) Personal Area Network (PAN): Short-extend MANET can improve the intercommunication between different cell phones, (for example, a cell phone, tablets, and wearable computers). Conventional wired links are supplanted with remote associations. MANET can likewise reach out to get to the Internet or different systems by instruments e.g. Remote LAN.

V. CONCLUSION

The development in the field of mobile computing is driving another elective path for versatile correspondence, in which cell phones frame a self-making, self-sorting out and self-administering remote system, called as Mobile Adhoc Network. Mobile Adhoc Network arranges are for the most part more helpless against physical security dangers than settled or hardwired systems. This paper tosses a light on various ideas of MANETS that can help specialists to the most extreme. Its inherent adaptability, absence of framework, simplicity of organization, auto-setup, minimal effort and potential applications make it a fundamental piece of future unavoidable figuring situations. As the contribution goes on, particularly the need of thick sending, for example, combat zone and sensor arranges, the hubs in specially appointed systems will be littler, less expensive, more fit, and come in all structures. Taking all things together, in spite of the fact that the across the board sending of specially appointed systems is still year away, the examination in this field will keep being extremely dynamic and innovative.

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