

MANET: Adaptive Network for Adversity

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Abstract: MANET is the acronym for mobile adhoc network or otherwise wireless adhoc network. All the nodes in a MANET are mobile and free to move in any direction and make connections to any node in the network irrespective of the violations of network topology as there is no such thing in a MANET. Since these nodes are mobile they are connected with wireless medium, it can be a common Wi-Fi or any other cellular or satellite transmission. MANET's are multi hop, self-configuring, infrastructure less network for mobile nodes. The nodes in a MANET are both hosts and routers according to the need, it means that it can relay unnecessary data to other nodes or act as a recipient if data seems reliable, it also acts a host in case of information requested.

As the transmission is wireless it has a range till which the signal strength is enough for communication, and all those devices lying within that area are considered within communicable range and can be directly interacted with.

MANET's have autonomous nodes not bound to any sort of arrangement or central node. All the wireless nodes in a radio range can communicate directly with each other using the high speed transmission medium and those lying outside the range can be relayed to it. All the nodes in the network have a wireless interface to communicate to other nodes within the range. MANET is a concept that has wide scale applications in various sectors like defence, disaster hit areas, remote areas with no infrastructure for communication. It has various other types like VANET's, FANET's, iMANET's etc.

Keywords: MANET, Adaptive network

1. Introduction

MANET has become one of the most prevailing field in communication because of its infrastructure less means of communication irrespective of the geographical location the either ends are or whatever remote area they are residing in. It is also flourishing because of the ubiquitous usage of hand held small devices and also the challenges it puts forward to the present communication techniques.

The history of MANET can be tracked back to 1972 when the first generation of adhoc networks were developed and used for military purposes, this stream of the first generation adhoc networks were called PRNET's (Packet radio networks). This evolved with technologies like ALOHA (Areal locations of hazardous atmospheres) and CSMA (Carrier sense multiple access) to SURAN (survivable adaptive radio networks) and became the milestone for the second generation of adhoc networks. By the mid 1990's mobile devices were taking the markets by storm and several organizations like IETF committed a working wing for the development and

standardization of routing protocols and access protocols.

By the late 1990's the idea of collection of nodes came to everybody's minds and the concept of commercial adhoc networks came into existence. Commercialization of this made it an even hot topic to pursue and develop. The production of hand held radio devices, laptops and the 802.11/Wi-Fi wireless networking paved the way for even development of MANET technology.

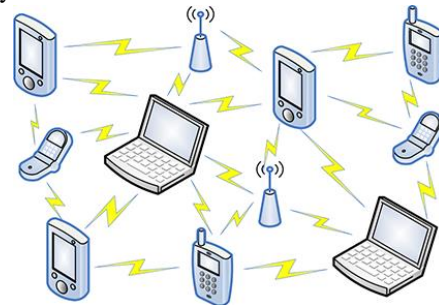


Fig. 1. Devices

As attractive and interesting this looks, but it has faced a lot of problems during development and while operations. Problems like dynamic topologies, multi-cast routing, device discoveries, exhaustible power sources are to name a few.

2. Routing in MANET

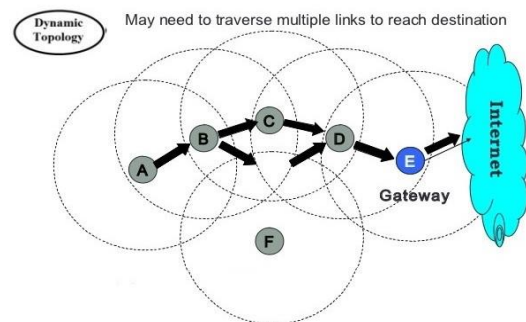


Fig. 2. Dynamic topology

There are two basic types of mobile wireless networks, and they are infrastructure networks and infrastructure-less networks. The infrastructure one's have fixed lines and hardwired gateways for efficient one hop communication between participating nodes used for purposes like WLAN etc., whereas in the infrastructure-less one's are self-configuring and self-organizing multi-hop network where the nodes are mobile

and topology is not fixed. So the routing of data packets become even harder. As there is no dedicated central entity for distant transmission the transmission is done through the nodes itself and those being out of range uses multi-hop relaying for packet transmission.

Routing protocols in MANET can be distinguished into three categories and they are reactive, proactive and hybrid routing protocols,

Reactive protocols: These protocols reduce routing overhead as they don't search or maintain any routes with no data traffic. The data packets carry complete source and destination address so that the intermediate nodes can forward it to its desired end, so the intermediate nodes maintain up-to-date information regarding active routes. Some reactive protocols are DSR (Dynamic source routing), AODV (Adhoc on-demand distance vector) etc.

Proactive protocols: These protocols are also called table driven protocols. These protocols maintain routes to all destinations nodes regardless of its need. In order to maintain correct and up-to-date route information nodes periodically send control messages, more likely to waste bandwidth when not in use. Some proactive protocols are DSDV Host Movement (Destination Sequenced Distance-Vector, 1994), CGSR (Cluster head Gateway Switch Routing, 1997), FSR (Fisheye State Routing, 1999) etc.

Hybrid protocols: By its name these protocols are both proactive and reactive in nature. These are hardwired to increase scalability by creating zones of closely associated nodes to work together and reduce route discovery overhead. Some hybrid protocols are zone routing protocol (ZRP) and zone-based hierarchical link state (ZHLS) routing protocol.

3. Challenges in MANET

1. Dynamic topology: Nodes are mobile and links of the network vary with time and routing is done with close proximity of one node to another.
2. Power consumption: Transmission of data to distant nodes requires lots of power and operation of these nodes on batteries pose a problem of running out of power.
3. Topology maintenance: Updating information of dynamic links across the nodes is a big challenge to address.
4. Autonomous: As there is no central node in this dynamic topology for network administration, a lot of security and transmission problems are faced.
5. Device discovery: Identifying and updating new movement across nodes to facilitate dynamic optimal route selection.
6. Bandwidth optimization: As the ever changing topology of MANET's the nodes need to send control messages to update the current positions of nodes and facilitate optimal

route discovery.

7. Data security: As there is a wireless transmission of data there are numerous possibilities of data being accessed by some unwanted node. The possibility of both active and passive attacks on the transmission is fairly high.

Active attacks: Flooding attack, black hole attack, wormhole attack, Gray-hole attack, session hijacking, repudiation attack, Denial-of-service, SYN flooding attack, link spoofing attack.

Passive attack: eavesdropping, traffic analysis, snooping.

4. Applications of MANET

Military operations: MANET's can be used for fast and temporary establishment of communications in hostile and remote locations for rapid deployment of troops.

Disaster relief operations: During times of natural disasters when the communication infrastructure of the area is destroyed MANET's can be used for relief operations etc.

Search and rescue operations: To carry out a search and rescue operation in an area with no or next to none communication infrastructure, this can be used to coordinate.

Sensor networks: Any sort of sensors when combined with MANET technology forms a grid of sensors to learn or survey properties of an area. As the sensors depend on each other for relaying their data to the node collecting information.

5. Conclusion

Constant evolution in the wireless communication field has made a new type of self-organizing and self-administering adhoc wireless network of mobile nodes other than the conventional hardwired or fixed topological networks.

Its flexibility, infrastructure less deployment, auto-configuration, low cost and ease of deployment has made this technology a future proof field for more exploration and development. In near future the size of the nodes will get even smaller and its dense deployment will be efficient and possible. MANET's are still vulnerable to data breaches and there is a lot of scope to eliminate these vulnerabilities.

The aim of this paper is to understand the challenges and applications of MANET so to boost the research in this field, and further optimize the routing in these networks.

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