Introduction of Mobile Ad hoc Network (MANET)

MANET stands for Mobile Adhoc Network also called a wireless Adhoc network or Adhoc wireless network that usually has a routable networking environment on top of a Link Layer ad hoc network.. They consist of a set of mobile nodes connected wirelessly in a self-configured, self-healing network without having a fixed infrastructure. MANET nodes are free to move randomly as the network topology changes frequently. Each node behaves as a router as they forward traffic to other specified nodes in the network.

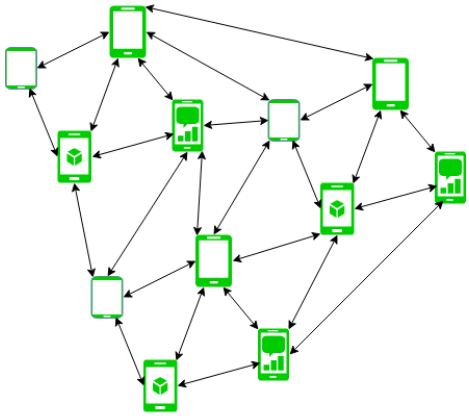

Figure - Mobile Ad Hoc Network

MANET may operate a standalone fashion or they can be part of larger internet. They form a highly dynamic autonomous topology with the presence of one or multiple different transceivers between nodes. The main challenge for the MANET is to equip each device to continuously maintain the information required to properly route traffic. MANETs consist of a peer-to-peer, self-forming, self-healing network MANET's circa 2000-2015 typically communicate at radio frequencies (30MHz-5GHz). This can be used in road safety, ranging from sensors for the environment, home, health, disaster rescue operations, air/land/navy defense, weapons, robots, etc.

Characteristics of MANET –

Network Monitoring and Packet Capture Techniques

- **Dynamic Topologies:**
  Network topology which is typically multihop may change randomly and rapidly with time, it can form unidirectional or bi-directional links.
- **Bandwidth constrained, variable capacity links:**
  Wireless links usually have lower reliability, efficiency, stability, and capacity as compared to a wired network
- **Autonomous Behavior:**
  Each node can act as a host and router, which shows its autonomous behavior.
- **Energy Constrained Operation:**
  As some or all the nodes rely on batteries or other exhaustible means for their energy. Mobile nodes are characterized by less memory, power, and lightweight features.
- **Limited Security:**
  Wireless networks are more prone to security threats. A centralized firewall is absent due to the distributed nature of the operation for security, routing, and host configuration.
- **Less Human Intervention:**
  They require minimum human intervention to configure the network, therefore they are dynamically autonomous in nature.

Pros and Cons of MANET –

Pros:

1. Separation from central network administration.
2. Each node can play both the roles ie. of router and host showing autonomous nature.
3. Self-configuring and self-healing nodes do not require human intervention.
4. Highly scalable and suits the expansion of more network hub.

Cons:

1. Resources are limited due to various constraints like noise, interference conditions, etc.
2. Lack of authorization facilities.
3. More prone to attacks due to limited physical security.
4. High latency i.e. There is a huge delay in the transfer of data between two sleeping nodes.

Improvement in MANET:

1. **Quality of Service (QoS):** Researchers are working to improve the quality of service of MANET by developing efficient routing protocols that provide better bandwidth, throughput, and latency.
2. **Security:** To ensure the security of the MANET, researchers are developing efficient security mechanisms that provide encryption, authentication, and authorization facilities.
3. **Power management:** To enhance the lifetime of MANET nodes, researchers are working on developing efficient power management techniques that reduce the energy consumption of nodes.
4. **Multimedia support:** Researchers are working to provide multimedia support to MANET by developing efficient routing protocols that can handle multimedia traffic efficiently.
5. **Standardization:** To ensure the interoperability of different MANET devices, researchers are working on developing standard protocols and interfaces that can be used by different MANET

Mobile Adhoc Network (MANET) is a wireless network made up of a collection of mobile nodes connected wirelessly and free of any fixed infrastructure. It is self-configuring and self-healing. MANET provides a lot of benefits, but it also has several drawbacks that need to be fixed. Researchers are always trying to make MANET's features better in order to get over these constraints. Future advancements in new technology and methodologies might make MANET a dependable and effective wireless network.

Advantages:

Flexibility: MANETs are highly flexible, as they can be easily deployed in various environments and can be adapted to different applications and scenarios. This makes them ideal for use in emergency situations or military operations, where there may not be a pre-existing network infrastructure.

Scalability: MANETs can easily scale to accommodate a large number of nodes, making them suitable for large-scale deployments. They can also handle dynamic changes in network topology, such as the addition or removal of nodes.

Cost-effective: Since MANETs do not require any centralized infrastructure, they are often more cost-effective than traditional wired or wireless networks. They can also be used to extend the range of existing networks without the need for additional infrastructure.

Rapid Deployment: MANETs can be rapidly deployed in areas where infrastructure is not available, such as disaster zones or rural areas.

Disadvantages:

Security: MANETs are vulnerable to security threats, such as attacks by malicious nodes, eavesdropping, and data interception. Since the network is decentralized, there is no central authority to ensure the security of the network.

Reliability: MANETs are less reliable than traditional networks, as they are subject to interference, signal attenuation, and other environmental factors that can affect the quality of the connection.

Bandwidth: Since MANETs rely on wireless communication, bandwidth can be limited. This can lead to congestion and delays, particularly when multiple nodes are competing for the same

Routing: Routing in MANETs can be complex, particularly when dealing with dynamic network topologies. This can result in inefficient routing and longer delays in data transmission.

Power Consumption: Since MANETs rely on battery-powered devices, power consumption can be a significant issue. Nodes may need to conserve power to extend the life of the battery, which can limit the amount of data that can be transmitted.

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