

Lecture 44: Mobile Adhoc Network (MANET): Concept, Architecture, and Advantages

Wireless Technologies

DI05011011: Mobile Communication

Agenda for Today

- 1. What is a MANET?
- 2. Infrastructure vs. Infrastructure-less Networks
- 3. Core Characteristics of MANET
- 4. MANET Architecture
- 5. How Routing Works in MANET
- 6. Advantages of MANETs
- 7. Real-world Deployment Scenarios
- 8. Summary and Next Steps

What is a MANET?

- A **Mobile Adhoc Network (MANET)** is a continuously self-configuring, infrastructure-less network of mobile devices connected wirelessly.
- **Adhoc** means 'for this purpose'. The network is formed on-the-fly for a specific need and can be dissolved when the need is over.
- Each device in a MANET acts as both a **host** (an endpoint generating data) and a **router** (forwarding data for others).
- There are no fixed base stations, no central servers, and no wired backbone.

Infrastructure vs. Infrastructure-less

- **Infrastructure Networks (Cellular, Wi-Fi BSS):**

- - Rely on fixed Access Points or Base Stations.
- - Devices communicate only through the AP.
- - If the AP fails, the network goes down (single point of failure).



- **Infrastructure-less Networks (MANET):**

- - No fixed APs.
- - Devices communicate peer-to-peer (P2P) directly or via intermediate nodes.
- - Highly resilient; if one node fails, traffic routes around it.

Characteristics of MANETs

- **1. Dynamic Topology:** Nodes move freely. The network structure changes unpredictably and rapidly.
- **2. Multi-hop Routing:** If node A wants to talk to node C, but they are out of range, node B in the middle can forward the packets.
- **3. Autonomous Operation:** Operates independently without any central administration.
- **4. Energy Constrained:** Nodes usually rely on battery power, and routing data for others drains batteries faster.
- **5. Variable Capacity:** Wireless links are subject to noise, fading, and interference, making bandwidth unpredictable.

- MANET architecture is primarily flat or hierarchical:
- **Flat Architecture:**
 - - All nodes are equal and share the same responsibilities.
 - - Suitable for small networks.
 - - Can suffer from excessive routing overhead as the network grows.
- **Hierarchical (Cluster-based) Architecture:**
 - - Nodes are grouped into clusters.
 - - One node is elected as the **Cluster Head**.
 - - Cluster Heads route traffic between clusters, reducing routing overhead for ordinary nodes.
 - - Better scalability for large networks.

Routing in MANETs

- Routing is complex because the network changes constantly. Protocols are categorized into:
- **1. Proactive (Table-driven):**
 - - Nodes continuously maintain routing tables to all other nodes.
 - - Routes are always available immediately, but consumes high bandwidth maintaining updates.
 - - E.g., DSDV (Destination-Sequenced Distance-Vector).
- **2. Reactive (On-demand):**
 - - Routes are discovered only when a node actually needs to send data.
 - - Saves bandwidth, but introduces a delay when initially sending data.
 - - E.g., AODV (Ad hoc On-Demand Distance Vector), DSR.

Advantages of MANETs

- **1. Rapid Deployment:** Can be set up instantly anywhere, without laying cables or installing towers.
- **2. High Fault Tolerance:** Decentralized nature means there is no single point of failure. The network adapts to node failures.
- **3. Cost-Effective:** No infrastructure costs (no cell towers to build or maintain).
- **4. Flexibility:** Nodes can join or leave the network freely. The network expands and shrinks organically.
- **5. Unrestricted Mobility:** Supports communication even when all participants are moving at high speeds.

Scenarios for MANET Deployment

- **Disaster Recovery:** Earthquakes or floods destroy cellular infrastructure. Rescue workers form a MANET to coordinate.
- **Military Operations:** Soldiers, tanks, and drones in a battlefield form a secure, mobile network where towers are impossible or easily targeted.
- **Temporary Events:** Conferences, concerts, or sporting events where temporary high bandwidth is needed between peers.
- **Personal Area Networks (PAN):** Connecting a smartphone, laptop, and smartwatch dynamically.

- MANETs are infrastructure-less, self-configuring networks of mobile devices.
- Devices function as both hosts and routers, enabling multi-hop communication.
- Networks have dynamic topologies and can be organized flat or hierarchically.
- Routing can be proactive (table-driven) or reactive (on-demand).
- Advantages include rapid deployment, fault tolerance, and cost-effectiveness, making them ideal for disaster recovery and military applications.

- In our final lecture, we will complete our study of MANETs:
- **1. Limitations and Challenges:** Security, battery, and bandwidth issues.
- **2. Comparison:** MANET vs. Cellular Networks.
- **3. Specialized MANETs:** Introduction to Vehicular Adhoc Networks (VANETs).
- This will conclude Unit 5 and the Mobile Communication course!