MANETs Introduction © Dr. Ayman Abdel-Hamid, CS5984 Spring 2006

Outline

• Introduction to MANETs
  ➢ Notion
  ➢ Communication Environment
  ➢ Features and Requirements
  ➢ MAC-layer protocols
  ➢ Routing protocols
  ➢ Security services

Notion

• MANET is a network architecture that can be rapidly deployed without relying on pre-existing fixed network infrastructure
• Lack of a centralized control entity
• Nodes can dynamically join and leave the network
  ➢ Without warning
  ➢ Without disruption to other nodes’ communication
• Nodes can be highly mobile
  ➢ Rapidly changing network topologies (time-varying network topology)
  ➢ Rapidly varying presence or absence of links

MANET Applications

• Establishment of military communication during deployment of forces in unknown and hostile terrain
• Rescue missions in remote or rural areas
• National crisis where communication infrastructure is non-operational
• Commercial use (exhibitions, conferences, or sales presentations)
• Education (wall-free virtual classrooms)
• Sensor networks ➔ Environmental monitoring (water pollution or hurricane warning)
• Short range ad hoc networks used to form Personal area networks (PAN) ➔ e.g., Bluetooth

Mobile Ad Hoc Networks Introduction
Communication Environment

- Nodes are equipped with portable communication devices
  - Limited battery life
- Connectivity between nodes is not a transitive relation
- Nodes identified by fixed IDs (e.g., IP address)
- In case no direct link exist between source and destination nodes
  - Use of multi-hop routing
  - The willingness of a node to forward traffic
  - Distributed Routing protocols needed to discover routes between source and destination
  - Fluctuating link capacity

Features and Requirements

- Must provide a high degree of reliability, survivability, availability, and manageability of the network
- Robust routing and mobility management algorithms
- Adaptive algorithms and protocols
- Low-overhead algorithms and protocols
- Multiple (distinct) routes
- Robust network architecture

MAC Layer Protocols for MANET

- MACA
- MACAW

Routing Protocols in a MANET

- Proactive
  - Continuously learn network topology by exchanging topological information among network nodes (route from source to destination is available immediately)
  - Cost of updating topology information may be very high
- Reactive
  - Rely on a query-reply dialog (on-demand)
  - Invoke a procedure to find a route to a destination (some sort of flooding the network with the route query)
  - May encounter excessive delays in the flooding process
- Hybrid
  - Combine aspects of proactive and reactive protocols
  - For example, proactively maintain topology of close neighbors, and reactively discover routes outside its neighborhood (controlled flooding)
Security Services in a MANET

- Traditional requirements of authentication, confidentiality, integrity, and non-repudiation
- Specific to MANET
  - Insecurity of wireless links
  - Energy constraints
  - Poor physical protection of nodes in a hostile environment
  - Vulnerability of statically configured security schemes
  - Establishing trust (no prior security association can be assumed)
    - Rely on cryptographic keys
    - Create trusted relationships between keys without aid of trusted third-party certification
  - Secure route-discovery and secure data forwarding