Mobile Ad-Hoc NETwork (MANET)

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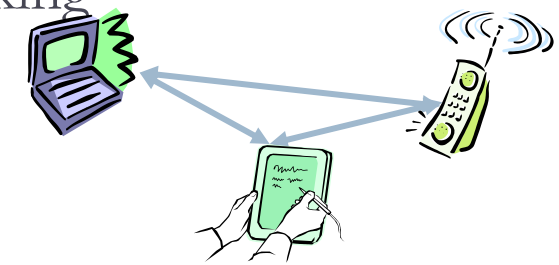
Introduction

- Standard Mobile IP needs an infrastructure
  - Home Agent/Foreign Agent tunnels, default routers in the fixed network
  - DNS, routing etc. are not designed for mobility
- Sometimes there is no infrastructure!
  - Remote areas, ad-hoc meetings, disaster areas
  - Cost can also be an argument against an infrastructure!
- Main Concern: routing
  - No default router available
  - Every node should be able to forward

Solution: Wireless ad-hoc networks

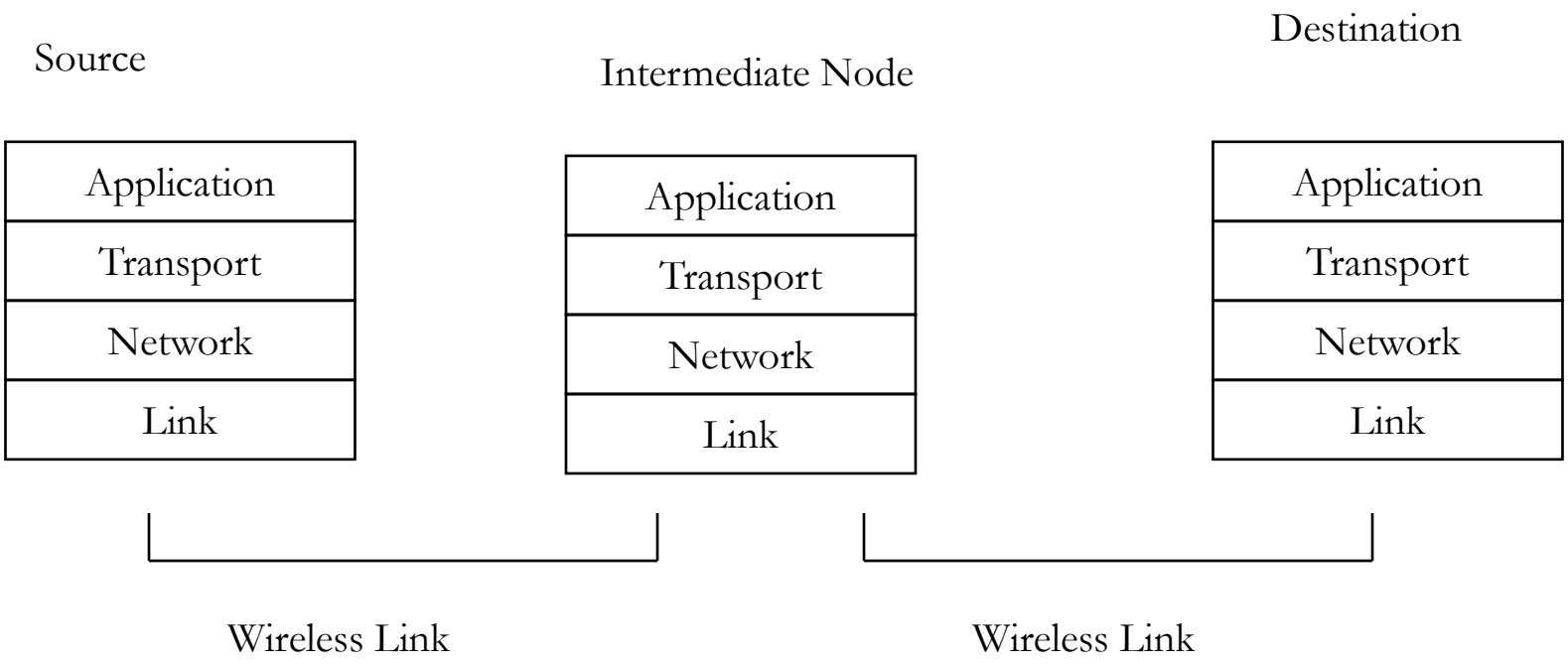
- Network without infrastructure
  - Use components of participants for networking
- Examples
  - Single-hop: All partners max. one hop apart
    - Bluetooth piconet, PDAs in a room, gaming devices…
  - Multi-hop: Cover larger distances, circumvent obstacles
    - Bluetooth scatternet, TETRA police network, car-to-car networks…
- Internet: MANET (Mobile Ad-hoc Networking) group



Examples – Mobile Ad-hoc NETworks (MANET)

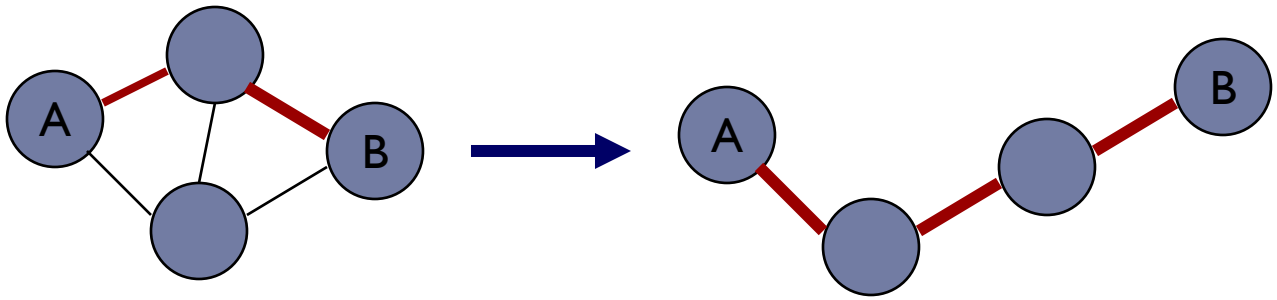
- Instant infrastructure:
  - Unplanned meetings, spontaneous interpersonal communications.
- Disaster Relief:
  - Infrastructure breaks down in disaster.
  - No planning can be done to setup infrastructure.
- Remote Areas:
  - Setting up infrastructure for remote area – too expensive (sparsely populated area)
- Effectiveness:
  - Services provide by existing infrastructure might be too expensive for certain applications. (sending small status for every minute.)

Schematic Model of MANET



Routing in MANET Complex – Why?

- Host movement frequent
- Topology change frequent
- Link Breakage



- No cellular infrastructure. Multi-hop wireless links.
- Data must be routed via intermediate nodes.

Battery

- Nickel Cadmium (Ni-Cd)
- Nickel Metal Hydride (Ni –MH)
- Lithium ion (Li-ion)
- Reusable Alkaline
- Lithium Polymer

Characteristics of MANETs

- Lack of fixed Infrastructure
  - Single hop Communication (direct comm b/w 2 nodes)
  - Multi-hop communication
  - Cellular networks, Wireless LAN cannot be considered as MANET
- Dynamic topologies
  - Network topology may change dynamically as the nodes are free to move
- Bandwidth-constrained, variable capacity links:
  - Wireless link have low capacity than wired link.
  - Bandwidth change dynamically.
  - Collision occurs frequently.

Characteristics of MANETs

- Energy-constrained operation
  - Some nodes in the ad hoc network may rely on batteries or other exhaustible means for their energy.
- Limited physical security
  - More prone to physical security threats than fixed cable networks
  - Eavesdropping, spoofing, Denial-of-service
- Other characteristics
  - Distributed peer to peer mode of operation
  - Multihop routing
  - Frequent changes to the concentration of nodes

Applications of MANETs

- Communication among portable Computers
  - Portables or computerized equipment can communicate among themselves.
  - Conference hall- no network infrastructure- exchange files via MANET.
- Environmental Monitoring
  - Environmental Management
  - Security Monitoring
  - Road traffic monitoring
  - Rainfall, Humidity (Wireless adhoc sensor Networks)

Applications of MANETs

- Military
  - Computerised equipment for soldiers, tanks, planes etc
- Emergency operations
  - Search-and-rescue
  - Policing and fire fighting
  - Earthquake (re-establish communication)

Summary

- Mobile Ad-hoc NETworks (MANET)
- Semantic model of MANET
- Characteristics of MANET
- Applications of MANET

Test Your Knowledge

- The growth of _____ and 802.11/Wi-Fi wireless networking have made MANETs a popular research topic since the mid- to late 1990s.
  - Laptop
  - Netbook
- MANETs are a kind of wireless ad hoc networks that usually has a routeable networking environment on top of a _____ ad hoc network.
  - Internet Protocol Suite
  - Media Access Control
  - Ethernet
  - Link Layer

References

- Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007.
- Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.