Wireless Network

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Lab Set B

Ad-Hoc, Mesh Wireless Networks

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ROUTING PROTOCOL FOR AD HOC, MESH NETWORKS

Outline

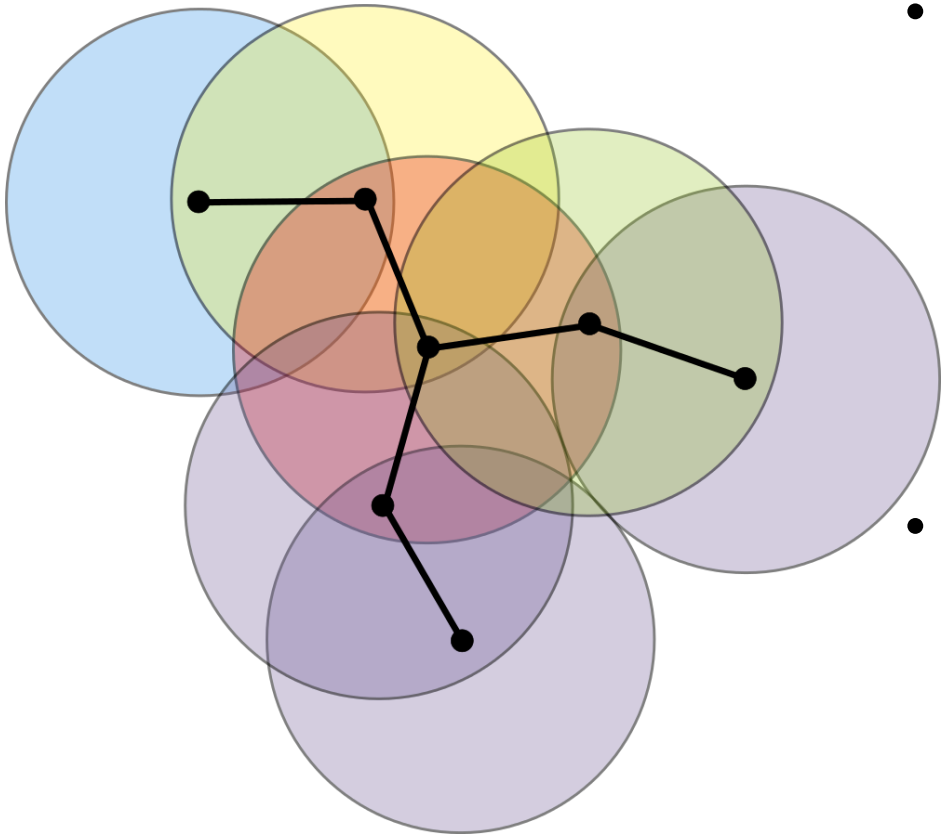
- Relevance to Ns3 lab
- Routing in ad hoc networks
  - Routing basics (AODV, DSR, DSDV)

Lab B - relevance

- Ad hoc network with multiple devices placed in the given service area
  - Lab B utilizes grid topology
  - **Hint**: identify the maximum range of direct communication
- Routing scheme (protocol) needs to setup path of forwarding nodes
- HOW THE FORWARDING AFFECTS CAPACITY OF WIRELESS LINK??

Ad Hoc, Mesh Networks

Visual Ad Hoc/Mesh Network

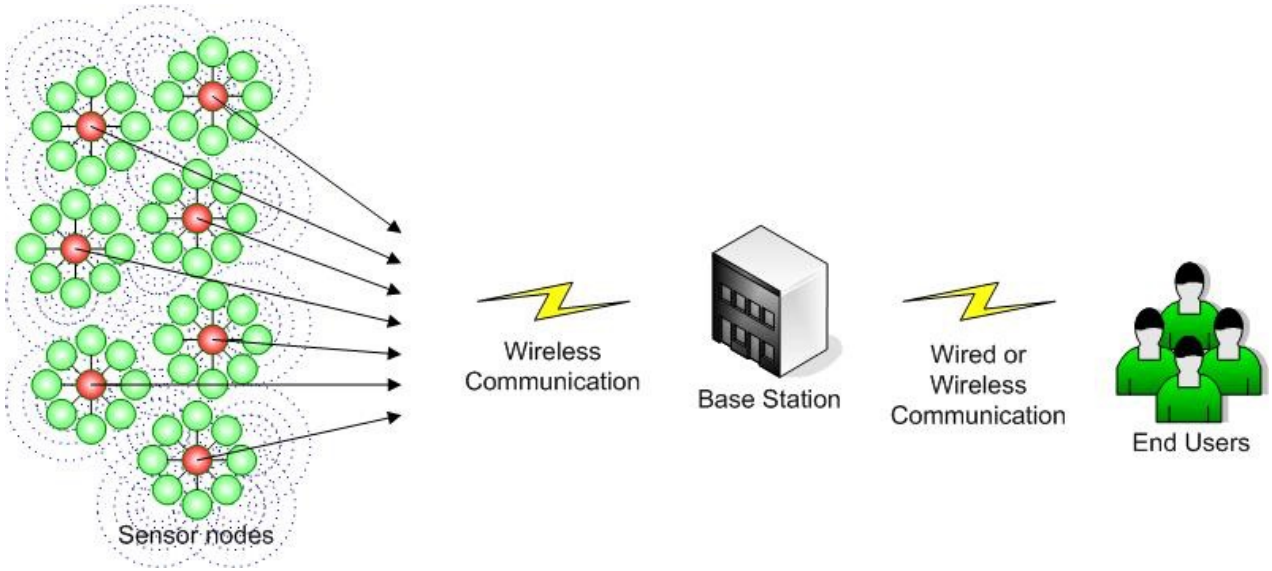


Ad Hoc, Mesh Networks

- Randomly placed set of nodes
  - Random set of source-destination pairs
  - Route/forward the data from the source nodes to the destination node
- Note: Peer-to-peer network ignores intermediate nodes
  - Or assume there are only direct links

https://commons.wikimedia.org/w/index.php?title=File:Adhoc_multihop.png

Sensor Networks

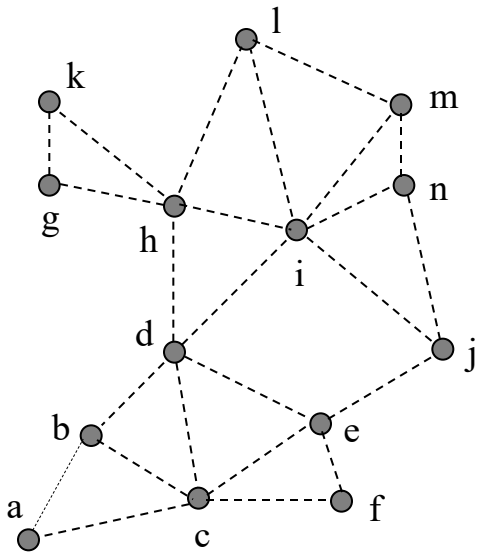


- **Large number** of **simpler devices**
  - Typically, route the data from the sensor nodes to the common base station
- Sensor data: smaller, fewer chunks of information
  - Redundancy of information
- Different topologies possible

ROUTING IN AD HOC/MESH NETWORKS

Routing Protocol

- Existing protocols are based on ‘number of hops’
  - Minimum hops doesn't mean optimal QoS route
- Channel variations affect delays, energy and bit-error rates
- Consideration for QoS in routing protocol
- Proactive vs. reactive protocols



Related Work

- Reactive protocols
  - AODV, DSR, TORA, CEDAR
- Proactive protocols
  - DSDV, STAR, OLSR
- These protocols are based on ‘number of hops’
- OLSR_R3 based on ‘max bandwidth bottleneck’
  - Increases end-to-end delay
  - Channel conditions are not considered

Ad hoc On-Demand Distance Vector (AODV)

- Distributed routing table
  - Each nodes knows only its next hop neighbors
  - **Flooding** distribution of routing request
- Three (3) basic messages:
  - **RREQ** – Route Request
    - Bcast, src., and dest. IDs
    - Src. request sequence and Time-To-Live (TTL)
    - Dest. response sequence (optional?)
  - **RREP** – Route Reply
  - **RERR** – Route Error
- Implementation improvement:
  - Snooping
  - Local route repair

AODV Example

DSR

- Dynamic Source Routing (DSR)
  - Similar to AODV but each node knows entire path to destination
  - No routing table needed unless source
  - Drawbacks
    - Scalability when snooping
    - Routing table overhead
    - Message overhead
    - Response to topology changes

DSR Example

DSDV

- Destination-Sequence Distance Vector (DSDV) routing
  - Shortest path – based on a distributed Bellman-Ford algorithm
  - Periodic discovery of neighbors and broadcasting routing table updates
  - Issue with
    - Slow response
    - Overhead
    - Loops and count-to-infinity problem
  - Solutions
    - Destination sequence number
    - Dumping
    - Full-dump vs Incremental updates

DSDV Example

Multi-hop Capacity

- Challenge in identifying the maximum possible capacity
  - Imagine telephone game with people continuously passing words, sentences…

QUESTIONS?