Defending Against Man-in-the-Middle Attacks on AODV Routing

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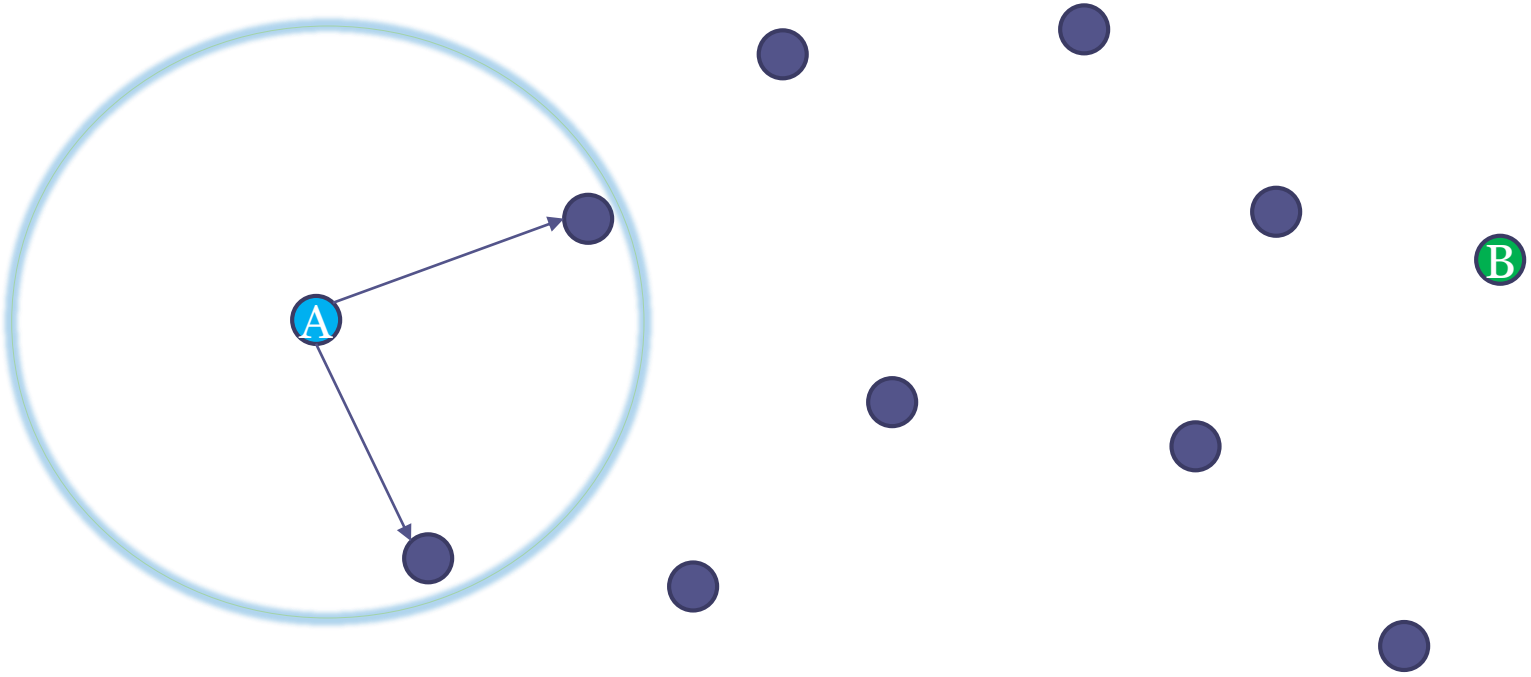
What is AODV Routing?

- Ad-hoc On Demand Distance Vector Routing (AODV)
- This is the routing protocol used in ZigBee, a popular standard for wireless mesh networks.
- A mesh network is a topology in which each node relays data for the network.

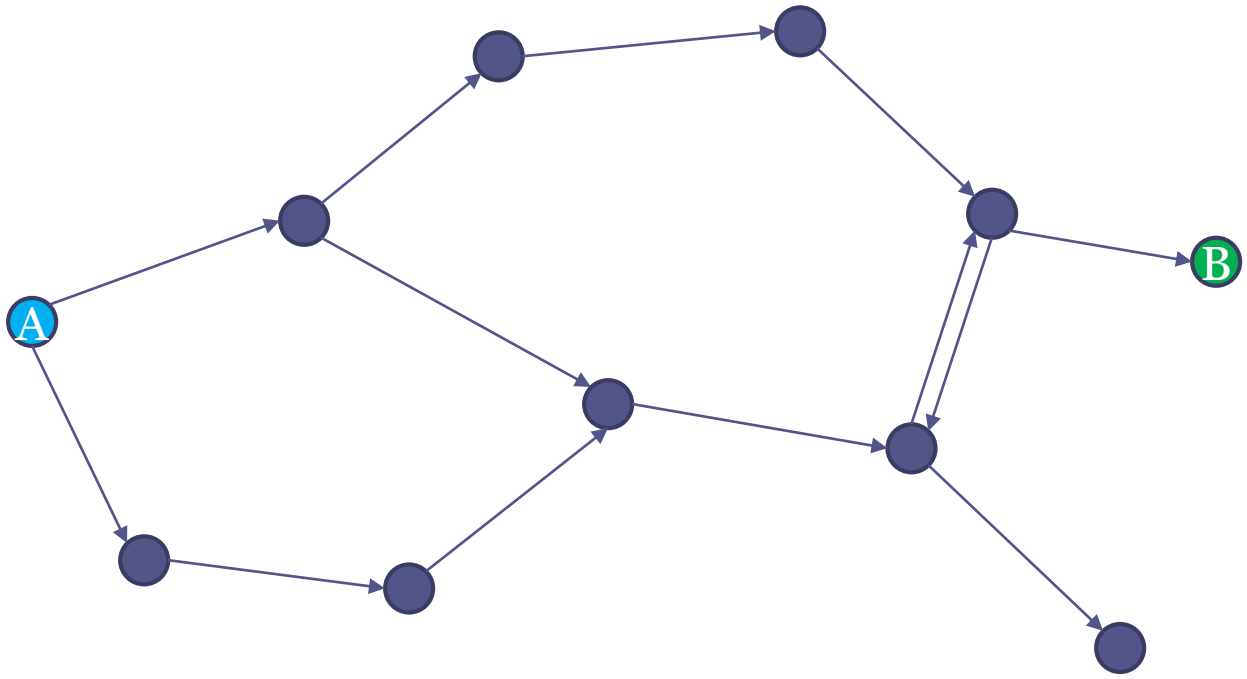
How does AODV work?

- Original sender broadcasts Route Request (RREQ).



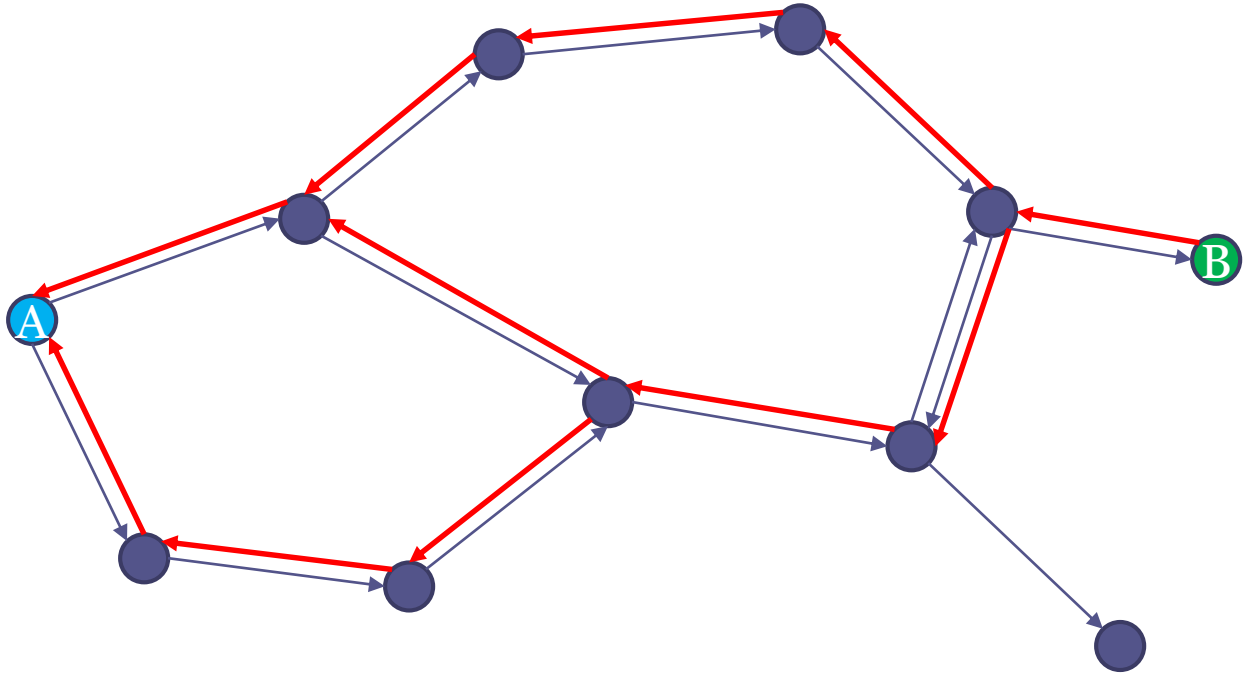
How does AODV work?

- Intermediate nodes propagate RREQ.



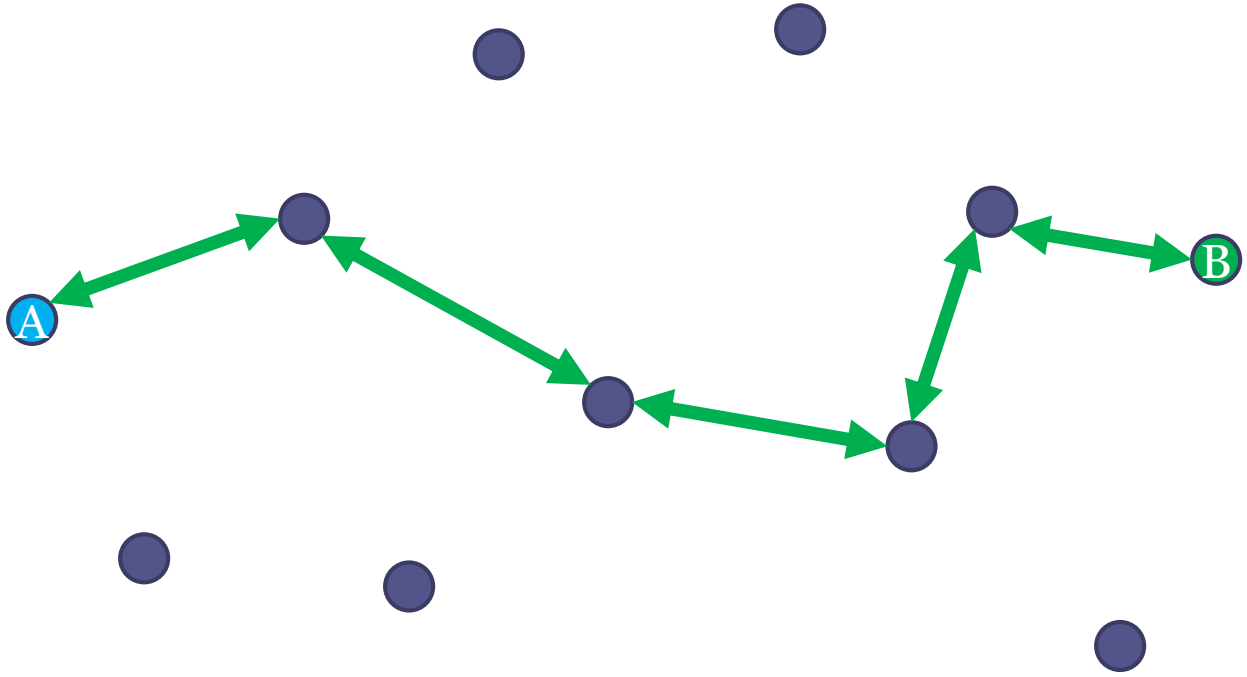
How does AODV work?

- Destination node sends Request Reply (RREP) back to sender for each RREQ.



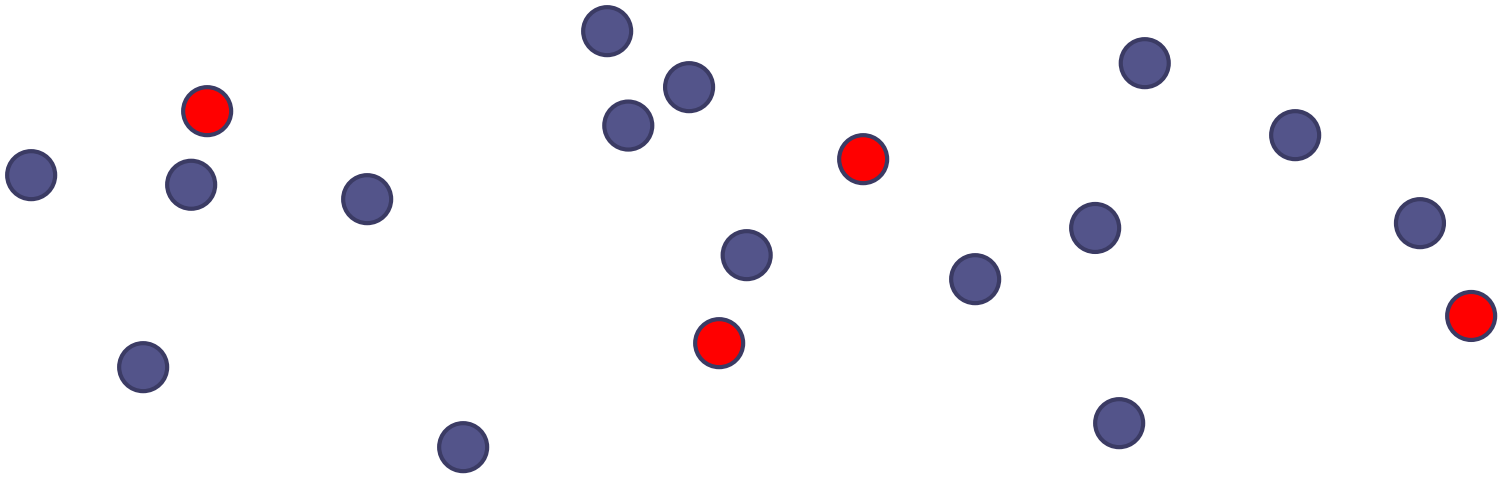
How does AODV work?

- Sender uses lowest hop-count route to communicate with destination.



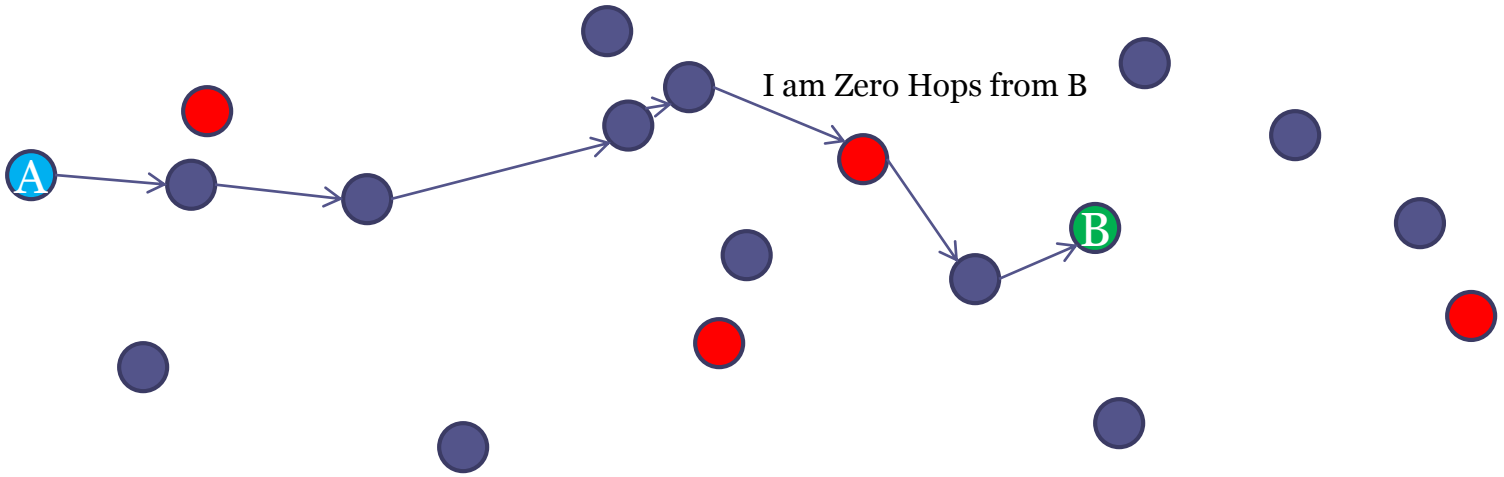
Attack Model (Initial Conditions)

- Of *n* deployed nodes, one or more are captured by an adversary.



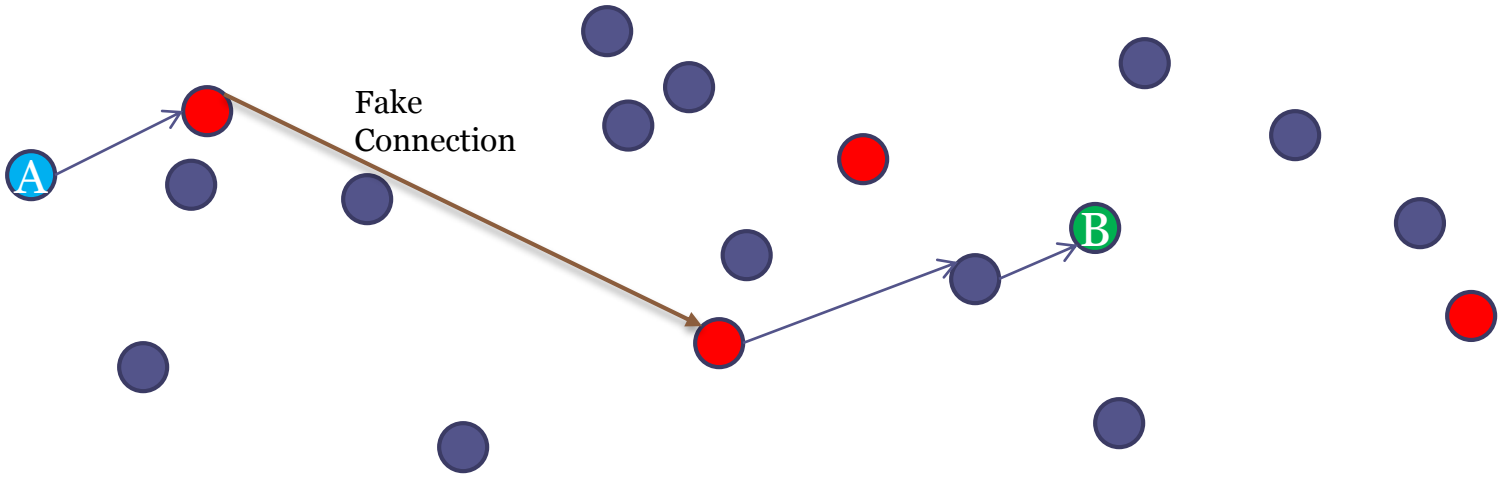
Attack Model (Getting Selected)

- A captured node spoofs the RREP in order to get selected as the shortest path.



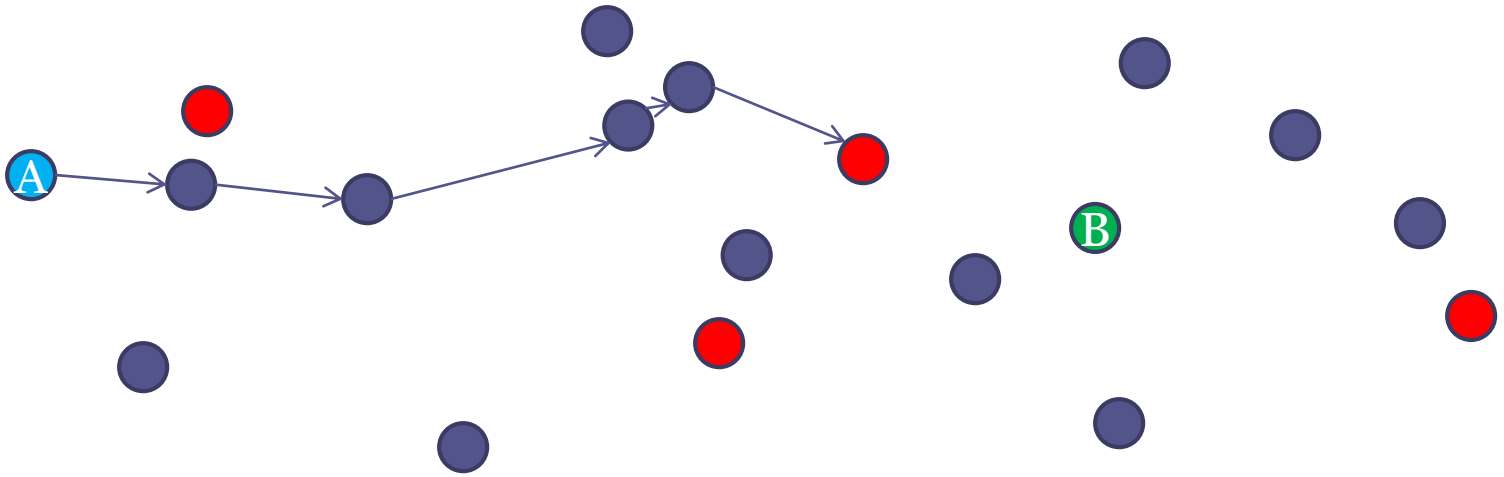
Attack Model (Getting Selected)

- A pair of captured nodes create a fake tunnel to make it likely that they are selected as the shortest path.



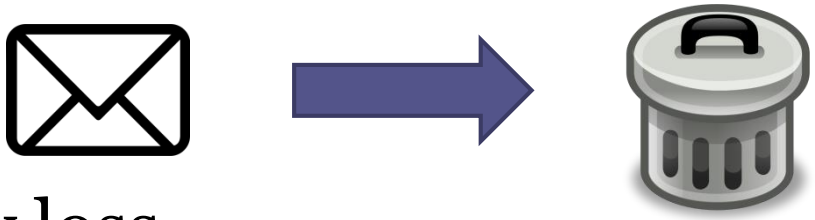
Attack Model (Exploitation)

- The captured node drops all packets rather than forwarding them.

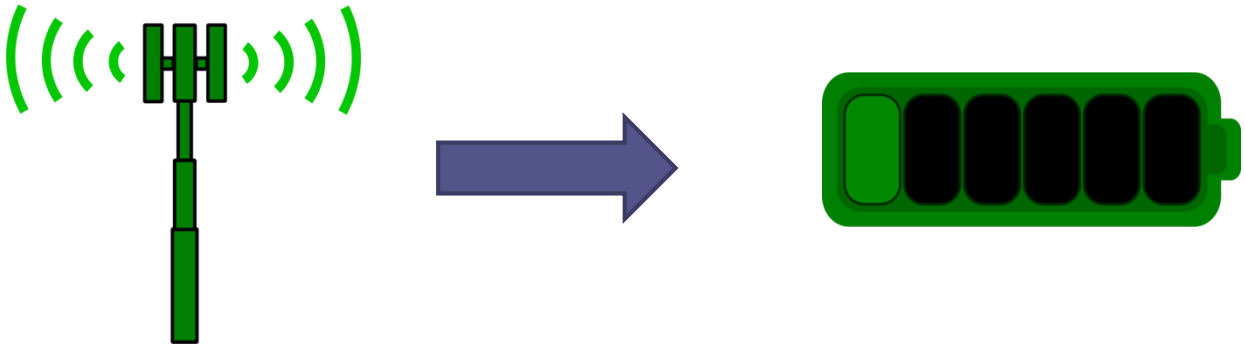


Attack Model (Results)

- Data loss
  - Packets never reach their destination.



- Energy loss
  - Nodes waste energy on radio communication.



Defensive Goals

- Primary Objective
  - Ensure that packets reach their destination if it is possible to do so.
- Secondary Objective
  - Minimize message complexity in order to reduce network transmissions.

Sources

- Perkins, Charles E., and Elizabeth M. Royer. "Ad-hoc on-demand distance vector routing." *Mobile Computing Systems and Applications, 1999. Proceedings. WMCSA'99. Second IEEE Workshop on*. IEEE, 1999.
- Tseng, Chin-Yang, et al. "A specification-based intrusion detection system for AODV." *Proceedings of the 1st ACM workshop on Security of ad hoc and sensor networks*. ACM, 2003.
- http://en.wikipedia.org/wiki/ZigBee
- http://en.wikipedia.org/wiki/Mesh_networking
- Images from openclipart.org