Passive and Active Hidden Terminal Detection in 802.11-based Ad Hoc Networks

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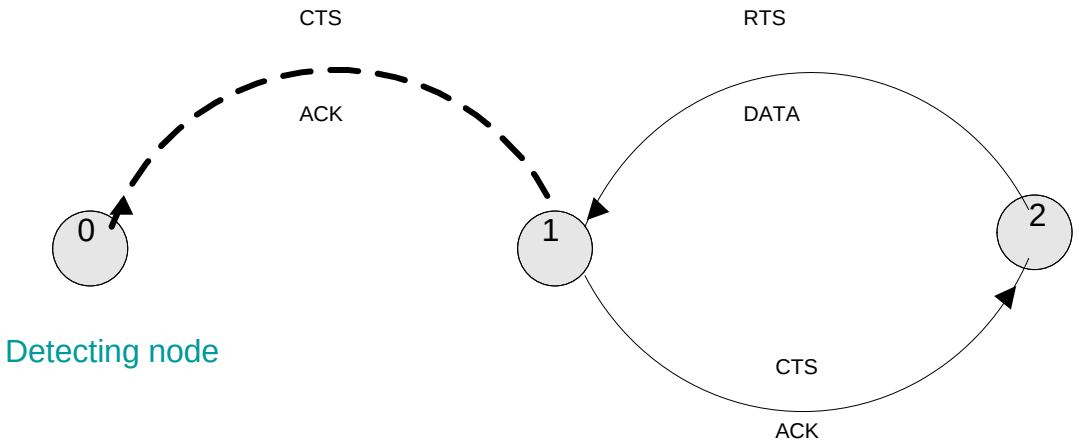
Outline

- Background and motivation
- Detection mechanisms
  - Passive detection
  - Active detection
- Simulations based on 802.11 ad hoc networks
- Conclusions and future work

Background and Motivation

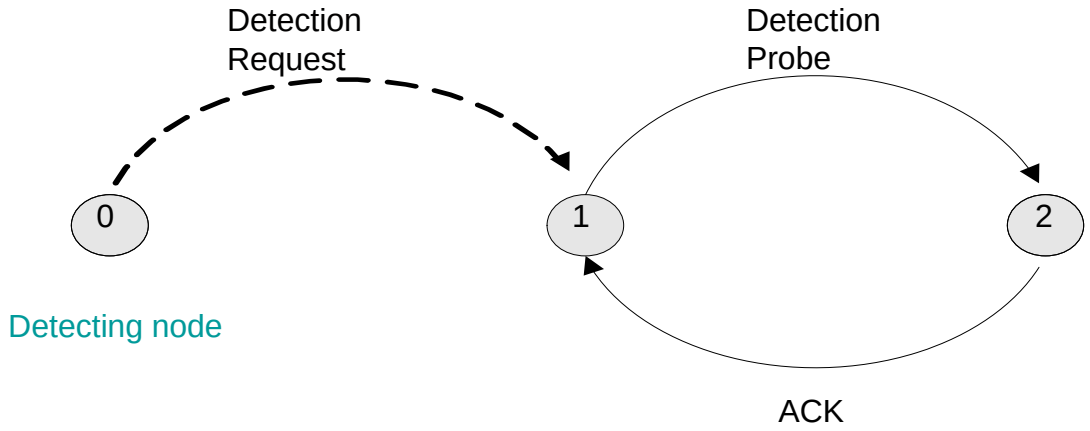
- Background information
  - Hidden terminal: a well-known problem
  - RTS/CTS does not really solve the problem
    - Extra overhead
- Motivation
  - Preventively get the knowledge of existing hidden terminals in a node's vicinity
    - Use RTS/CTS only when necessary
- This knowledge is obtained through hidden terminal detection

Passive detection



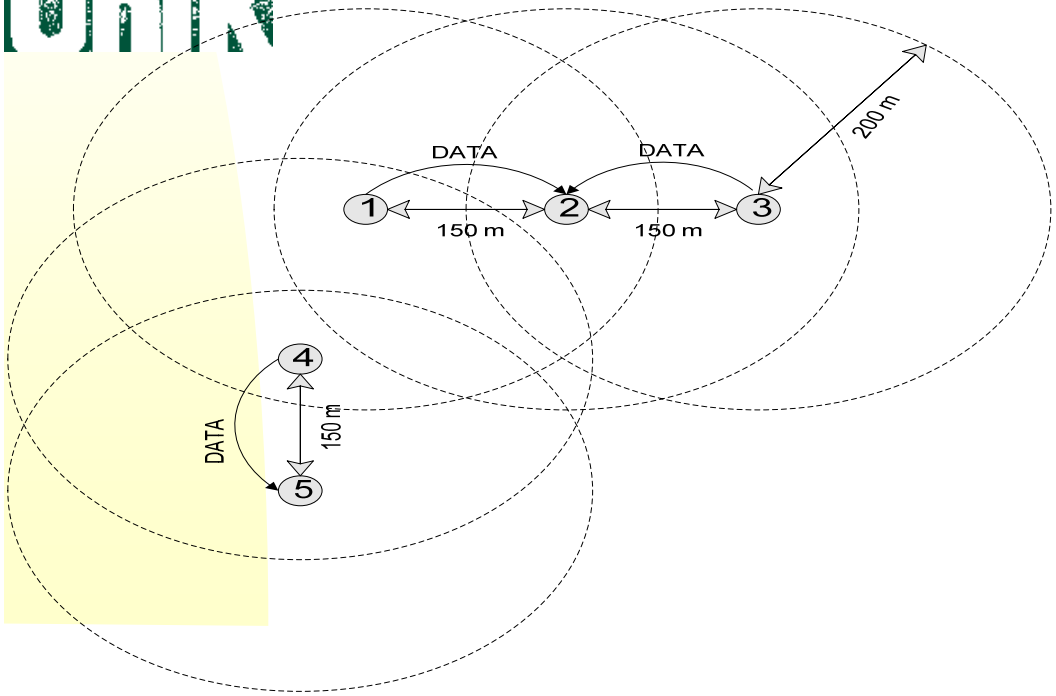
- Passively monitor ongoing traffic in the neighborhood of the detecting node
- No extra protocol traffic
- Hidden terminal detected by the incomplete reception of a DATA/ACK pair (without RTS/CTS), an RTS/CTS pair (with RTS/CTS)

Active detection



- Actively initiate hidden terminal detection via Detection Request and Detection Probe packets
- Extra overhead introduced
- Hidden terminal detected by counting missing ACKs after Detection Probe packets

Simulation set I – passive detection

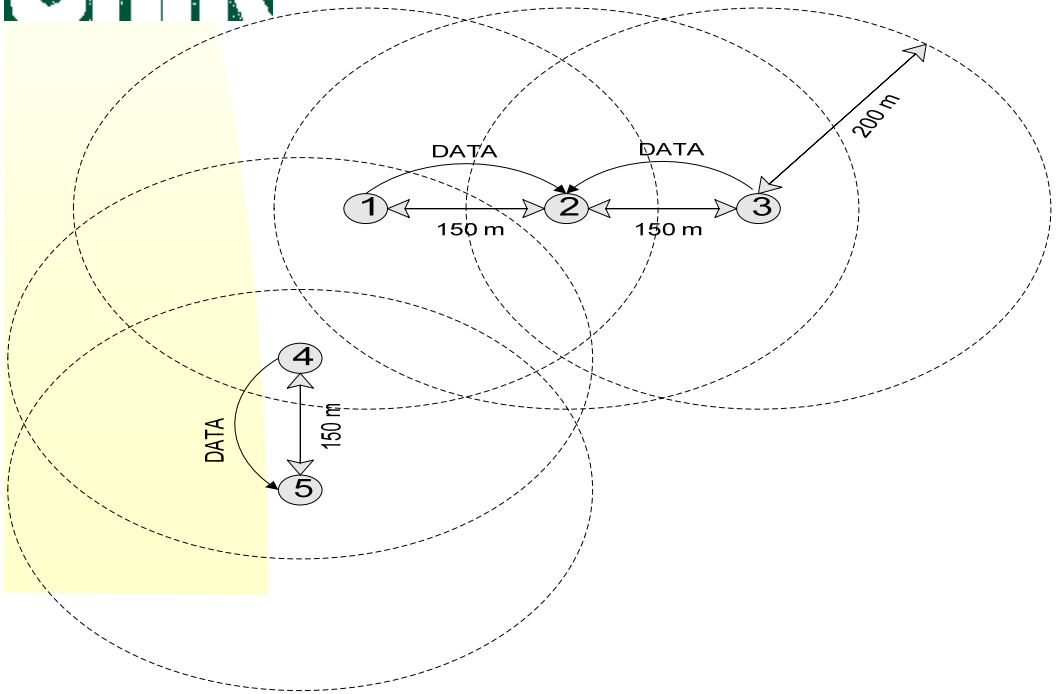


Hidden terminal reports for passive detection

Node	One-hop neighbor	Hidden terminal report
1	2, 4	3, 5
2	1, 3	No hidden node observed
3	2	1
4	1, 5	2
5	4	No hidden node observed

- Simulation result: an incomplete picture of existing hidden terminals

Simulation set II – active detection

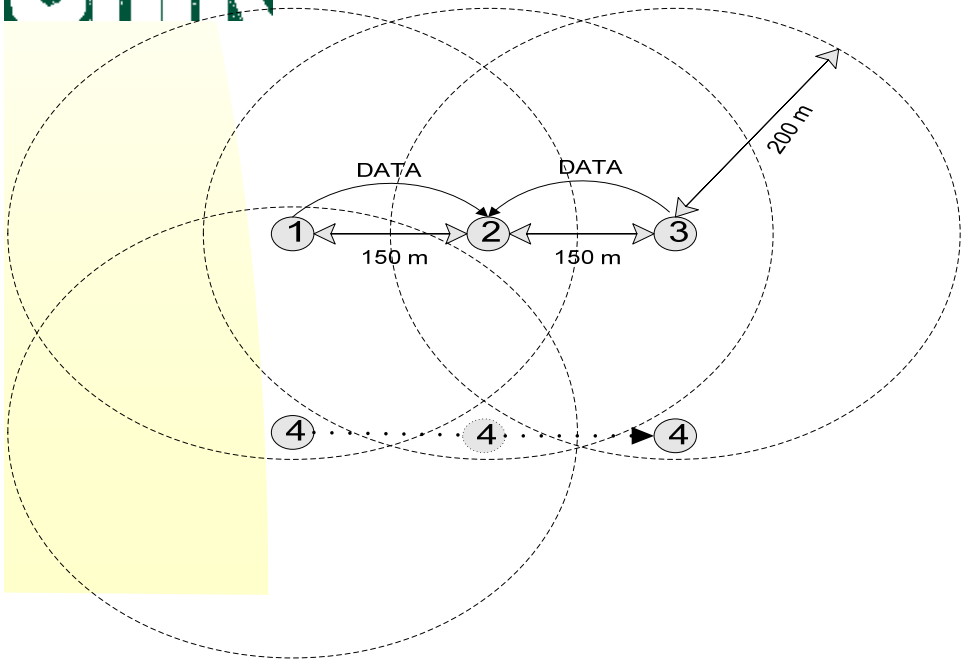


Hidden terminal reports for active detection

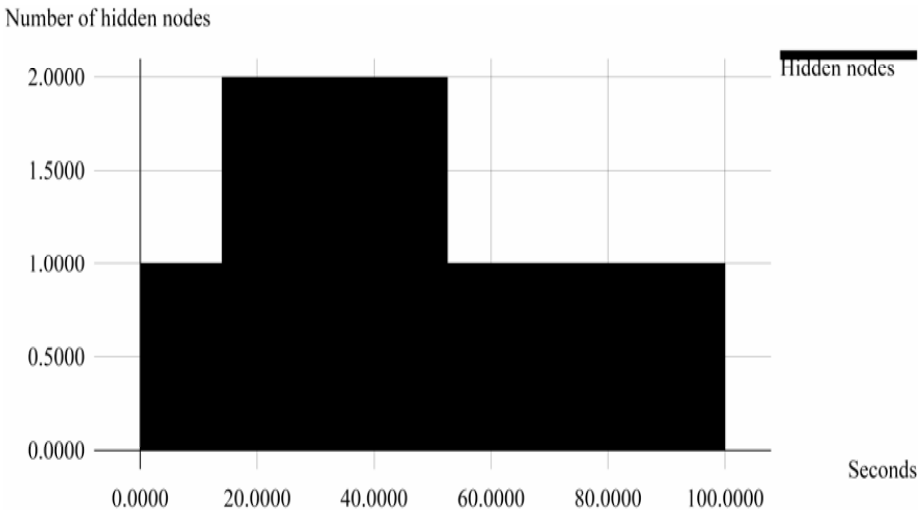
Node	One-hop neighbor	Hidden terminal report
1	2, 4	3, 5
2	1, 3	4
3	2	1
4	1, 5	2
5	4	1

- Simulation result: all hidden terminals are detected, at a cost of extra overhead

Simulation set III – detection by mobile node



Hidden terminal reports from a mobile node



- Simulation result: the detection mechanism works fine also for mobile nodes

Conclusions and future work

- Two hidden terminal detection mechanisms have been proposed, where
  - Passive detection relies on background traffic and introduces no extra protocol overhead, but results in an incomplete picture of the hidden nodes
  - Active detection generates extra protocol overhead, but gives a complete list of all hidden nodes
- These mechanisms apply to both WLANs and multihop ad hoc networks
- Future work
  - Study the tradeoff between detection overhead and RTS/CTS overhead
  - Parameter optimization for detection in various scenarios