

Revealing the Problems with 802.11 Medium Access Control Protocol in Multihop Wireless Networks

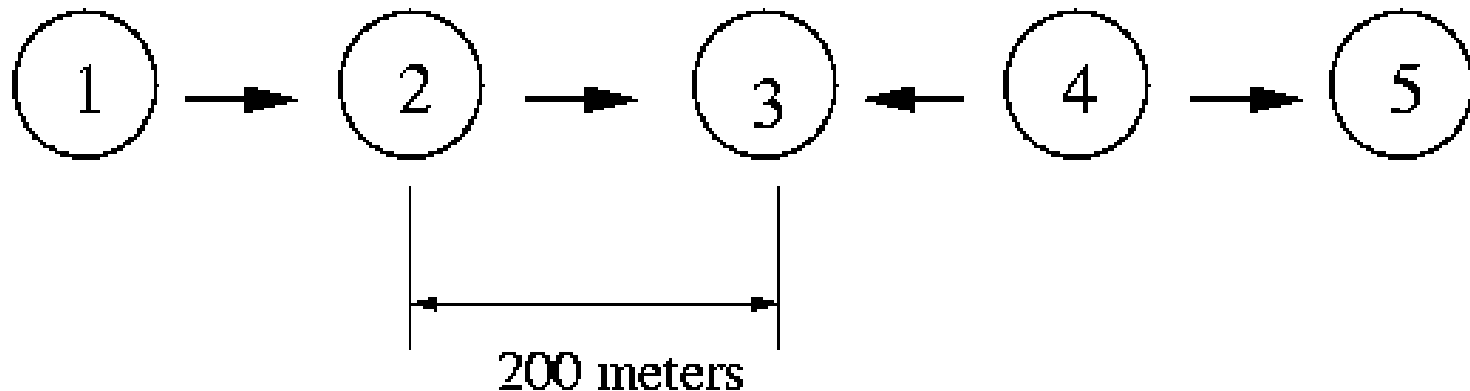
Arvind Santhanam
University of California, San Diego
Electrical and Computer Engineering
`arvind@cwc.ucsd.edu`

17th June 2002

Main Problems

- Instability and unfairness between TCP sessions over 802.11.
- Unsuitability of 802.11 for multi-hop networks.
 - ★ Hidden Node Problem.
 - ★ Exposed Node Problem.

Network Topology

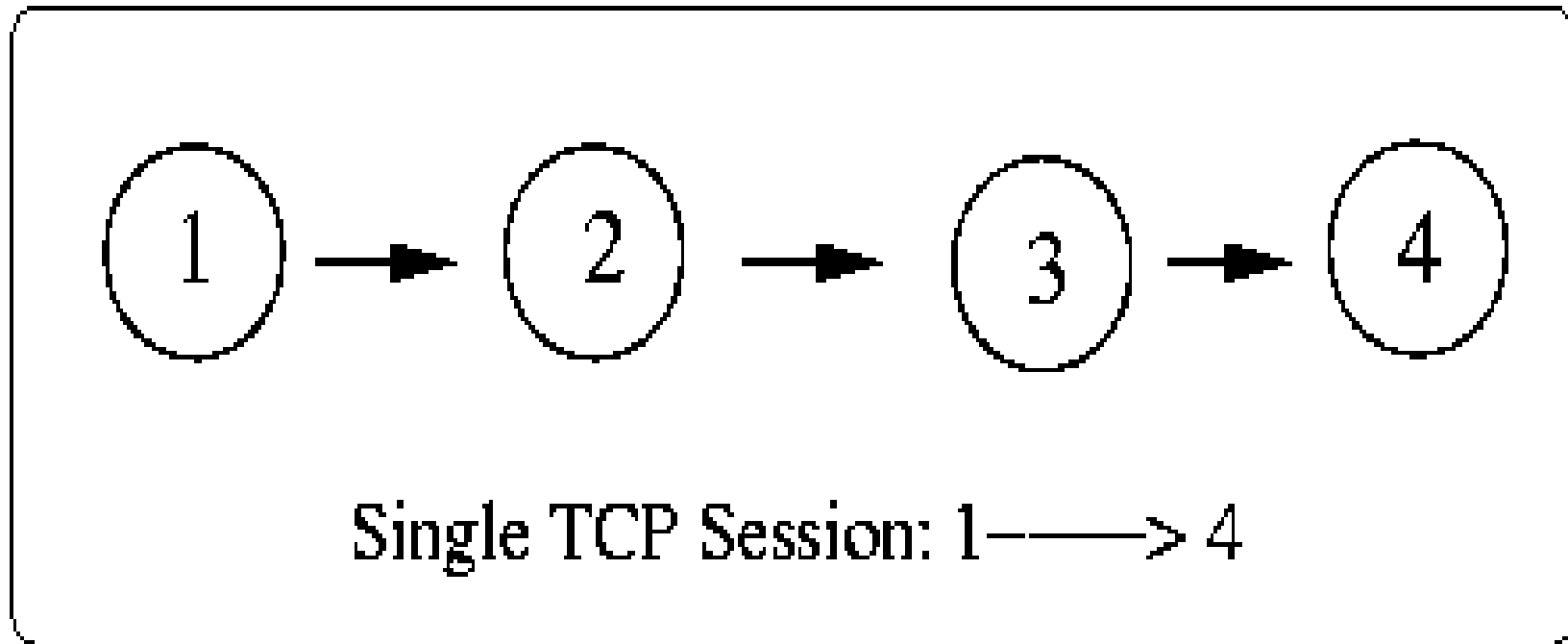


Transmission Range: 250 meters

Interference/ Sensing Range: 400–500 meters

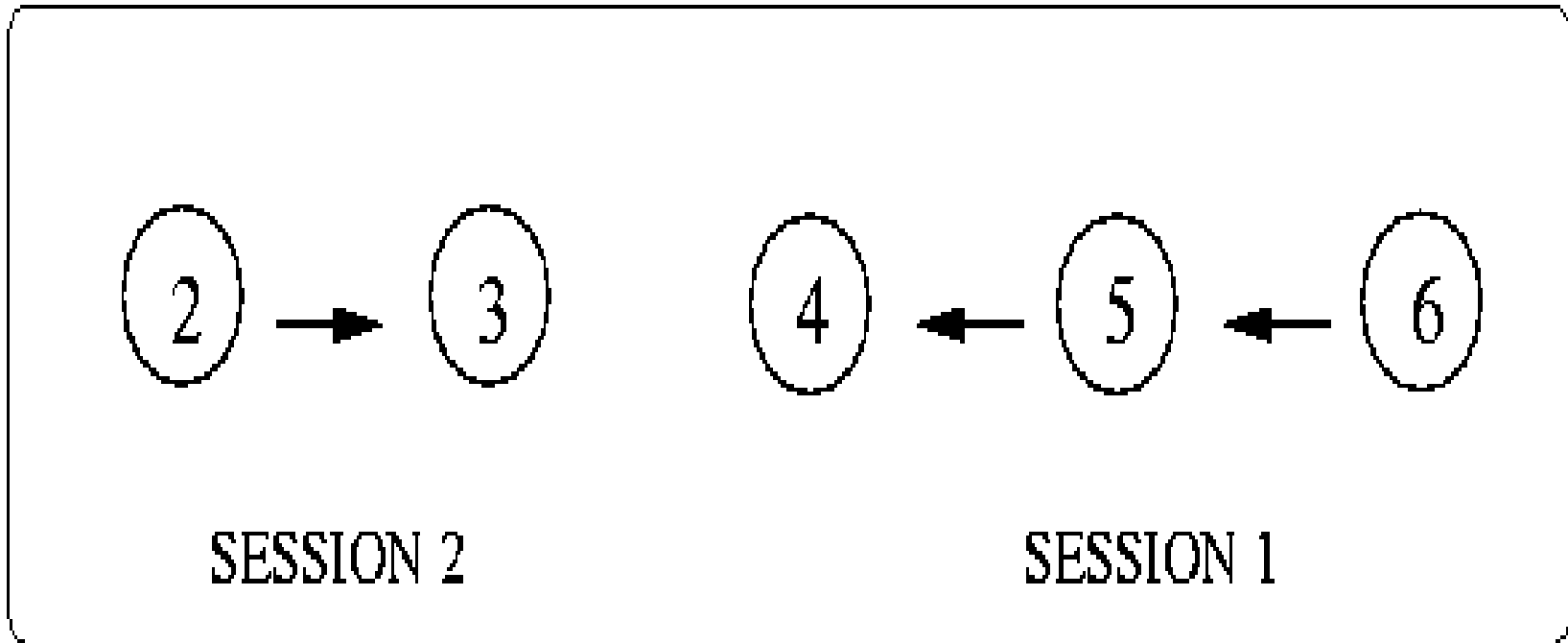
- Static nodes in string topology.
- Interfering/ sensing range of nodes is about twice the transmission range.

Experiment 1: Throughput Vs TCP Window Size



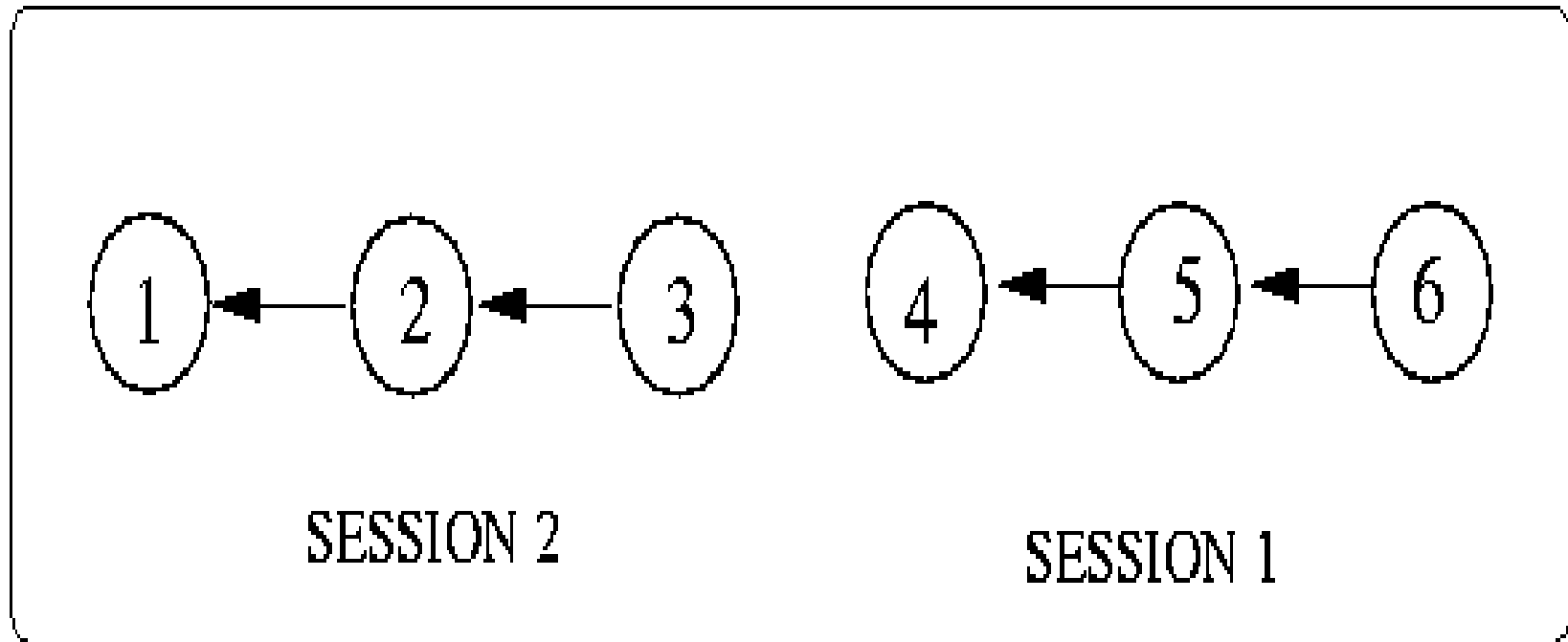
- TCP throughput falls sharply for large maximum transmit window sizes.
- Causes: Frequent Route failures and Timeouts for large TCP transmit windows.
- 802.11 initiates route discovery after 7 unsuccessful consecutive channel accesses.

Experiment 2: TCP Session Shut Down



- Session 6 \longrightarrow 5 \longrightarrow 4 is shut down by one-hop session 2 \longrightarrow 3.

Experiment 3: Random Toggling of TCP Sessions



- Session 6 \longrightarrow 5 \longrightarrow 4 and session 3 \longrightarrow 2 \longrightarrow 1 toggle after random intervals.
- Only one session is active at any time.
- Unfair and unpredictable.

Recommendations

- Alleviate the hidden node and exposed node problems by simple changes to the current 802.11 MAC standard.
 - ★ Adjusting the Interference/ sensing range.
- Alter the back-off mechanism in 802.11.