A MAC Protocol for Full Exploitation of Directional Antenna in Ad-hoc Wireless Networks

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Outline

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Introduction (1/3)
Introduction (2/3)
Directional antennas in ad hoc networks offer many benefits compared with classical omni-directional antennas including increase of spatial reuse, coverage range and network capacity.

Unfortunately, directional transmissions increase the hidden terminal problem, the deafness problem and the problem of determination of neighbors’ locations.
Problem Definition

- An example of hidden terminal problem and deafness problem.
The Proposed Protocol

- Circular Directional Control messages
- Circular Directional RTS
  - The RTS is transmitted *consecutively in a circular way*, until it scans all the area around the transmitter.
  - The neighbors are *informed with the intended transmission*.
- D-NAV
  - D-NAV uses a table that keeps track of *the directions* and *the corresponding durations*.
Circular Directional Control Messages

HELLO from neighbors
### Location Table

<table>
<thead>
<tr>
<th>Me</th>
<th>Neighbor</th>
<th>My Beam</th>
<th>Neighbor’s Beam</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>A</td>
<td>C</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>A</td>
<td>D</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>
Circular Directional RTS
D-NAV
Simulations (1/3)

- Random topology with 7 nodes.
Simulations (2/3)

- Random topology with 15 nodes.
Simulations (3/3)

- Grid topology with 9 nodes

![Graph showing throughput vs load for Omni and 8 elements configurations.](image)
Conclusions

- The proposed algorithm is based on the circular directional control messages that scans the area around to find neighbors’ location periodically.
- Also the circular directional RTS will inform the neighbors for the intended communication.
- Finally, the authors use a simple scheme for neighbors to defer their transmission in order not to destroy the ongoing transmission.