A New Cooperative Strategy for Deafness Prevention in Directional Ad Hoc Networks

ICC 2007

Chi-Han Lin

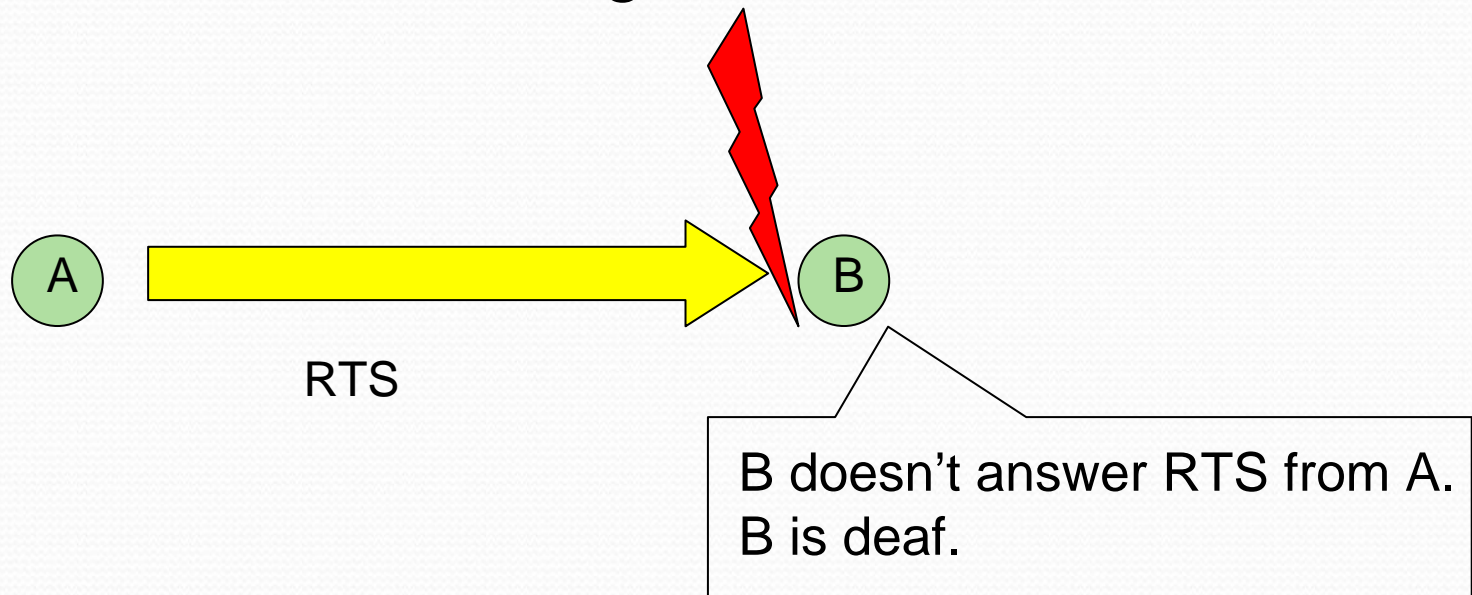Nov. 29, 2007

Outline

- Introduction

- Related works

- Cooperative-MAC(CMAC)

- Simulation

- Conclusions

Introduction

- ## What is deafness：

  - A terminal is said to be deaf if it doesn't answer an RTS message addressed to it.

A

B

RTS

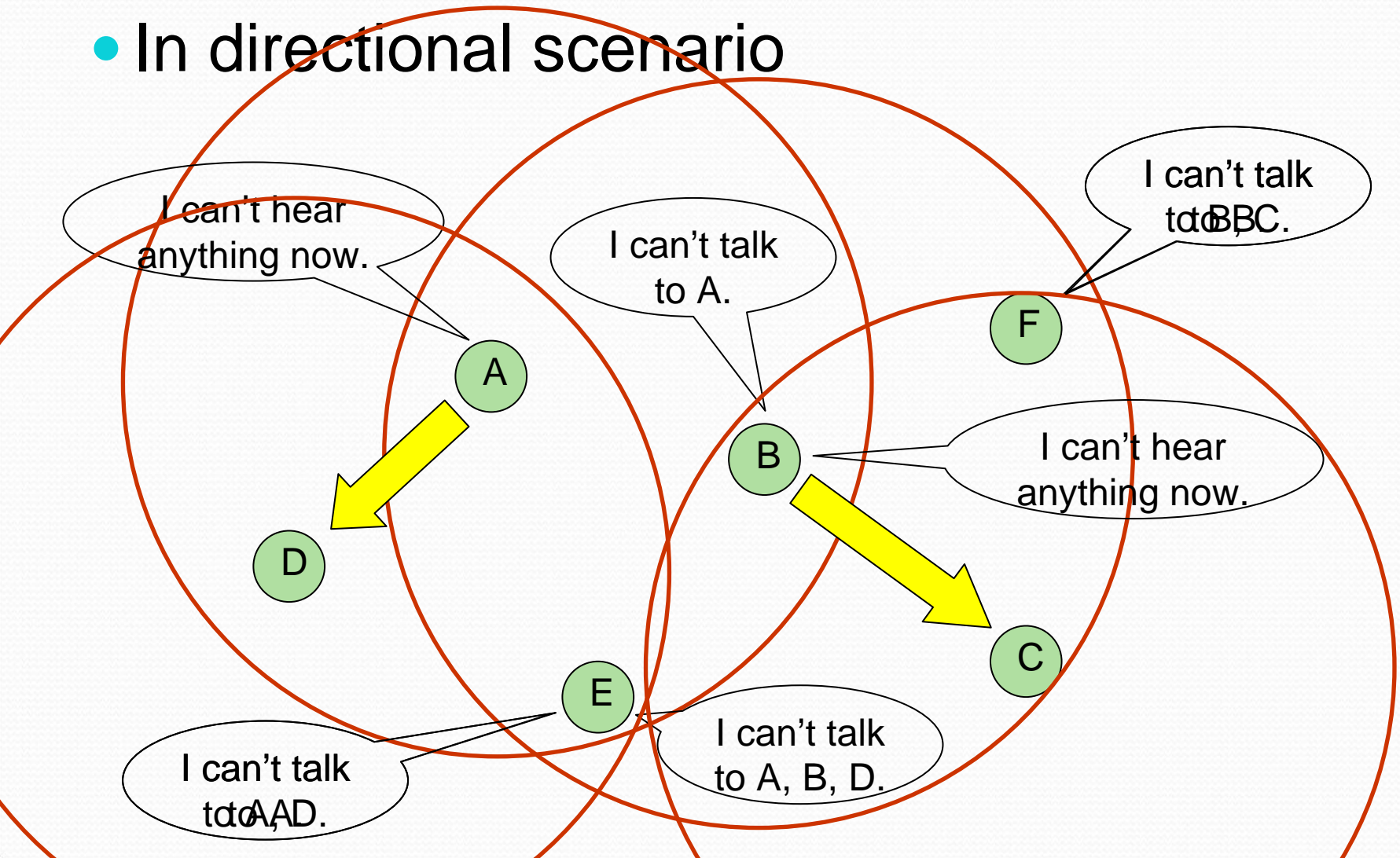B doesn't answer RTS from A.
B is deaf.

Introduction

- The problem of deafness in the directional scenario is more significant than in the omni-directional scenario.
- This paper proposes a protocol to solve this problem and improve the performance.
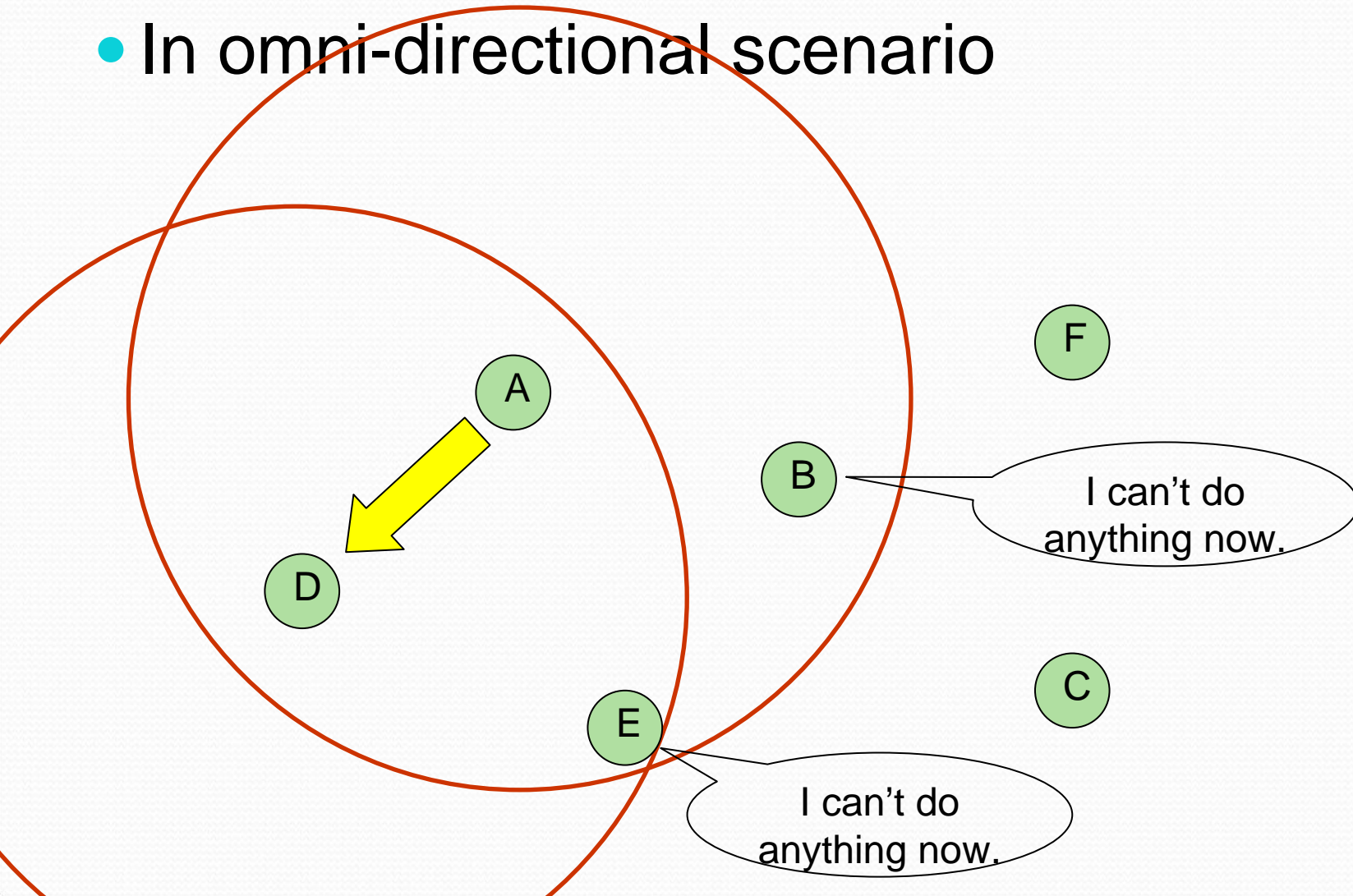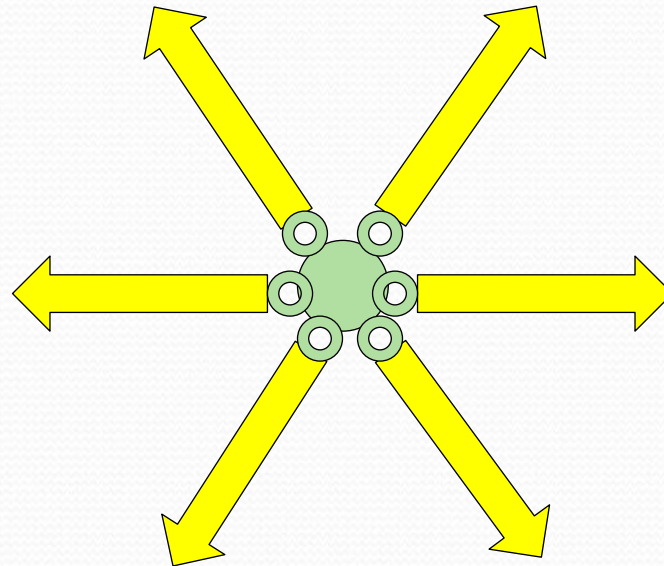
Introduction

- In directional scenario

Introduction

- In omni-directional scenario

Related works

- Circular RTS/CTS Mechanism (CRCM)
  - RTS and CTS packets are broadcast omni-directionally by means of a sequence of directional transmissions.

Cooperative-MAC(CMAC)

- Assumptions
  - Each node can decode more than one packets simultaneously, provided that they come from different directions.
  - Each node can't receive anything during the transmission.
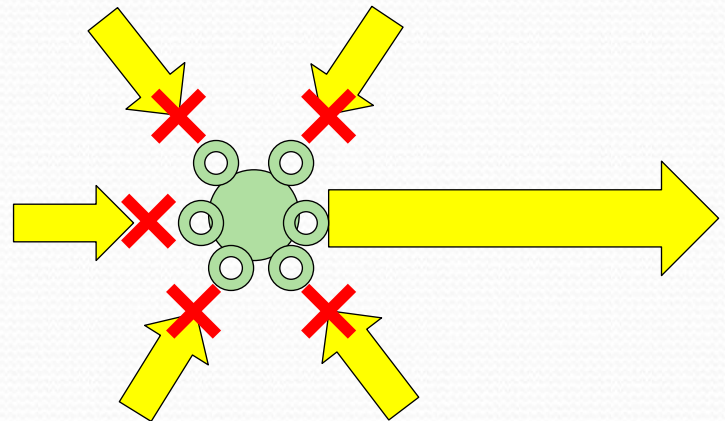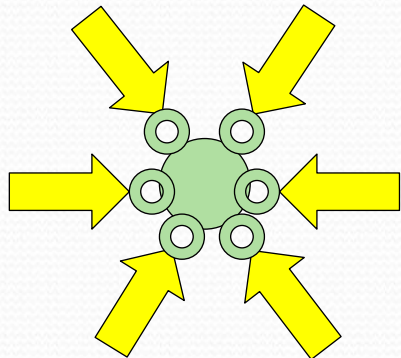
Cooperative-MAC(CMAC)

- CMAC employs three solutions to let the nodes have a fair image of their neighbors' state:
  - Circular delivery of RTS and CTS.
  - Multiple Receptions.
  - Cooperation among nodes.

Cooperative-MAC(CMAC)

- Cooperation among nodes
  - The main cause of deafness is a mistaken idea of the network activity.
  - This mechanism helps the nodes to know the new links built during the transmission.
  - Each node maintains an internal table, called Communication Register(CR), where all the known ongoing communications are reported.

Cooperative-MAC(CMAC)

- Cooperation among nodes

11
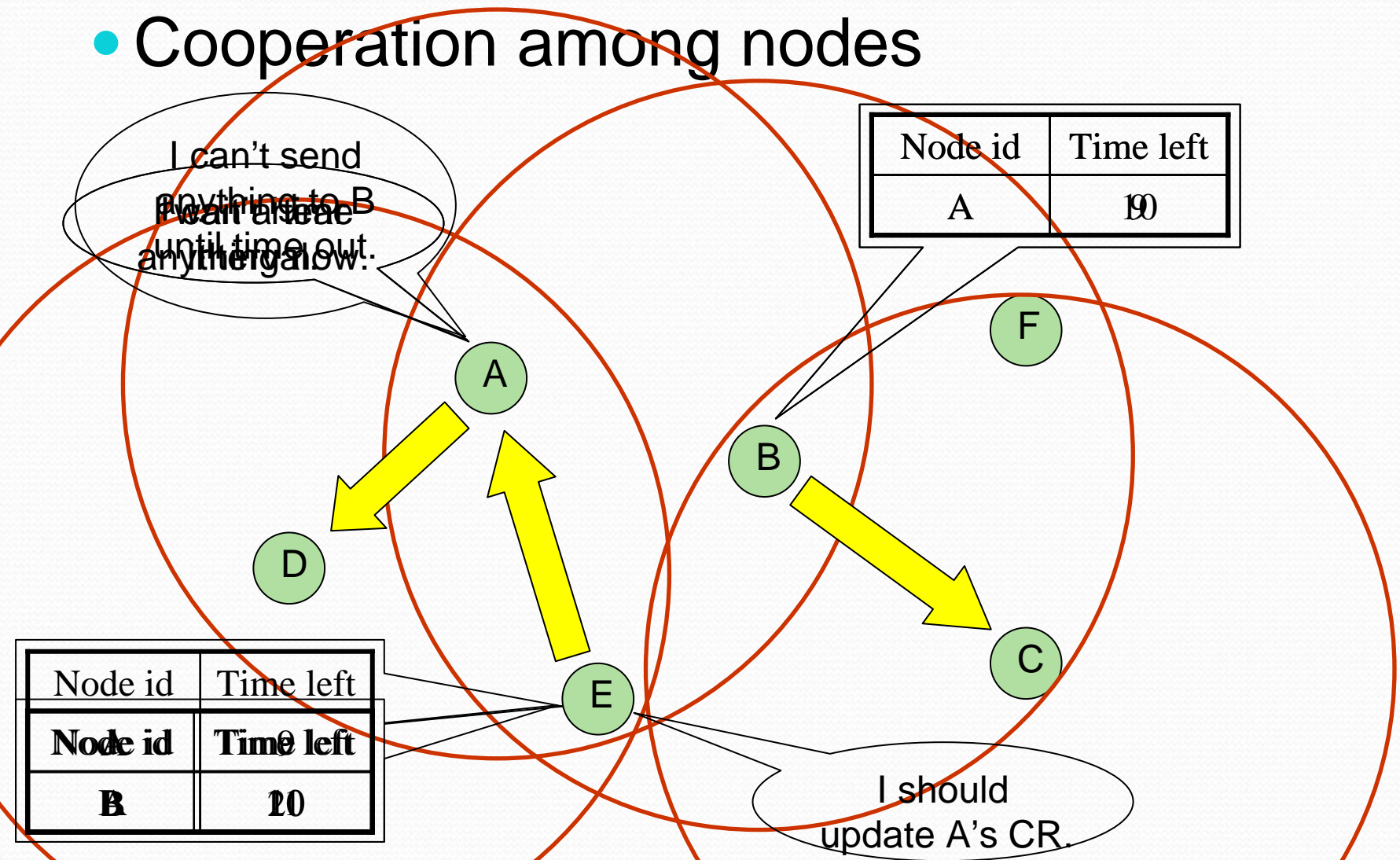
Simulation

- Simulation environment：
  - Every node is equipped with 8 antennas.
  - The network was made up by 10 or 15 nodes.
  - Located inside a 1500m $\times$ 1000m rectangle.

Simulation

	CRCM	MUD	L-CMAC	B-CMAC
Circular delivery of RTS/CTS	◯	◯	◯	◯
Multiple receptions	—	◯	◯	◯
Cooperation among nodes	—	—	◯	◯
The overhead of collaboration frames	—	—	◯	◯
Interference is generated by collaboration frames.	—	—	◯	—
The size of collaboration frames	—	—	120 bits (fixed)	optimal

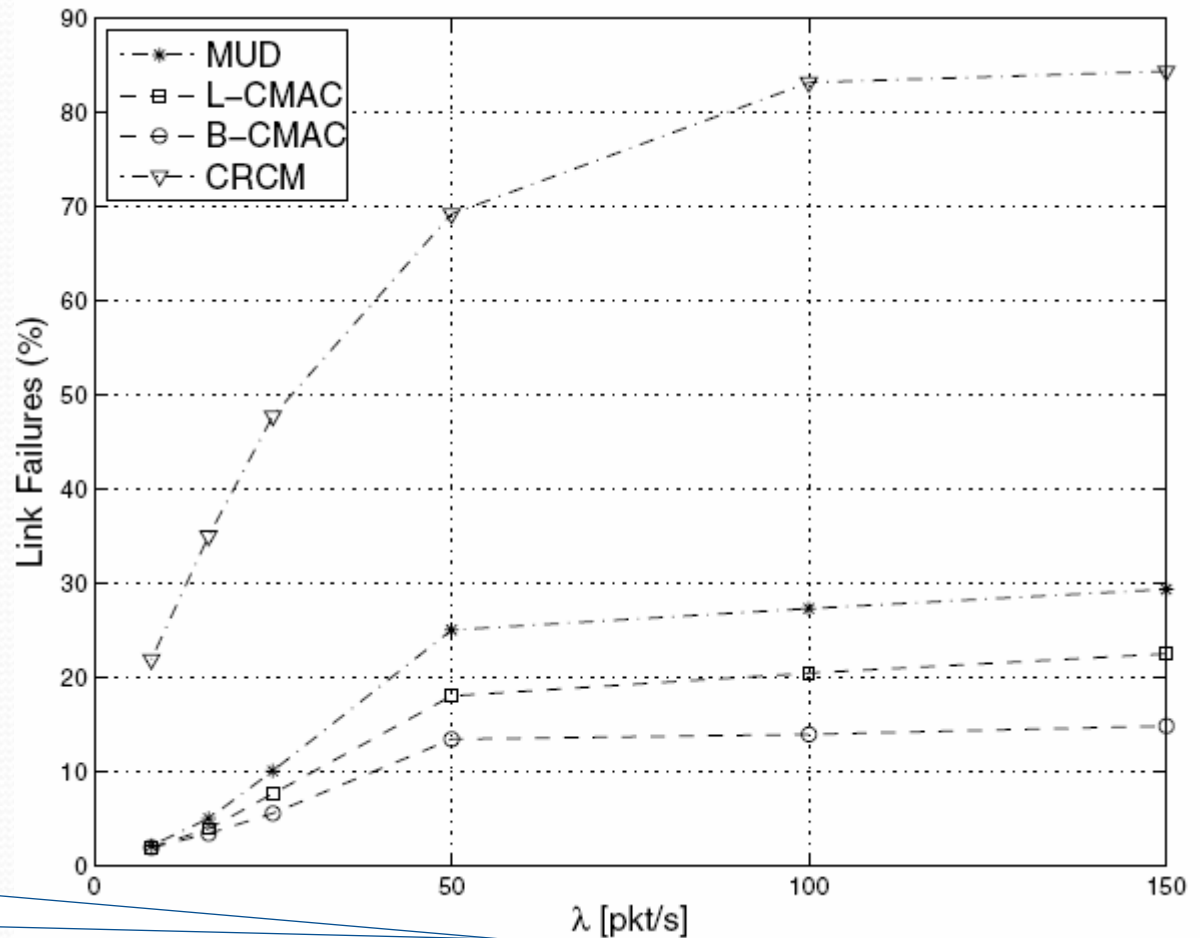The lower bound of CMAC

The upper bound of CMAC

Simulation

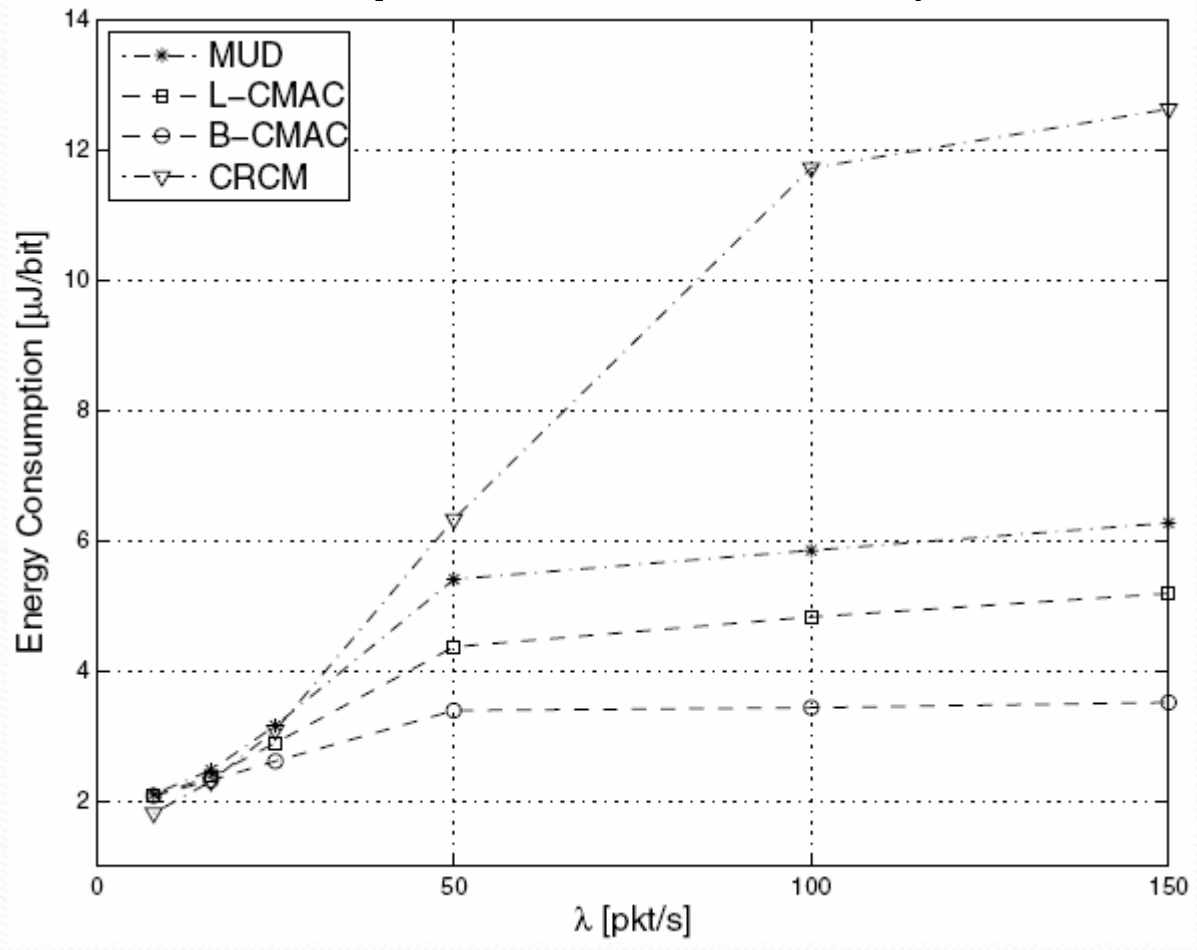- Link failures vs. load (10 nodes)

Link failure=

$$\frac{\text{The total fault RTS}}{\text{All of the RTS}}$$

The traffic rate of each node.

Simulation

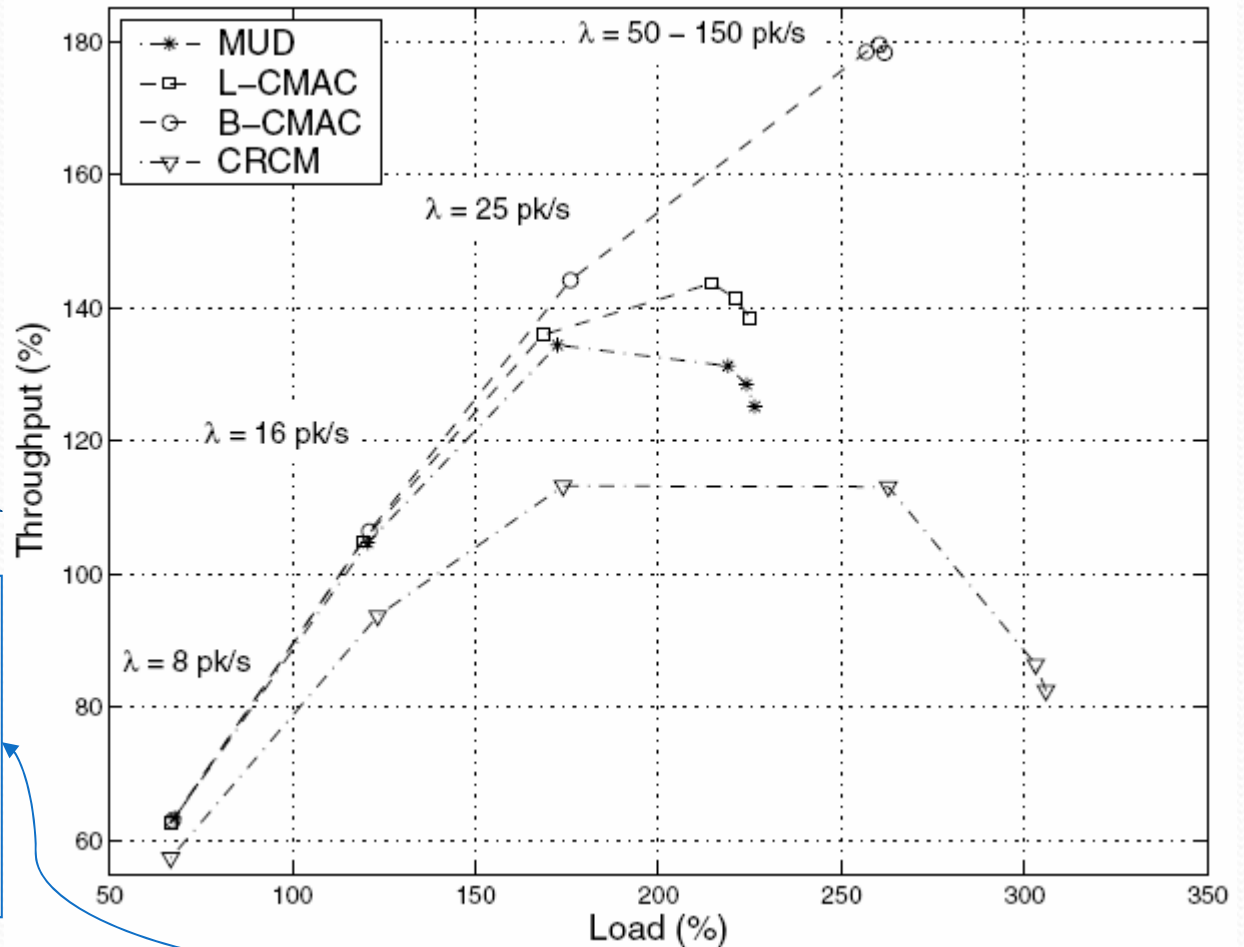- Power consumption vs. load (10 nodes)

Simulation

- Throughput vs. effective load (10 nodes)

Throughput=

$$\frac{\text{Successfully sent bits}}{\text{Simulation time} * \text{bit rate}}$$

Load=

$$\frac{\text{Totally sent bits}}{\text{Simulation time} * \text{bit rate}}$$

Conclusions

- This paper proposes CMAC to solve the problem of deafness in the directional ad hoc networks.

- The cooperation in this paper is used for telling the nodes (which engages in data transmission) correct information.