Collision Prevention
in Distributed 6TiSCH Networks

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Karine Altisen, Stéphane Devismes

Master thesis, 21st of June,2017

Outline
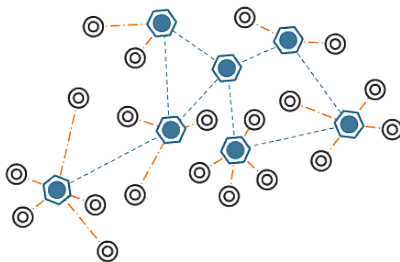
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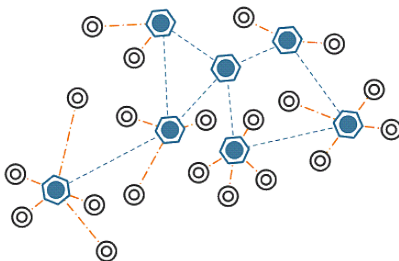# General Introduction

IoT & Wireless Sensor Networks

- Network technologies and IoT.

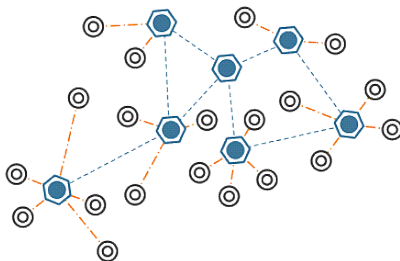# General Introduction

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- WSN: standardization of IoT nodes communication.

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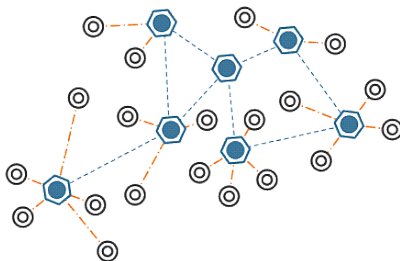
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- Low power consumption, low cost.

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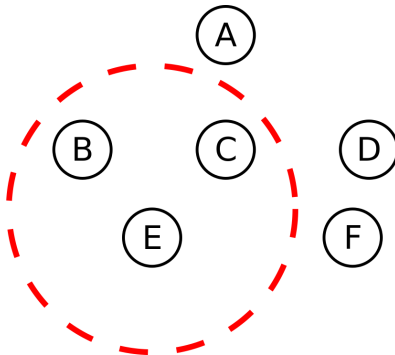- ▶ IEEE802.15.4 one of the main standards of WSN.

General intoduction
IEEE802.15.4

Converge Cast Structure
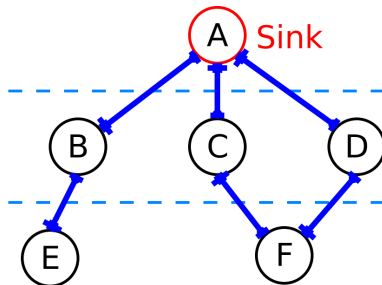
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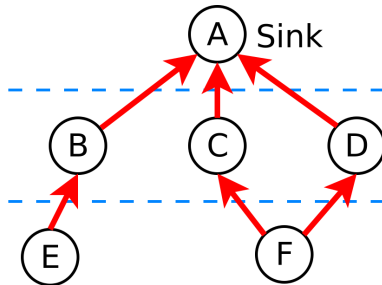- Sink is selected.

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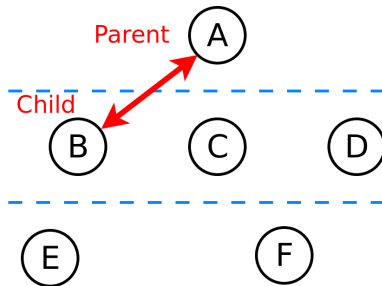- Sink is selected.
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- Communication pairs.

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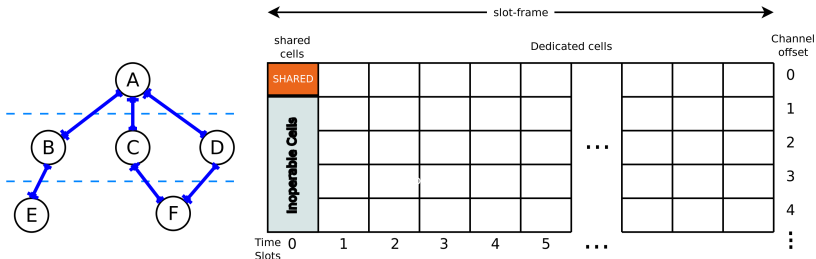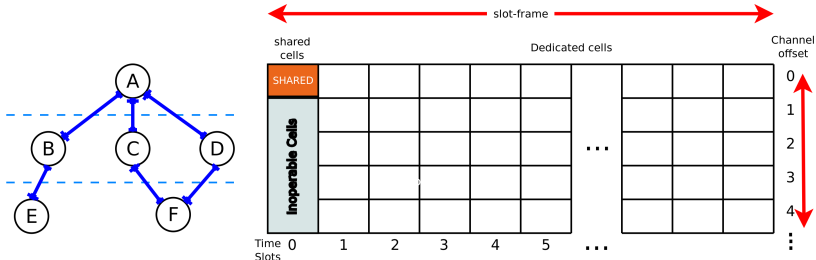
IEEE802.15.4 Protocols

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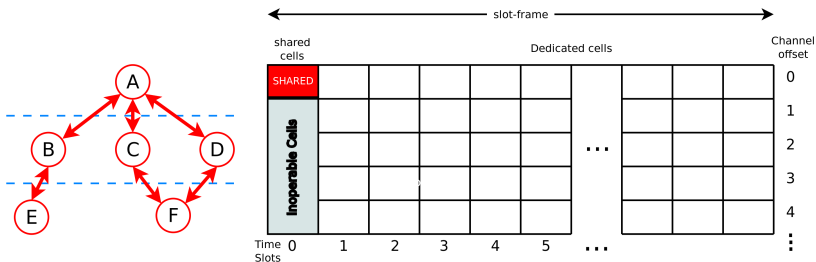
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- Shared cells/Dedicated cells..

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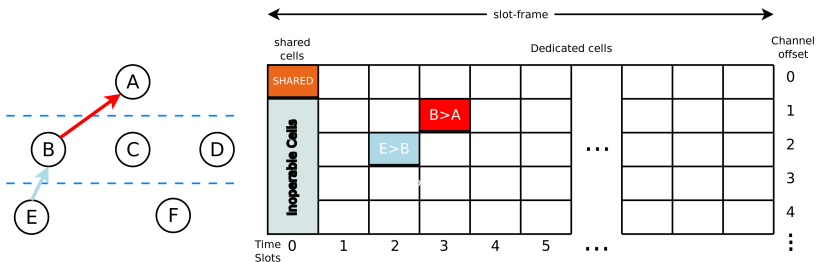
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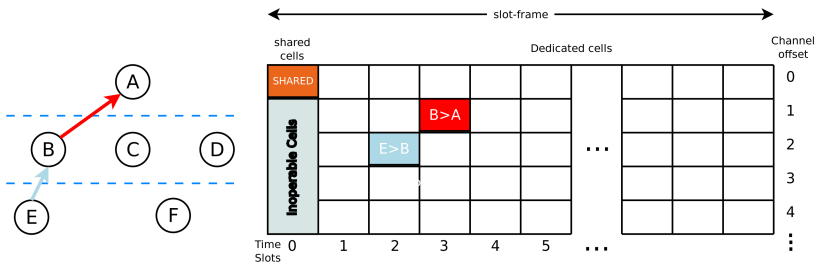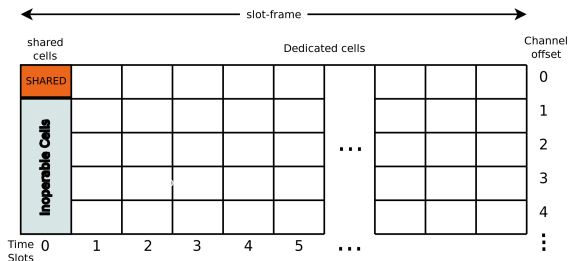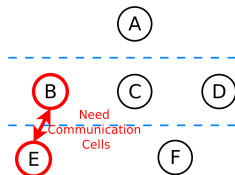
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- 6TiSCH operation sublayer 6top will manage the TSCH.

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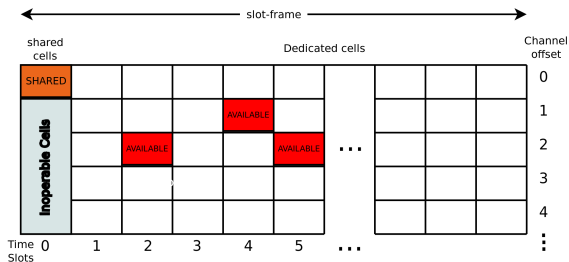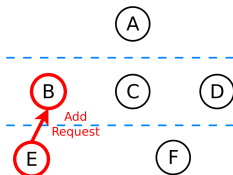
Cell Reservation Process

1. Scheduling function decides new cell should be assigned.

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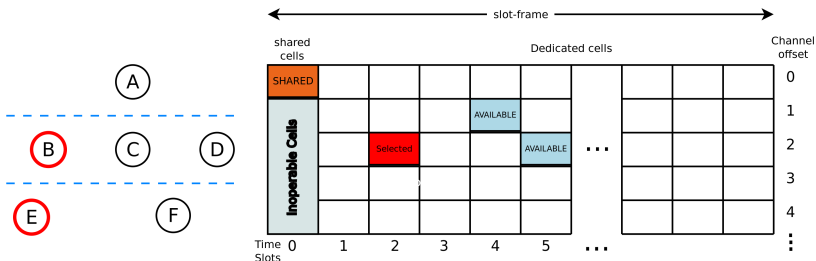
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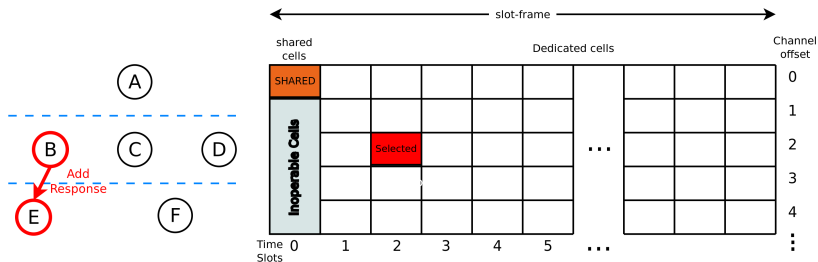# IEEE802.15.4 Protocols
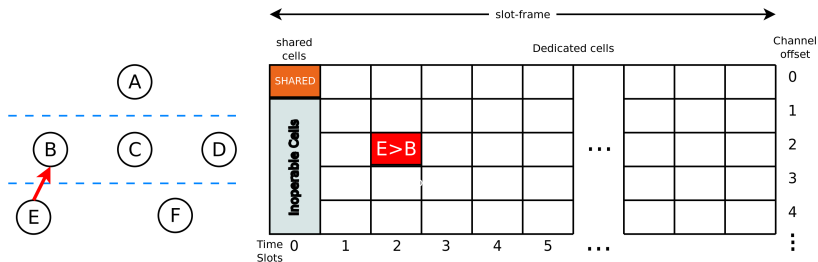
Cell Reservation Process

1. Scheduling function decides new cell should be assigned.
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4. Parent node replies with an Add response.
5. Cell is added and communication starts.

Outline

Project challenges & Objectives

Collision in Dedicated Cells

- ▶ Collision free Dedicated Cells?
- ▶ Neighbor nodes can select the same communication cell.

Project challenges & Objectives

Collision in Dedicated Cells

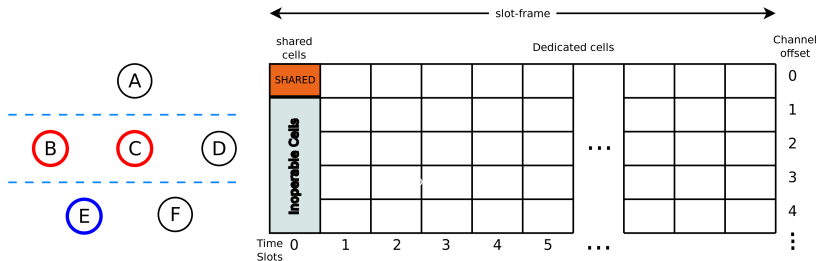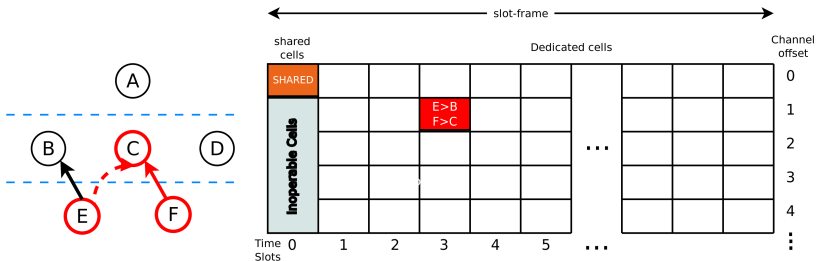- Collision free Dedicated Cells?
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Collision in Dedicated Cells

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- ▶ Neighbor nodes can select the same communication cell.
- ▶ Collision at the reception Node.

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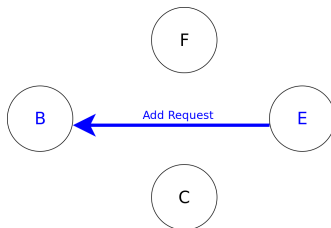
Outline

Using 6top Transaction

Why?

- ▶ Submitted in the shared slot.
- ▶ Contains the reserved cells.
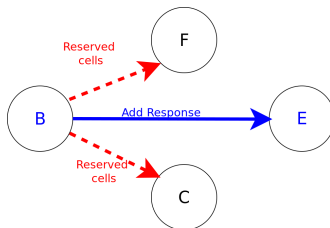
How?

- ▶ The child node Sends an Add Request.

Using 6top Transaction

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How?

- The child node Sends an Add Request.
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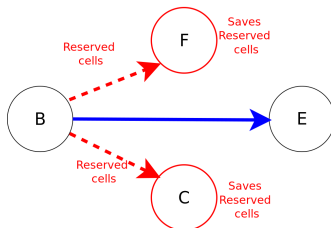- The parent replies with the selected cells.
- The Neighbor nodes collects the reserved cells and save them.
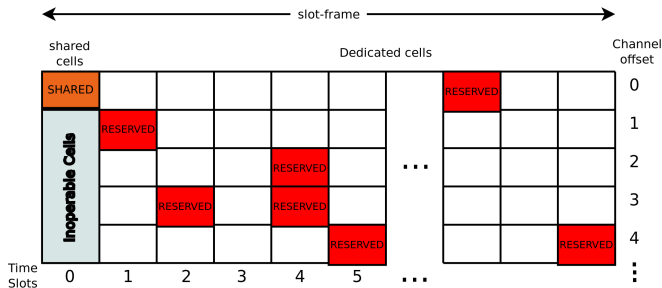
Outline

Avoid Table structure and functioning
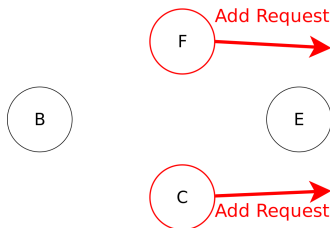
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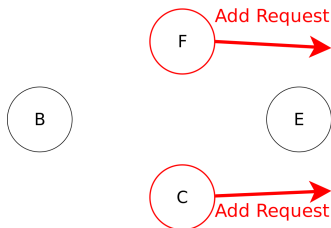# Avoid Table structure and functioning

Avoid Table

- ▶ The cells reserved by neighbors will be saved by a structure similar to TSCH table.
- ▶ Scheduling function will avoid selecting cells found in this structure.
- ▶ 6top will manage this table.

Outline

Cell Buffer

Why?

- Some of the 6top Transaction are lost.
- Number of the neighbors will not receive the reserved cells.

How?

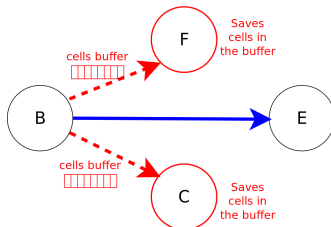- Creating a cell buffer that will contain k reserved cells for each node.

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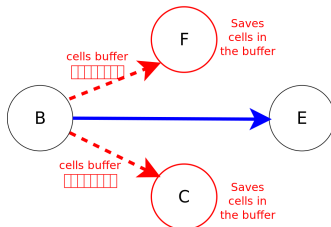- Creating a cell buffer that will contain k reserved cells for each node.
- Transmitting the cell buffer each time a cell is reserved.

Outline

Simulator Architecture
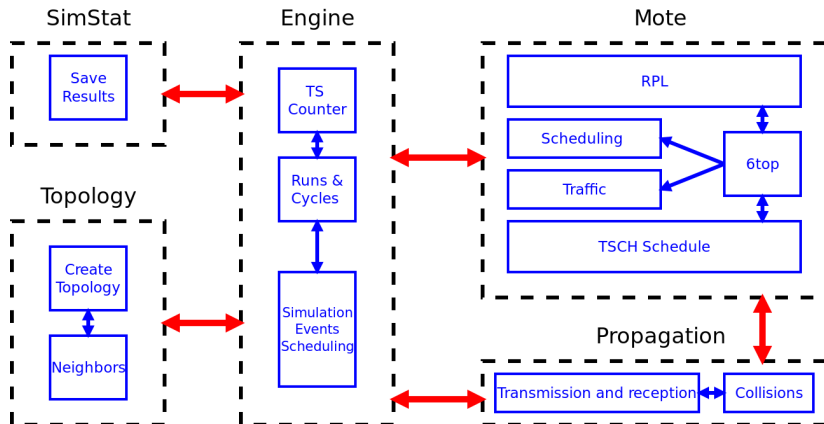
Simulation Parameters

Parameter	Value
Number of Motes	100
Number of cycles per run	1000
Number of runs per simulation	1000
Timeslot duration	$10ms$
Slotframe length	101
Number of channels	16
Area	$1Km \times 1Km$
Topology constraint	≥ 3 neighbors with PDR 50 %
Radio sensitivity	-97 dBm
Radio range	100m
Traffic	1 packet/node each 10 cycles

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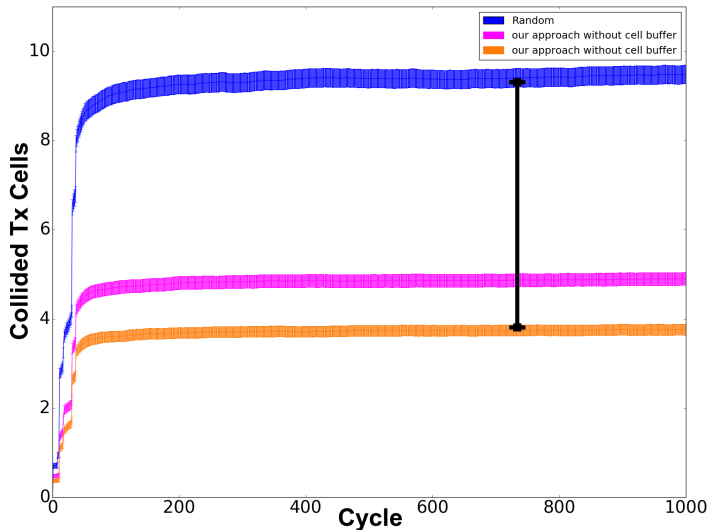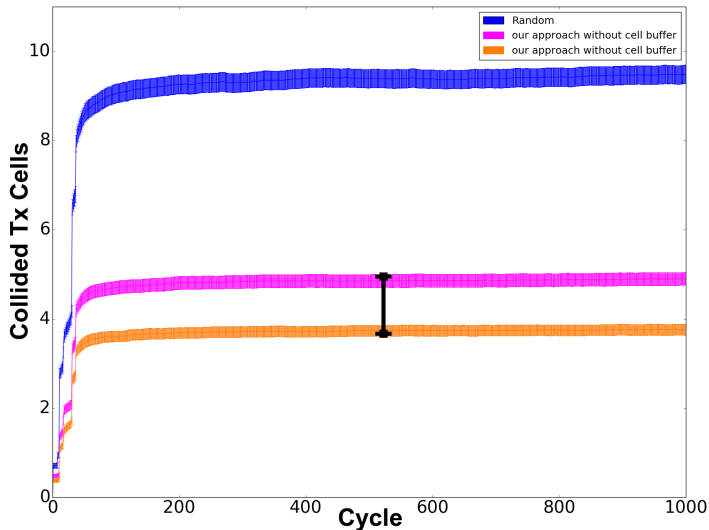
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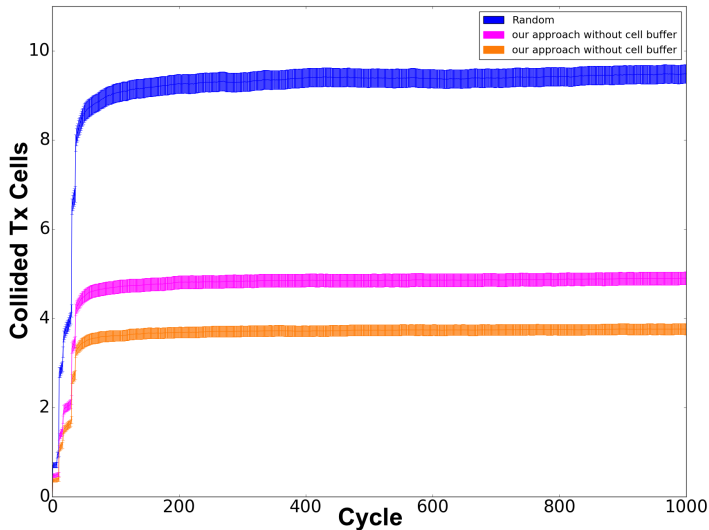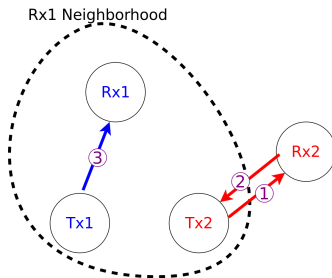
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Results

Collision reasons

- The lost 6top transactions.
- Special Case That Induce Collisions.

Housekeeping Approach

Collision in Dedicated Cells

- Housekeeping approach and cell relocation.
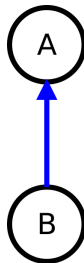- Tx housekeeping.

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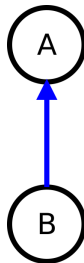

0.8	Cell 1 PDR
0.8	Cell 2 PDR
0.8	Cell 3 PDR

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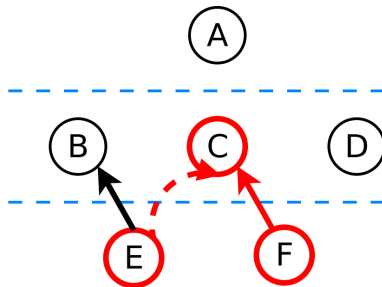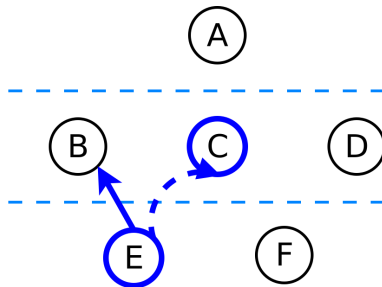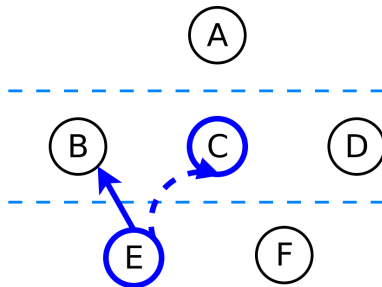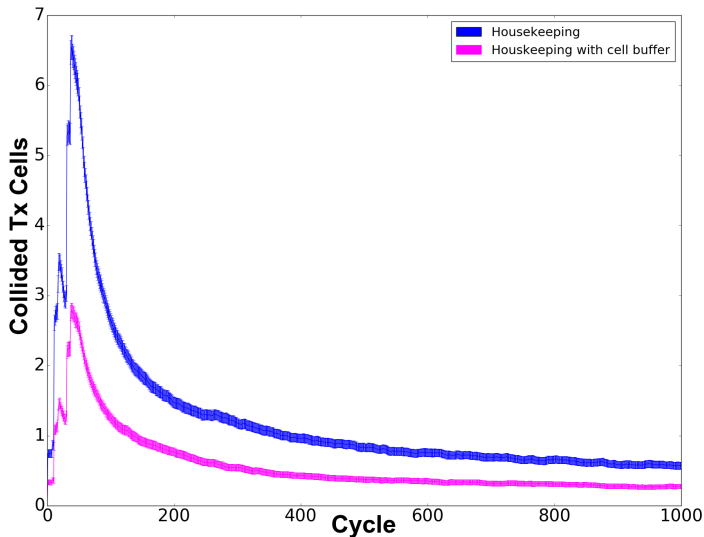
Housekeeping Approach

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- ▶ Housekeeping approach and cell relocation.
- ▶ Tx housekeeping.
- ▶ Rx housekeeping.
- ▶ Dealing with collisions after they occur. Good idea ?

Comparison with Housekeeping

Summary

- Our implementation introduce no overhead in the network.
- The implementation achieved 60% reduction in the number of collided Tx cells.
- The Combination of Our approach and Housekeeping accomplish an almost collision free dedicated cells.

- Outlook
  - Our goal is to reach a place were we have collision free network, using more complex methods.
  - Our perspective in this project was work on 6top, but our next steps is to study the effects of traffic in the protocols performances.

Contributions

- ▶ Understanding the simulator code.
- ▶ Optimizing, and implementing on top of this code.
- ▶ Designing the proposed mechanisms, and enhancing them.
- ▶ Publishing a poster in Computational sciences days in Grenoble, organized by LabEx PERSYVAL-Lab.
- ▶ Submitting a paper to Wimob 2017 conference.

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Thanks for your attention!
Questions?

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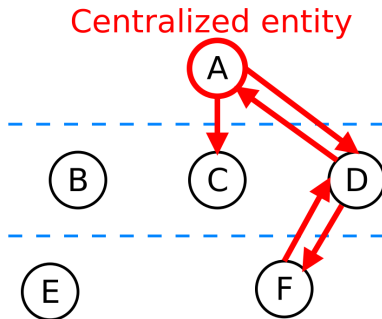- ▶ 6TiSCH offered the integration of TSCH over IPv6.
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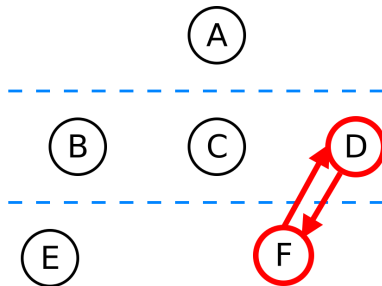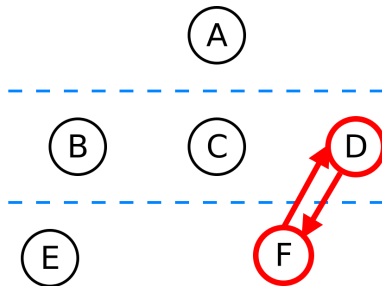# IEEE802.15.4 Protocols

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