Collision Prevention in Distributed 6TiSCH Networks

Ali Jawad Fahs

Université Grenoble Alpes (UGA) - UFR IM^{2}AG
Laboratoire d'Informatique de Grenoble (LIG), Team Drakkar
VERIMAG,Synchrone
Supervised by : Olivier Alphand, Franck Rousseau
Karine Altisen, Stéphane Devismes

Master thesis, 21st of June,2017

Outline

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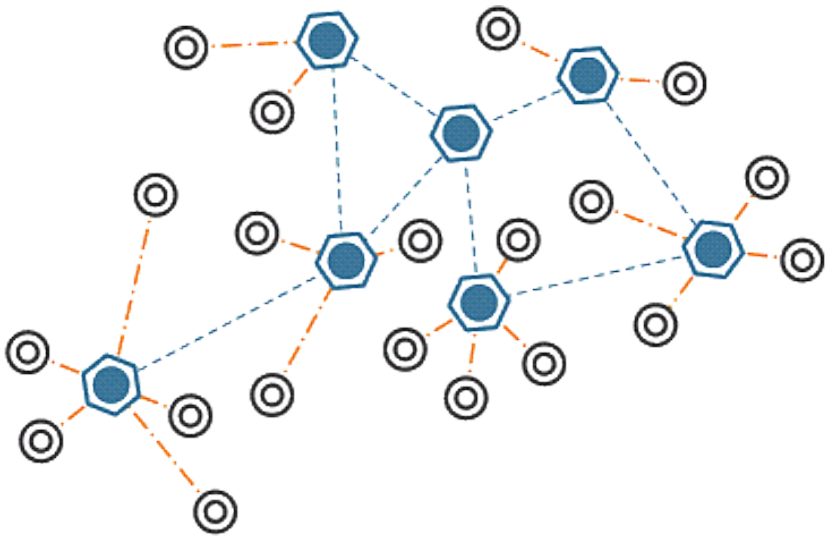
General Introduction

IoT & Wireless Sensor Networks

- Network technologies and IoT.



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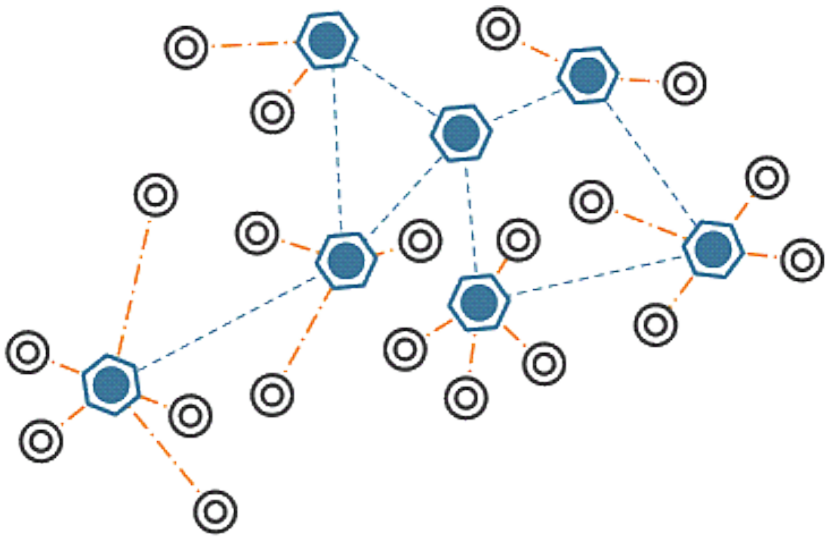

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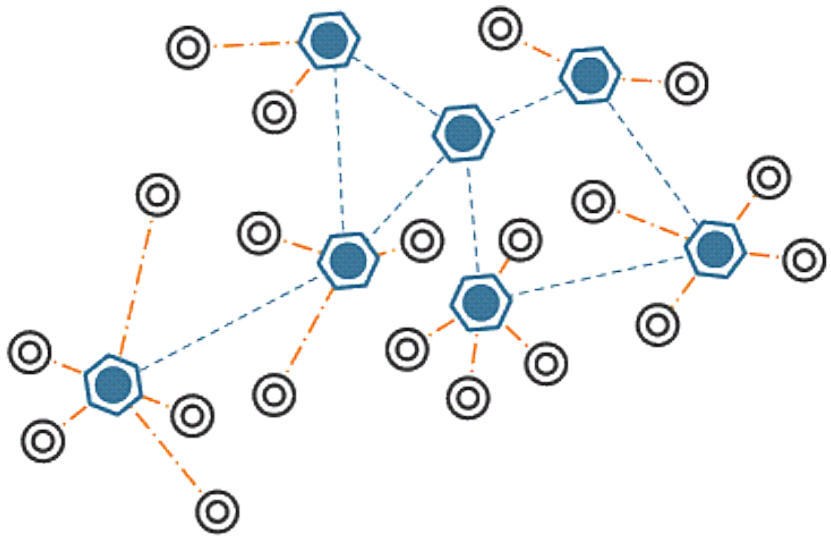

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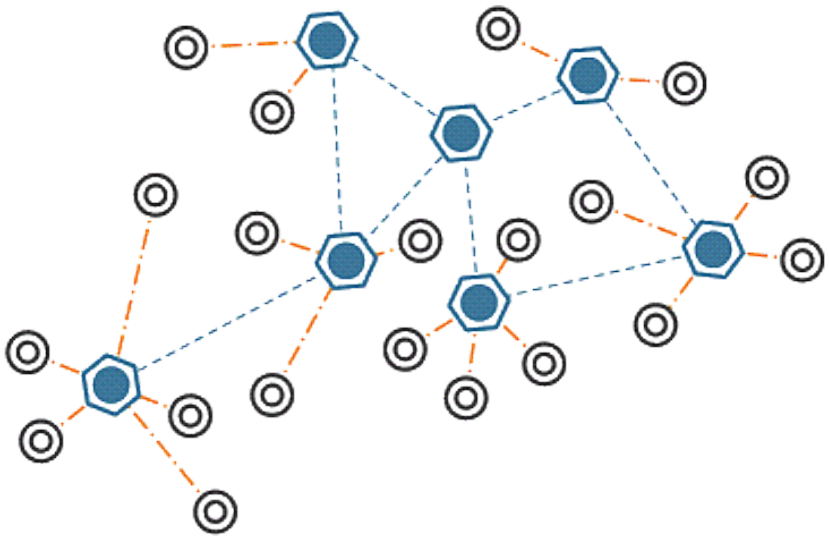
- IEEE802.15.4 one of the main standards of WSN.



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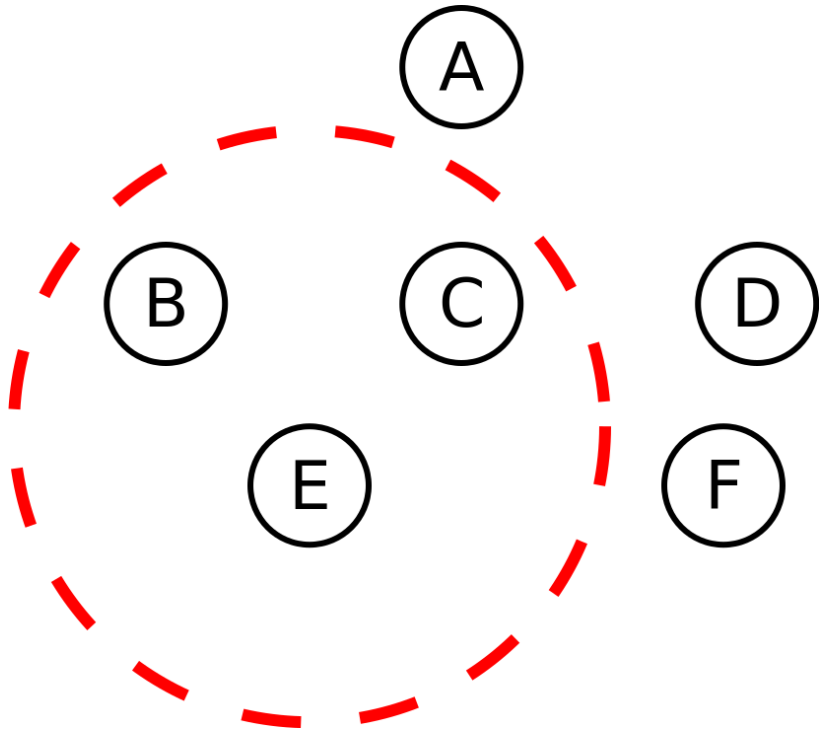

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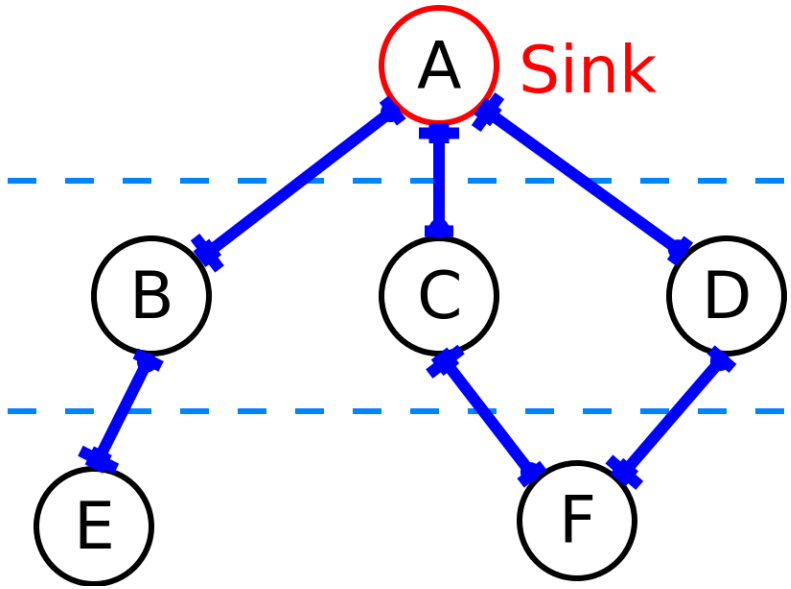

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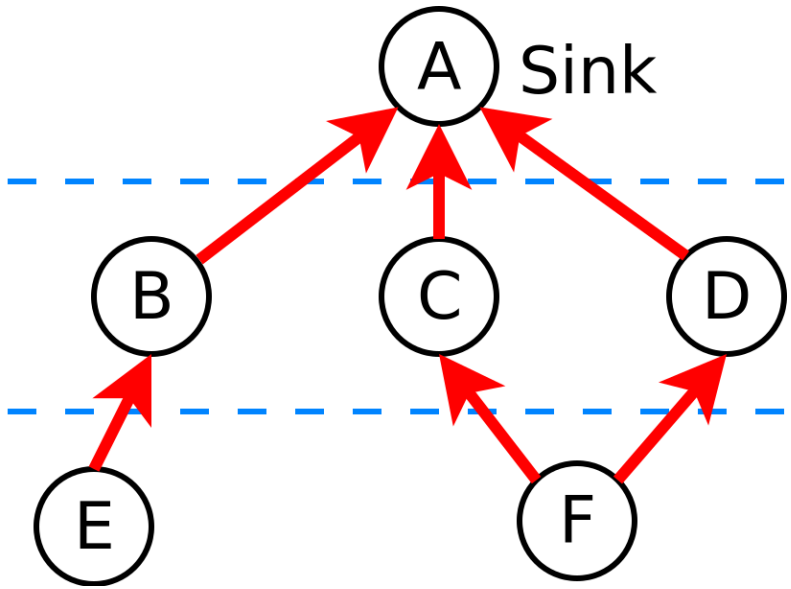

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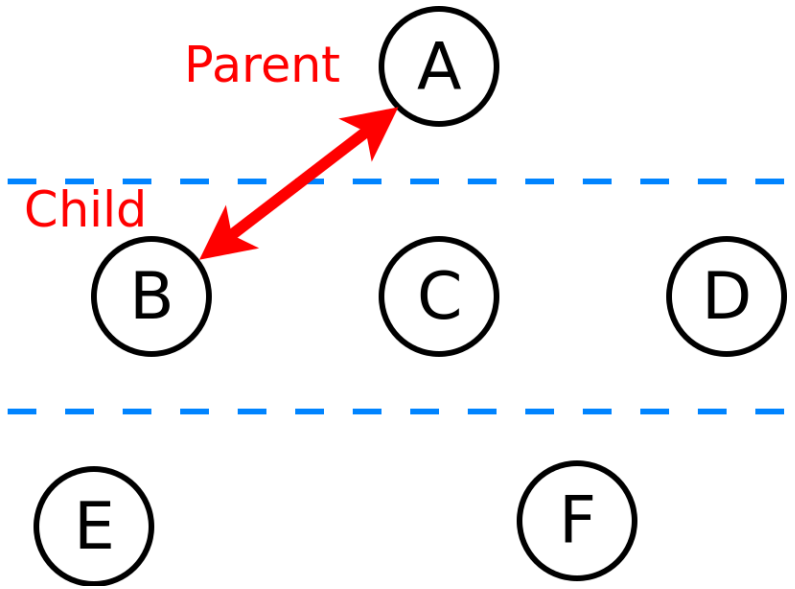

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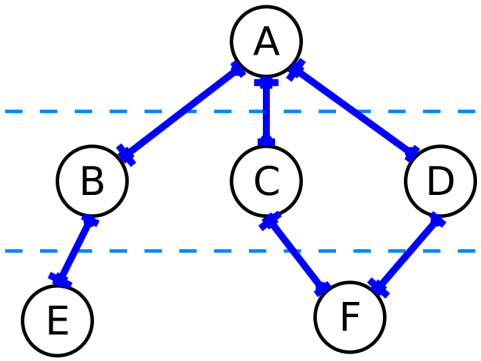

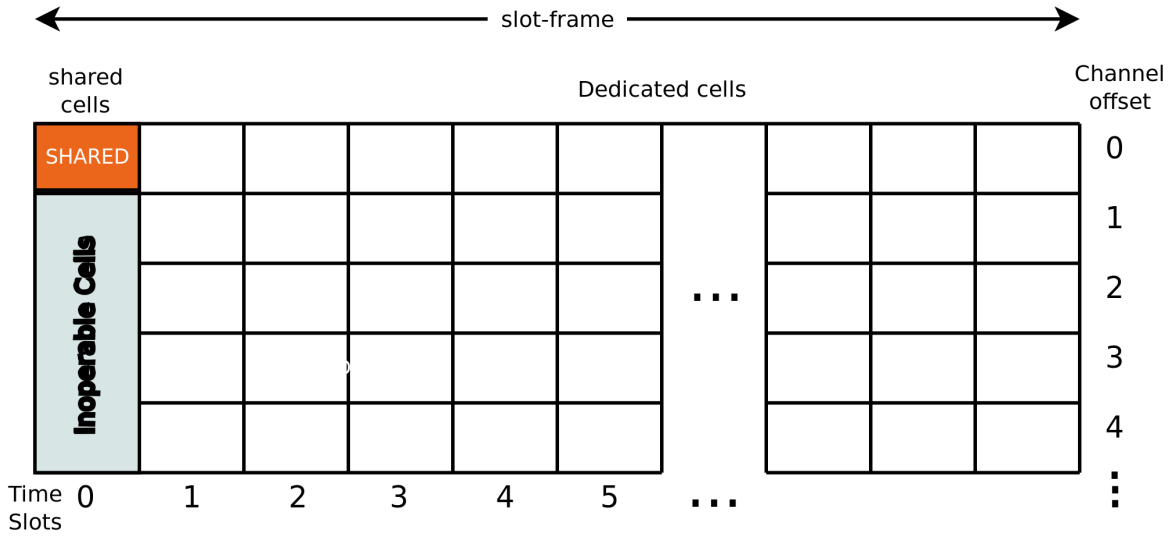

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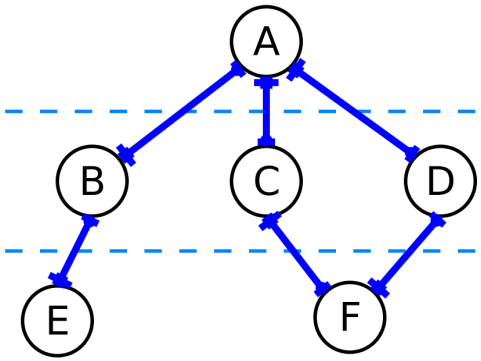

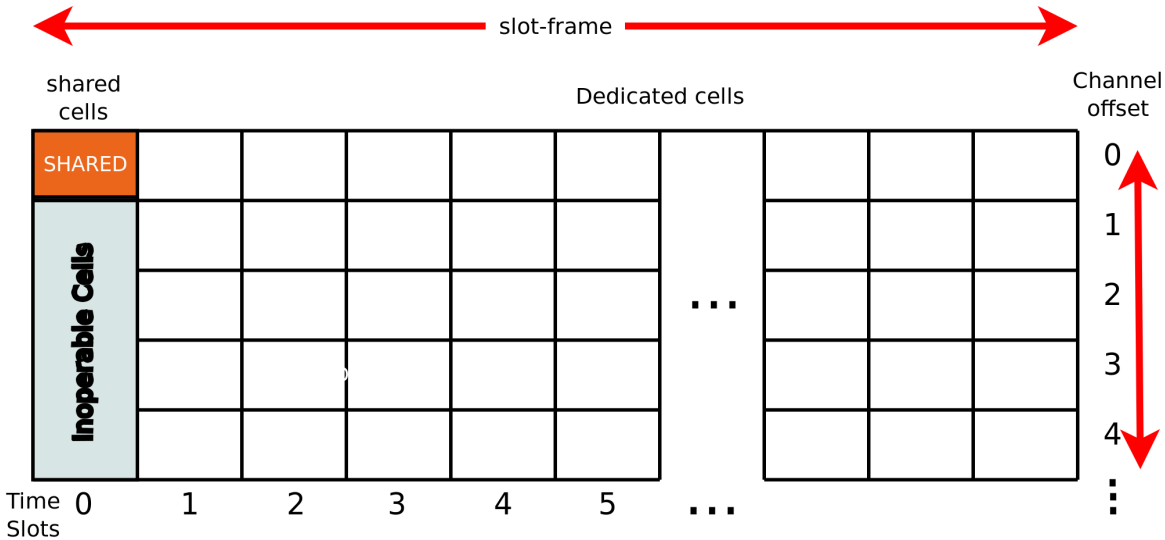

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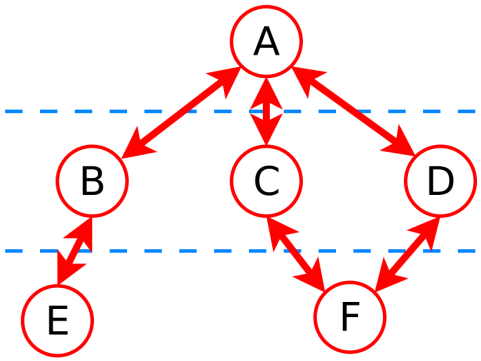

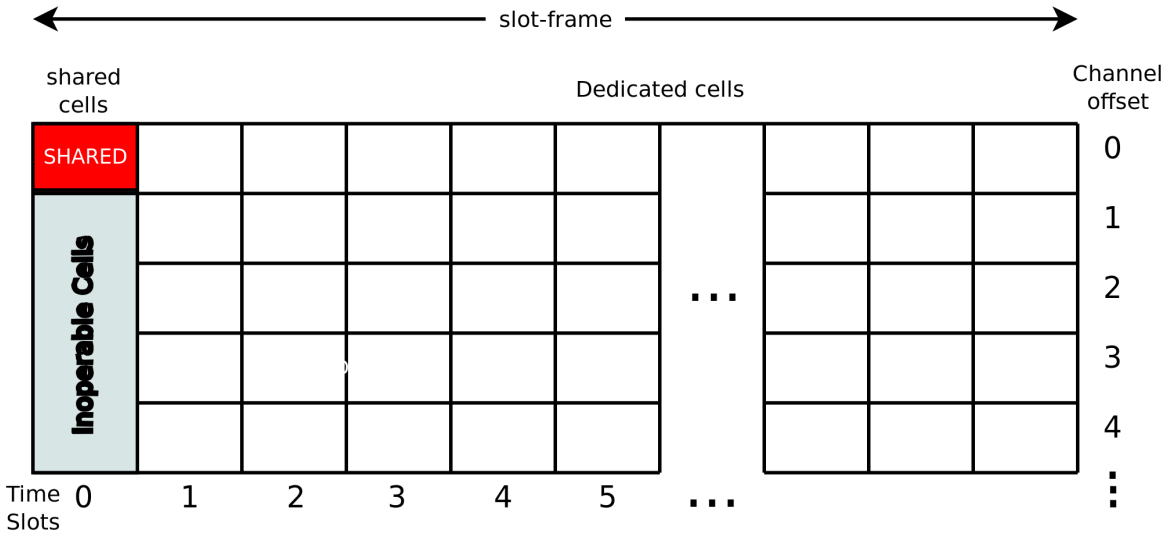

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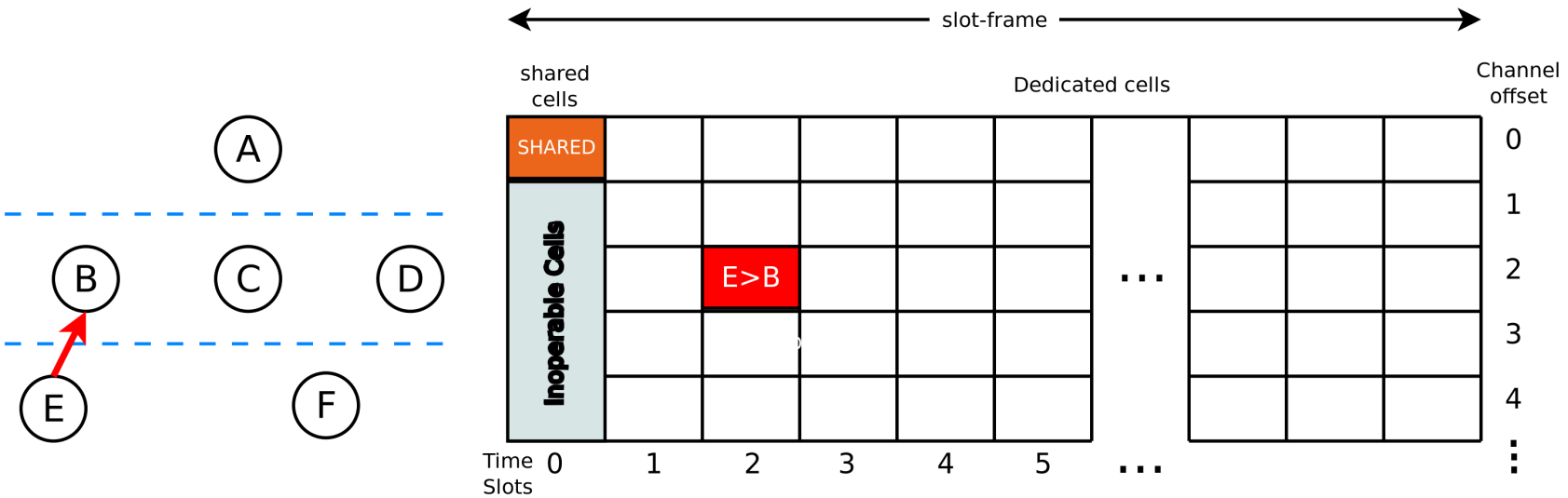

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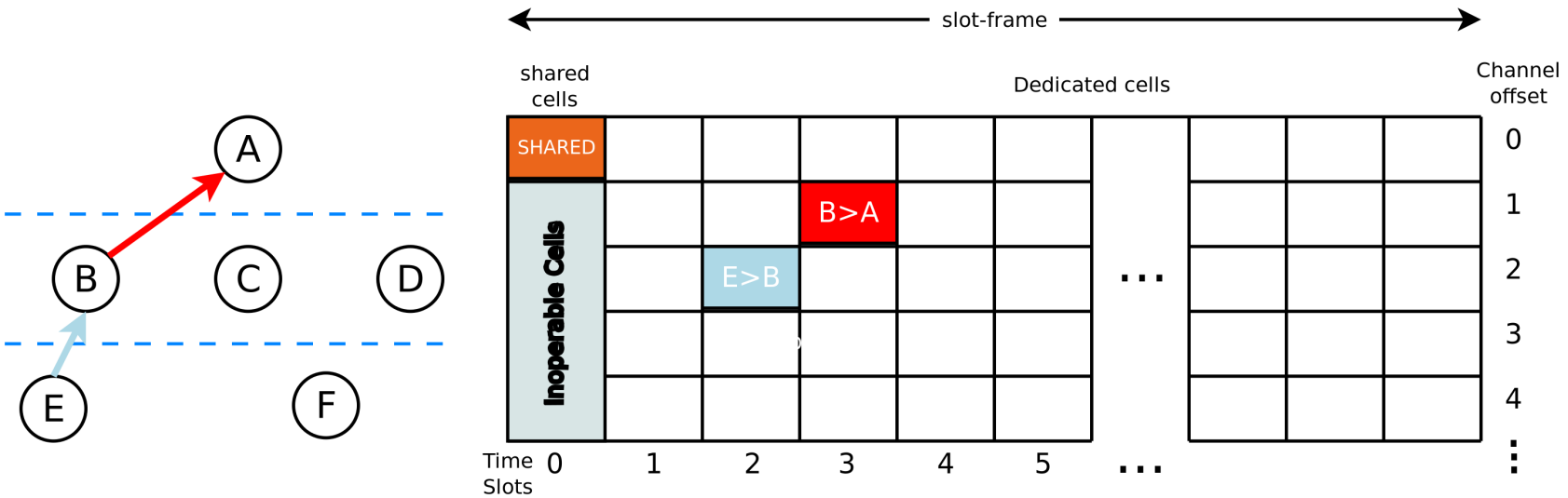

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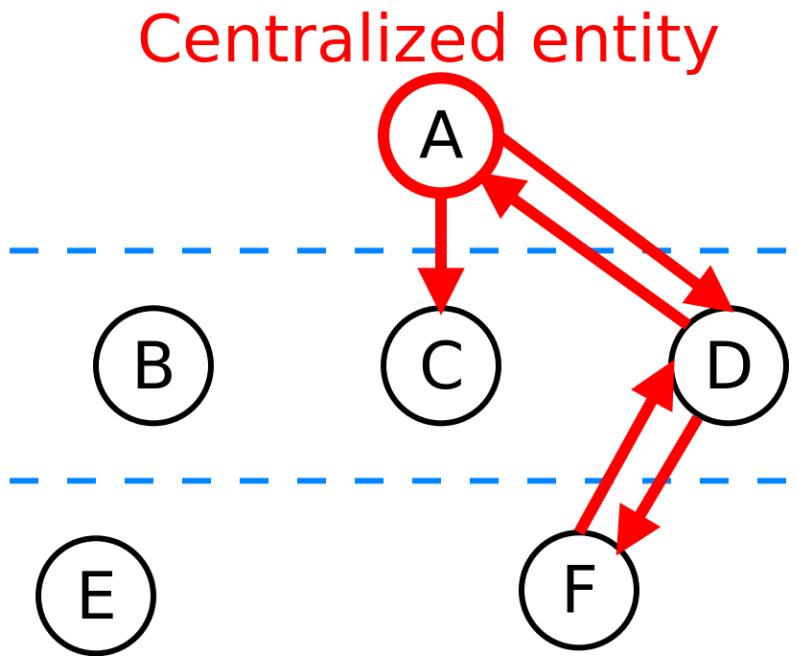

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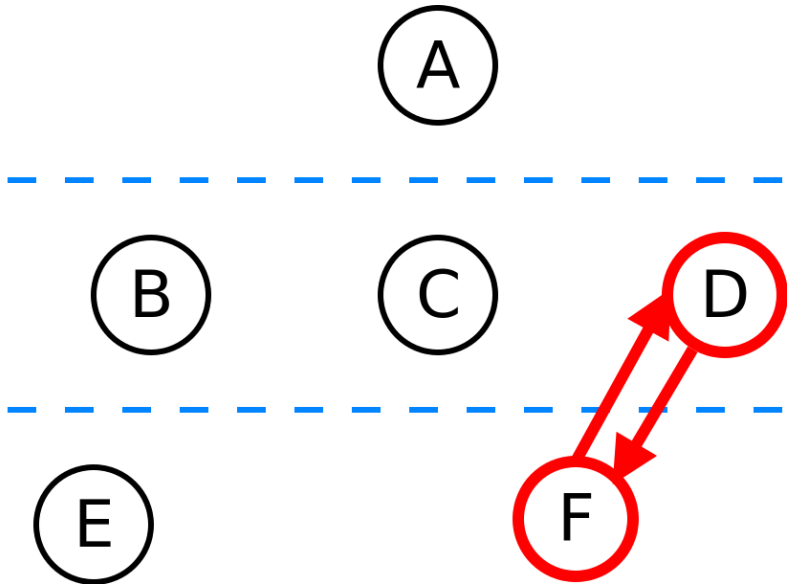

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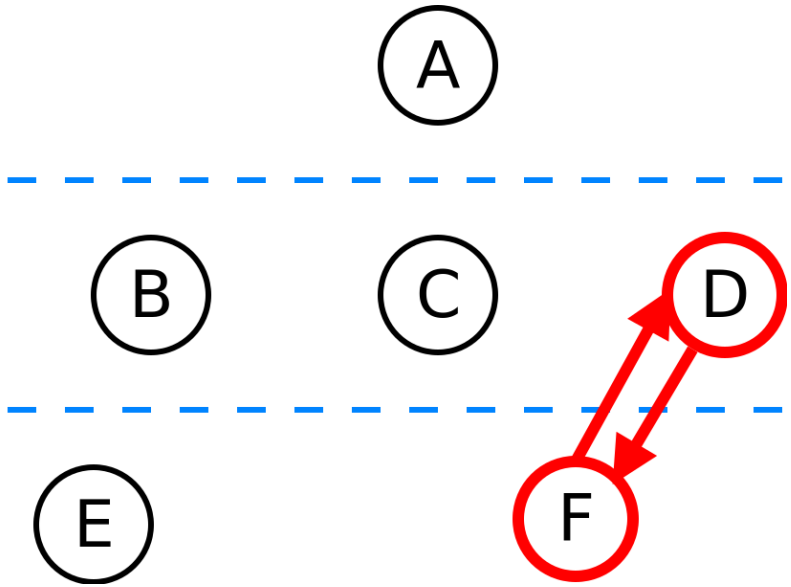

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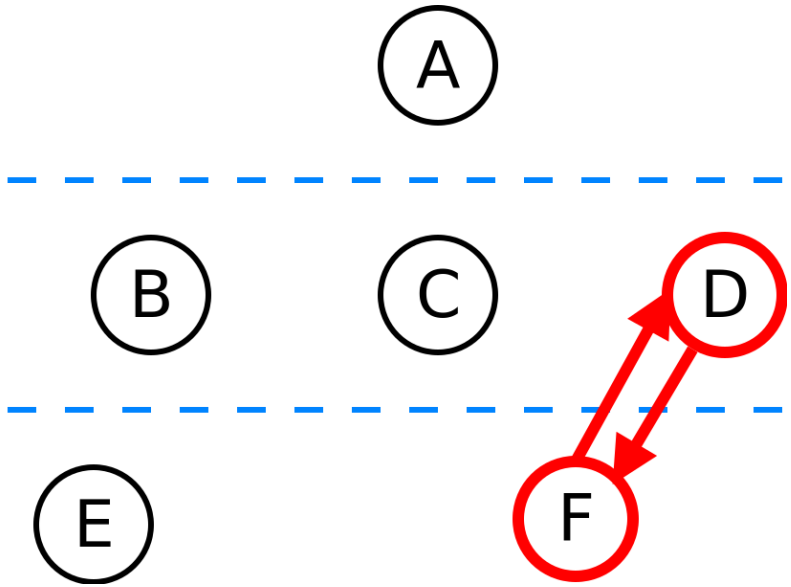

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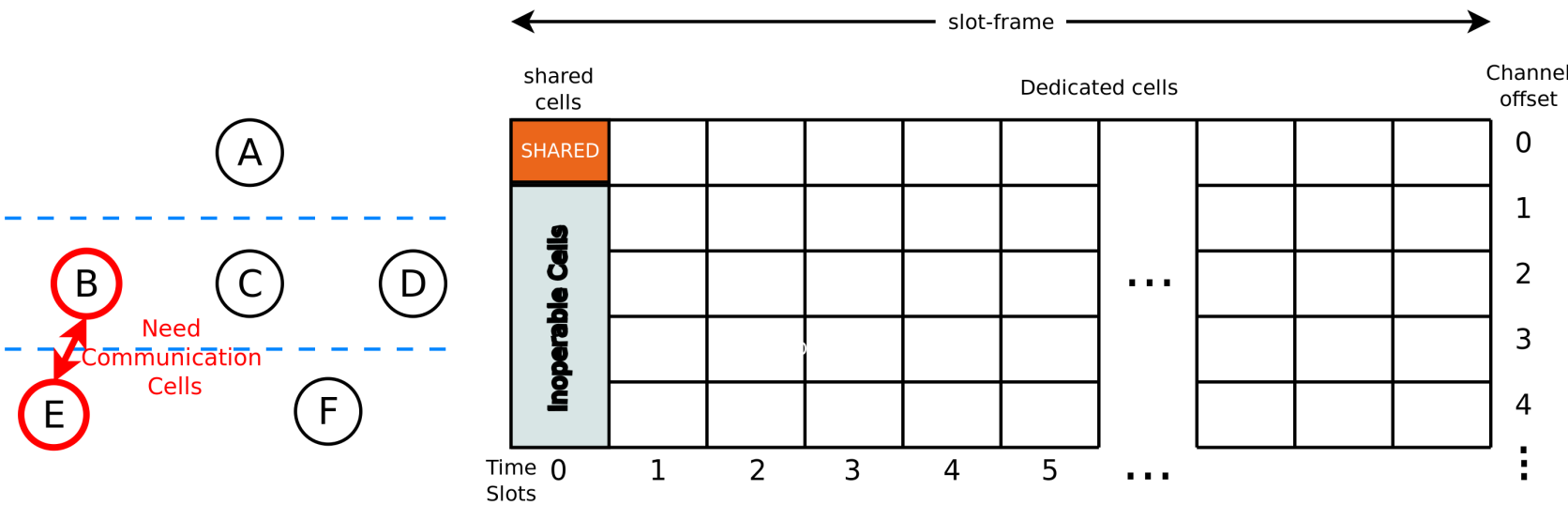

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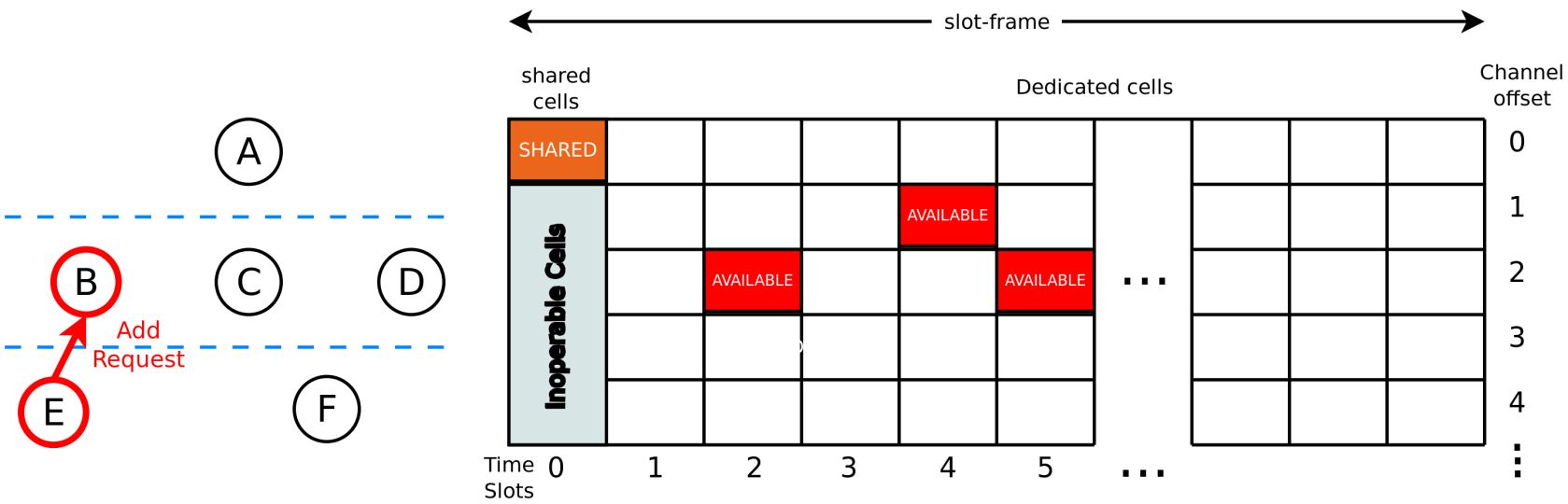

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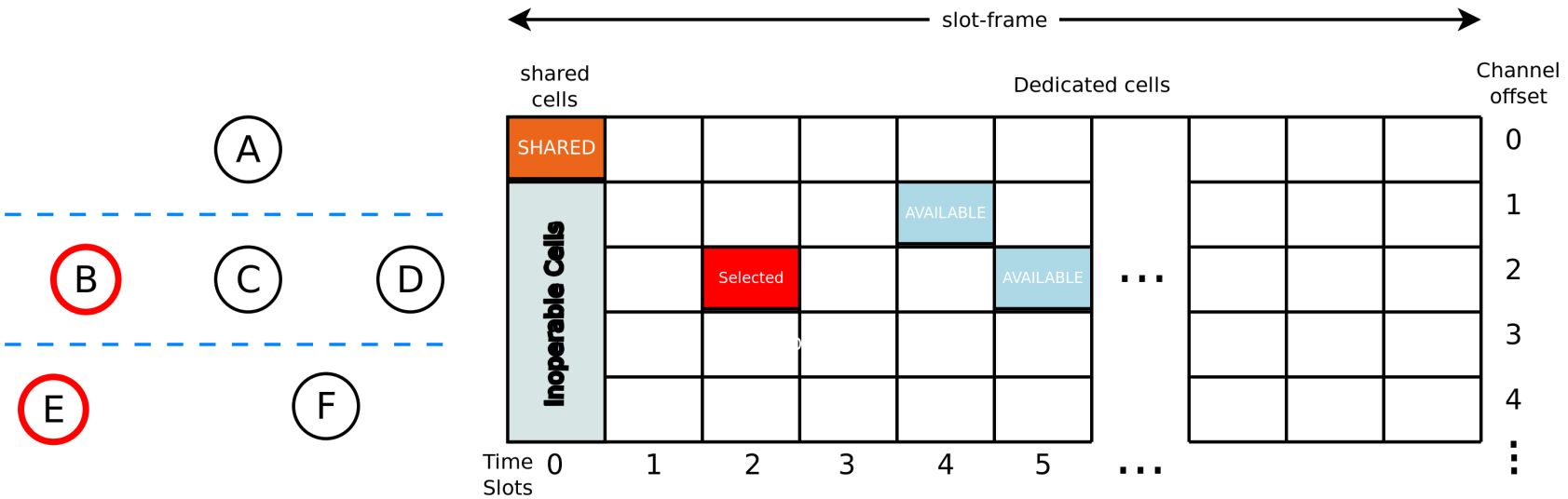

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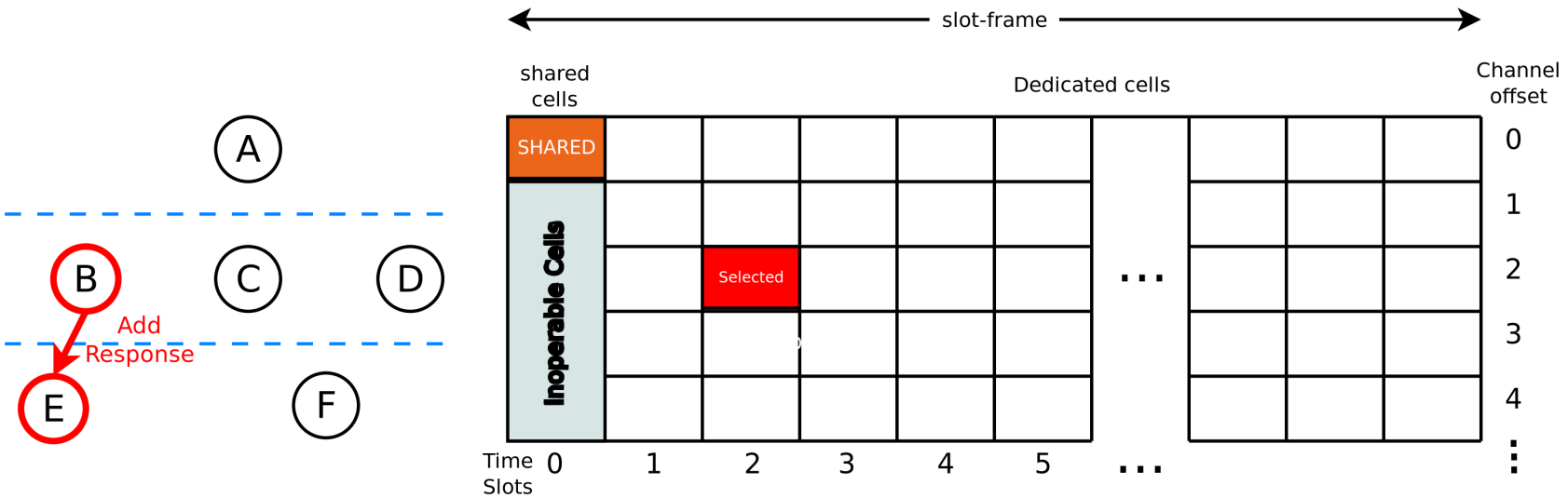

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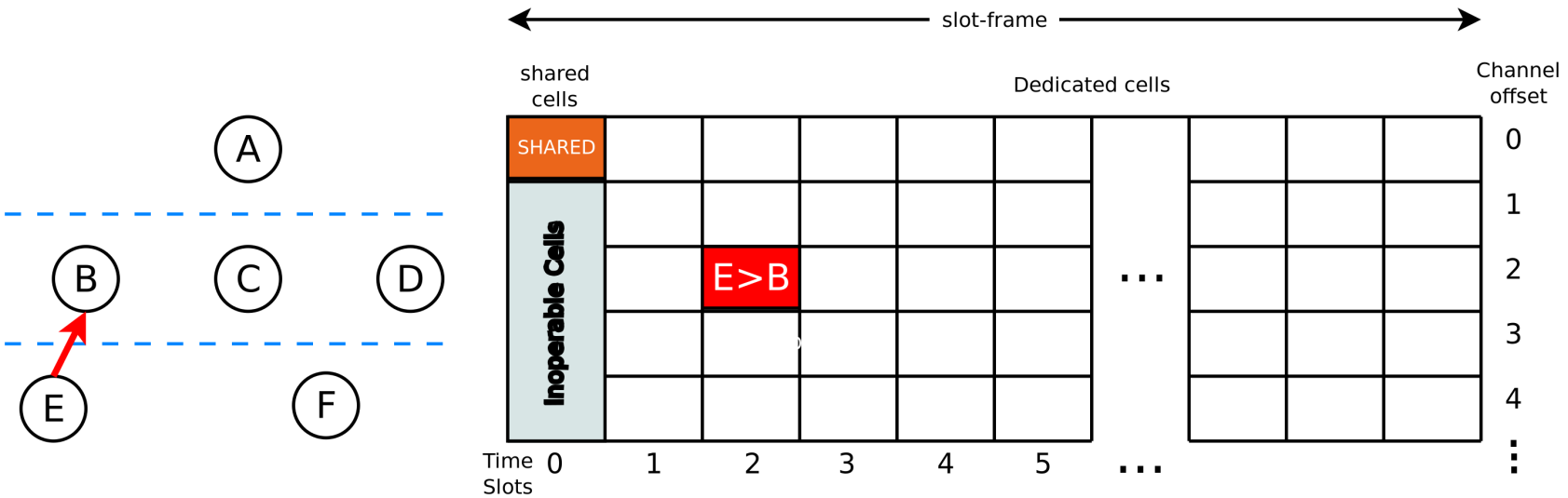
- Cell is added and communication start.



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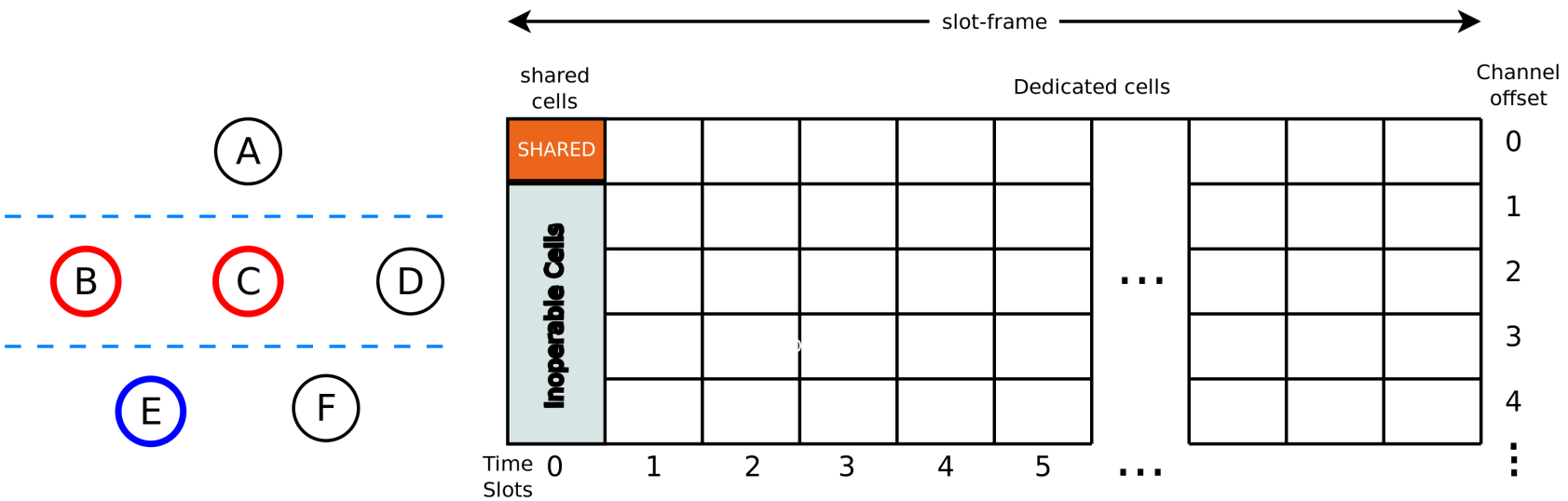

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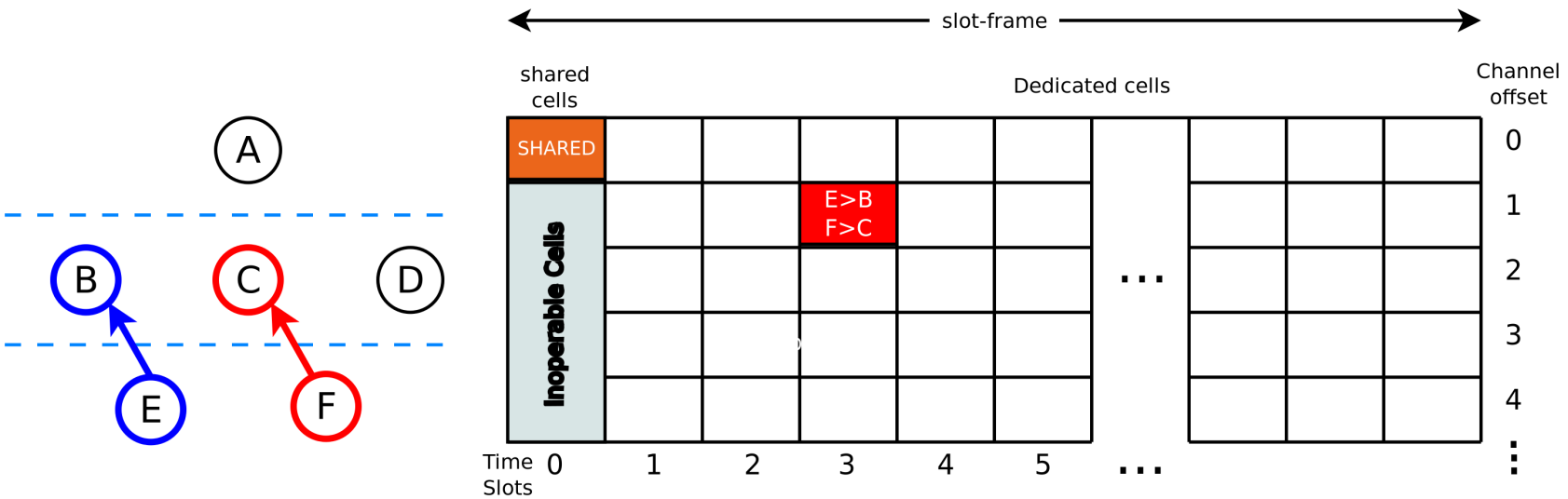

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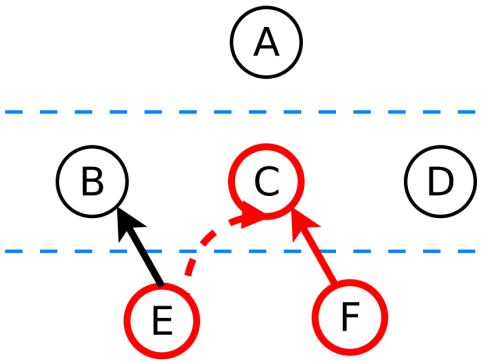

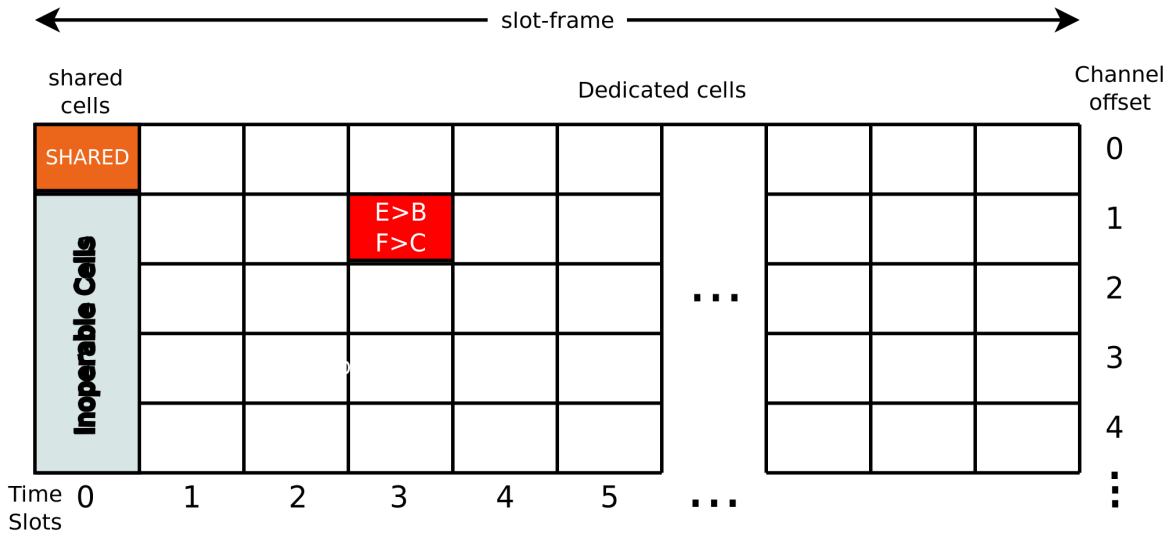

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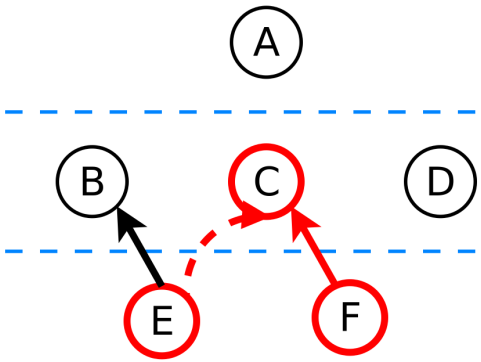
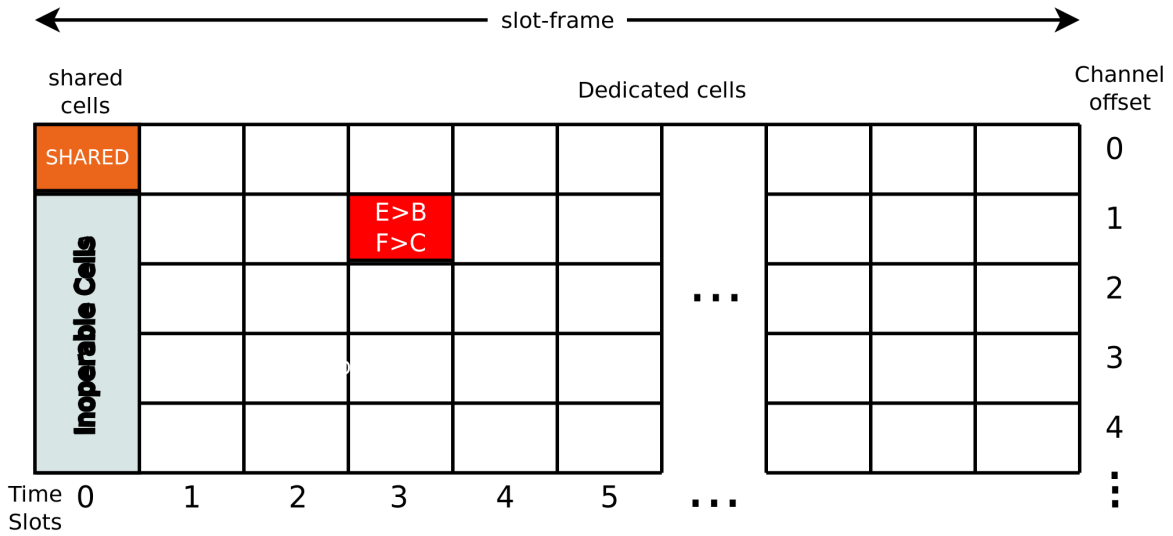
- Collision in terms of power, latency.





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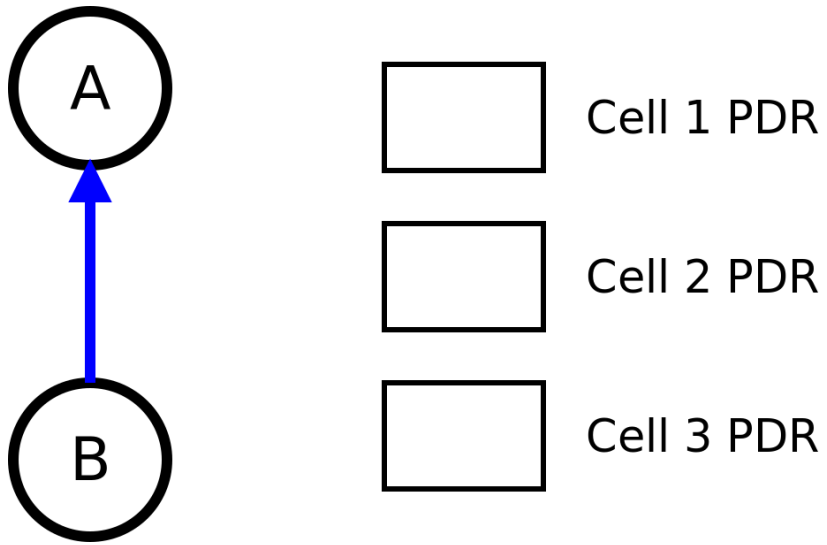

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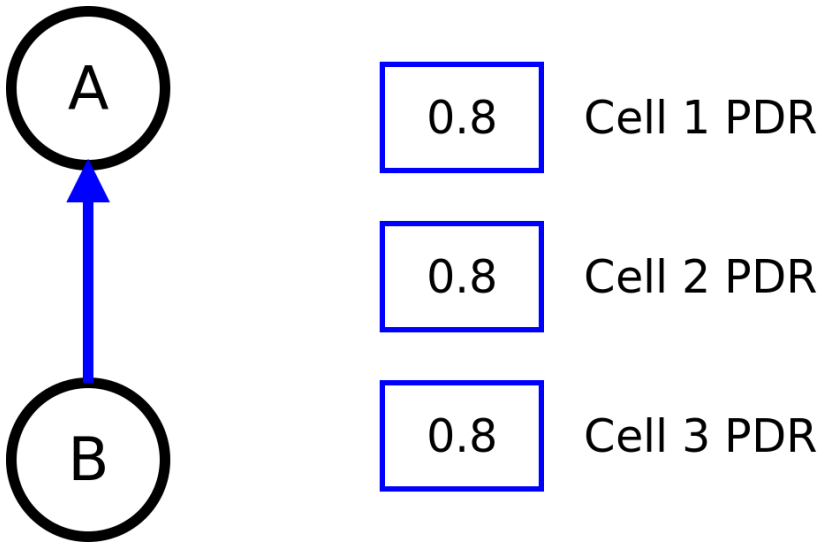

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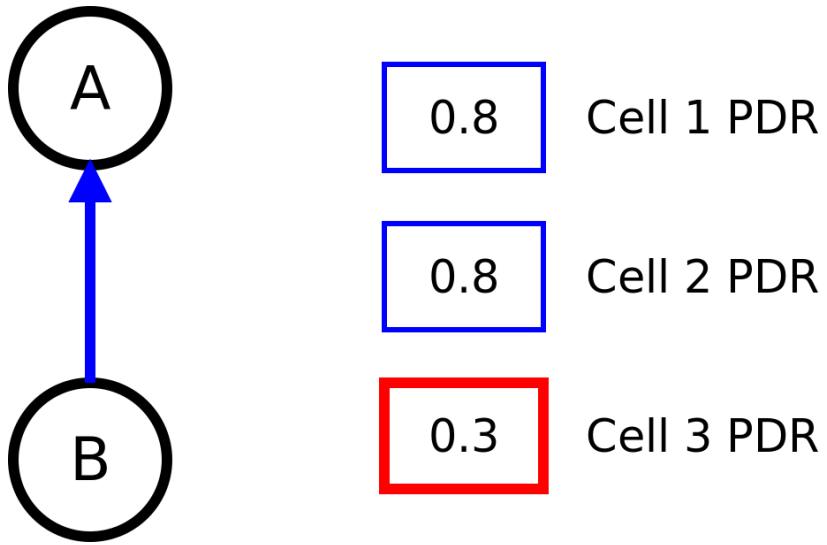

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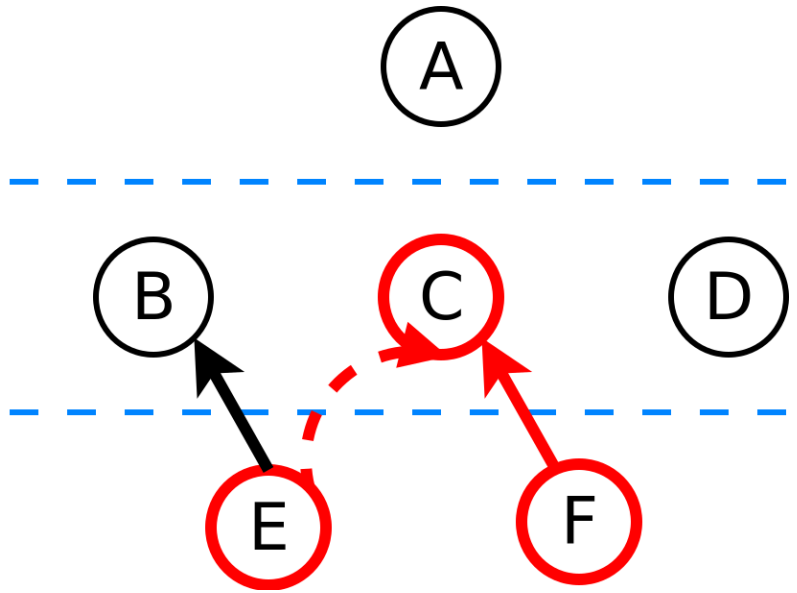

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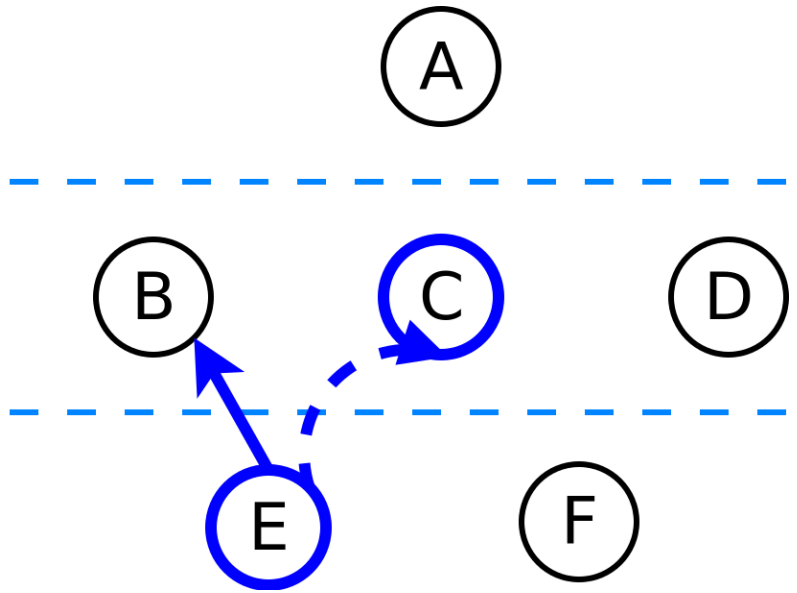

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Collision in Dedicated Cells

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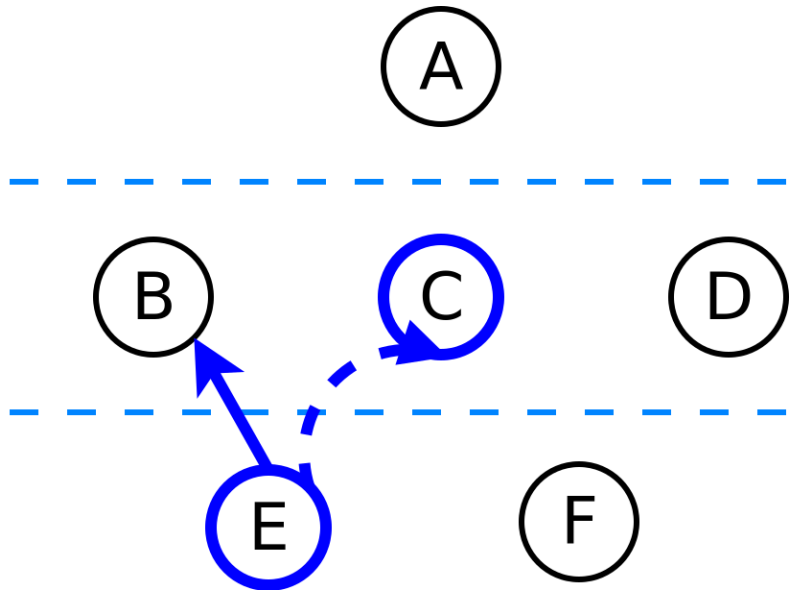
- Rx housekeeping.
- Dealing with collisions after they occur. Good idea ?



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- Creating a flexible mechanism, compatible with all scheduling functions

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Using 6top Transaction

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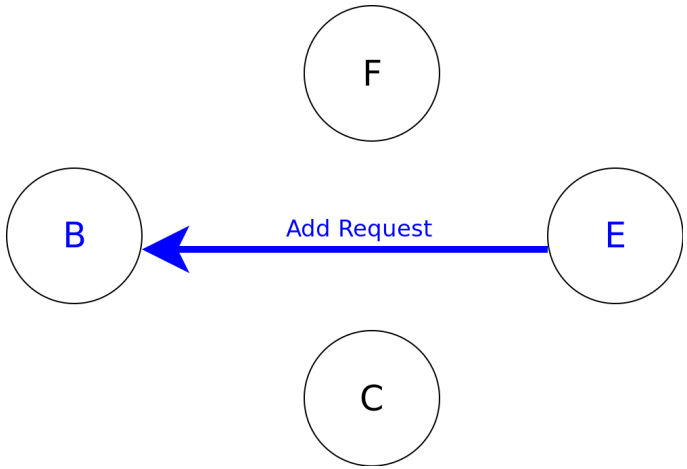

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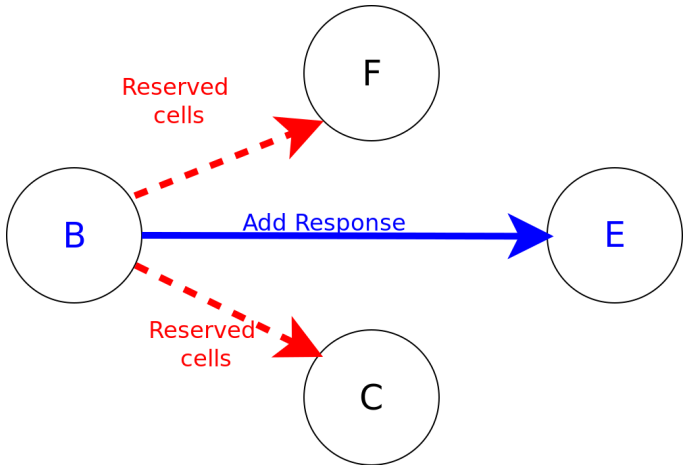

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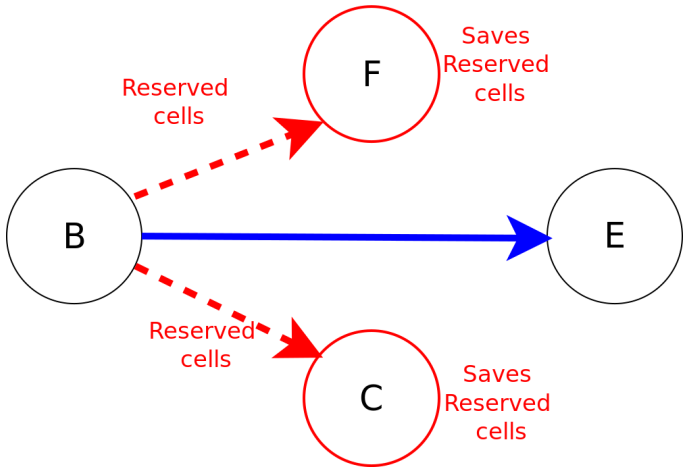
- The Neighbor nodes collects the reserved cells and save them.



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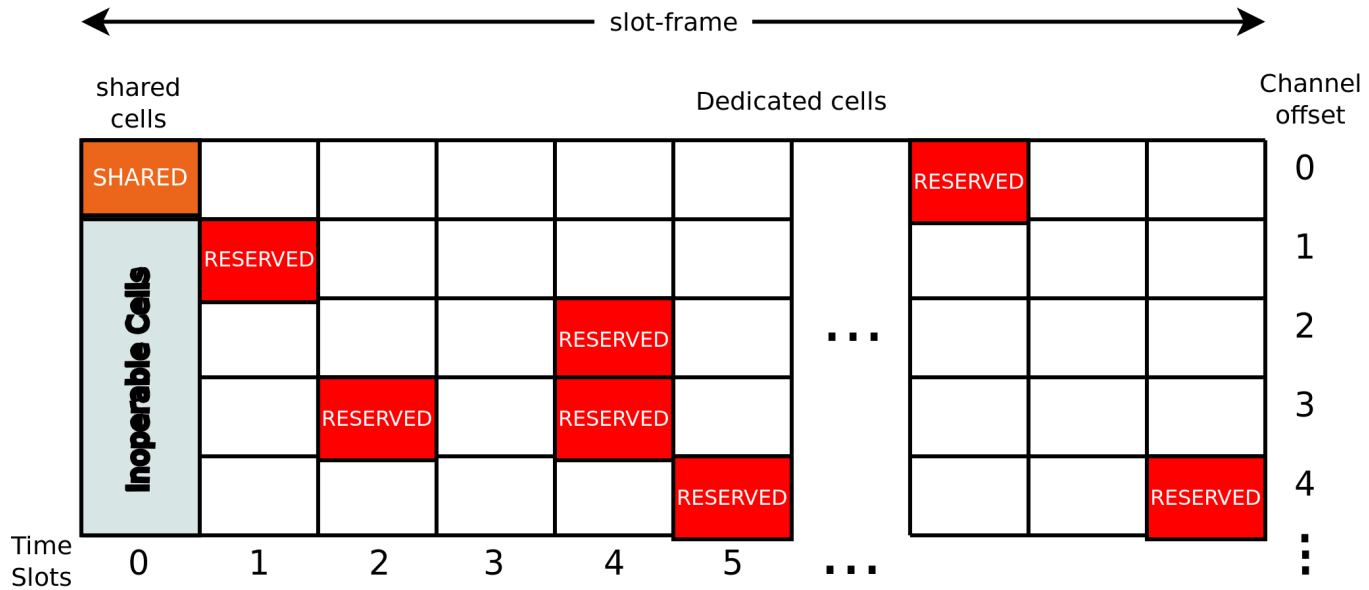

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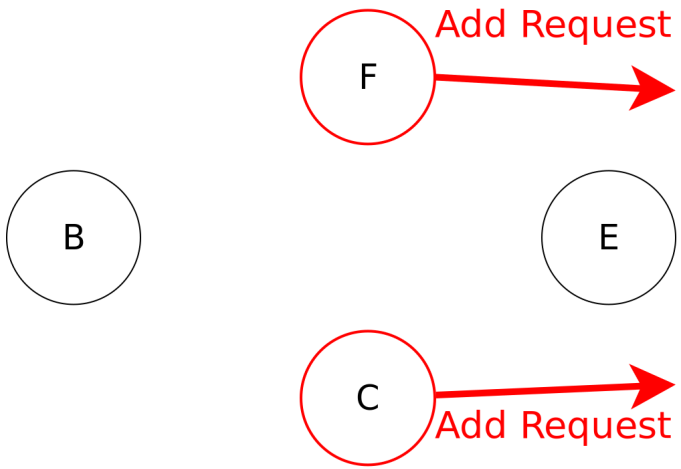
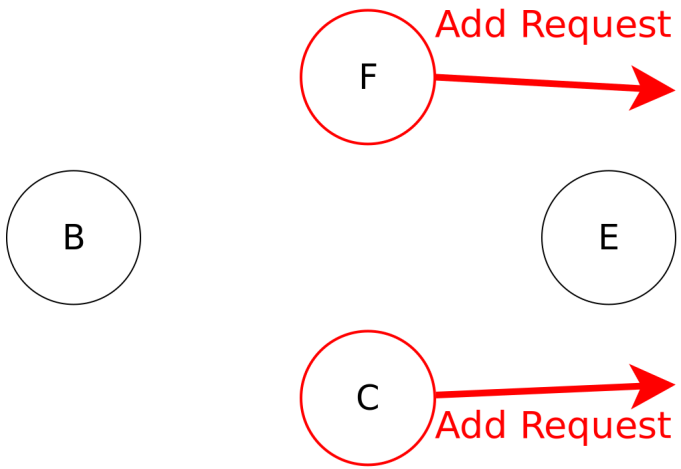
- Scheduling function will avoid selecting cells found in this structure.



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.



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- According to this equation, and by taking the worst case scenario a buffer of length 10 can assure us 95% of success

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Simulator Architecture

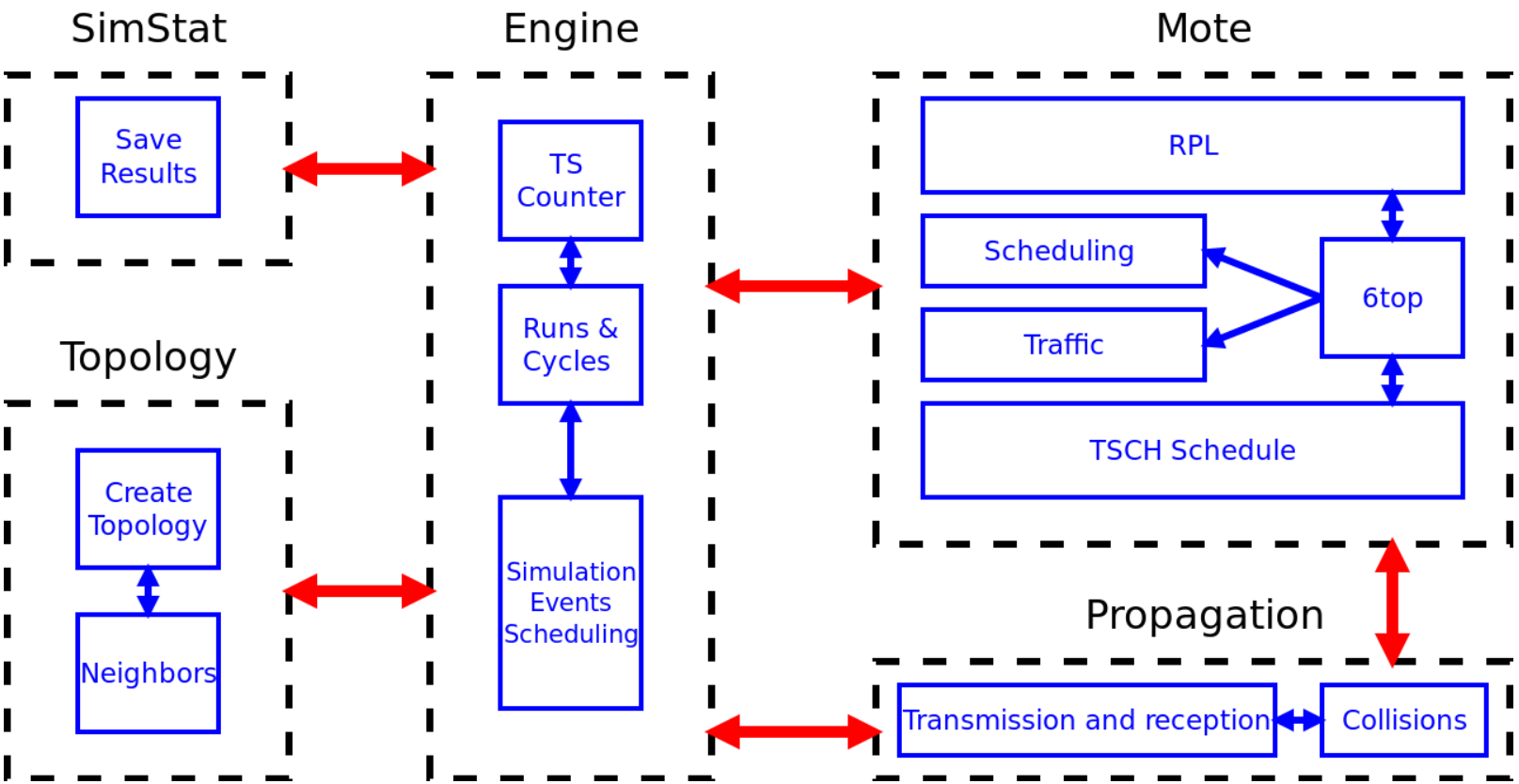

Figure: Simulator Architecture

Outline

Results

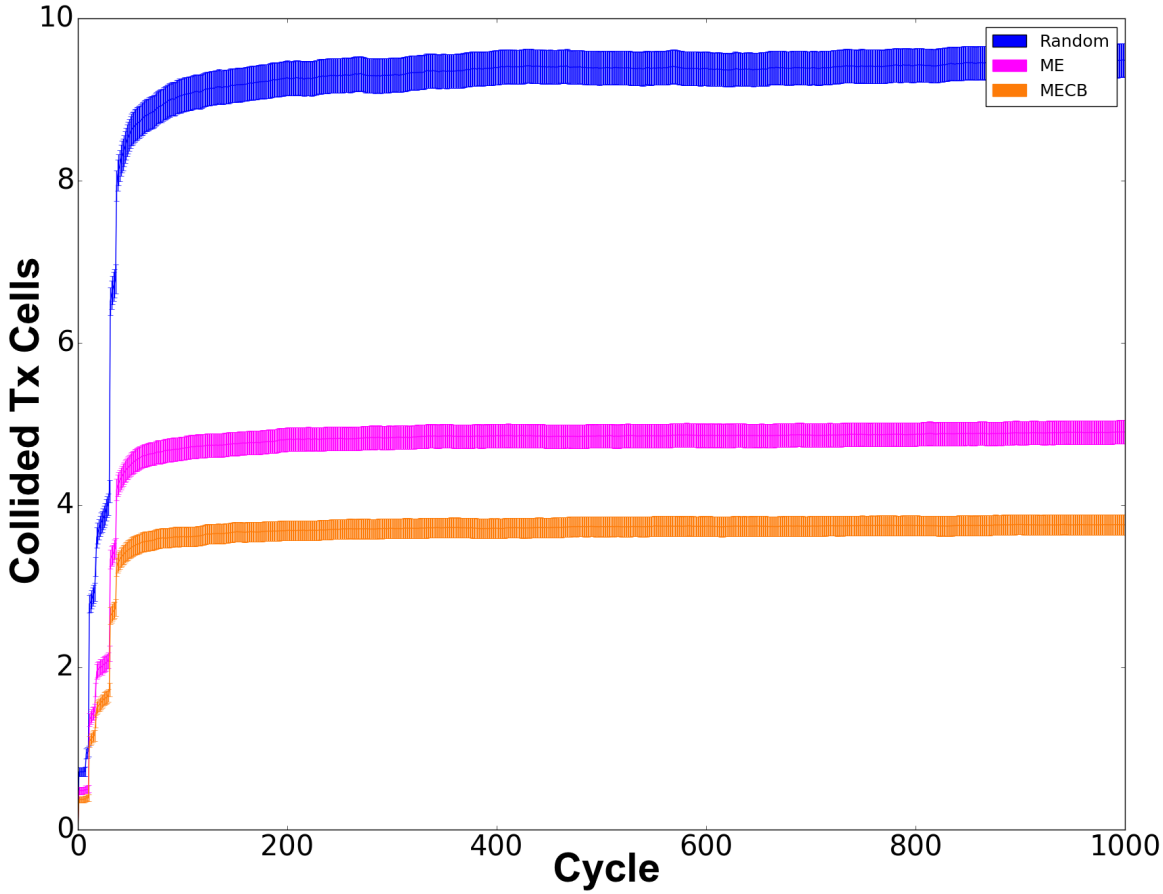

Figure: Simulation of the Number of Collided Tx Cells as Function of Cycle Number (Time)

Cell Buffer

- The lost 6top transactions.

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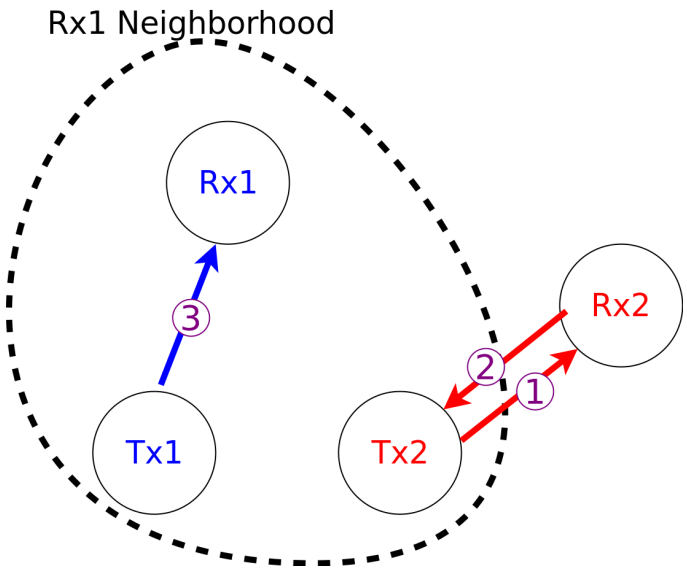
- Special Case That Induce Collisions.



Comparison with Housekeeping

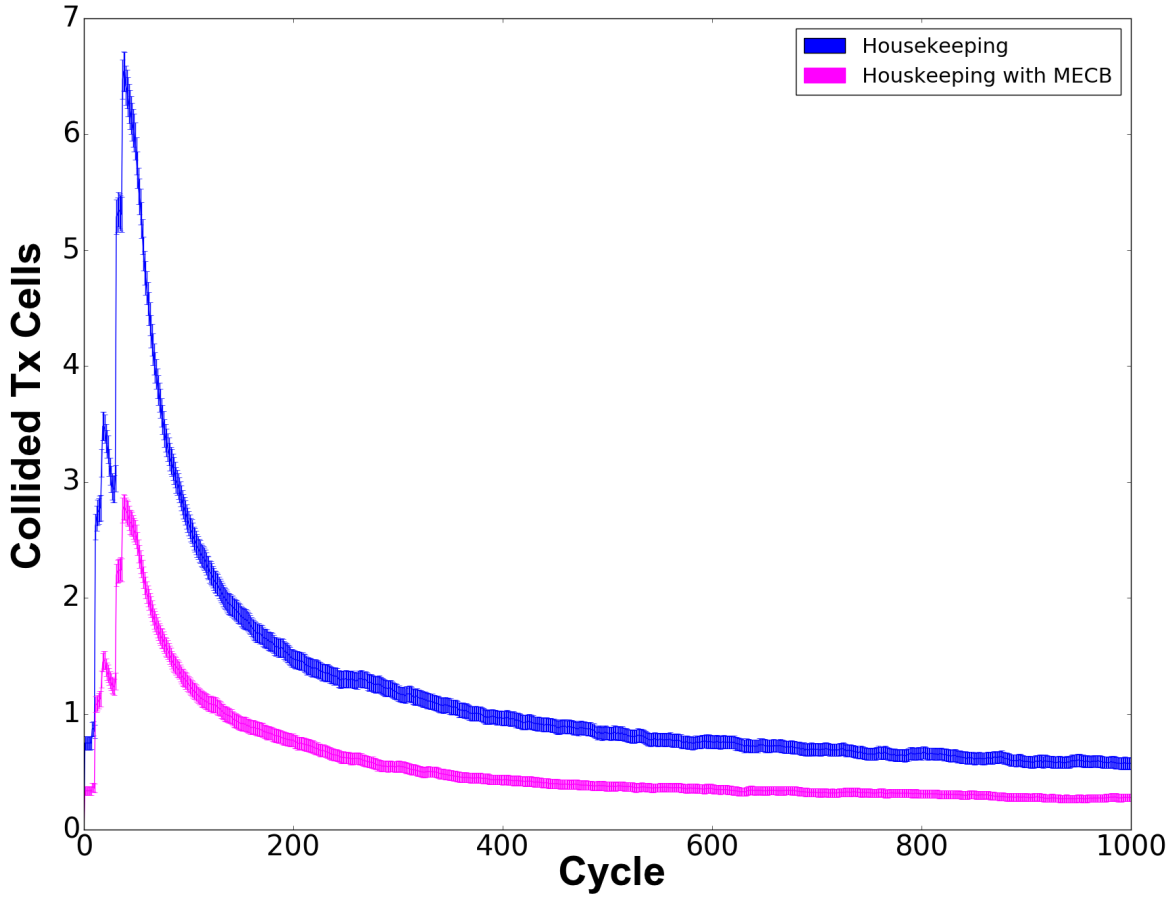


Figure: Simulation of the Number of Collided Tx Cells as Function of Cycle Number (Time) - comparison with the housekeeping approach

Comparison with Housekeeping

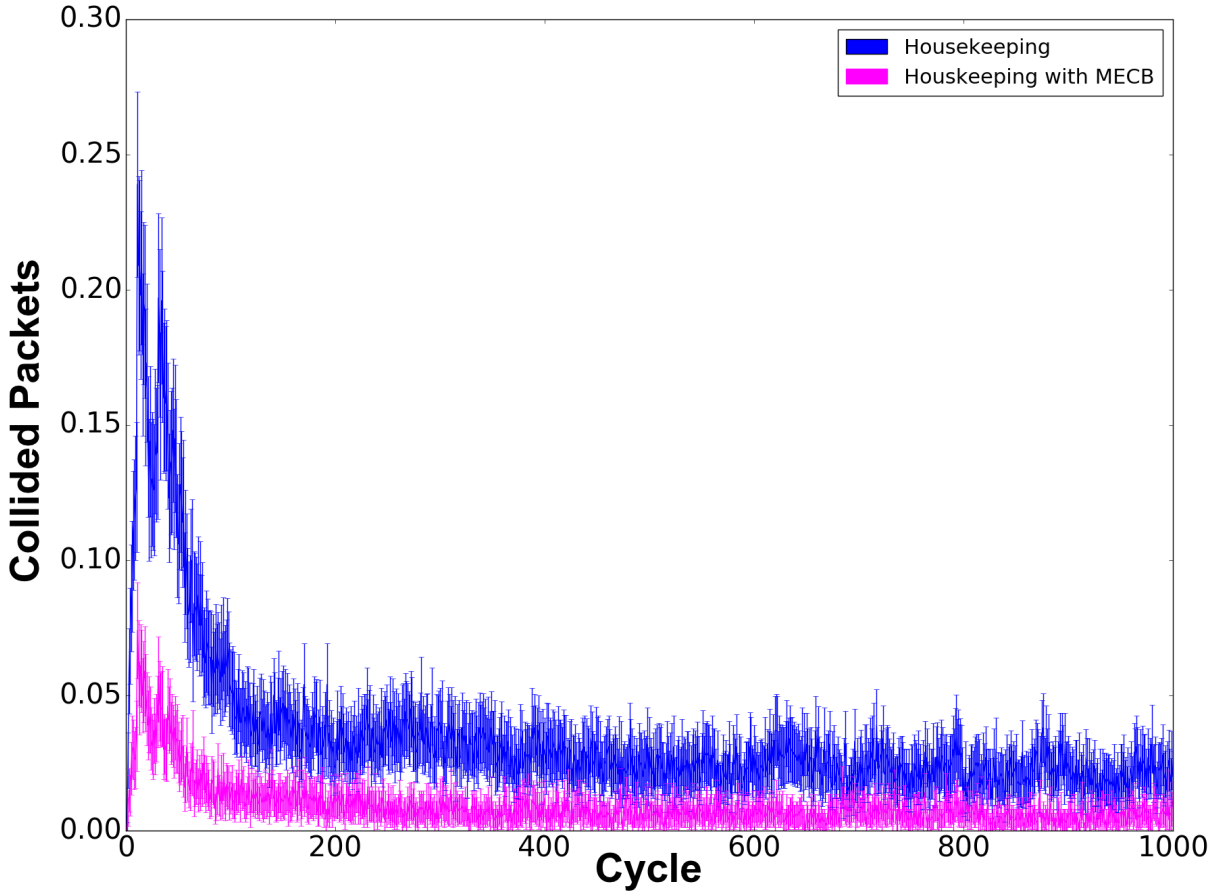


Figure: Simulation of the Number of Collided Packets as Function of Cycle Number (Time) - comparison with the housekeeping approach

Summary

- Our implementation introduce no overhead in the network.
- The implementation achieved 60% reduction in the number of collided Tx cells and 70% reduction of the Collided Packets.
- 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 prespective in this project was work on 6top, but our next steps is to study the effects of traffic in the protocols performances.