Collision Prevention in Distributed 6TiSCH Networks

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Outline

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- IEEE802.15.4 one of the main standard for those Networks

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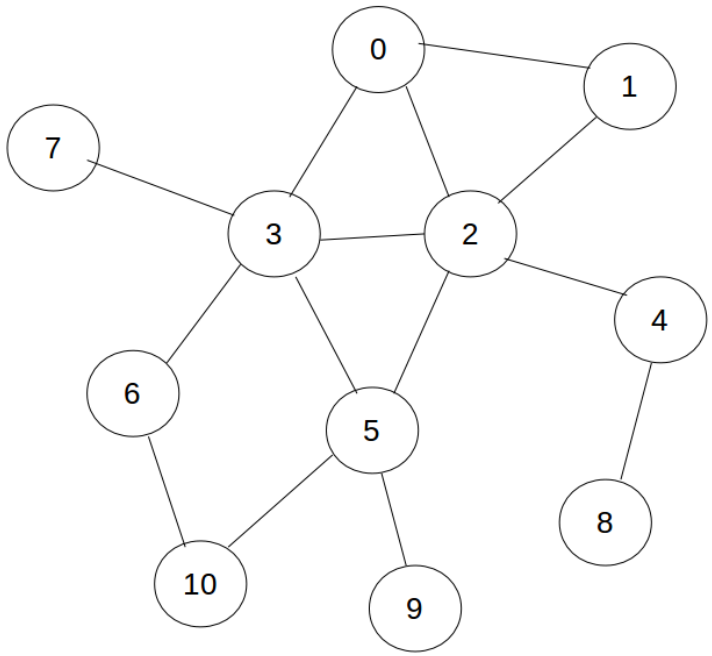

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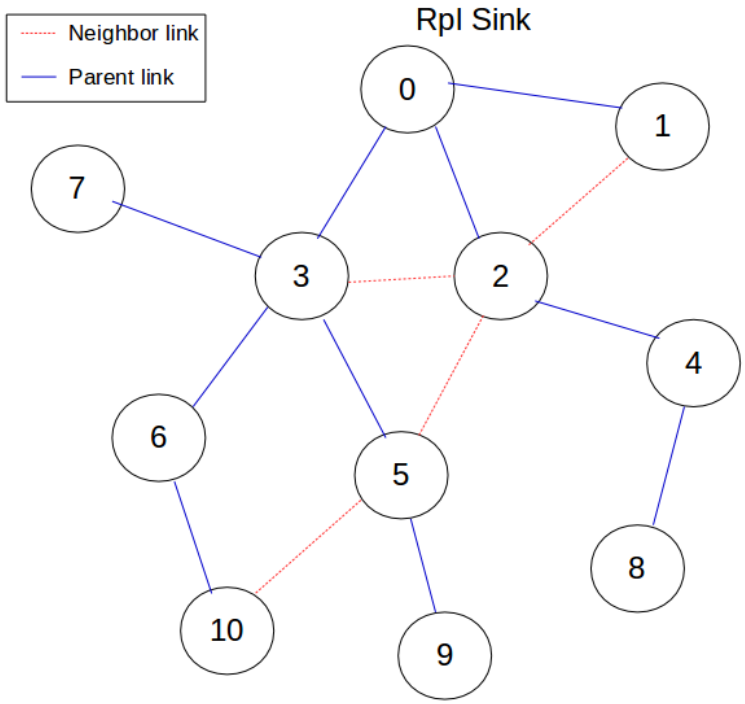

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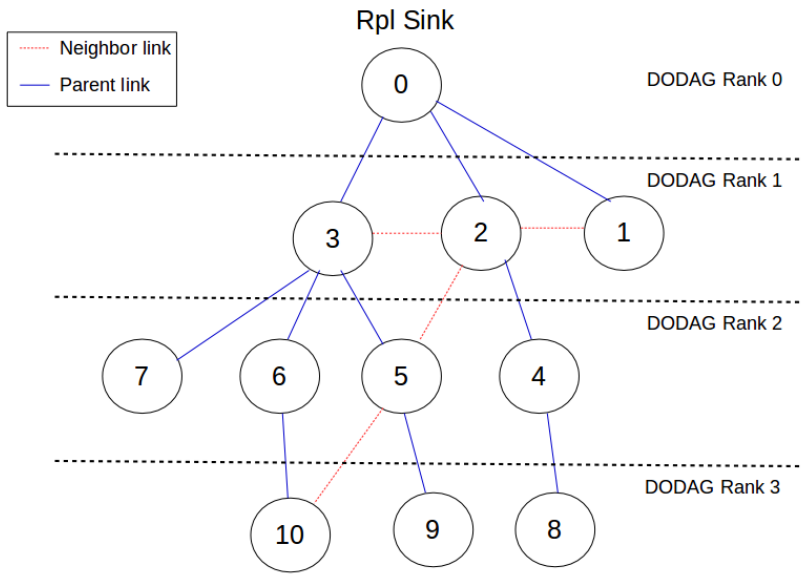

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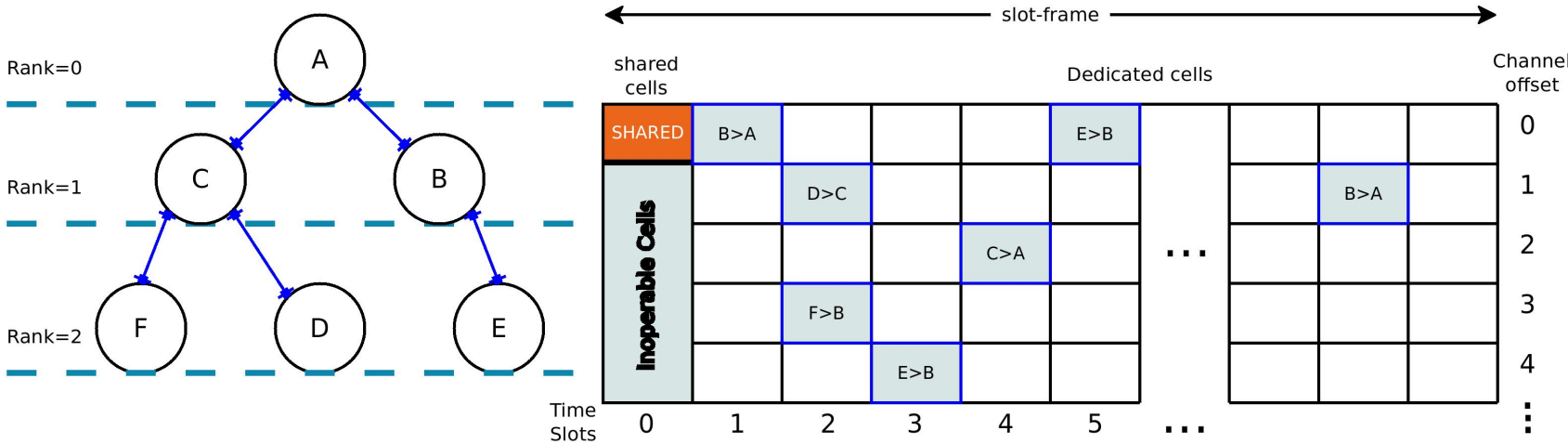

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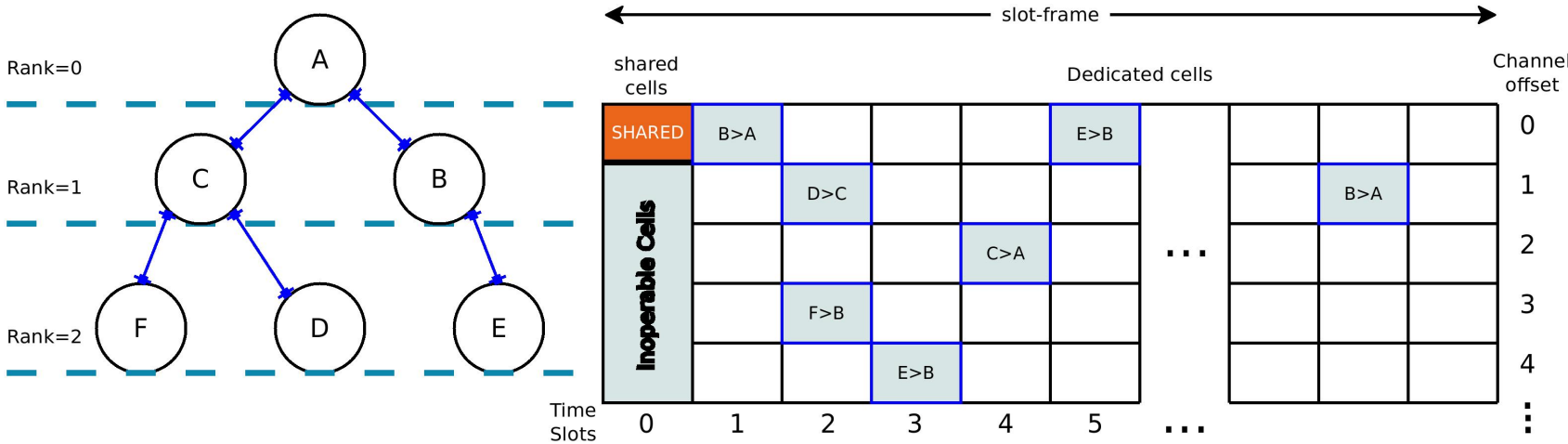

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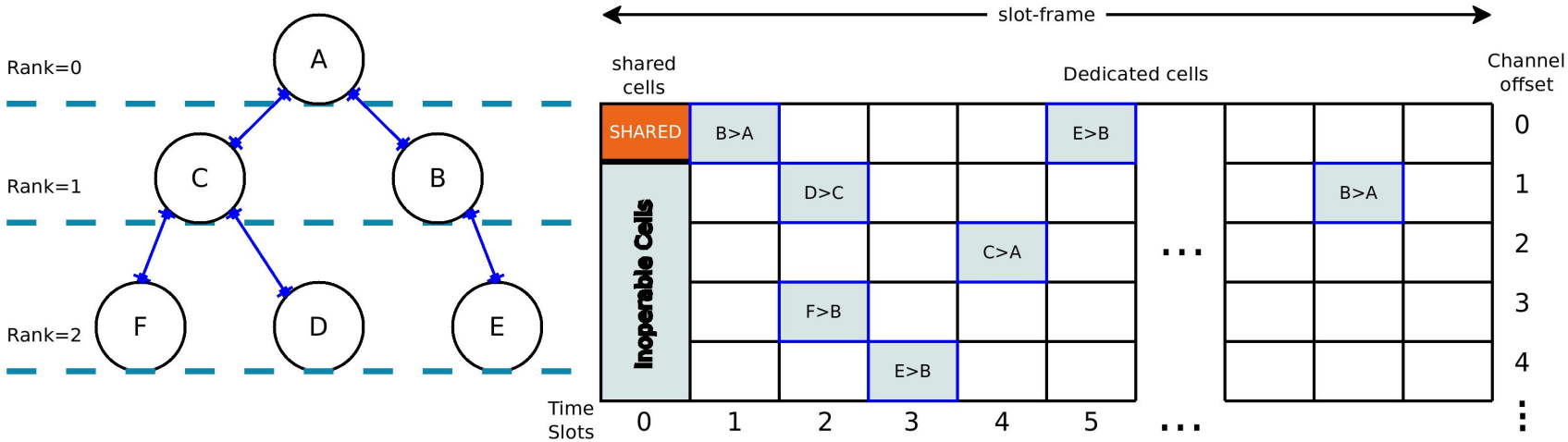

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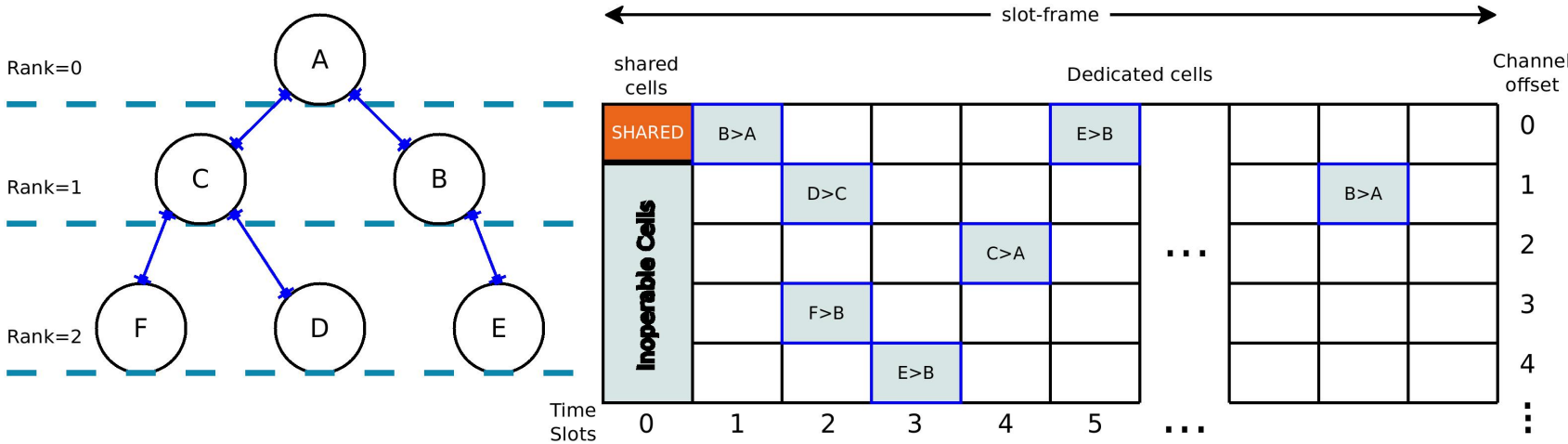

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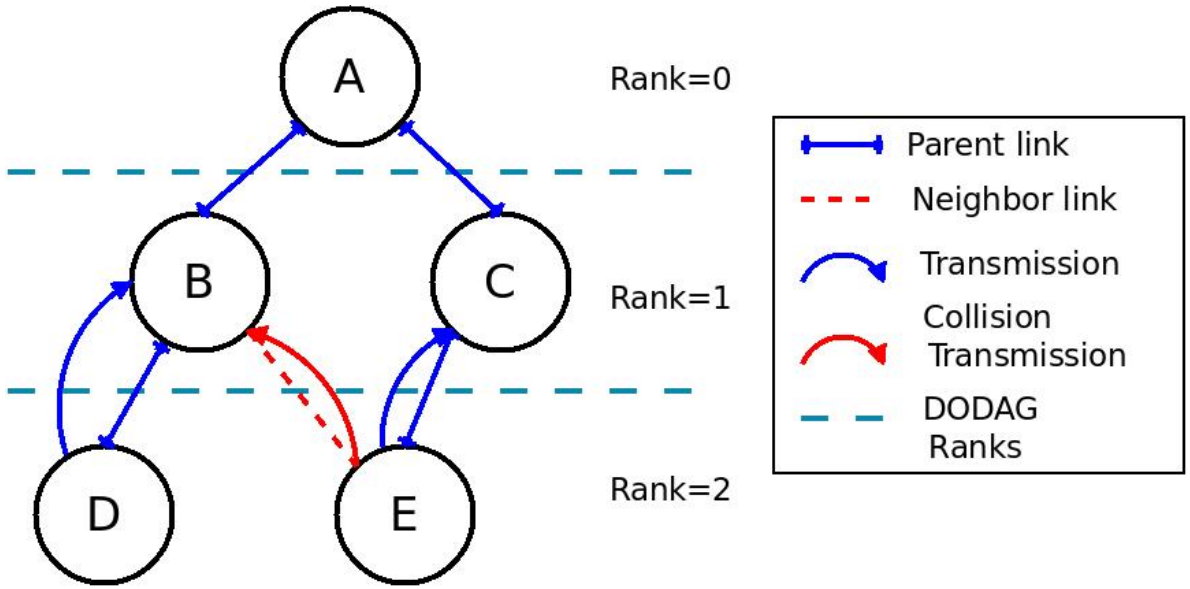

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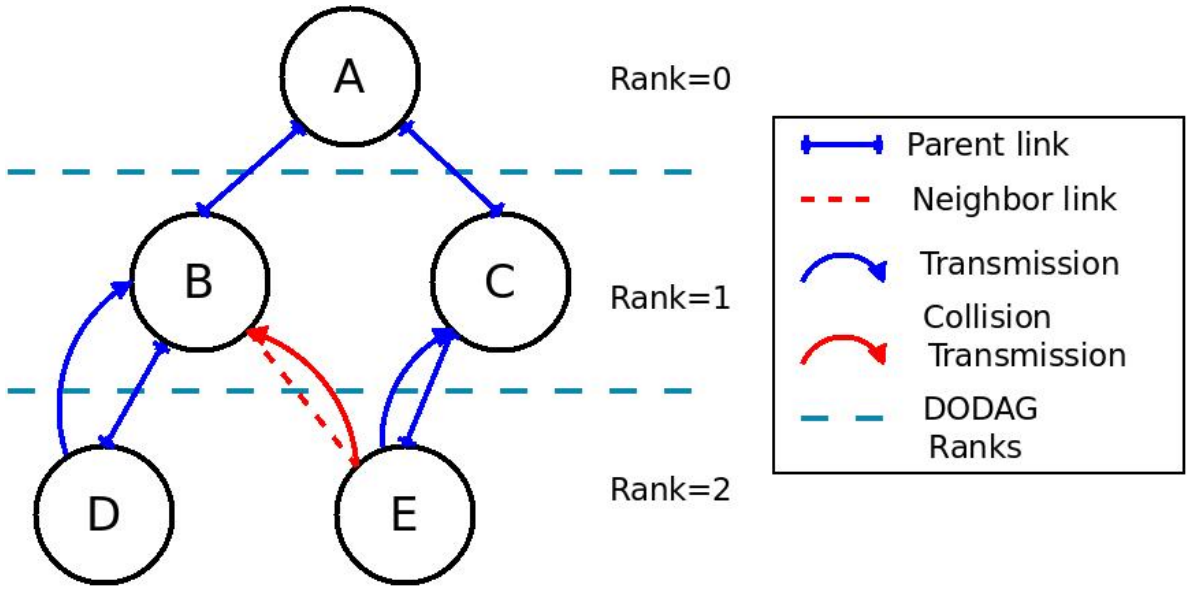

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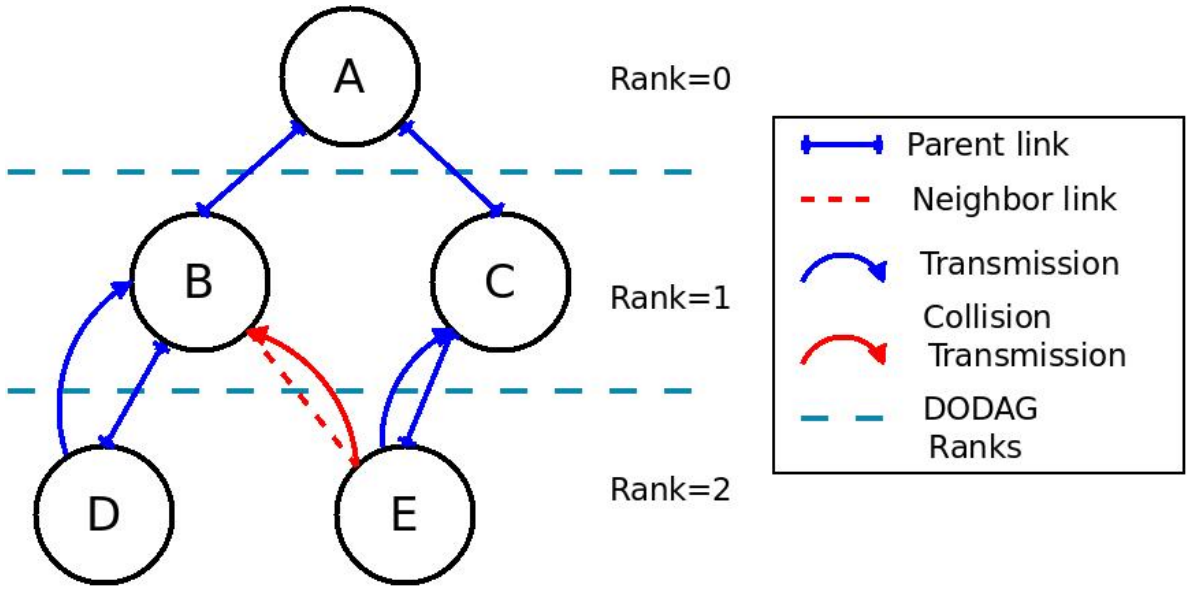

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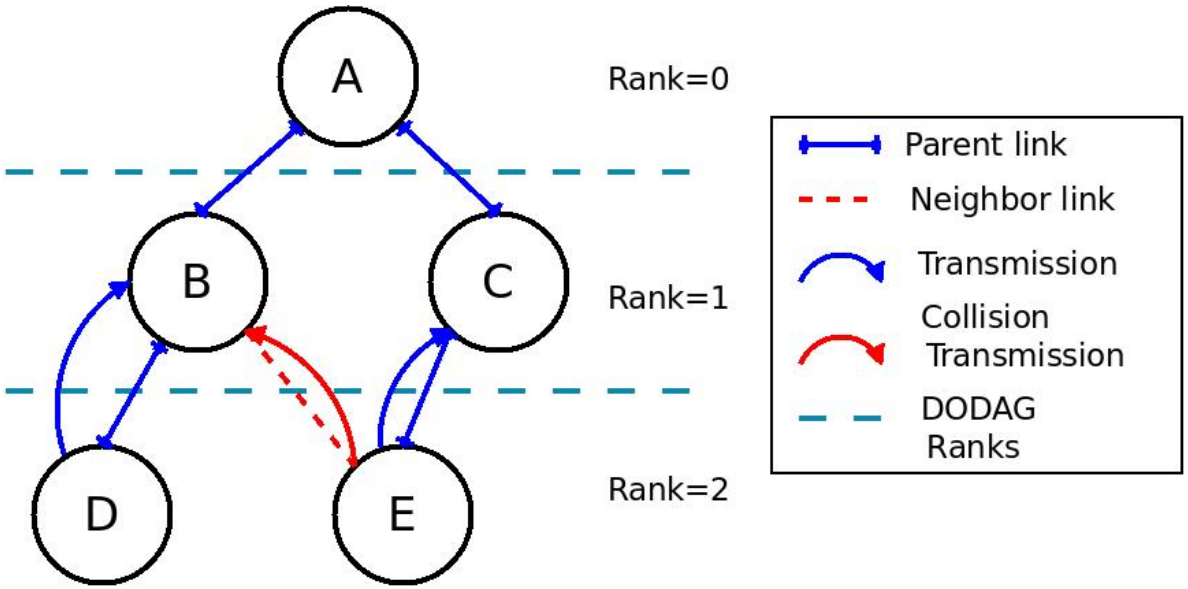

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- 6top is responsible for the cell addition and deletion.

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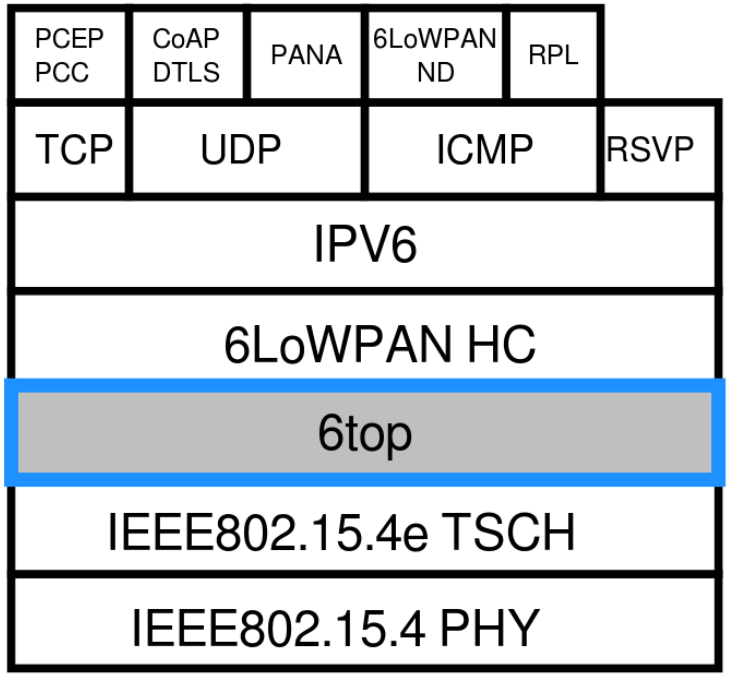

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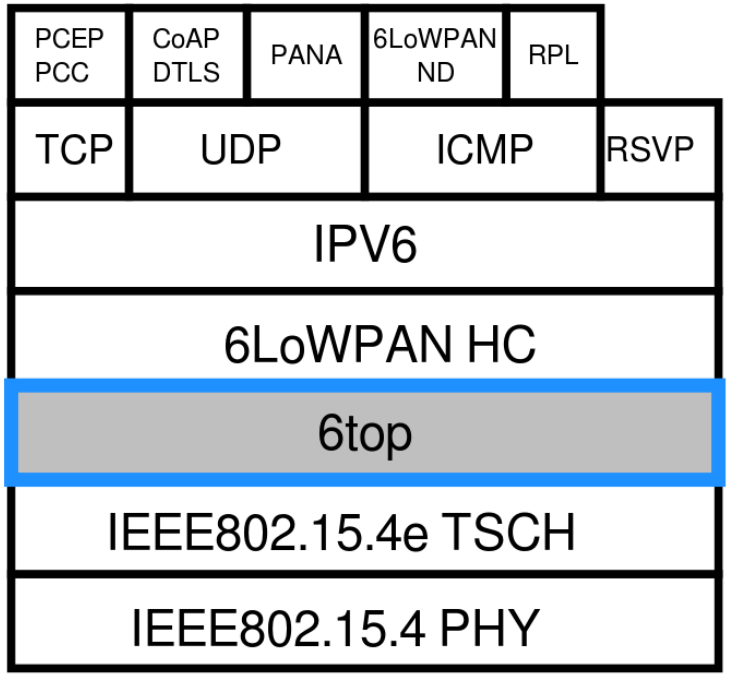

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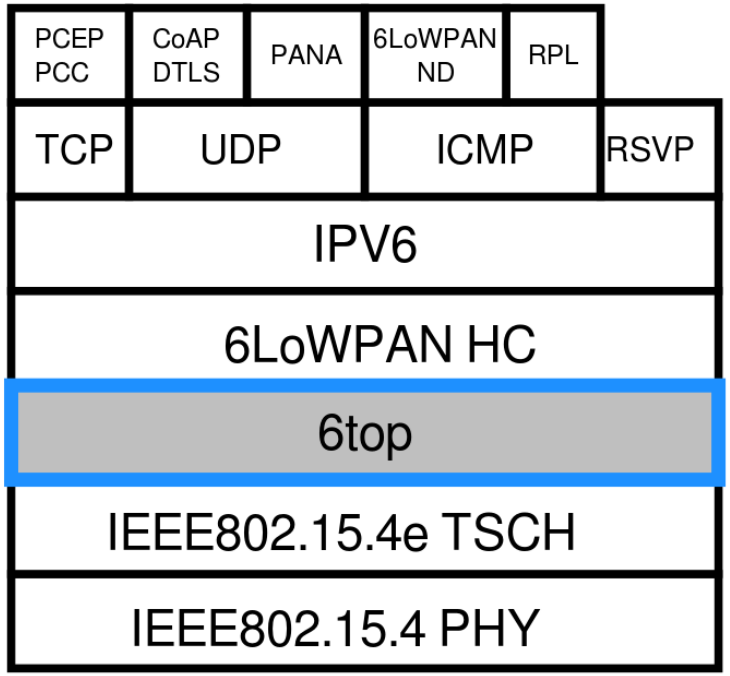
- 6top enables the distributed scheduling in 6TiSCH network.



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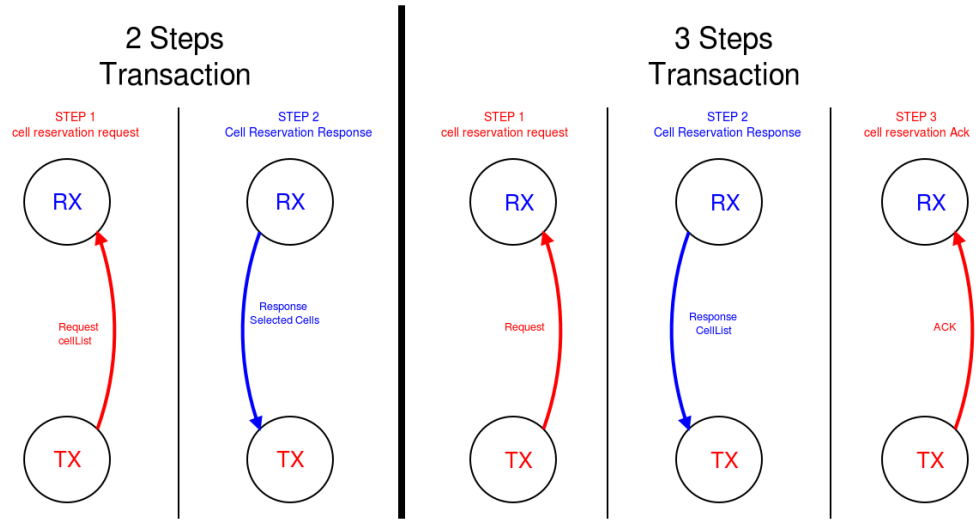

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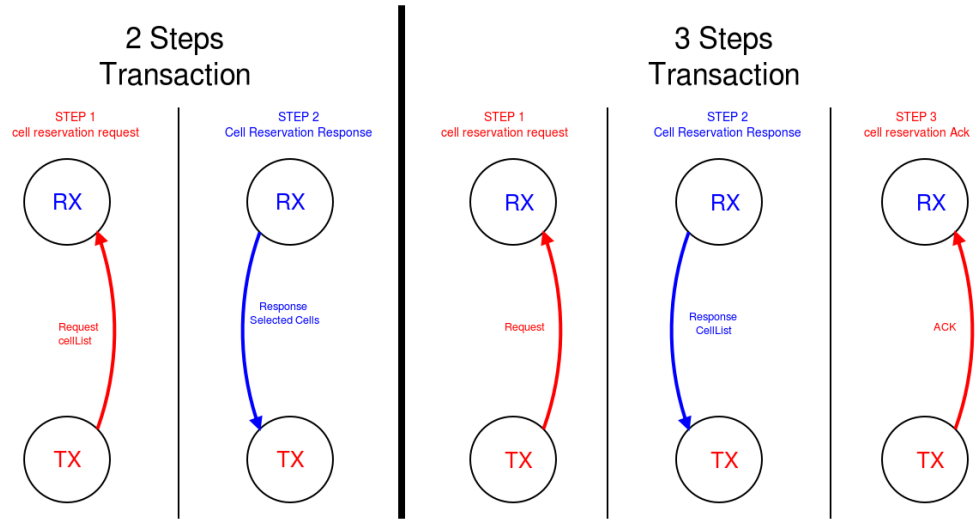

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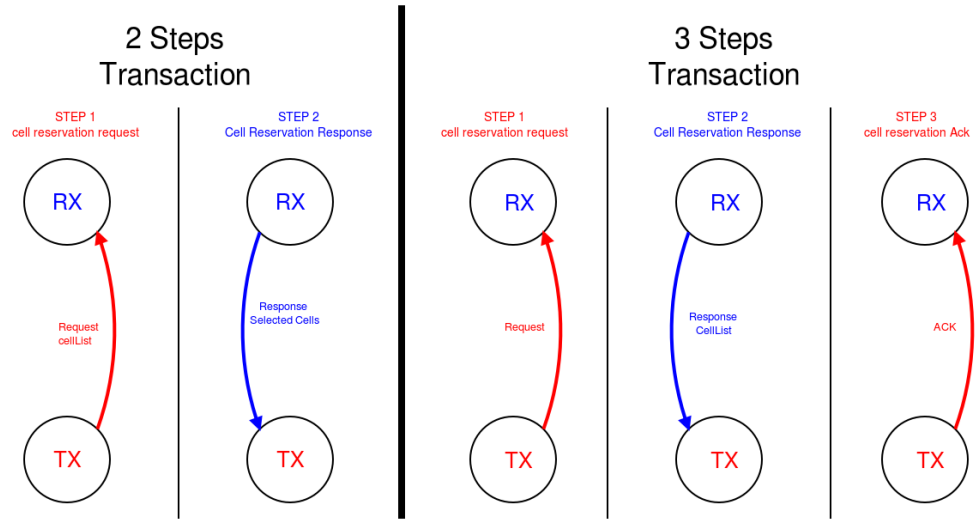

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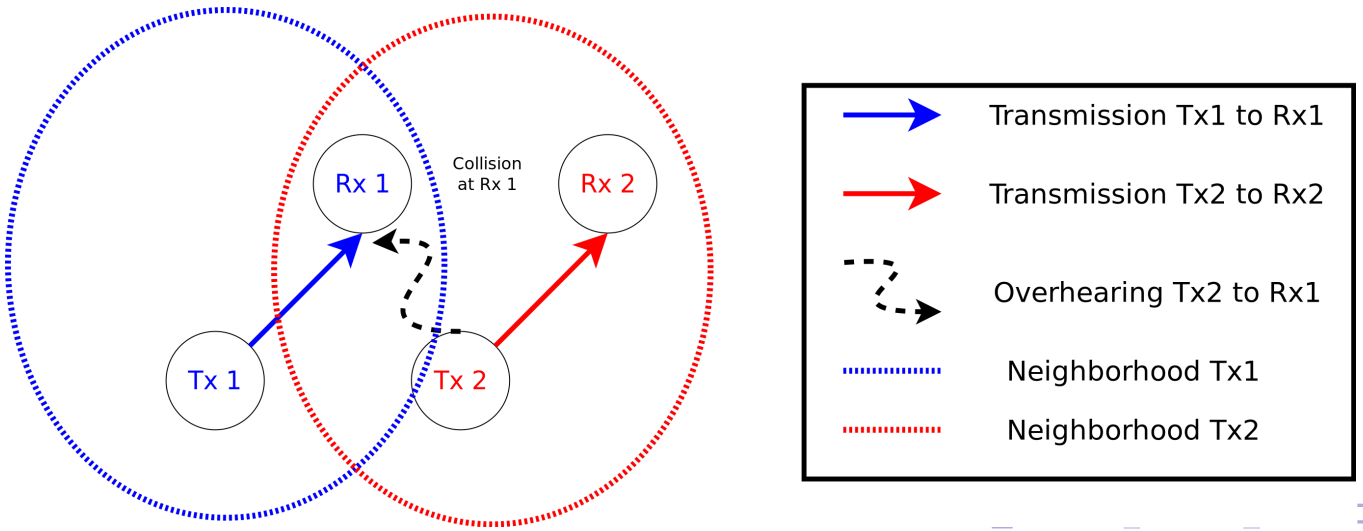

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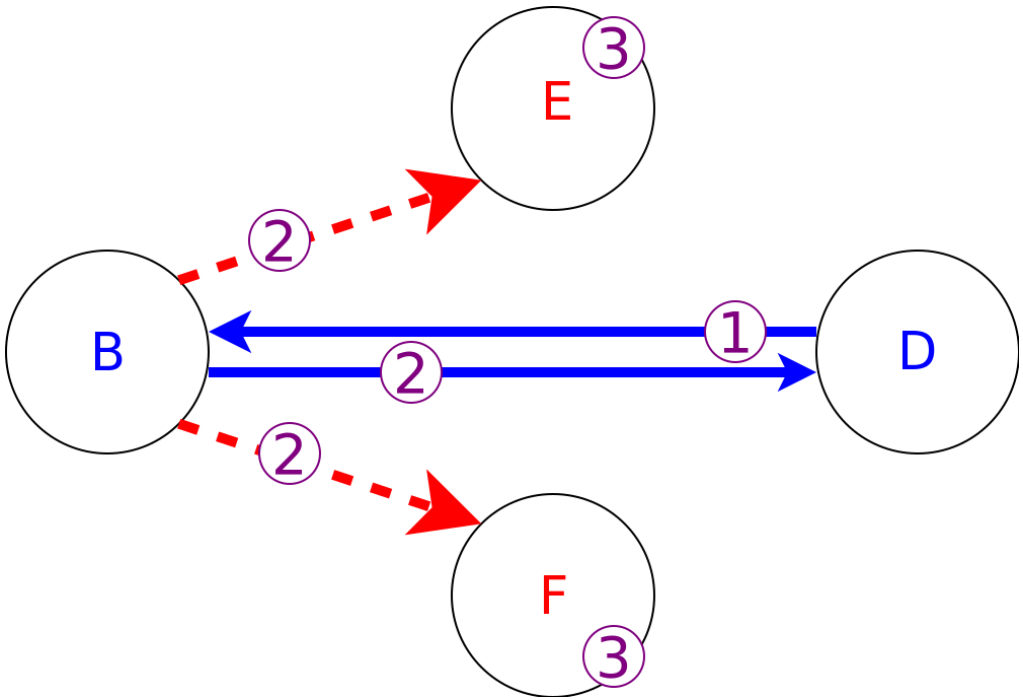

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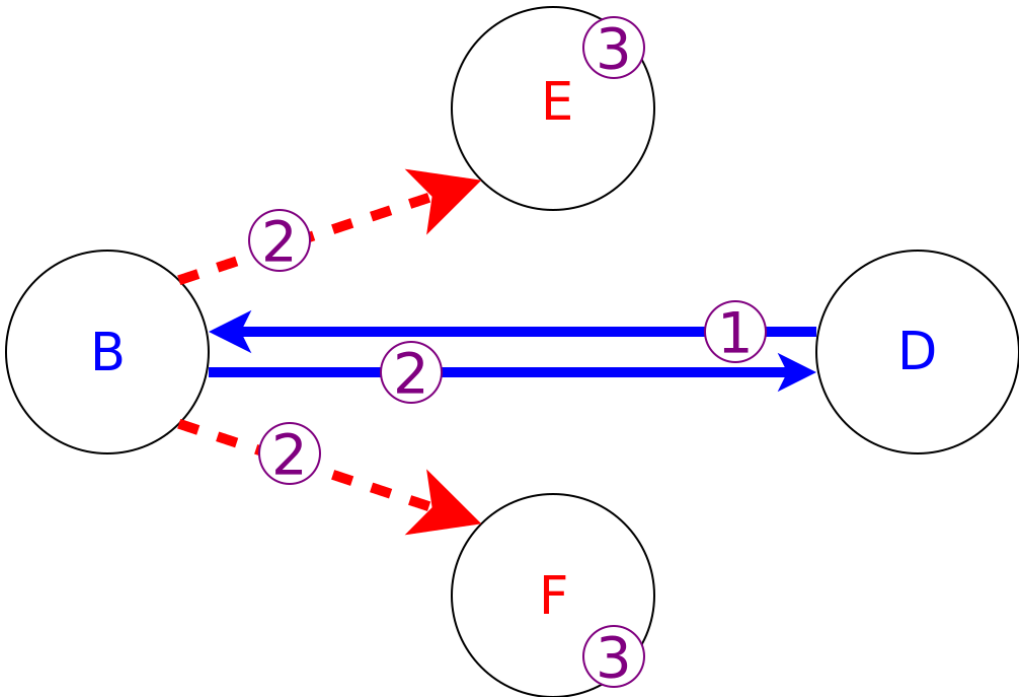

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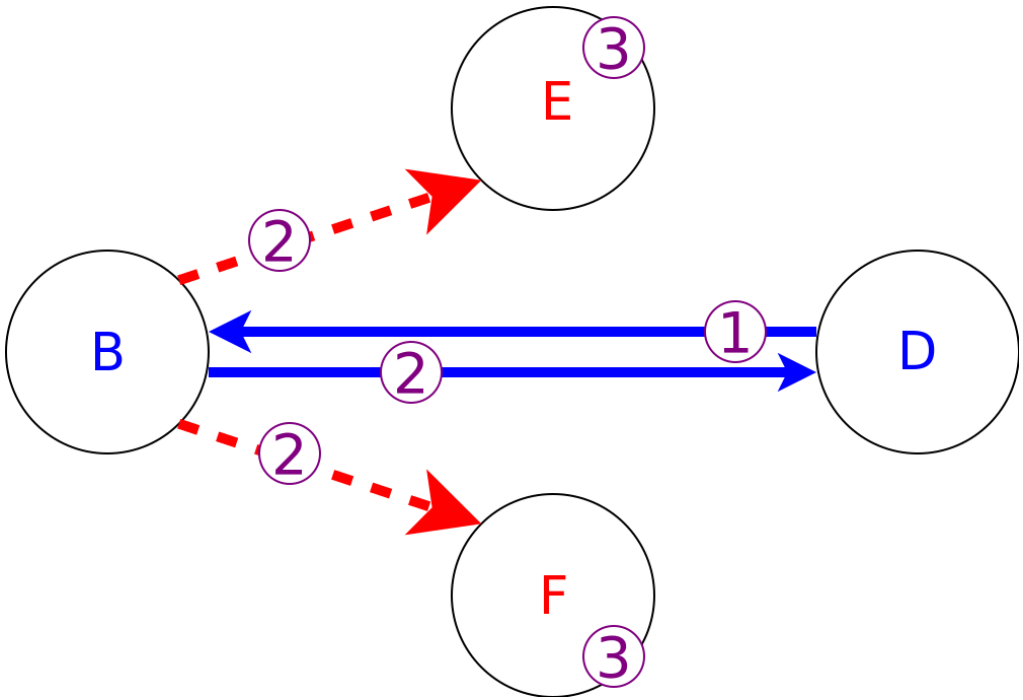
- The Add Response is transmitted in the shared cell, E & F will receive and extract the cells.



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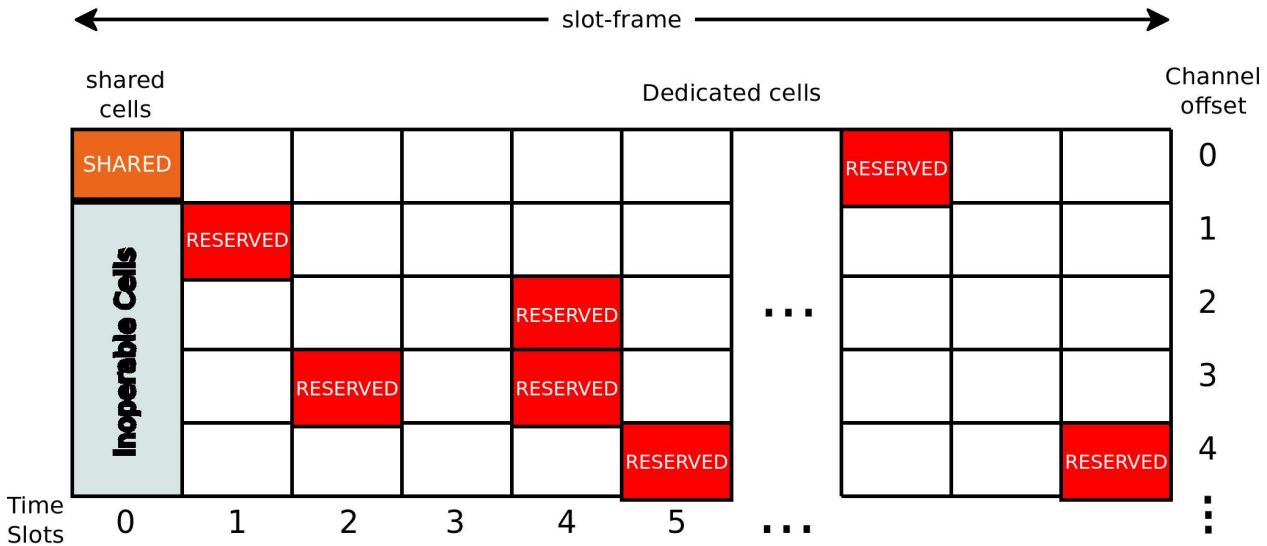

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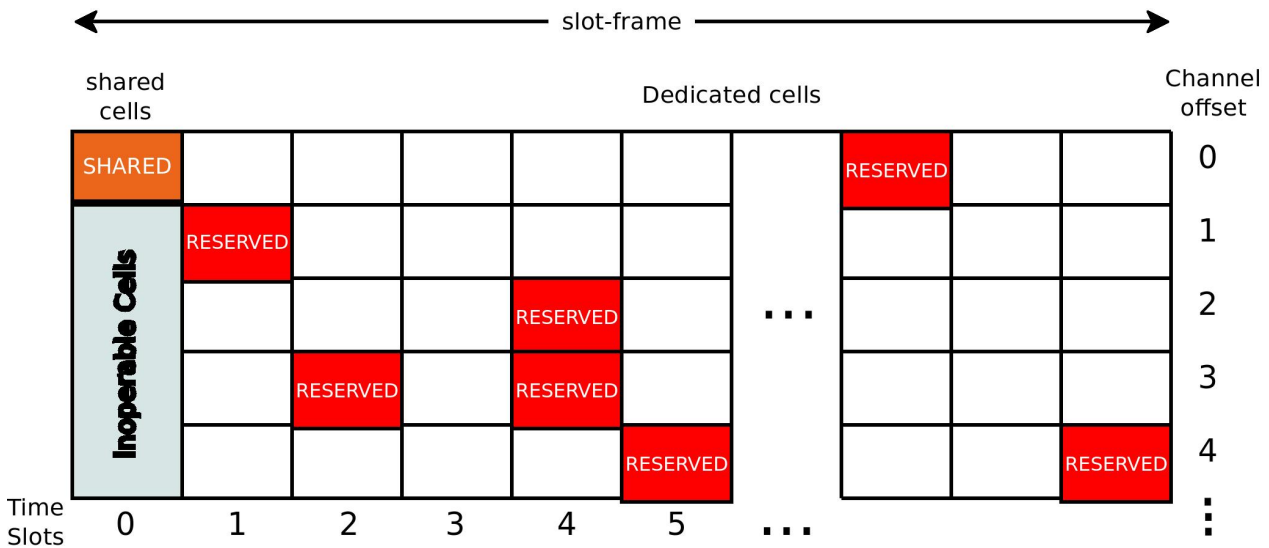

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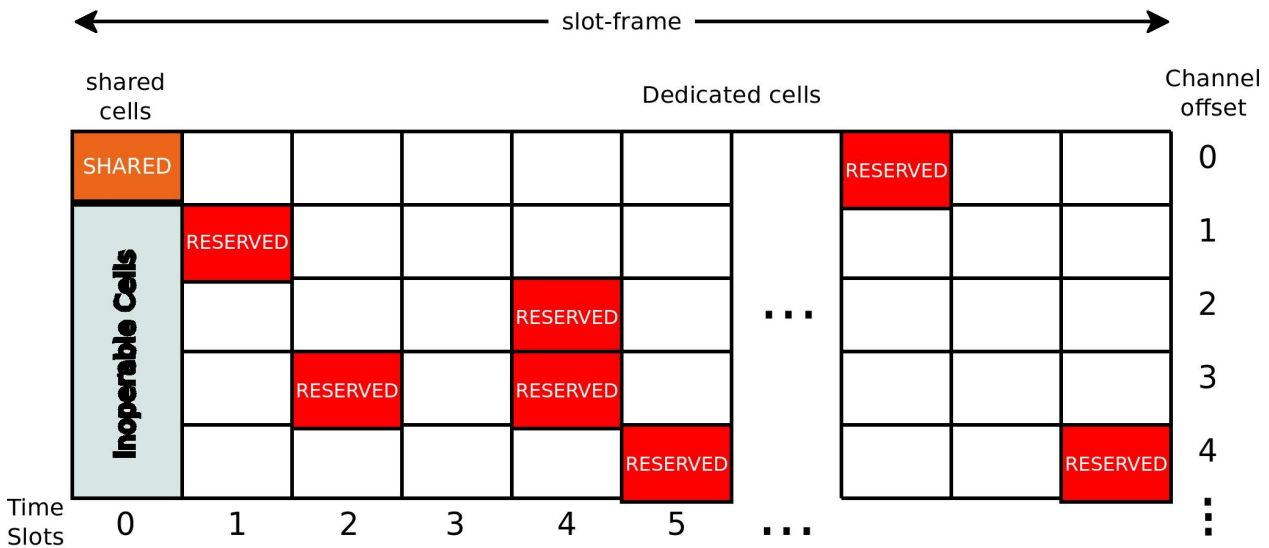

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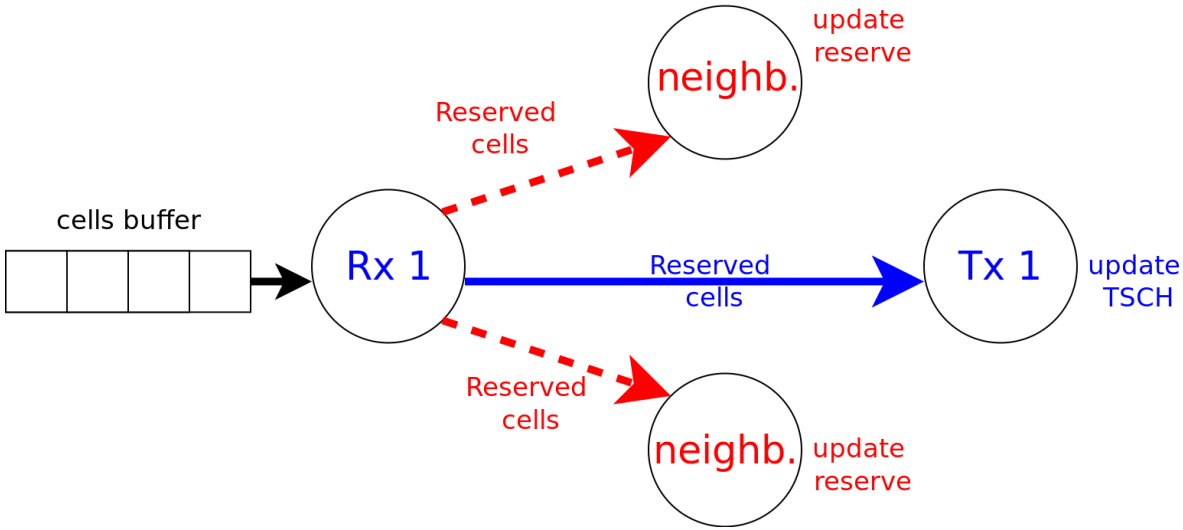

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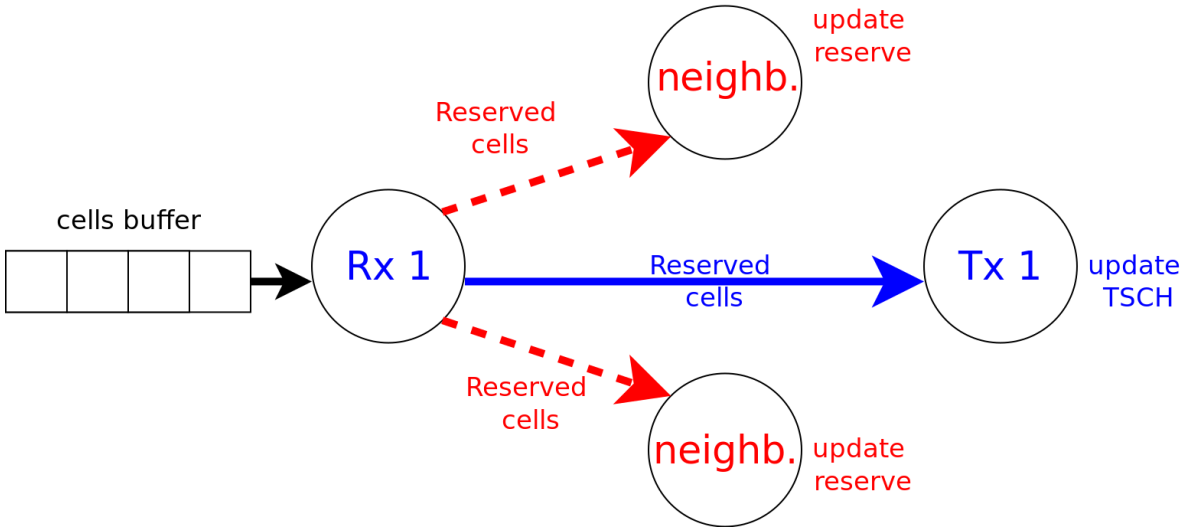

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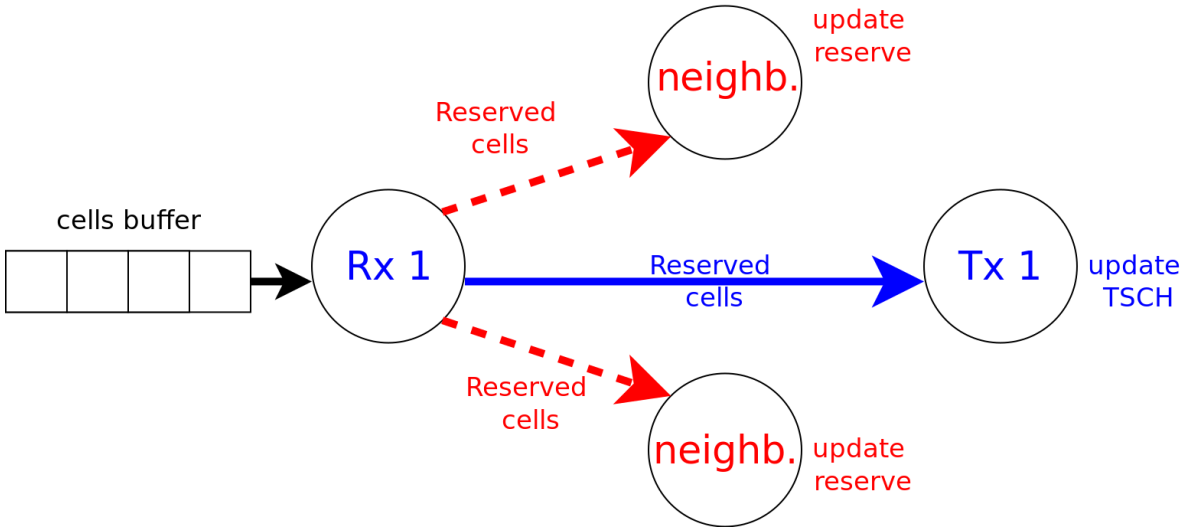

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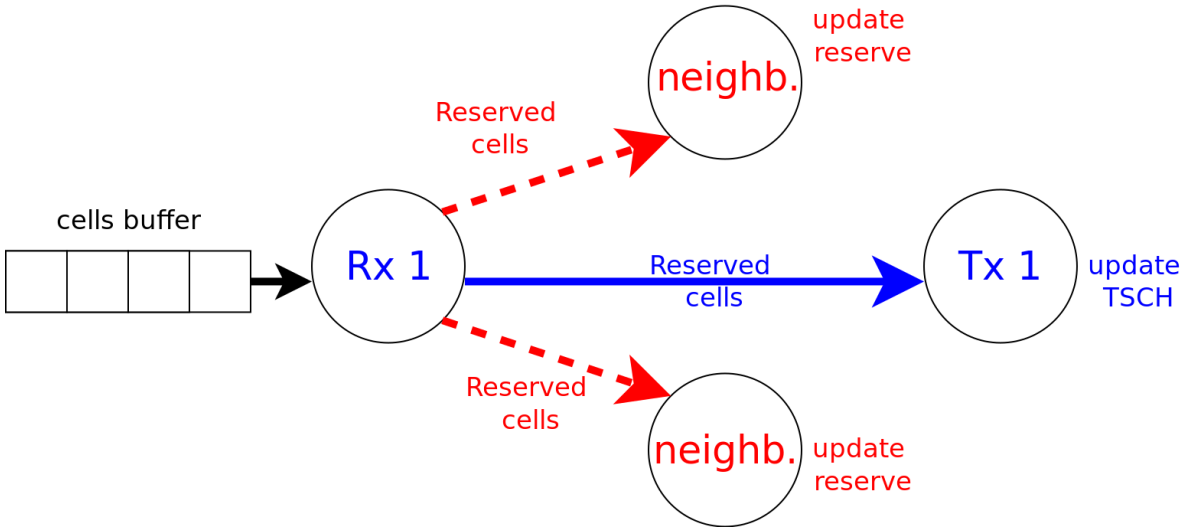
- By saving the reserved cells in a buffer, and sending the buffer this probability can be reduced.



Cell Buffer

- We have created a probablistic model to calaculate the optimal length of the buffer.
- p is the probability of successful transmission.
- we are confidence with a probability P_o that one of the transmission is successful.
- k is the number of retransmission (the optimal length of the buffer).
- we end up with the following equation using binomial distribution:

$$\left\lceil \frac{\log(1 - P_0)}{\log(1 - p)} \right\rceil$$

- 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

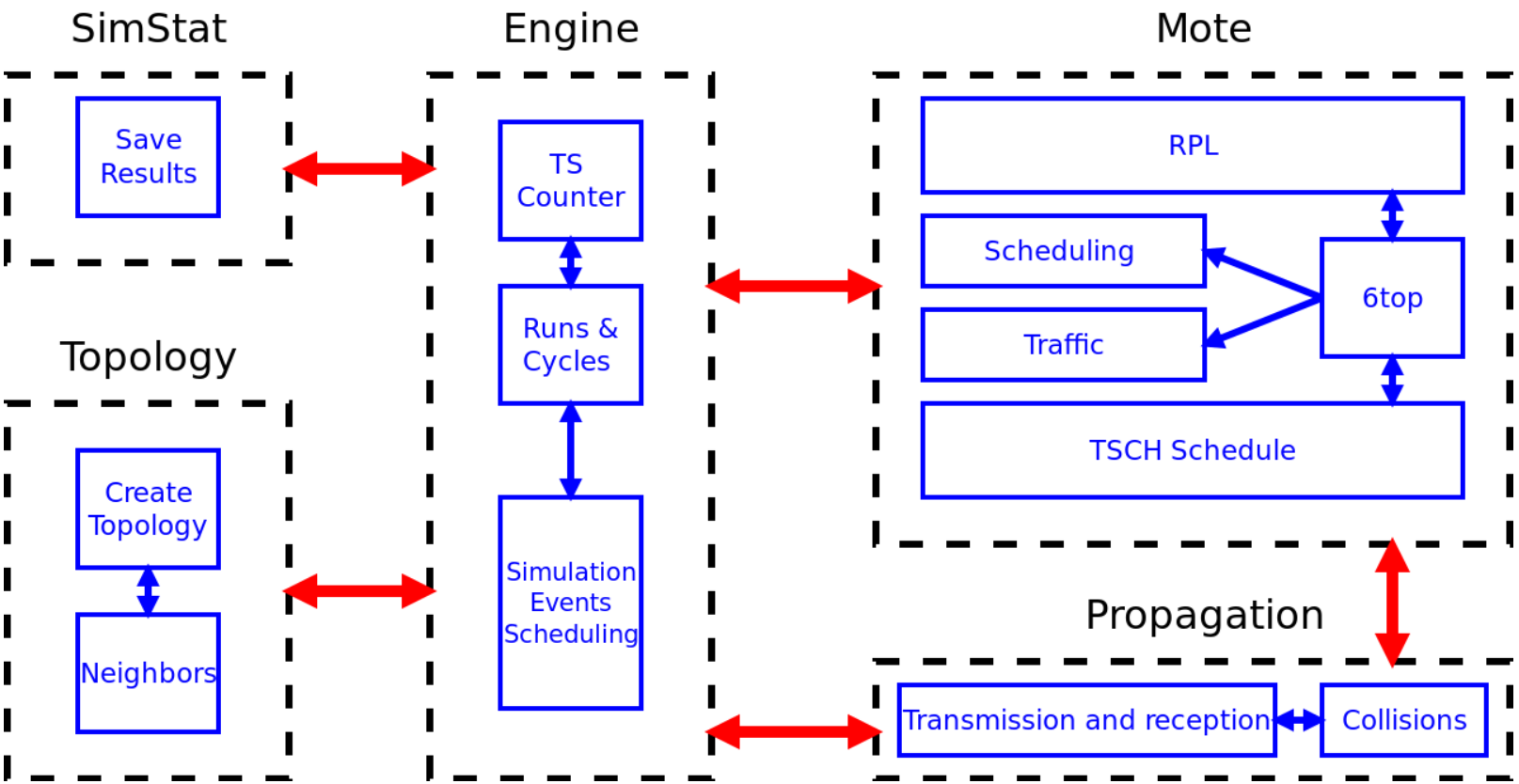
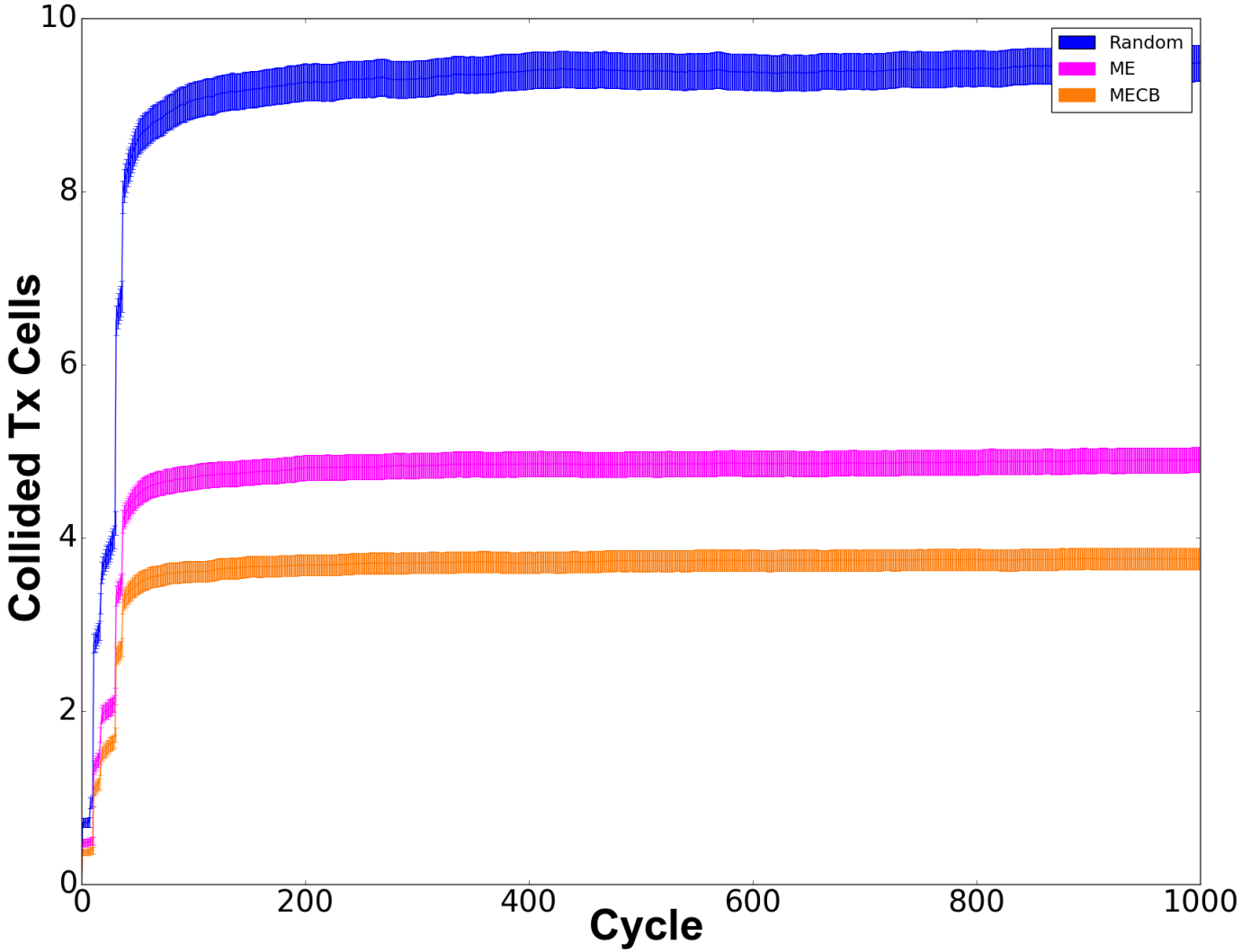
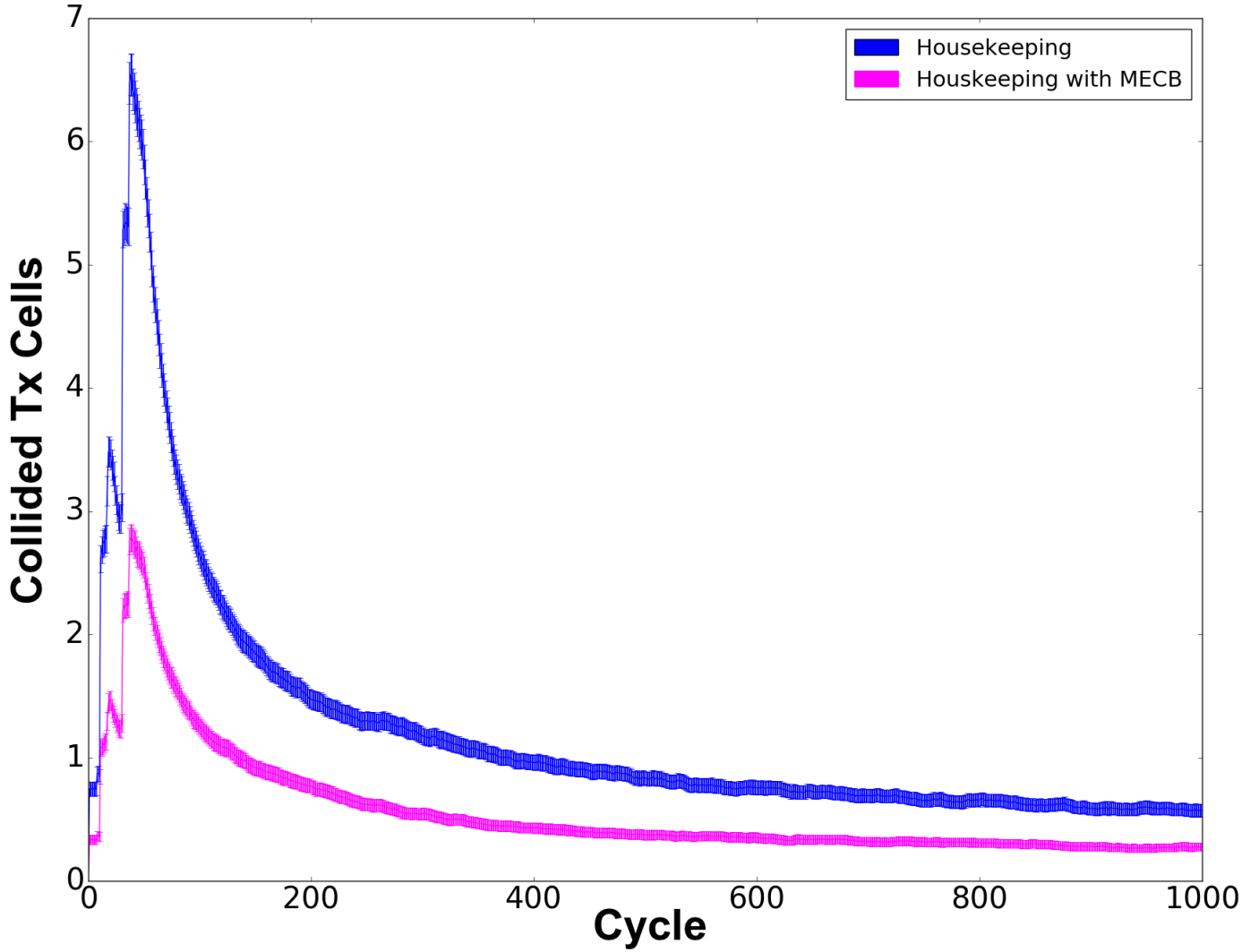


Figure: Simulator Architecture

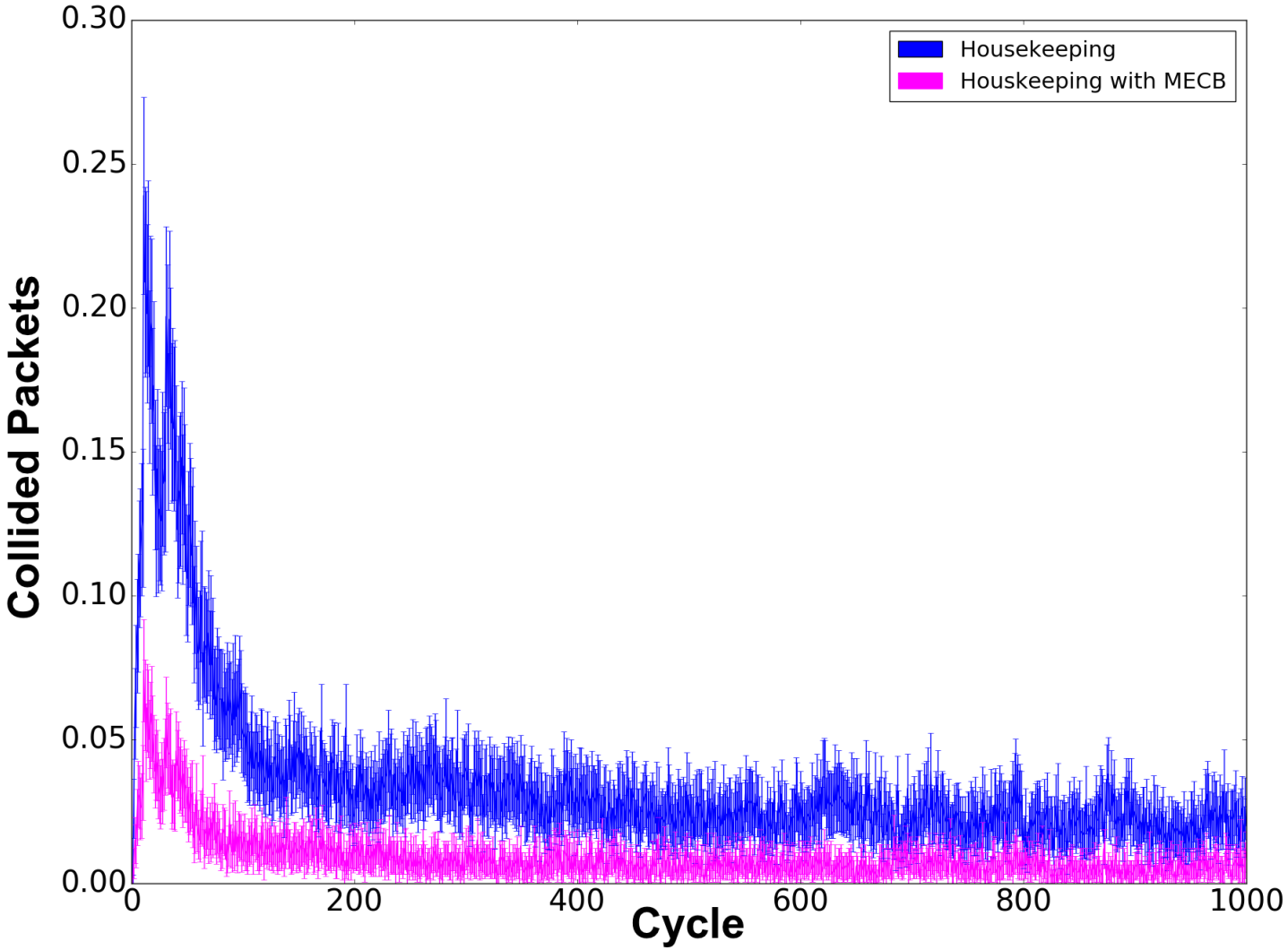
Results


Random
ME
MECB
Collided Tx Cells
Cycle
0
2
4
6
8
10
0
200
400
600
800
1000

Results


Housekeeping
Houskeeping with MECB
Collided Tx Cells
Cycle
0
1
2
3
4
5
6
7
0
200
400
600
800
1000

Related Work Results comparison



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.