A Reliable MAC Protocol for Broadcast VANETs

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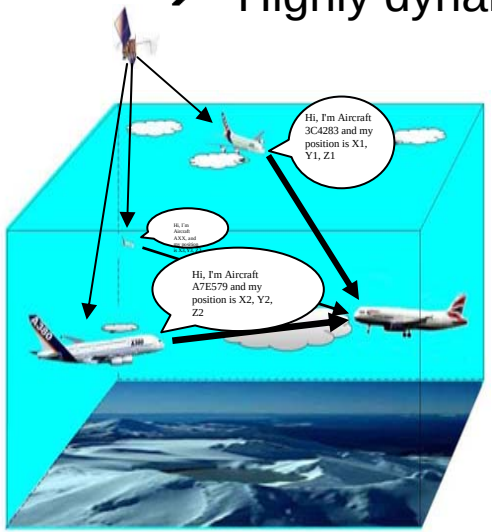
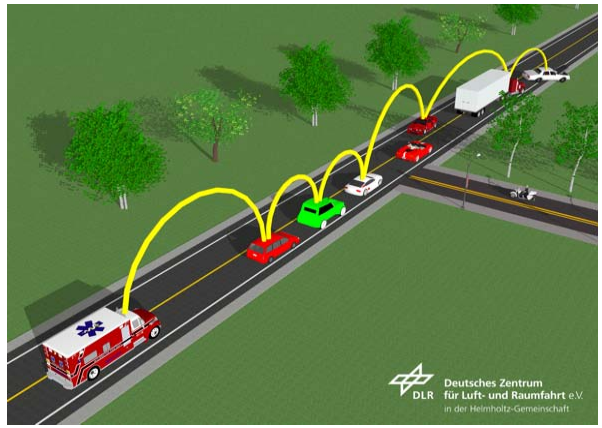
MAC layer in highly dynamic Broadcast VANETs

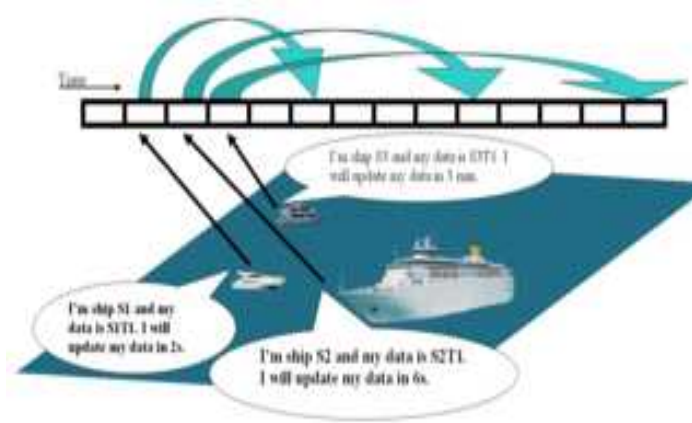
- MAC layer: Medium Access Control Layer.
- No infrastructure available (ad-hoc) → Distributed protocol.
- No information about the receivers → Broadcast.
- Highly dynamic network → Unknown network configuration.



Automatic Dependence Surveillance- Broadcast



Car2Car



Automatic Identification System

- **MAC layers in Broadcast Vehicular Ad-hoc Networks (VANETs)**
- Special constraints in highly dynamic VANETs
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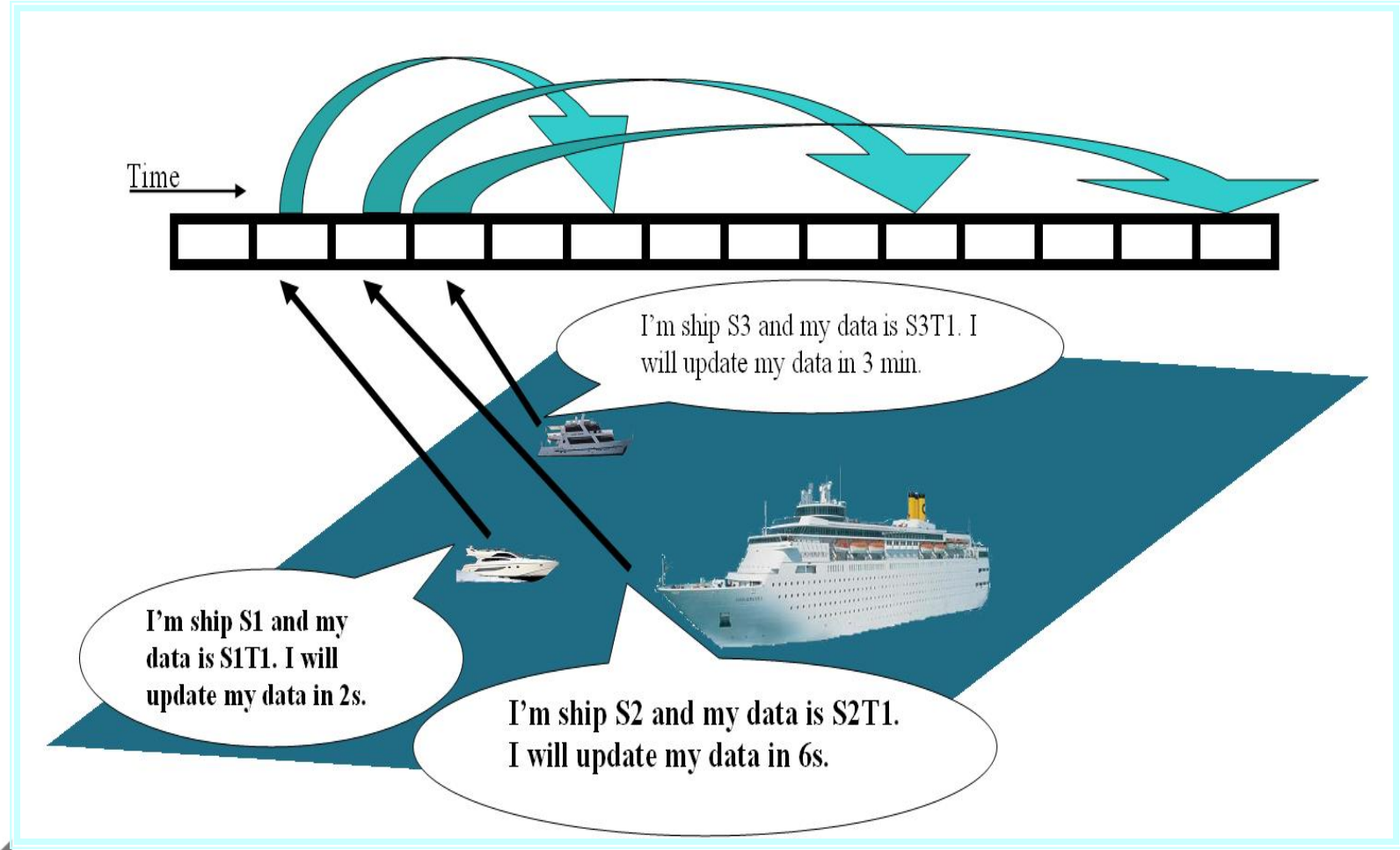
MAC layers for Broadcast VANETs

Protocol group	Disadvantages
Based on CSMA/CA	Assume static networks and/or a priori knowledge of the network
Based on TDMA or CDMA	Hidden and exposed terminal problem

No optimal MAC layer protocol for broadcast VANETs

SOTDMA. Self Organized Time Division Multiple Access



- MAC layers in Broadcast Vehicular Ad-hoc Networks (VANETs)
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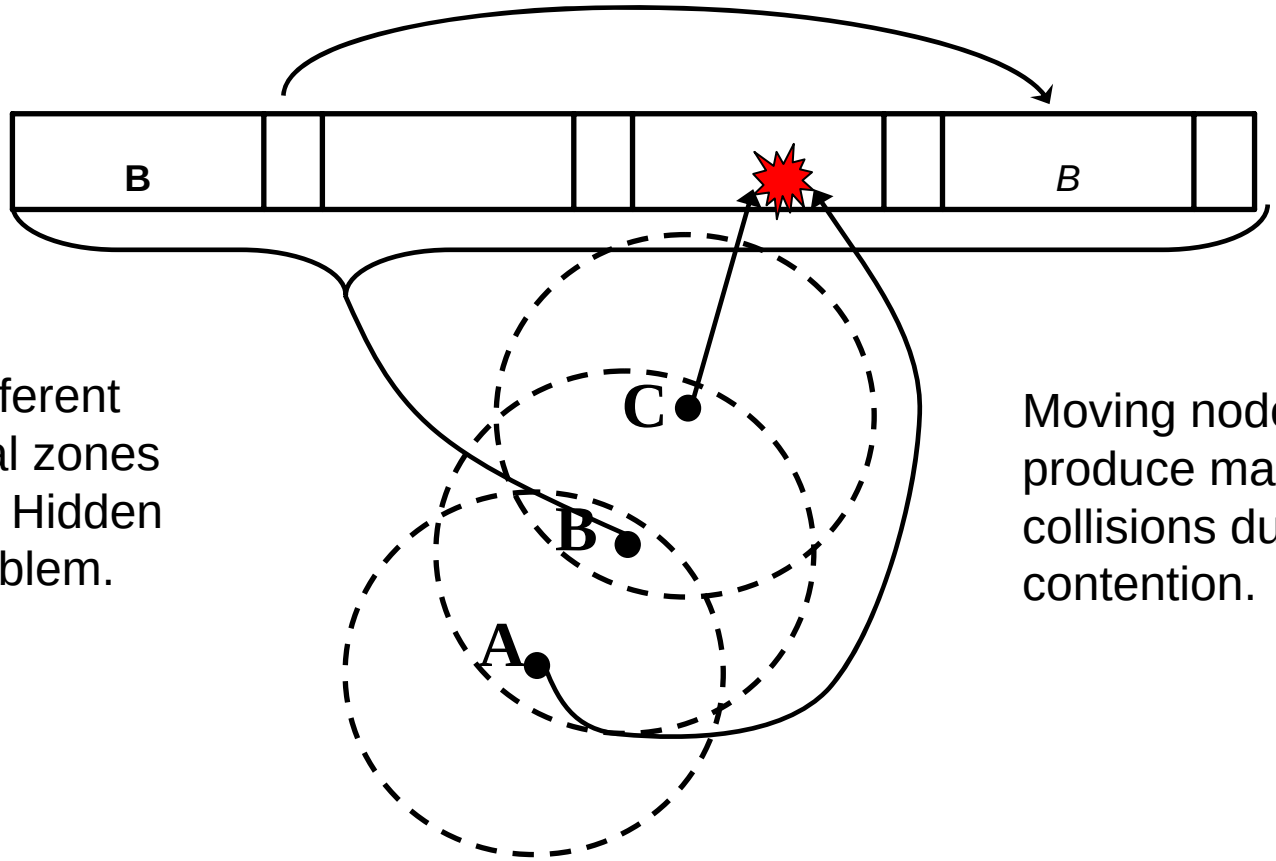
Problems in highly dynamic VANETs.



Nodes in different geographical zones produce the Hidden terminal problem.

Moving nodes may produce massive collisions due to contention.

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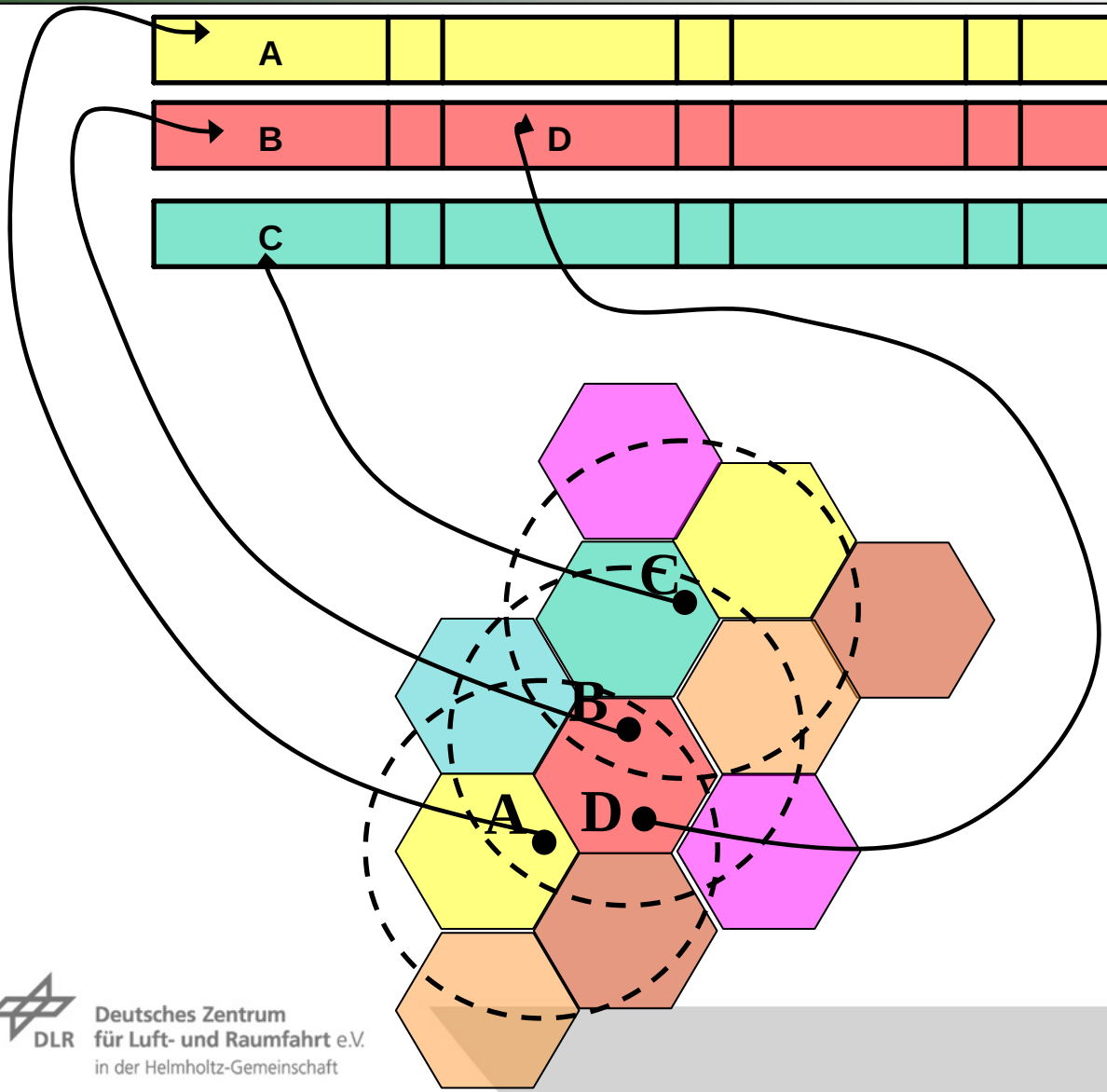
Some extra information that we could use

- Periodic beacons
- Time (GNSS)
- Location (GNSS+Map)
- Direction (GNSS)
- Speed (GNSS)

} ORIENTATION

A Solution for the hidden terminal problem

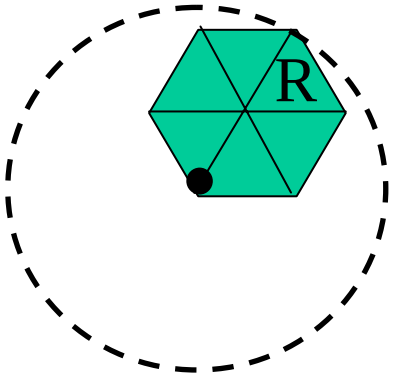


Divide the world map in hexagonal cells. A channel is assigned to each cell.

Intracell: SOTDMA

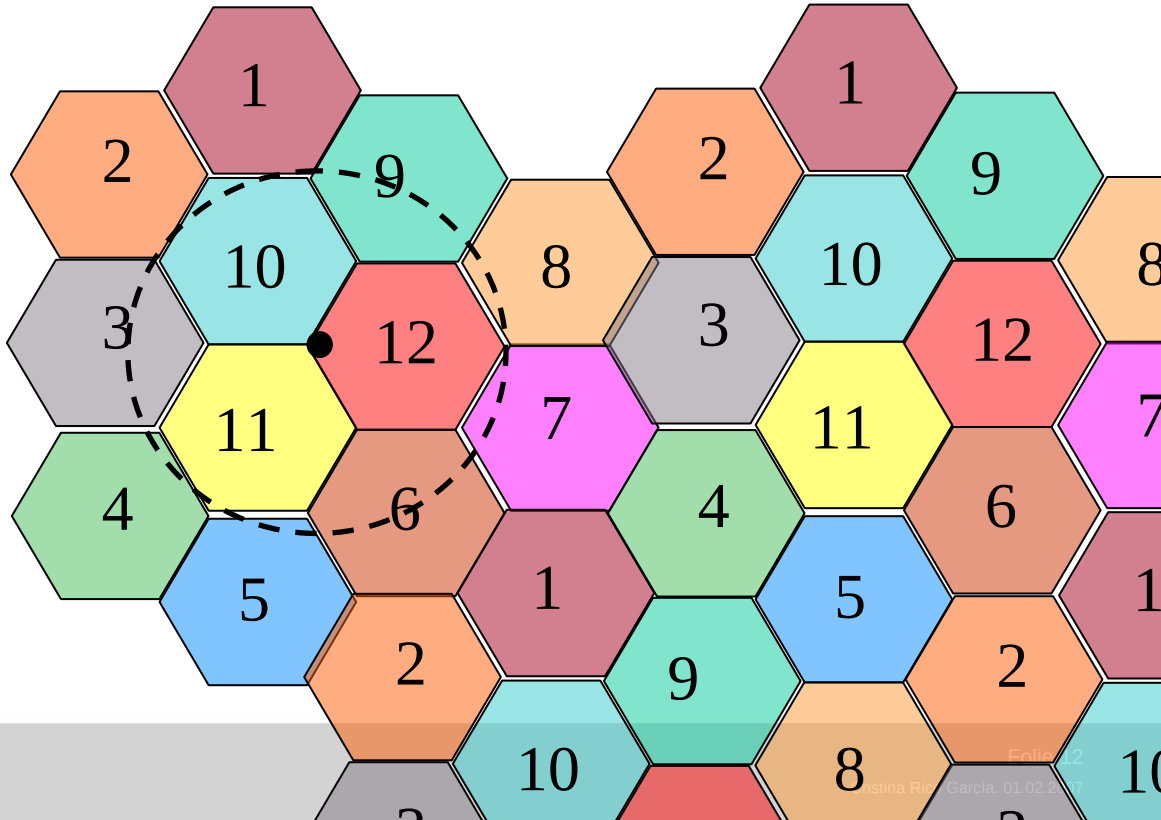
Intercell: CDMA location awareness

Number of Necessary Codes



All the nodes inside a cell must “hear” each other. The range should be at least the maximum diameter of a cell = 2R.

- Minimum number of codes that avoid the hidden terminal problem → Relation cell size – minimum tx range.
- In a range of at least 4R there must not be any repeated code.



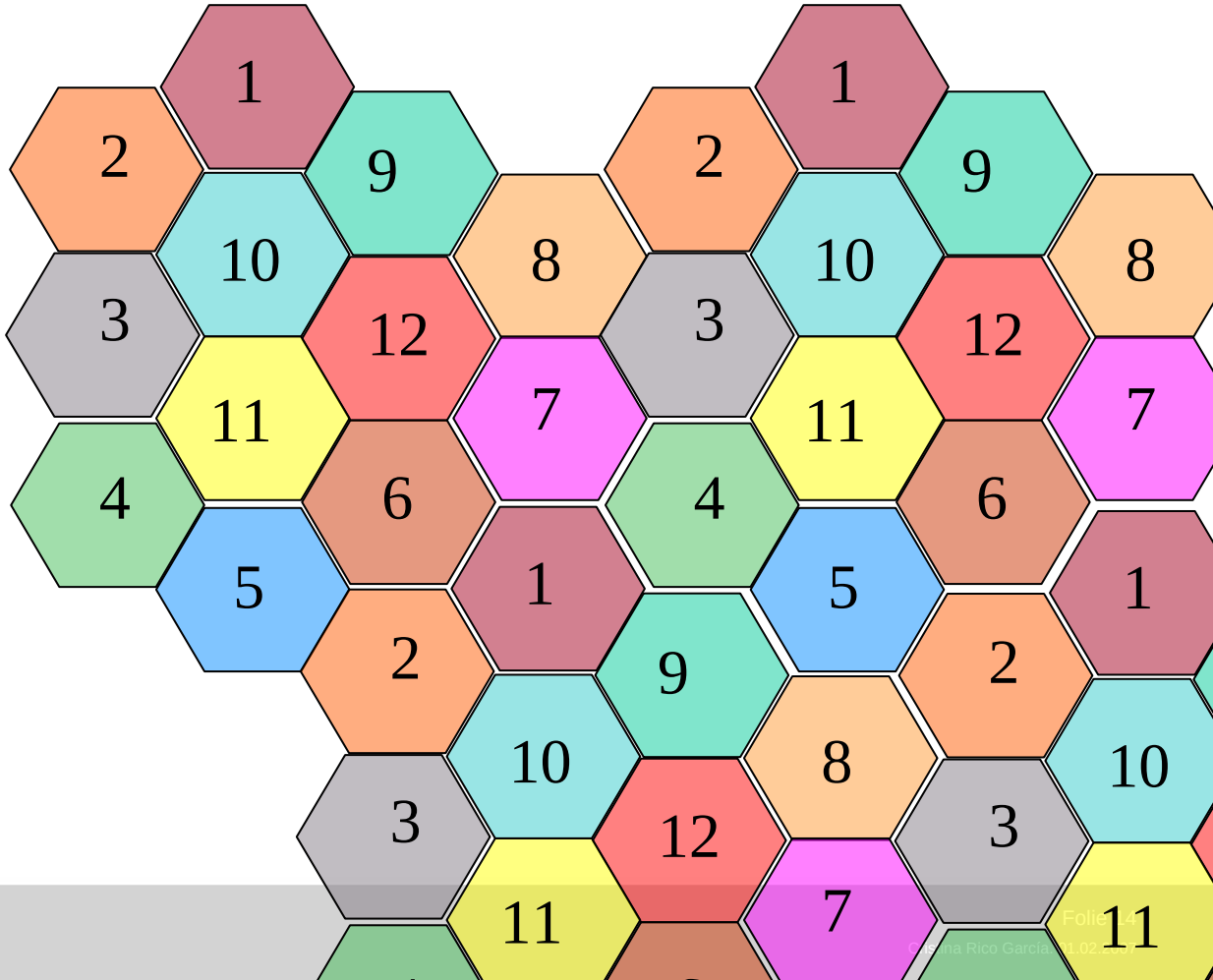
Conclusions and Outlook

- Conclusions
  - No optimal MAC protocol for high dynamic broadcast VANETs.
  - COMB uses additional information. It avoids all collisions in ideal conditions.

- Outlook
  - Analyze the effect of the near-far problem in the protocol.
  - Optimization of the cells dimension.

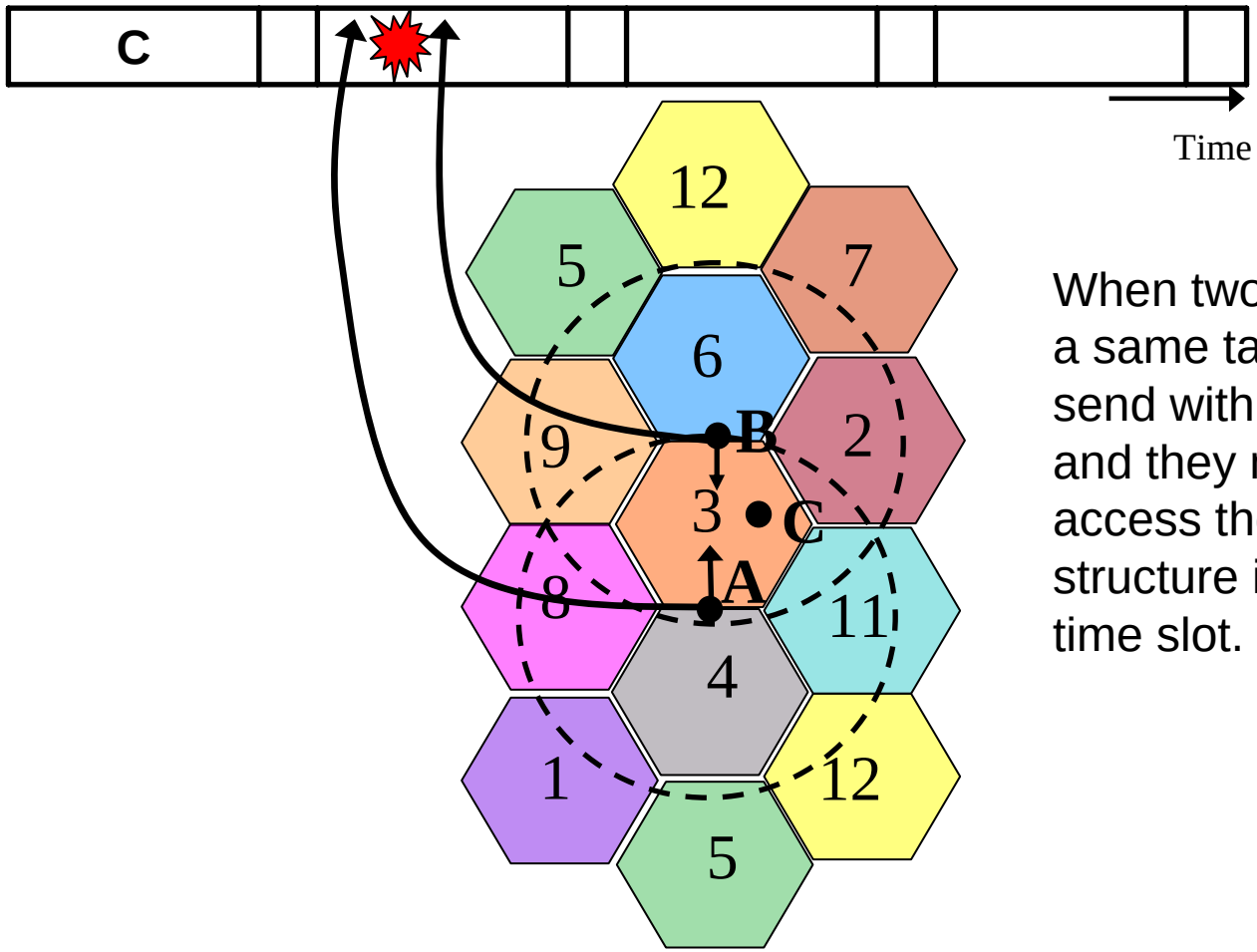
Thank you for your attention

Questions?



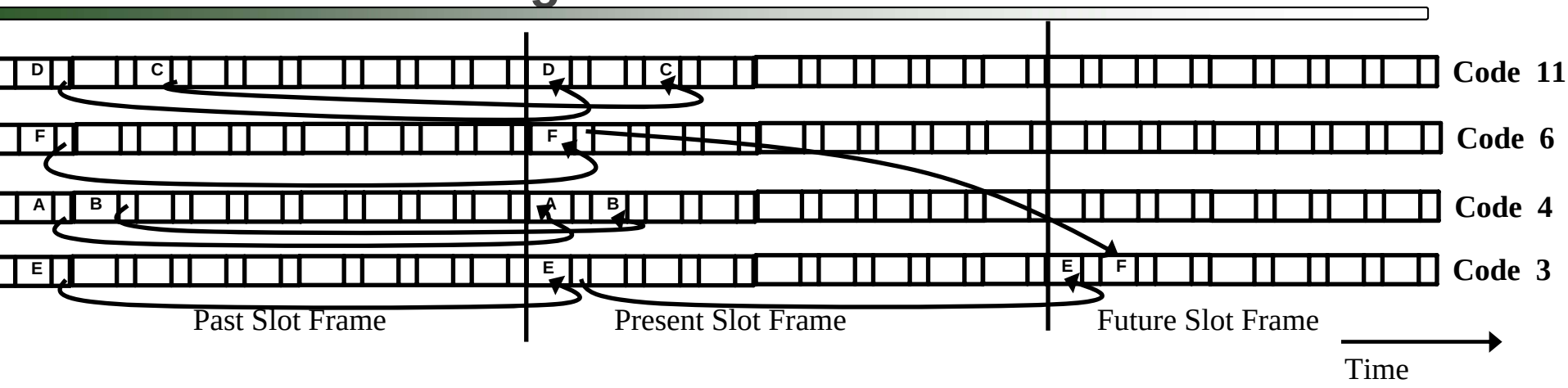
BACKUP

Nodes crossing to a new cell



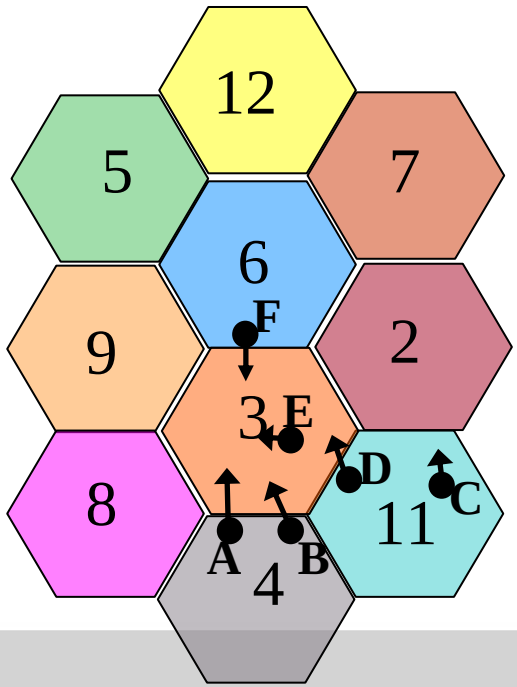
When two nodes cross to a same target cell, they send with the same code, and they might try to access the SOTDMA structure in the same time slot. **COLLISION**.

Nodes crossing to a new cell



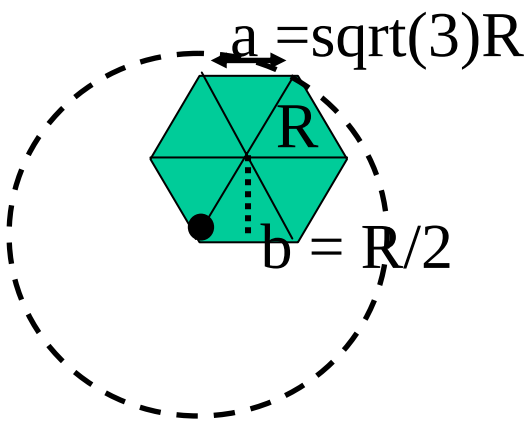
The nodes infer to which cell they are going to cross from their speed, direction and position information.

They observe at least two target SOTDMA frames, and one frame of the neighbors.



They reserve the first free slot in the target cell according to their cell priority.

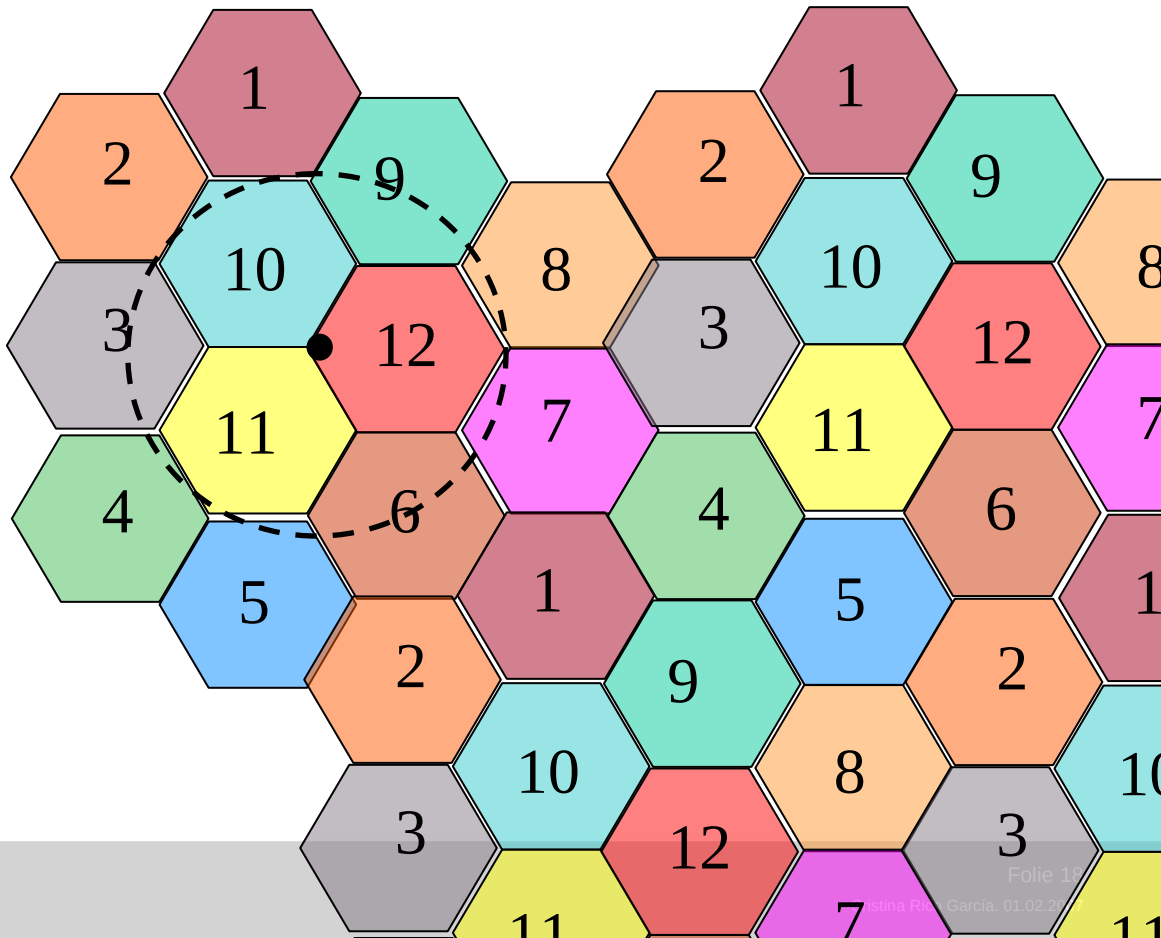
Number of Necessary Codes



All the nodes inside a cell can see each other, they are “in range”: The range should be at least the maximum diameter of a cell = 2R.

A map can be painted with four colors….

How many colors (codes) do we need? In a range of at least 4R there shouldn’t be any repeated code.



Consideration about the range: Minium-maximum range

Maximum range for 12 codes:
R(1+sqrt(3))

Minimum range:
2R+2frames(maximum speed)

Margin:

0,73R-2frames = few Kilometers (35%)