ulm university universität ulm

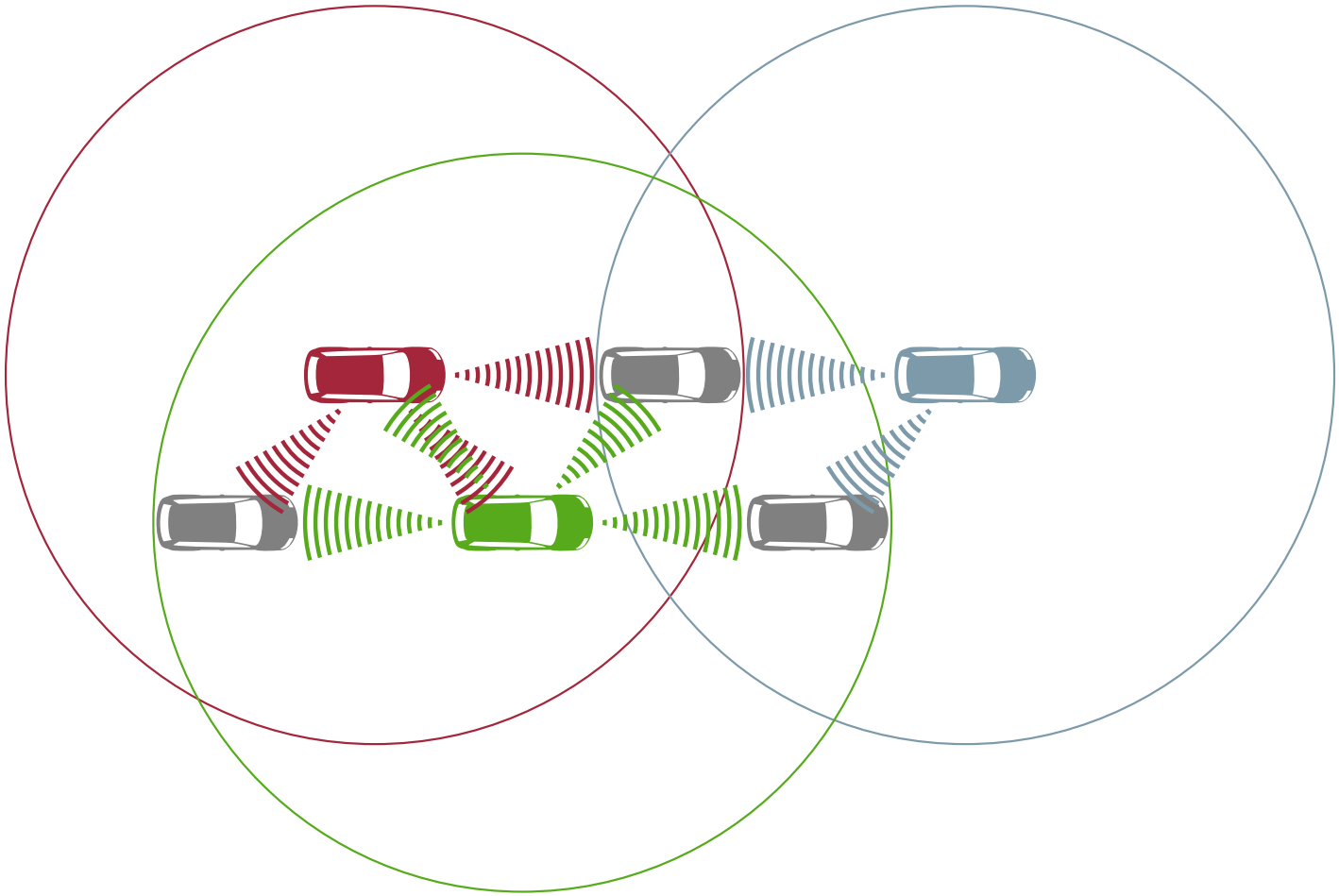
Rens W. van der Heijden, Stefan Dietzel, Frank Kargl

April 18, 2013

SeDyA

Secure Dynamic Aggregation in VANETs

VANETs- a brief introduction



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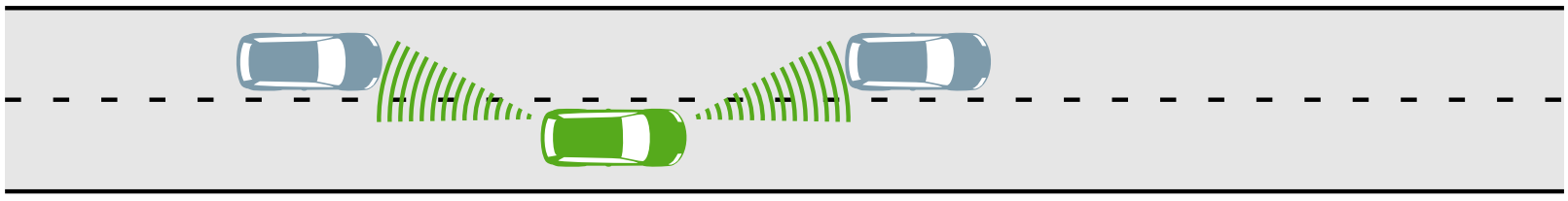
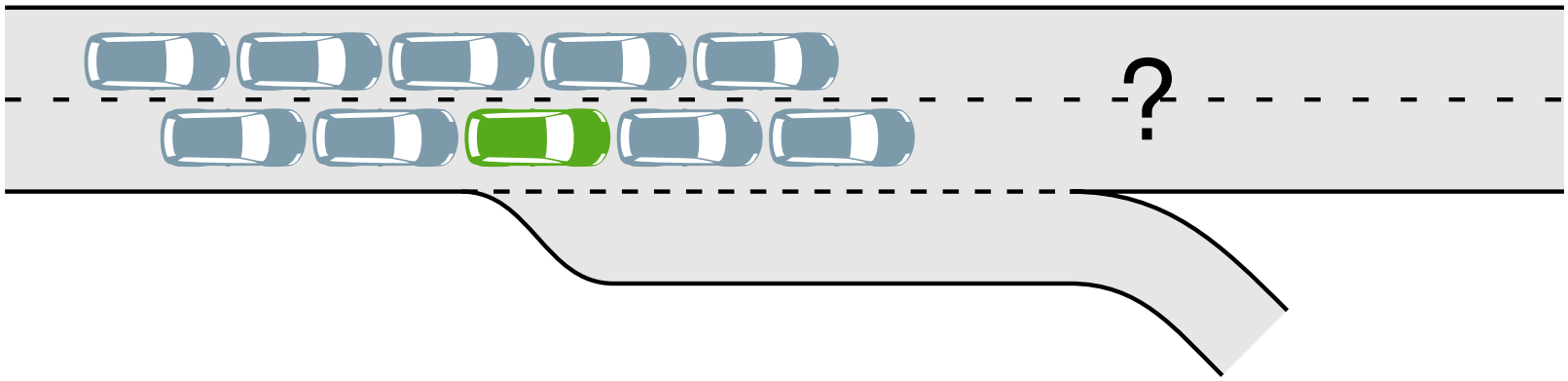
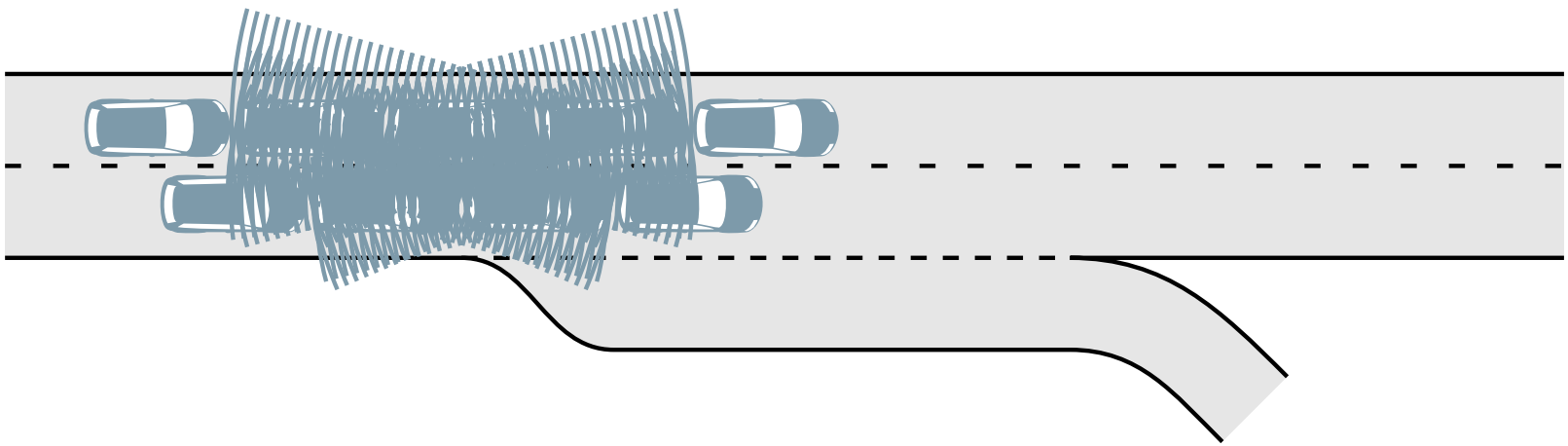


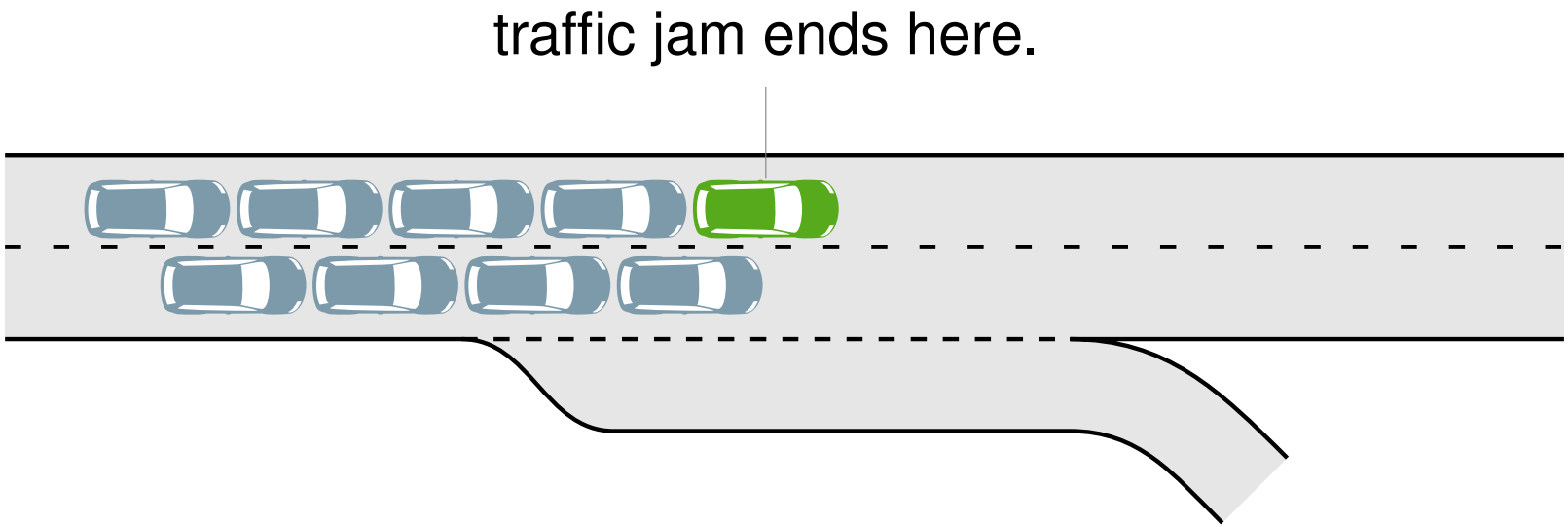
Example use case: traffic jam length



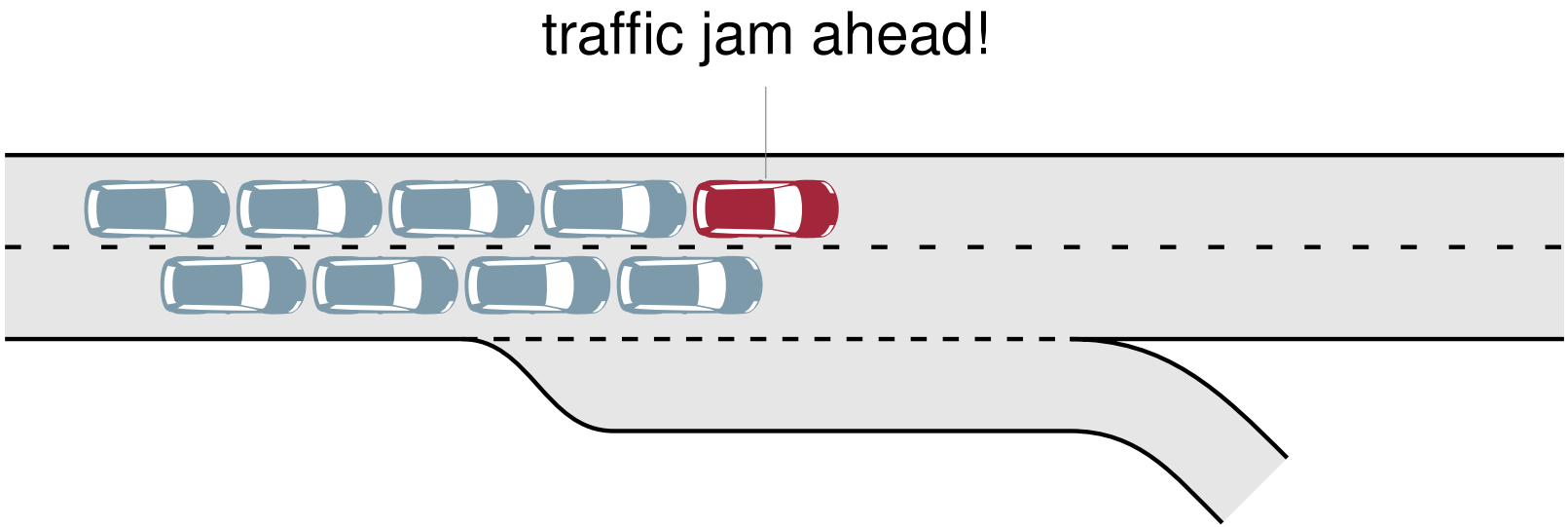
Broadcast Storm!



Aggregation- summarizing messages



Security- what can go wrong?



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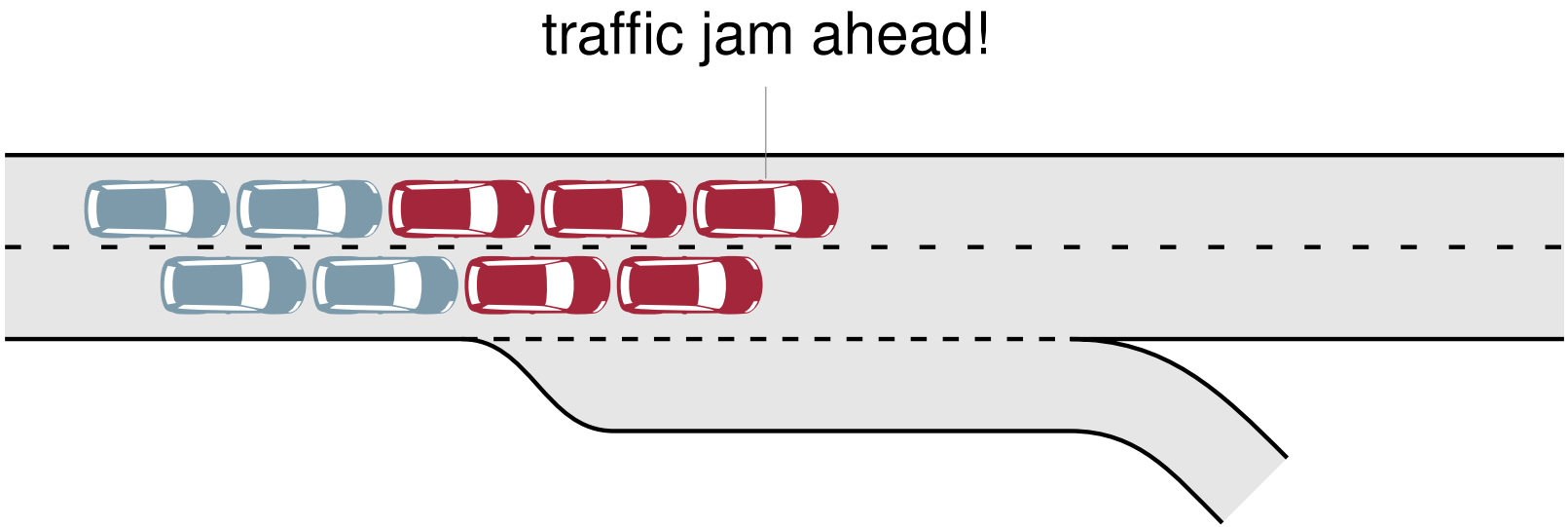

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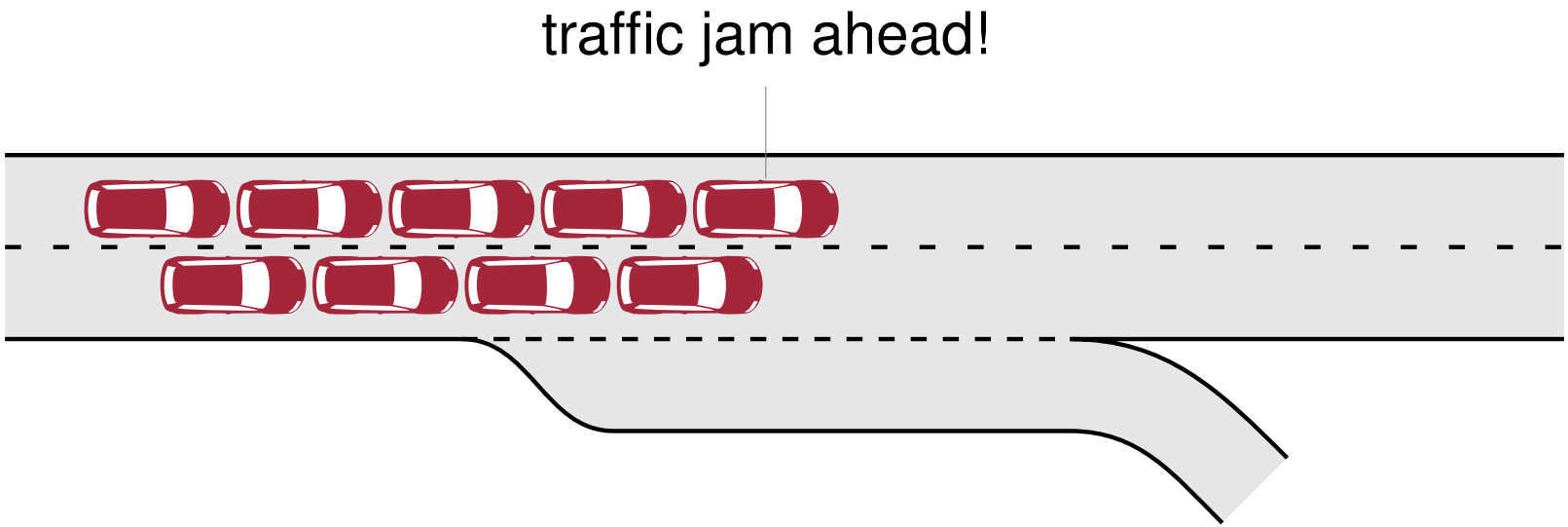
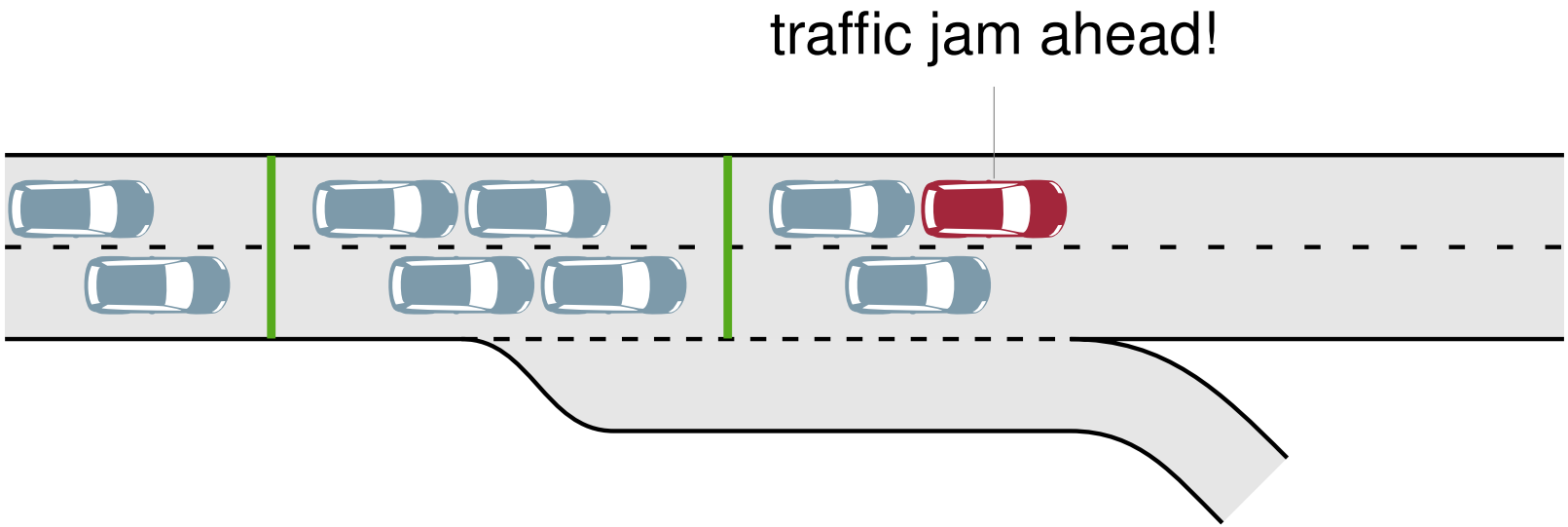


Possible solution- fixed segements



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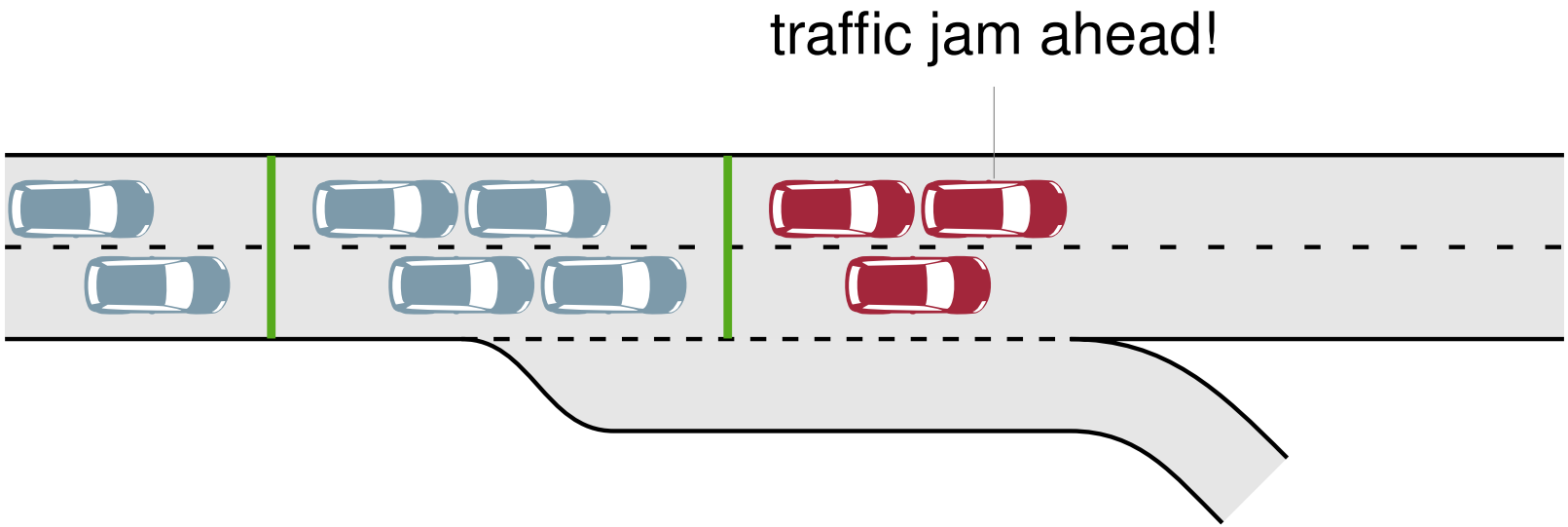

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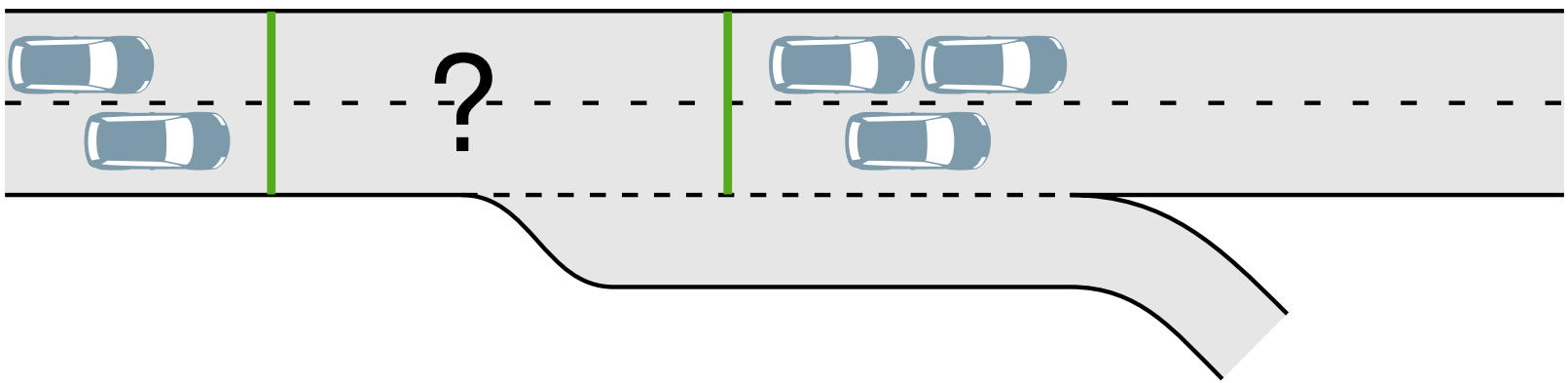
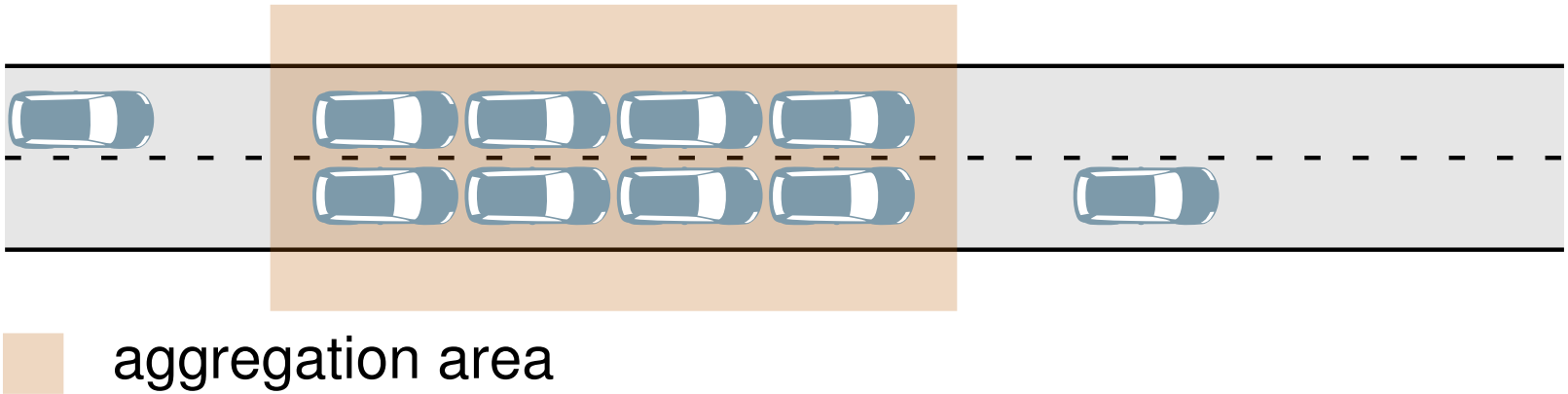


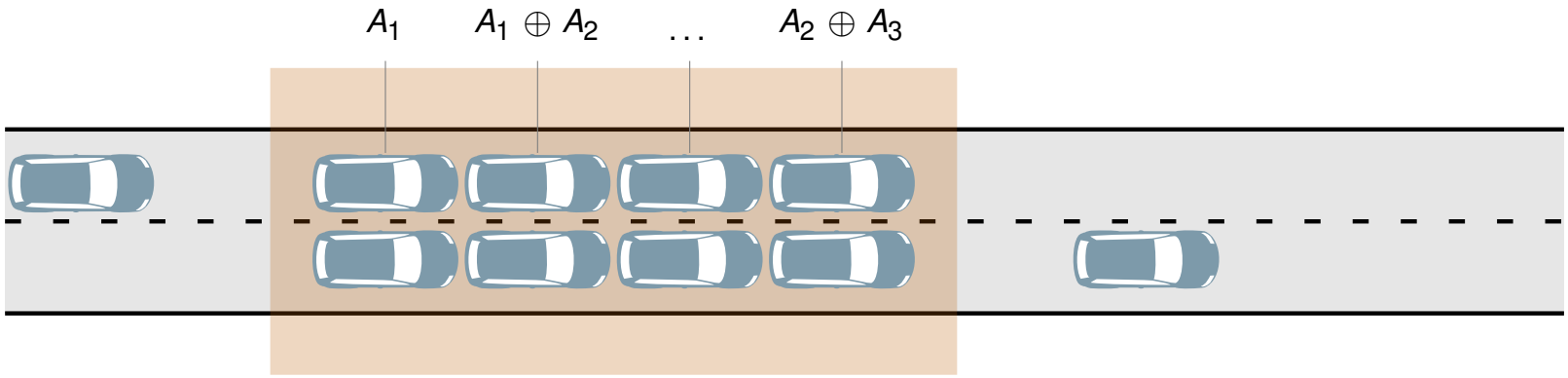
SeDyA

Secure Dynamic Aggregation

Overview

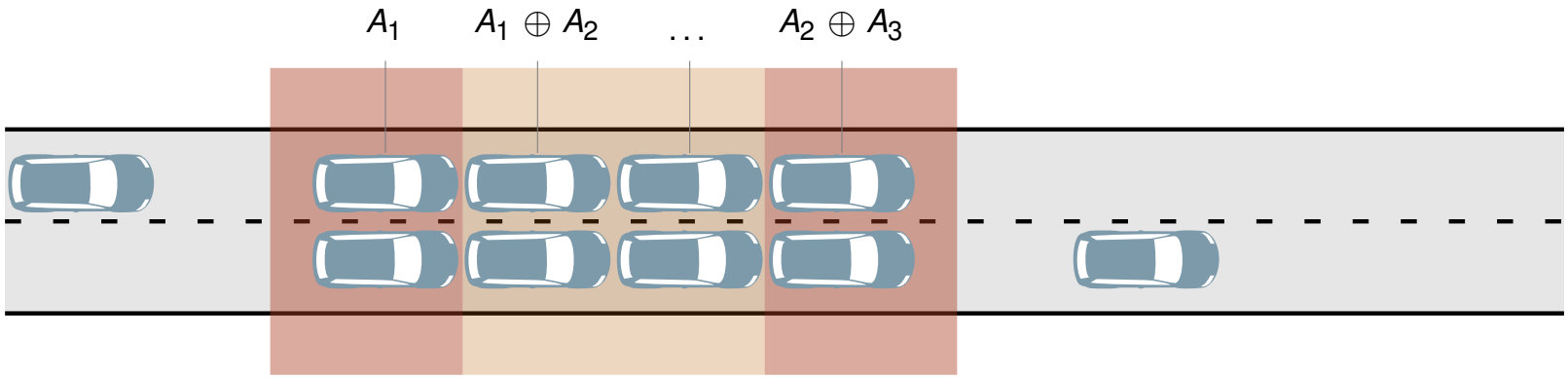


Overview

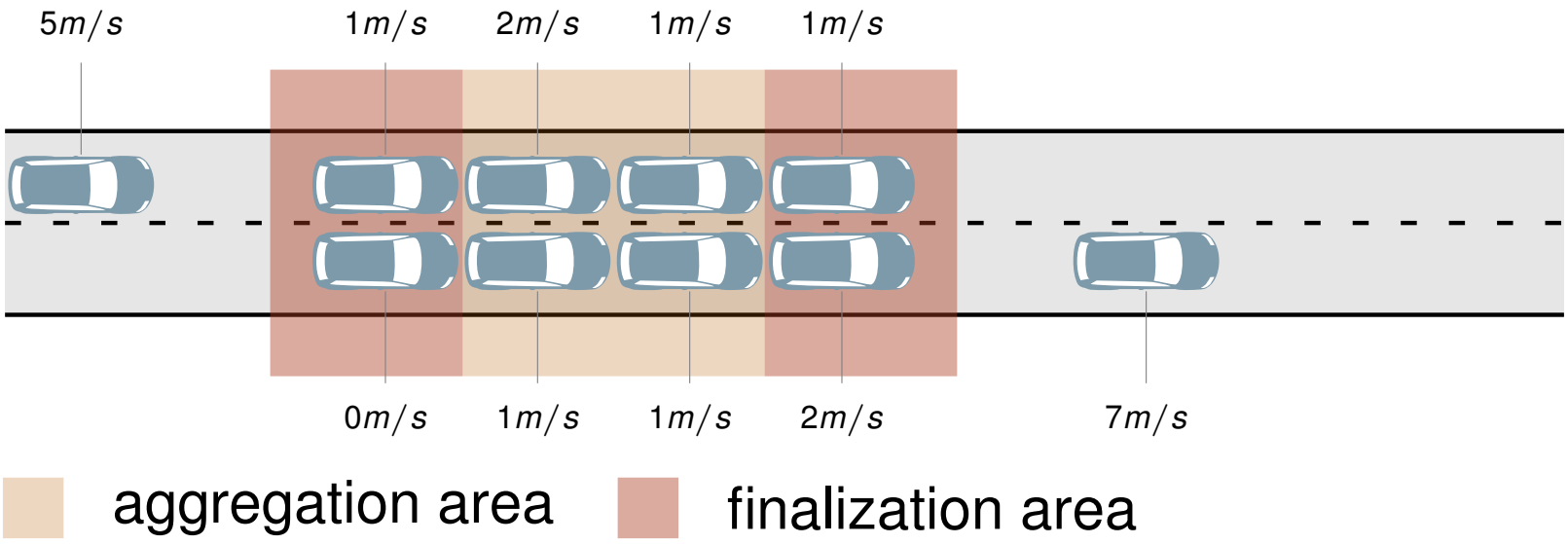


aggregation area

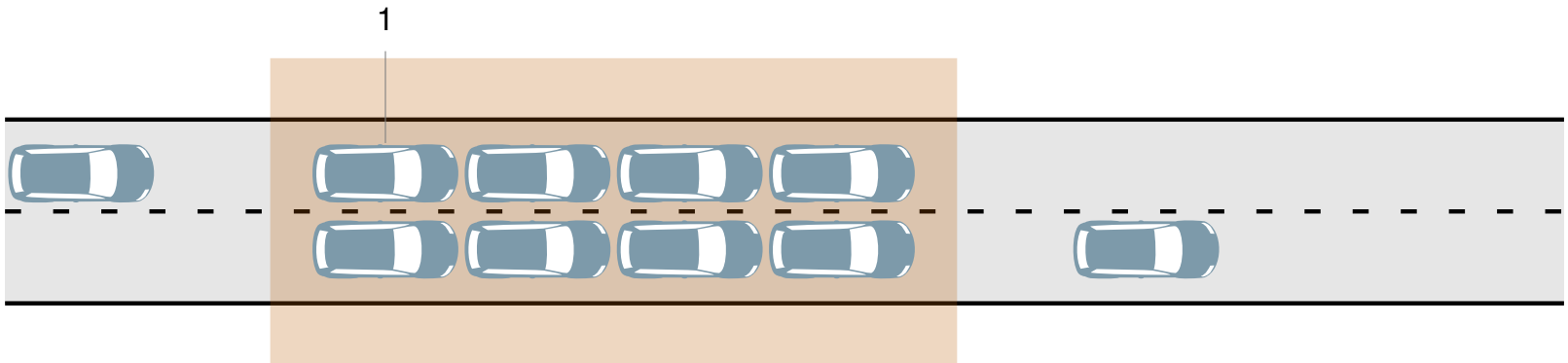
Overview


A_1
$A_1 \oplus A_2$
...
$A_2 \oplus A_3$
aggregation area
finalization area

Scenario


5m/s
1m/s
2m/s
1m/s
1m/s
0m/s
1m/s
1m/s
2m/s
7m/s
aggregation area
finalization area

Phase 1: Aggregation phase



aggregation area

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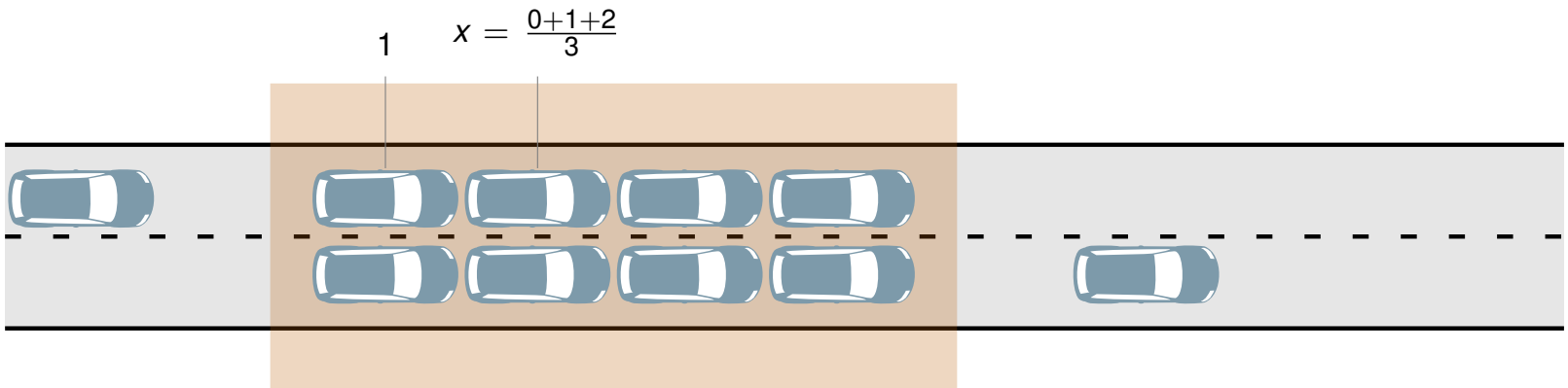

aggregation area

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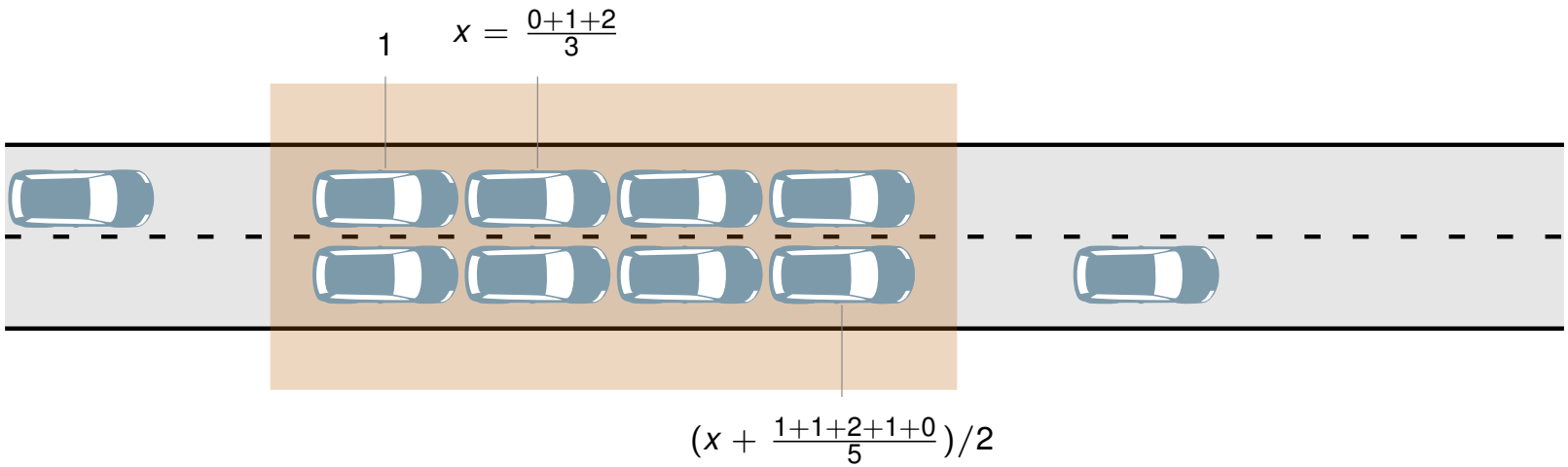

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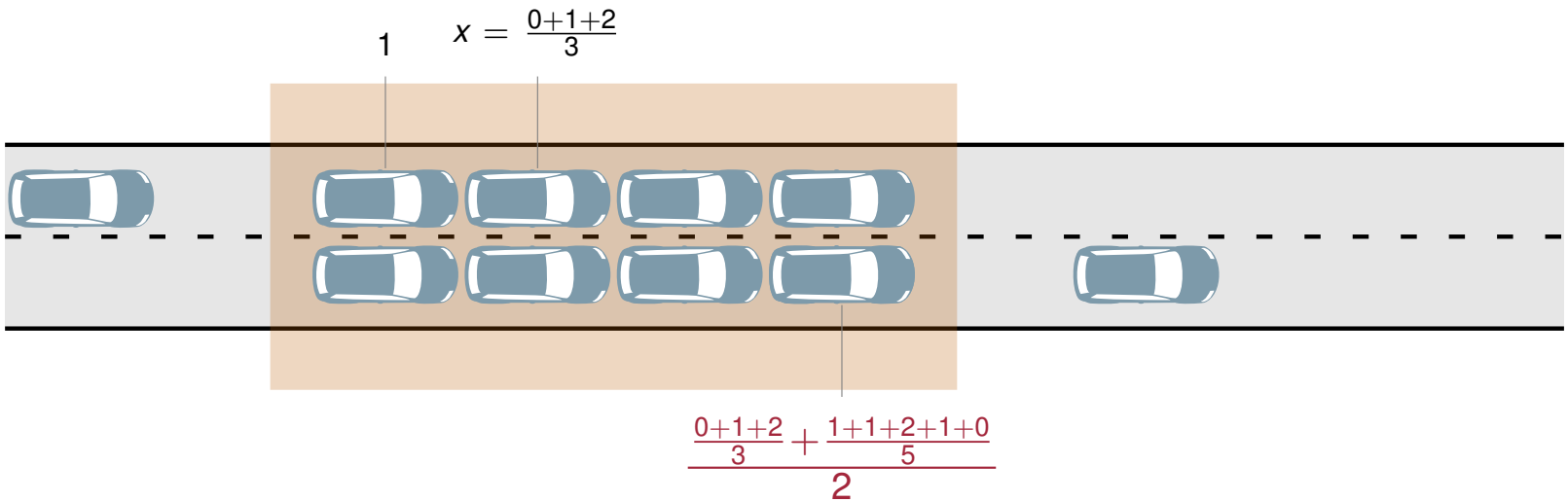

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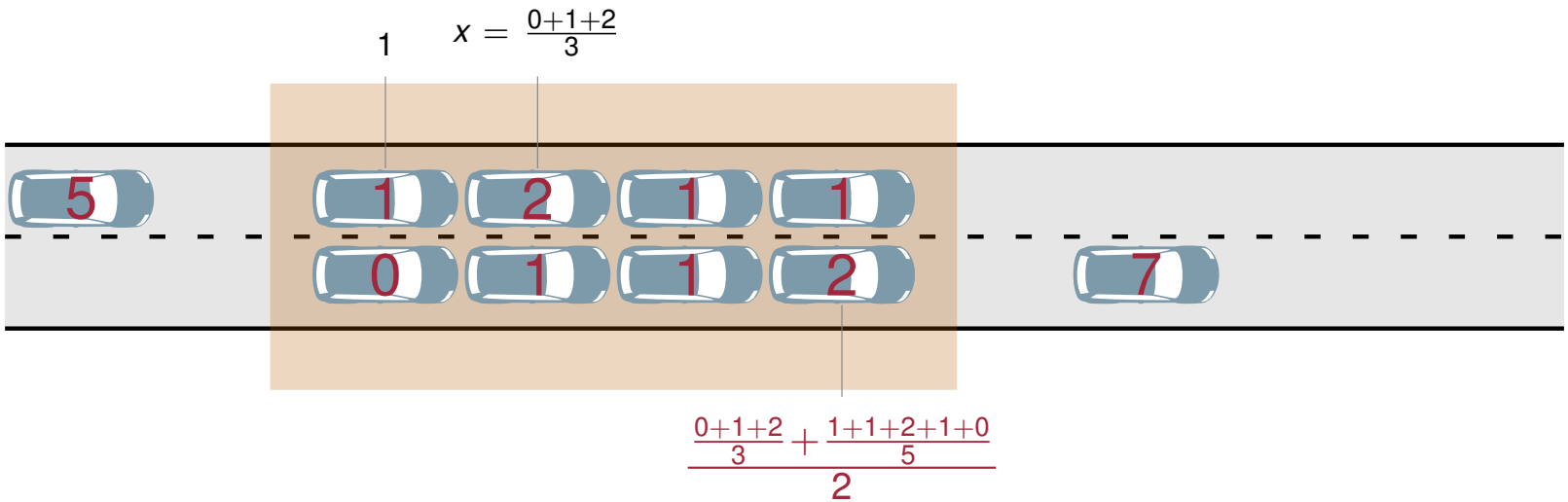


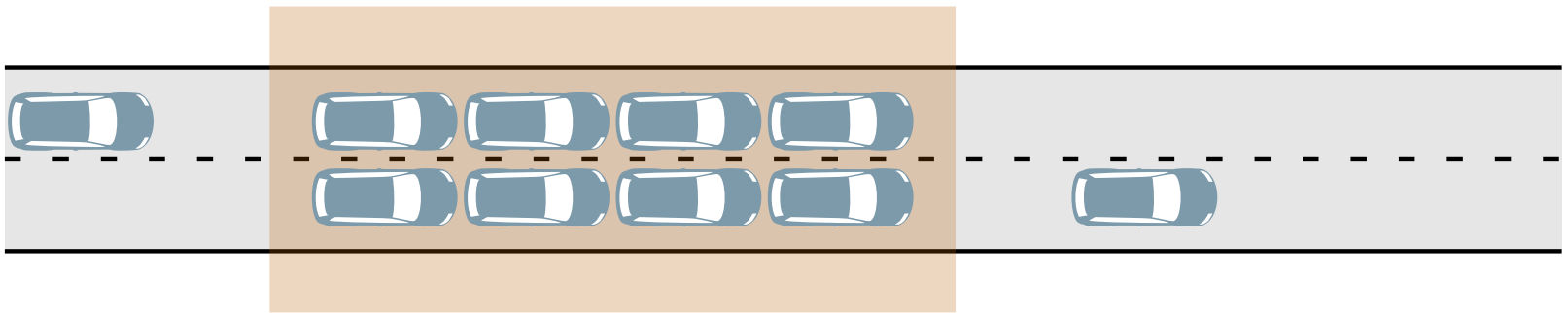
aggregation area

$\rightarrow$ FM sketches

$\rightarrow$ FM sketches $\rightarrow$ duplicate insensitivity

Phase 1: Aggregation phase

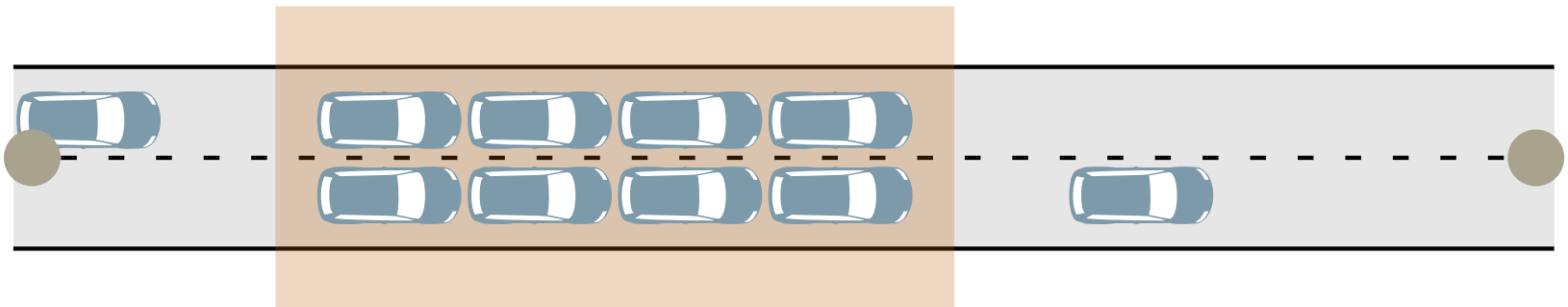
making it ‘dynamic’



aggregation area

Phase 1: Aggregation phase

making it ‘dynamic’



aggregation area

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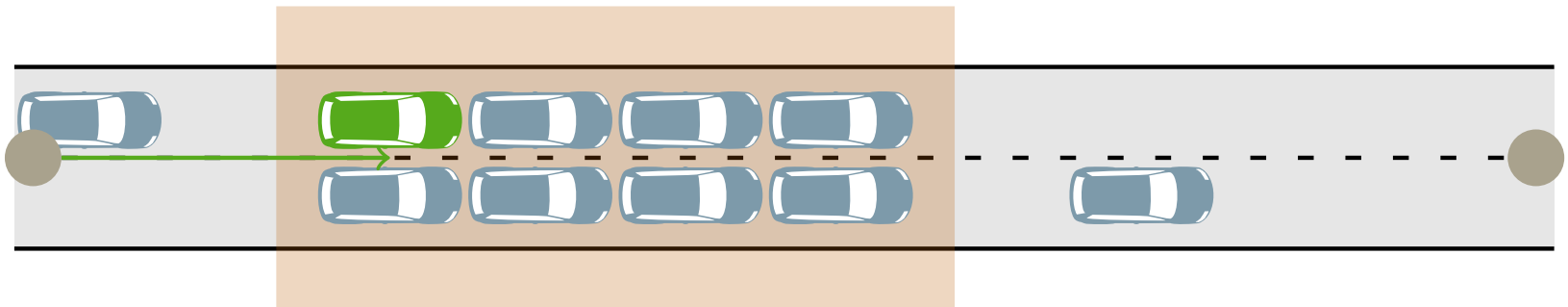
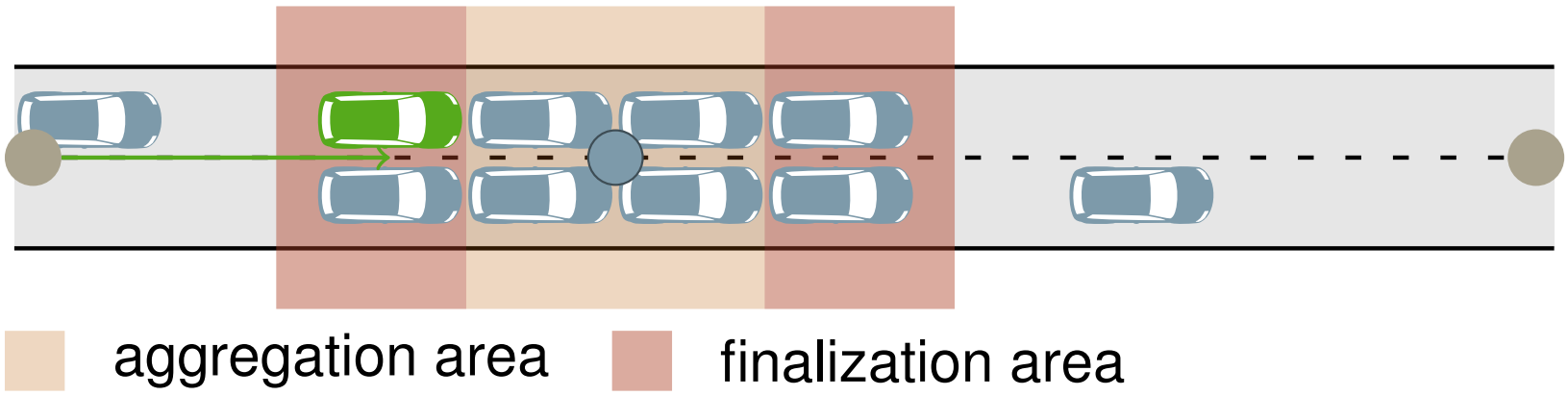


aggregation area

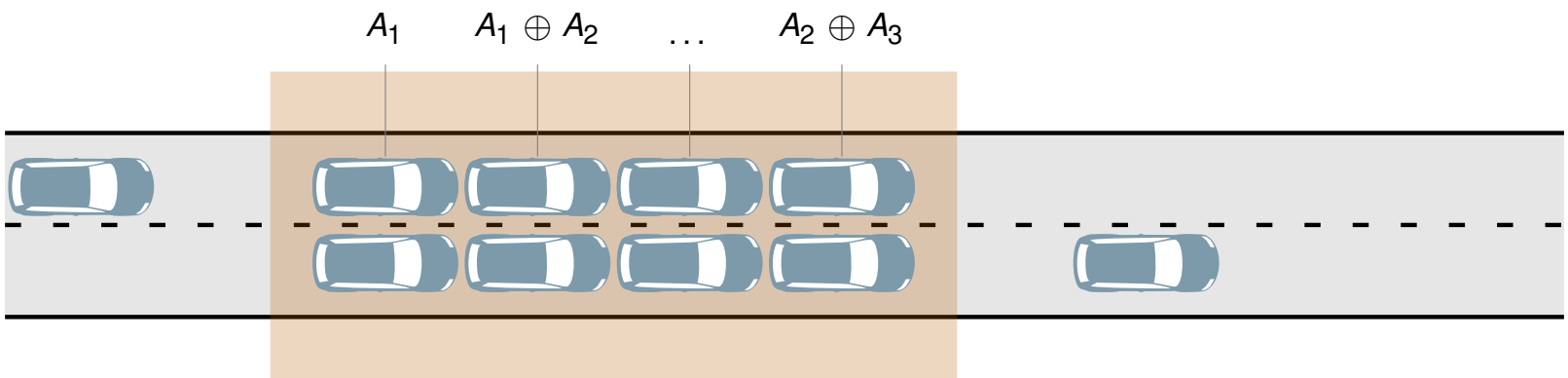
Phase 1: Aggregation phase

making it ‘dynamic’



Overview

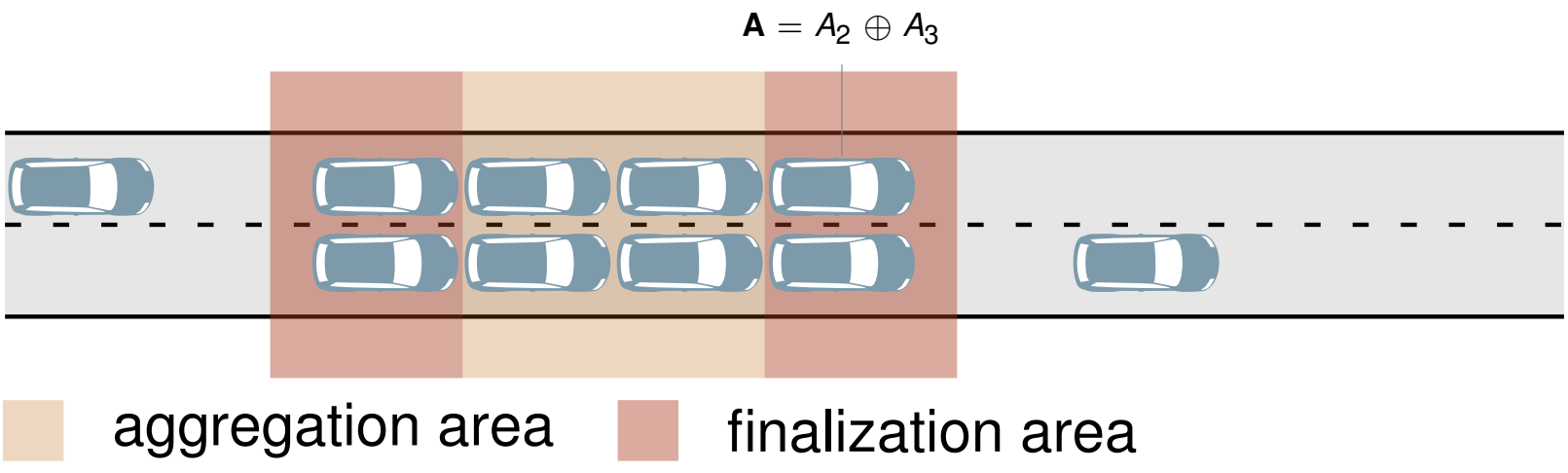
Phase 2: Finalization Phase



aggregation area finalization area

Overview

Phase 2: Finalization Phase



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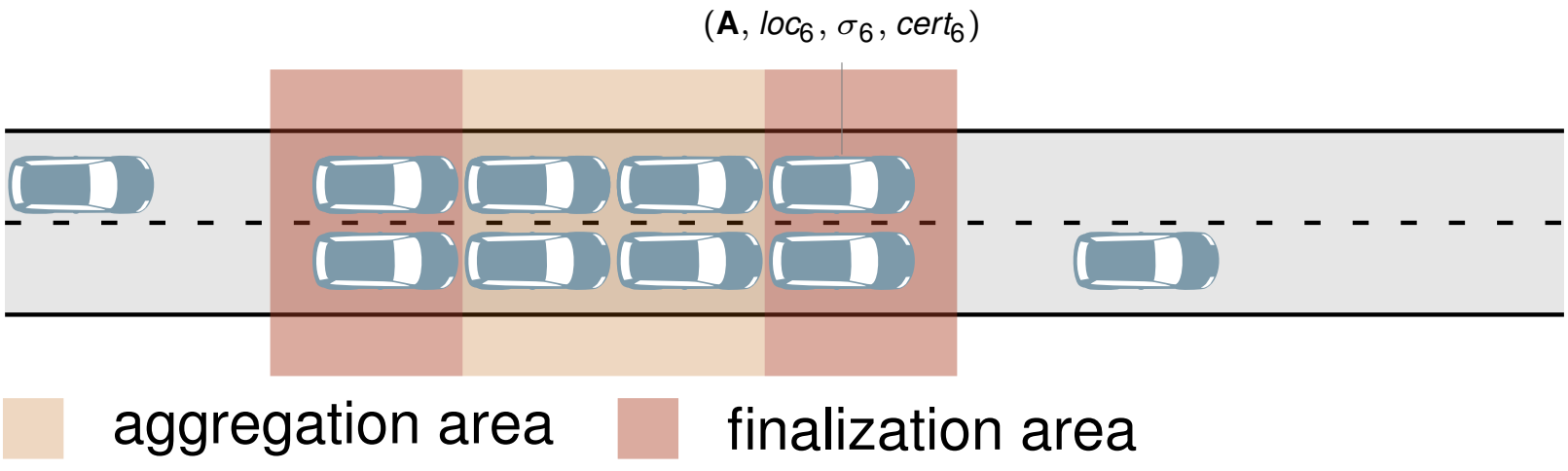

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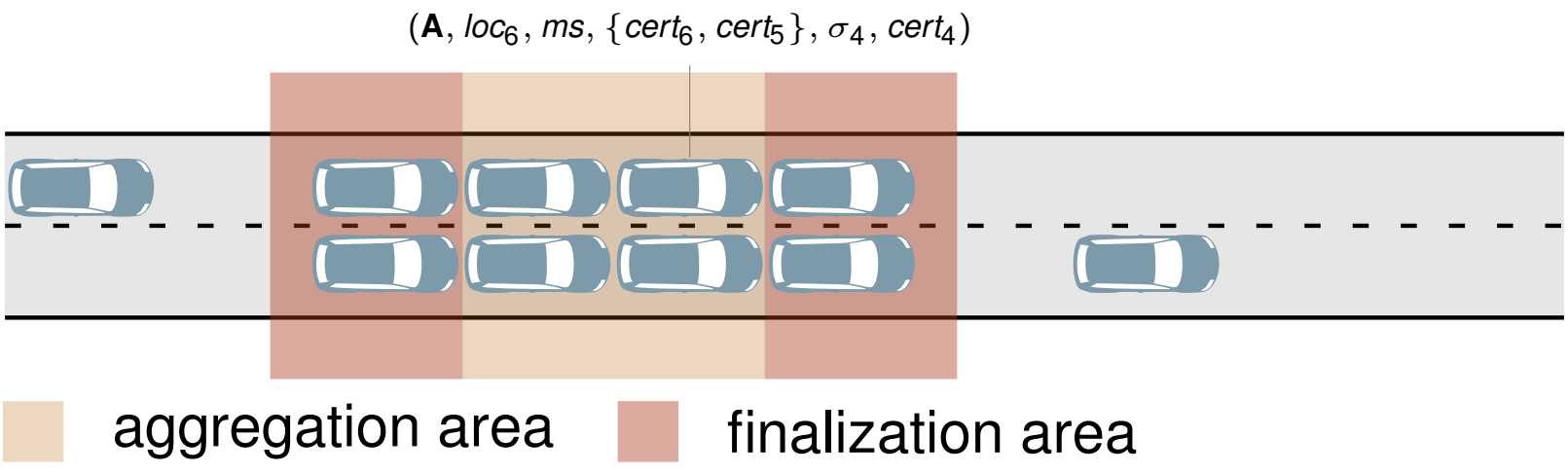
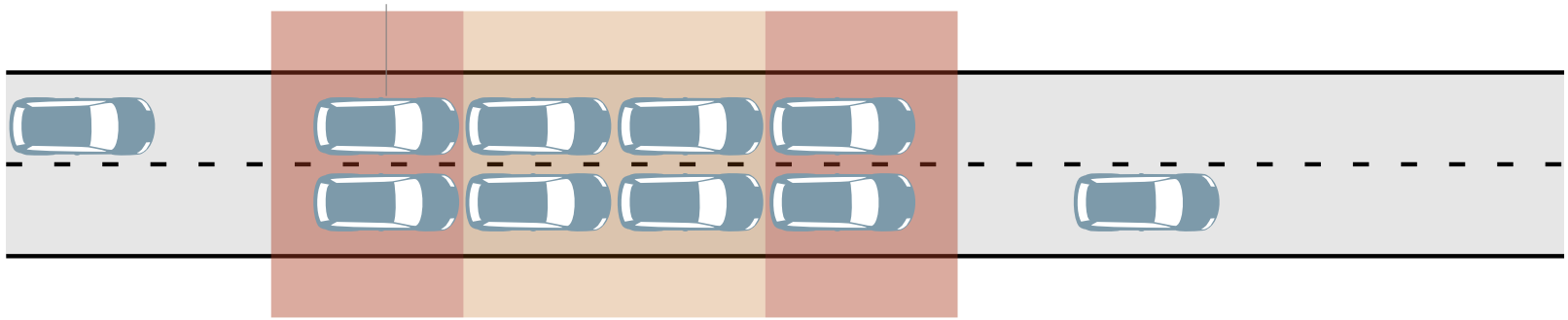


Overview

Phase 3: Dissemination Phase

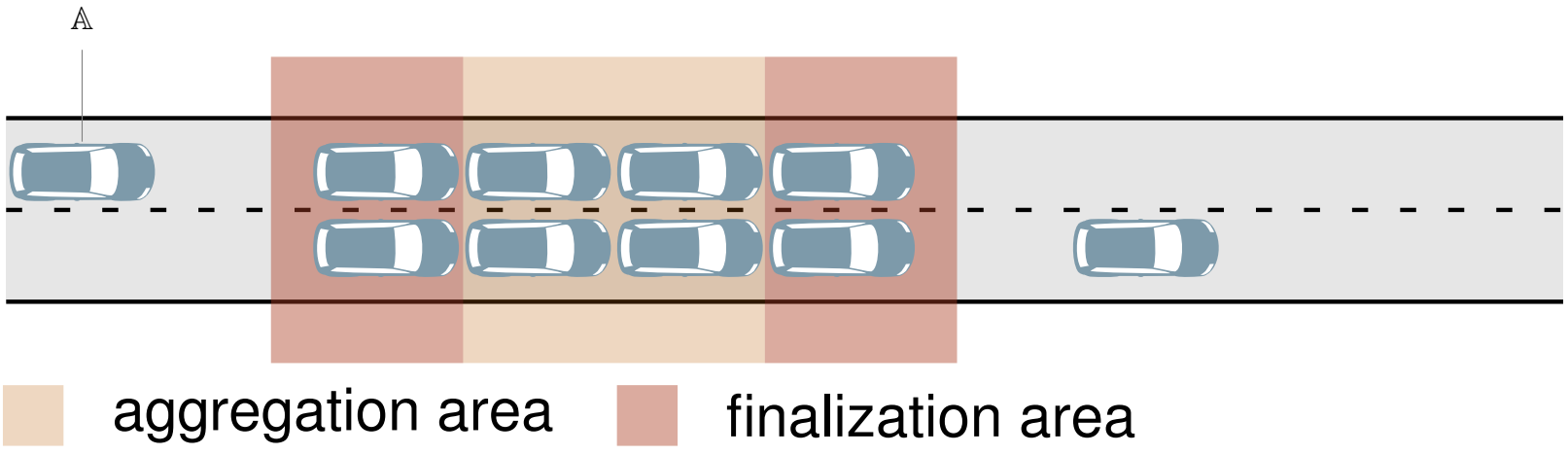
$\mathbb{A} = (\mathbf{A}, loc_6, ms, \{cert_6, cert_5, cert_4\}, \sigma_1, cert_1)$



aggregation area finalization area

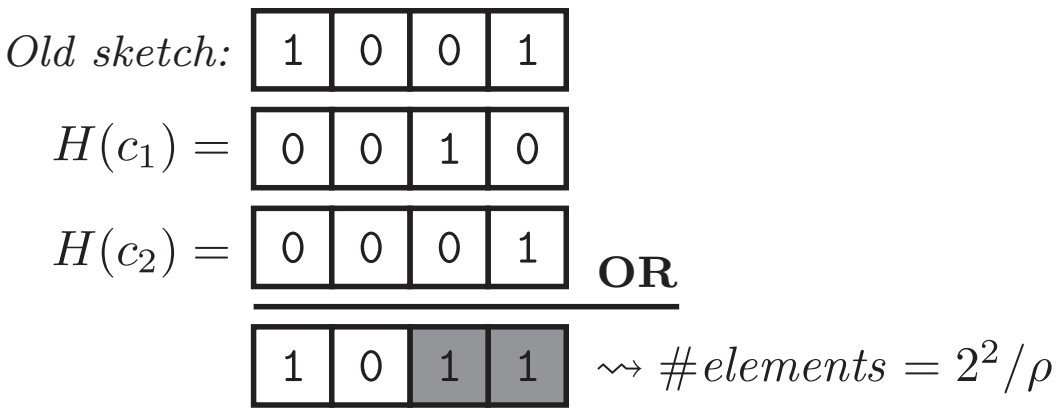
Overview

Phase 3: Dissemination Phase



Aggregation: FM Sketches

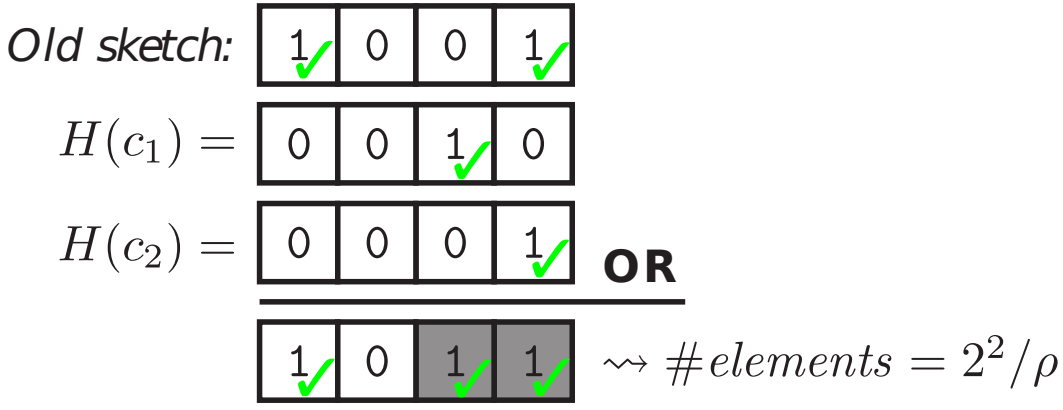
Probabilistic but duplicate-insensitive counting



P. Flajolet and G. Nigel Martin, Probabilistic counting algorithms for data base applications, Journal of Computer and System Sciences, vol. 31, no. 2, pp. 182–209, Oct. 1985.

Related work

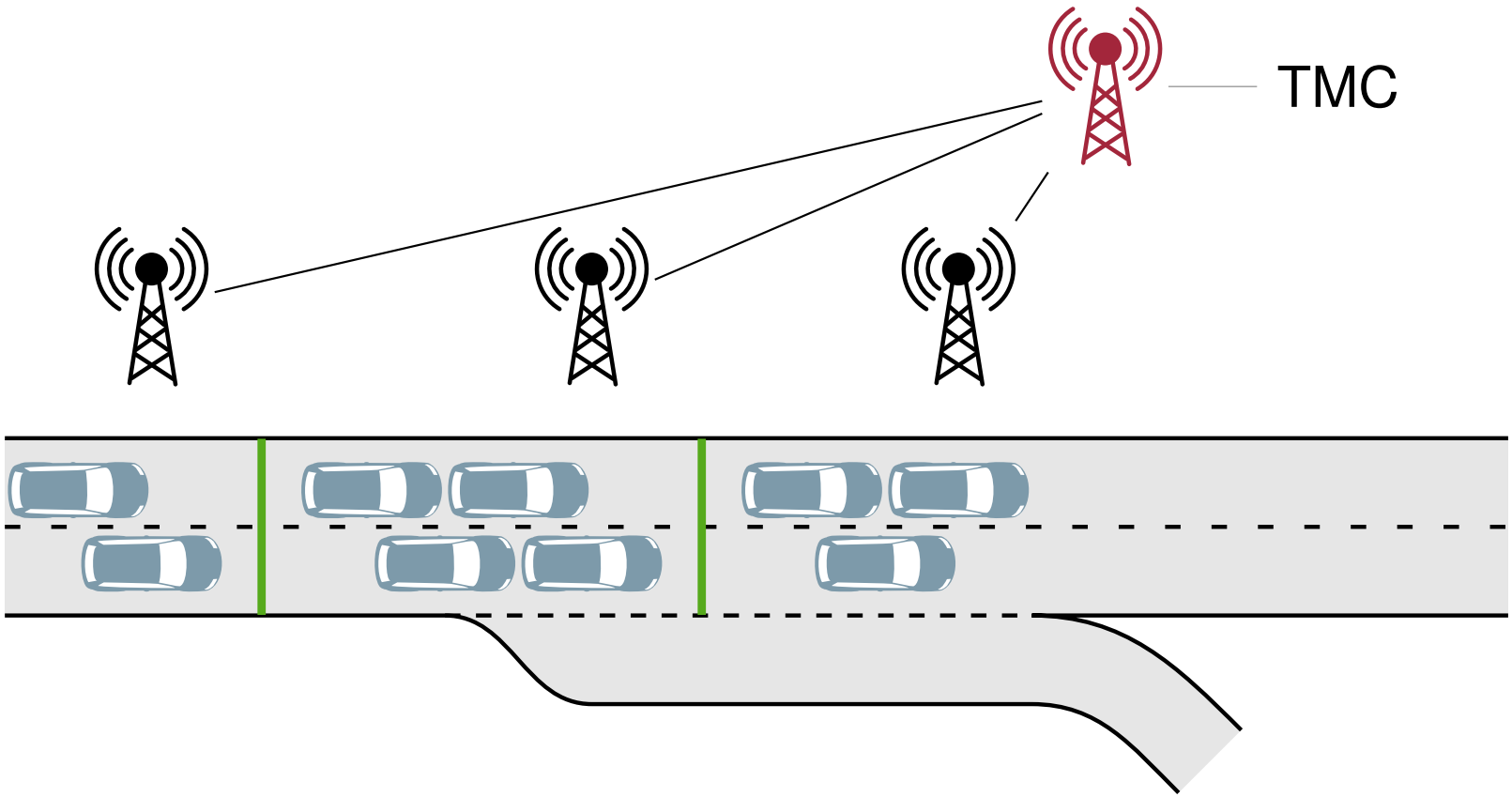
AM-FM sketches



M. Garofalakis, J. M. Hellerstein, and P. Maniatis, Proof sketches: Verifiable in-network aggregation, in 2007 IEEE 23rd International Conference on Data Engineering, page 996-1005, 2007.

Related work

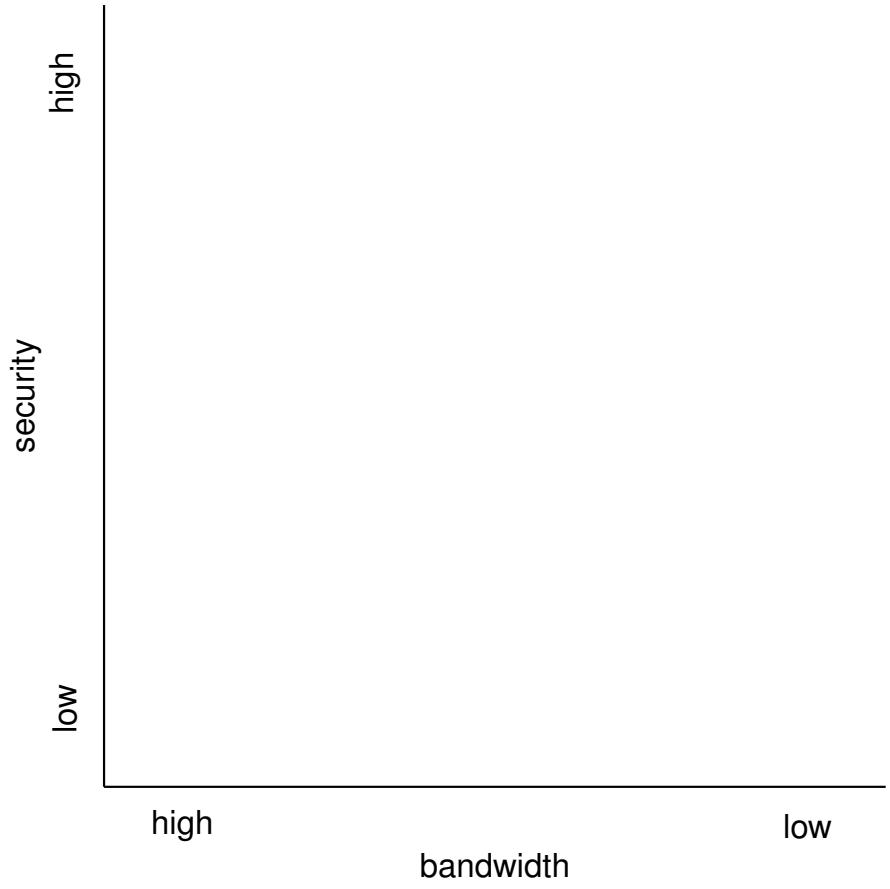
SAS



Q. Han, S. Du, D. Ren, and H. Zhu. SAS: A secure data aggregation scheme in vehicular sensing networks, in 2010 IEEE International Conference on Communications, 2010.

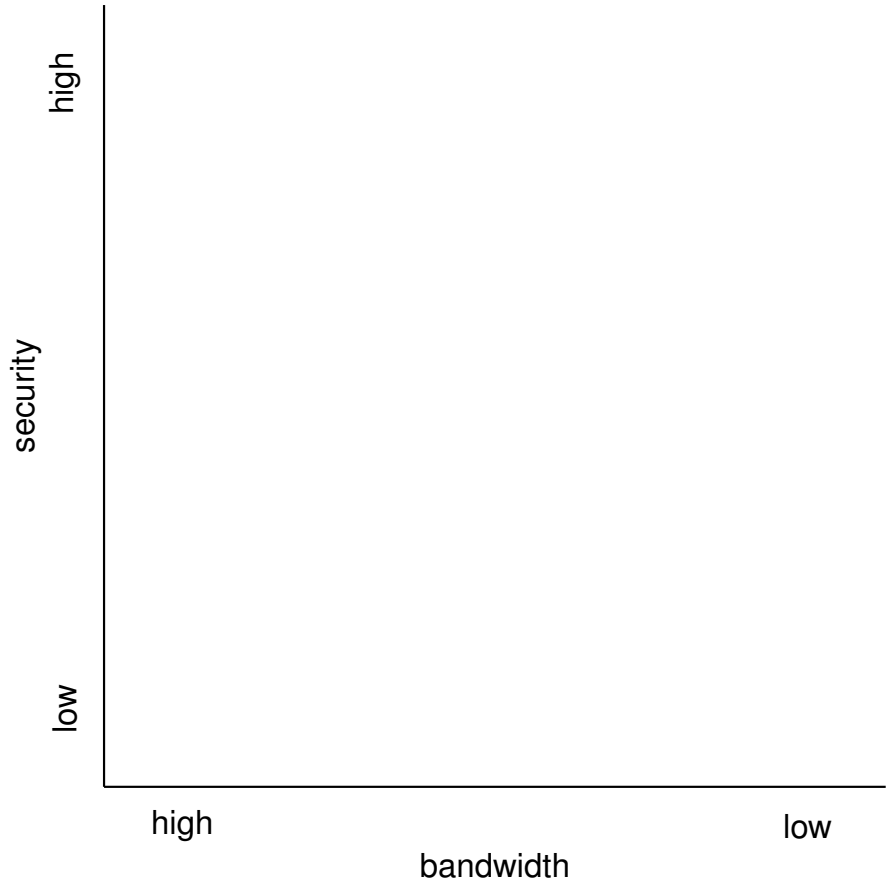
Conclusion

- SeDyA trades-off:



Conclusion

- SeDyA trades-off:
  - Efficiency
  - Security



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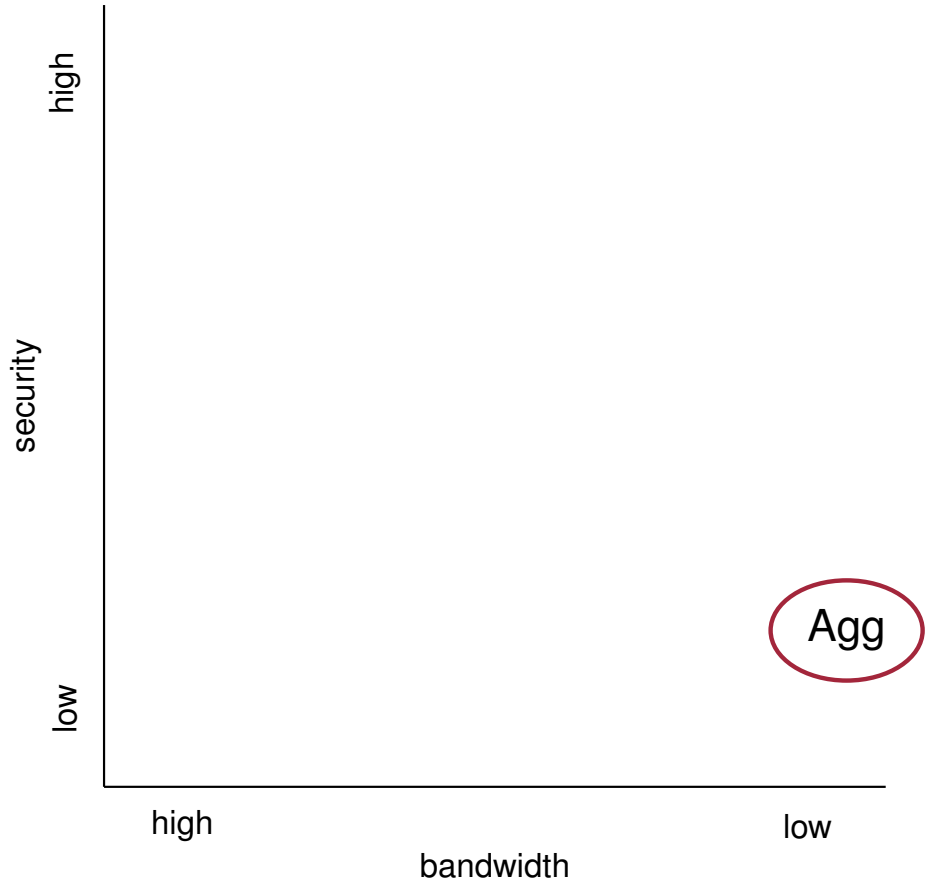
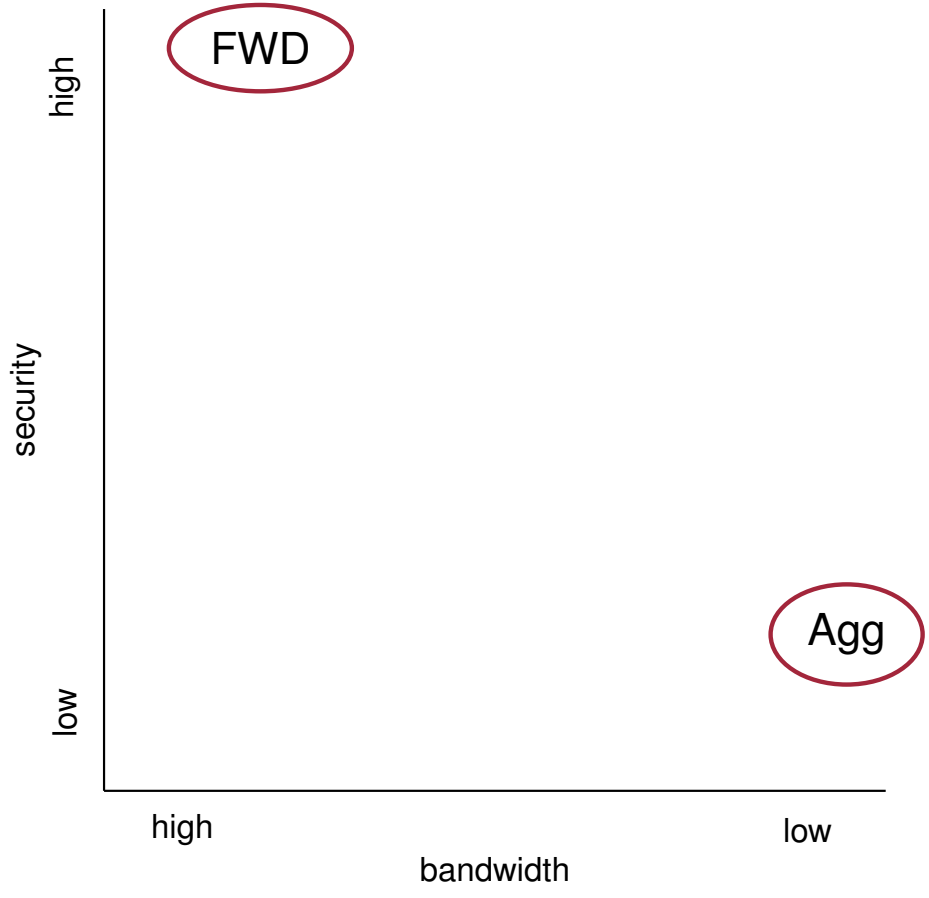
  - Security



Conclusion

- SeDyA trades-off:
  - Efficiency (insecure aggregation: Agg)
  - Security (beacon forwarding: FWD)



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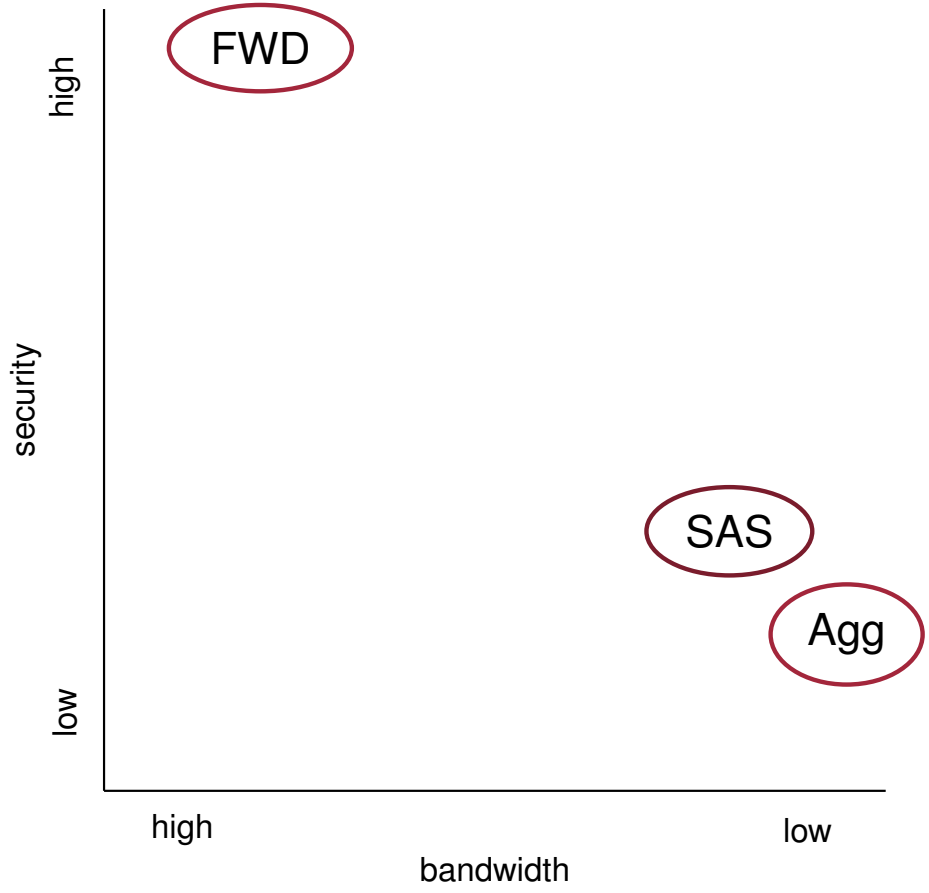

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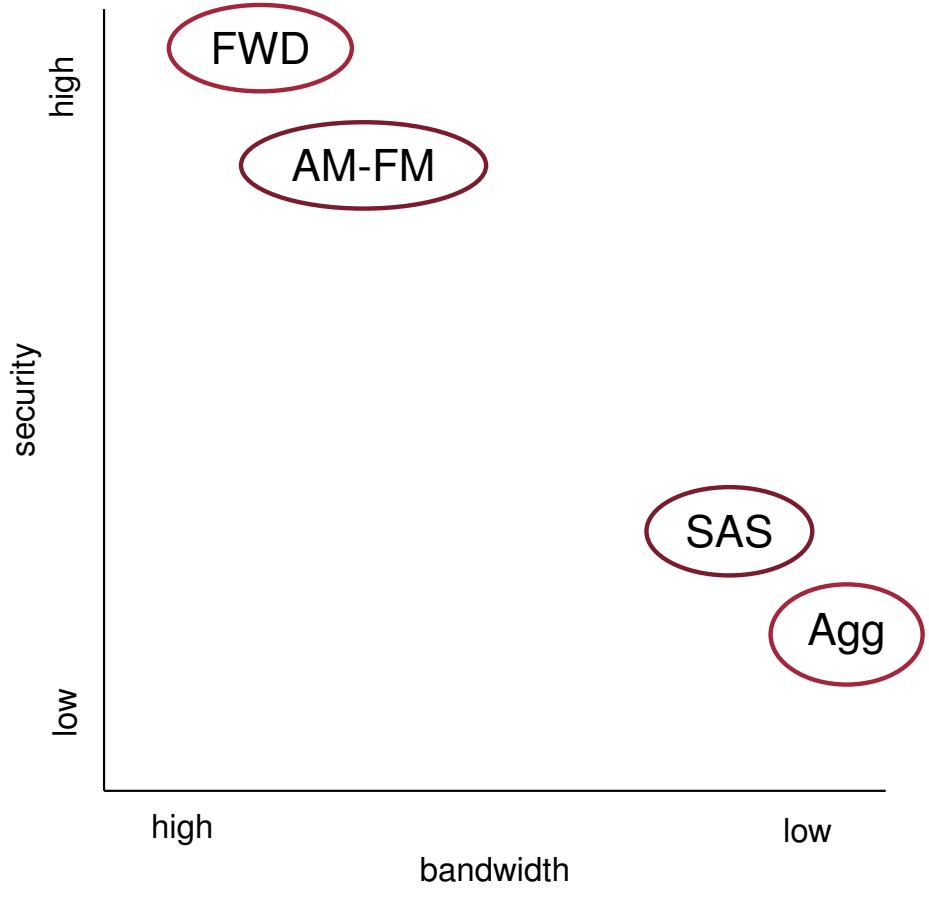

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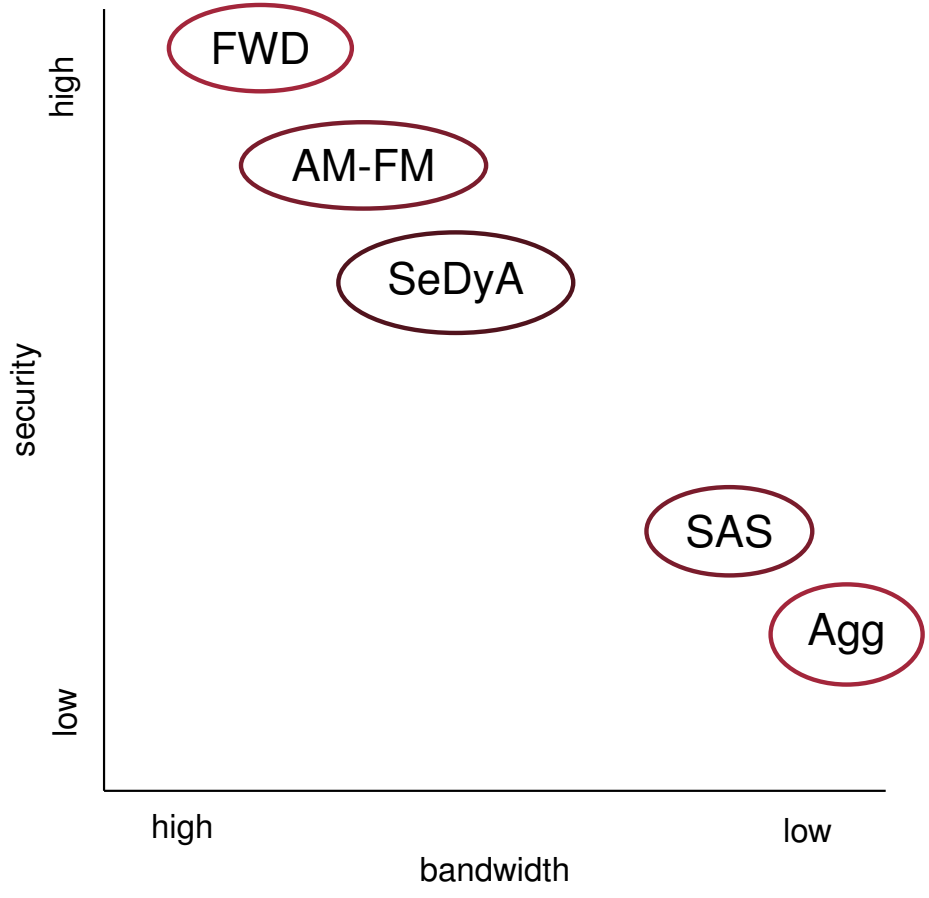

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  - Security (beacon forwarding: FWD)
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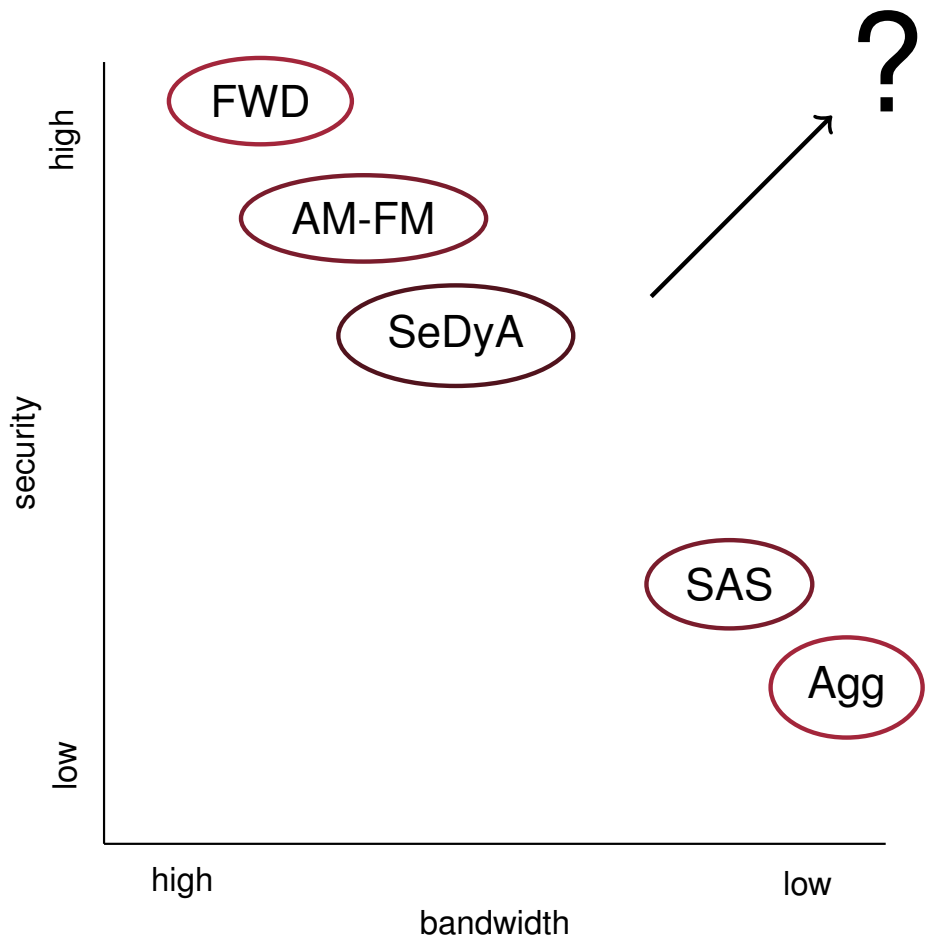
  - More data on trade-off



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  - Security (beacon forwarding: FWD)
- Future work:
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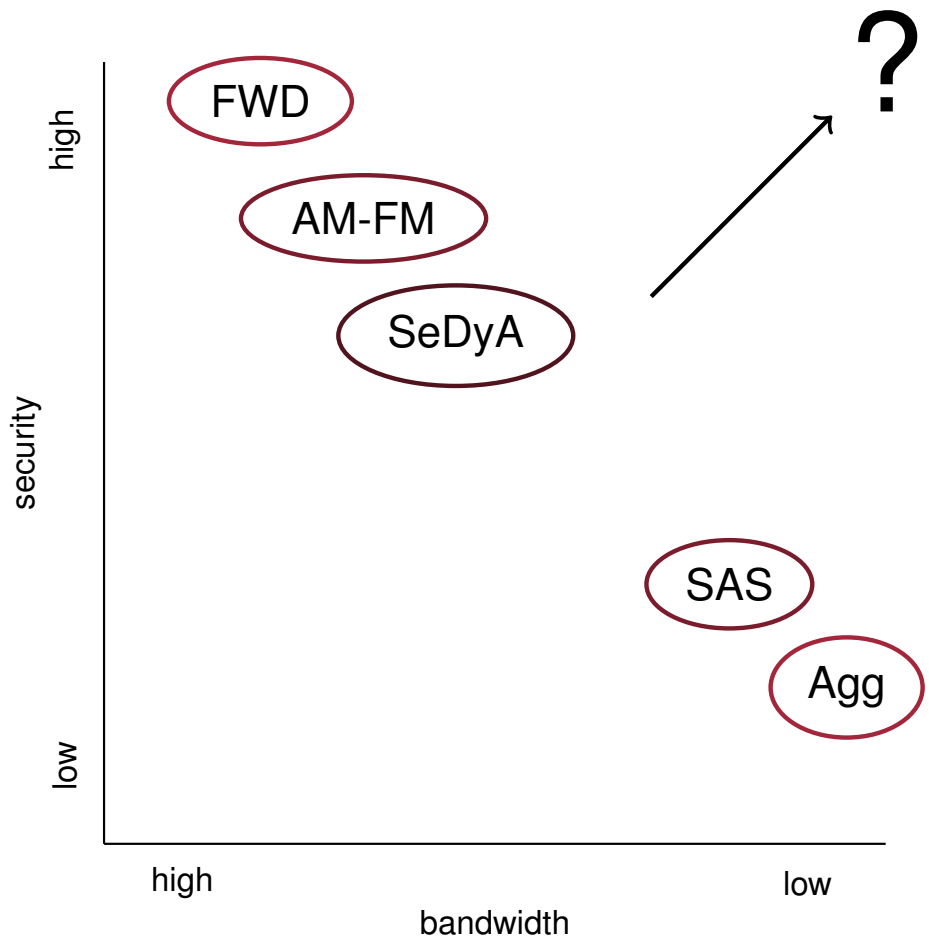
  - Misbehavior detection



Questions?